

Alfa and Omega in Student Assessment; Exploring Identities of Secondary School Science Teachers

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Just as research is quilted so is life – I think of my son finishing lower secondary school as I am writing this, and my daughter's agony and reflections as she is choosing her path in life. All these are personal events that are contributing to a mother's and a researcher's reflections on identity formation as a relational and ongoing process.

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Delta: *“I look at the teaching entirely as a mean or method and am really concerned with how to use appropriate methods ... but I am not so concerned with testing and student assessment. I do not look at the relationship between the teaching and what I measure”.* (5.12.00)

1 Introduction; Motivation and Objectives

With the introductory comment from Delta, I wish to give the opening remarks to one participating teacher and thereby address an overall motivation for developing this project. According to this quotation, Delta does not emphasize student assessment. An initial motivational aspect has hence been the lack of emphasis on evaluation and assessment in the educational institutional history of Norway. Furthermore, Delta does not see any reason for looking at the relationship between his teaching and his assessment procedures. The corresponding challenge for educational research is to further elucidate his educational practices, his reflections concerning student assessment as well as the meaning behind his terminology in various statements about assessment. Some introductory comments will be stated concerning the contribution of Delta (1.3.). There are also some methodological aspects that have to be stated as an introduction to the creation of this written account of the research process. These three aspects of assessment, teachers and methodology are combined in the overall stated objectives of the project (1.2.).

1.1 Motivational aspects as background

There are five aspects of the field of educational research and educational practice that merged form the main motivation for this dissertation. These five aspects are the challenges in the field of student assessment; the choice of addressing student assessment from the perspective of the teacher as the main actor in educational practice; thirdly the main dilemma of science education as an asset of an overall didaktik approach; next the ethnographic methodological approach as a consequence of the second and third aspects; and finally my background which is a key interpretative frame due to my presence in all stages of this project.

This introduction here will be colored by a major event that gave me the appropriate structure to reflect upon my own research process. When I was introduced to the academic ethnographic concept of ‘serendipity’ (Woods, 2002), I finally found a term that would

serve the dual purpose of framing events of particular importance with the preferred attitude. I like to talk about challenges instead of problems, of opportunities instead of obstacles. Therefore, I immediately sat down and labeled my research diaries with yellow stickers according to events of serendipitous significance. This labeling serves the function of defining crucial steps taken in the research project and are hence an analytical tool for research reflection in retrospect as well as during the process.

1.1.1 Why student assessment?

“Dear Simon. I am afraid of growing up, because when I finish school I must have good grades, if not I will not get a job, and without a job I will not get a house or place to live, and without a place to live, I will not get food, and without food, I will die. Does this sound a little overstated? Fraidycat.” (Aftenposten, 12.5.2001) And exactly so crucial are grades and so crucial are evaluation and assessment for each one of us. I start here with a quotation from a student whose age and gender is unimportant. This is one of the few places in this presentation where the student is visible. As educators, we are constantly reminded of the necessity and difficulty of assessment.

The question of ‘why student assessment’ is the teacher’s question to me when I approach them with a request to discuss assessment with me. My experience is that many teachers welcome a dialogue partner into their rather enclosed practice. These teachers take this as an opportunity to talk about the how’s, the why’s, the whose and the what’s of their own subjects and in the school they are practicing. However, why did I have to talk about evaluation and assessment? Most of the teachers considered it one of the most difficult issues of education due to complexity and a lack of terminology. Therefore-

My answer to you as a reader is the same as my answer to the teachers, but worded differently. Evaluation and student assessment are the core of teaching. Student assessment carries with it the dilemma of giving advice or being an advisor on the one hand and controlling the outcome of the learning process we have been counseling on the other. It embraces two opposites that in the totality of the game of education have to be treated as equally important, but the focus will swing between the extremes of pure control and pure counseling.

The normative standpoint of the motivation to address student assessment is that if student assessment did not exist there would not be any education. Educating is the 'bildung' of human beings. Assessment is embedded in all educational activities either as counseling and guidance or as control and marking. Furthermore, within a normative approach to assessment there is no relationship between teacher and student without responses, verbal or non-verbal. A lack of response statements is open to infinitely possible interpretations. The lack of responses therefore represents the educational uncertainty of what the students have learned and what they are supposed to learn. The presence-of-response-statements are of two different kinds. We can state in what aspects the student has been failing and/or in what aspects of the learning activity the student has been successful according to some implicit or explicit norm. Presence of response statements limit the possible interpretations and hence increase certainty and predictability in learning. Absence and presence of response statements are based on some norm and some implicit or explicit standard of learning in that subject. Made explicit, the student may be invited into the secrets of the subject; the teacher has enabled the student to vision the learning potential. Made implicit, the student has not been given this possibility, and the foundation is hidden from the student. In the first case, the teacher has also been made able to direct their practices, but in the second case, the teacher would not know the direction of the practices. Regardless of an implicit or explicit foundation for assessment, teachers are always assessing. There is no teaching without assessment.

The changes over the last century showed us that student assessment theories have developed from an isolated focus on testing into becoming the heart of teaching planning and processes. Assessment as a classroom activity called for renewed thinking about assessment techniques. Constructivist and later socio cultural epistemological theories carry with them profound changes in the view of what knowledge is and what learning is. The competencies requirements of the teachers have been extended from administering testing to integrate assessment into almost every learning activity. This requires the ability to reflect on what assessment is, and here we have arrived at the core of my intention for this dissertation. The practitioners challenge of implementing a multifold of assessment purposes.

As stated in a review article by Black and Wiliam in 1998 called "*Assessment and Classroom Learning*," "*It is hard to see how any innovation in formative assessment can*

be treated as a marginal change in classroom work. All such work involves some degree of feedback between those taught and the teacher, and this is entailed in the quality of their interactions which is at the heart of pedagogy.” (P. Black, J. & William, 1998c, p.16) By putting emphasis on measuring the outcomes of formative approaches, the qualitative contribution of the student-teacher interactions requires natural classroom settings while most of the conducted research has some elements of experimental control build into the design. Ecological validity, understood as validity in accordance with the factors included in the design of instructional situation, is required in order to investigate “*key determinants for the outcomes of any changes*”. (Ibid)

However, these authors, based on a number of projects reviewed, conclude that the various underlying approaches to assessment are both implicit and explicit assumptions about the psychology of learning. This conclusion points towards a broader framework for the interpretation of teacher practices in student assessment. Student assessment is connected to teachers’ beliefs about knowledge, about learning and about the significance of the single subject, whether implicitly or explicitly stated by the teacher. This again is connected to the teachers’ interpretation of his or her identities. A change in student assessment strategies, as we have seen from the summative to the formative, calls for a change in teacher interpretation of their overall identities as a teacher. Furthermore, it calls for a changed attitude towards the mutual constitution of the teacher and the student identities.

Educational evaluation has its own language and its own theories. When evaluating there has to be a reference of some kind based on norms and values that sometimes are stated as criteria and sometimes implicitly lie within the institutional setting. Whether implicit or explicit this norm foundation may to different degrees veil different attitudes and reasoning among teachers. That is why practices, reasoning and the corresponding rationale within evaluation are such an intriguing field to try to uncover.

Generally, evaluation is also a genuine human mental activity undertaken by most of us, but in varying degrees. When we think we simultaneously evaluate. This general human mental activity is not equal to educational evaluation. It has however the potential of becoming a part of our tools as educational evaluators, but in that case it needs to be

qualified according to the subject, to the students, the institutional setting, what we find important for learning...

So- the next question is-

1.1.2 Why teachers?

During the first year of the project, I was debating two different approaches to the dilemmas of educational evaluation and assessment. My initial idea was to look at student assessment practices in the light of the intentions set by curricula guidelines and national strategic documents about assessment and thereby compare educational practices and teacher activity as an indication of the degree of realization of national educational intentions. However, the other possible approach was to make the teachers the true main actors and use their terminology about student assessment as the criteria for framing the project. I would set the theoretical framing and the focus of how to address student assessment issues with help from the teachers and address the issues from the angles that the teachers address them. For obvious analytical reasons these two approaches proved impossible to combine. Therefore, I had to arrive at a conclusion that maybe has been the most difficult and definitely the most painful one during the whole project.

Therefore, this is a dissertation about the teachers and their perspectives on student assessment. It has intentionally been written on their premises to the greatest extent possible after taking into consideration the necessary restructuring in accordance with academic standards. Throughout the text I have tried to be true to the notion that we need to give the teachers a place in theory building about student assessment. The teachers deserve that. They live the challenges, the dilemmas and the controversies that this project has come to be about.

A previously mentioned review article (P. Black, J. & William, 1998c) formulated the key weaknesses of classroom student assessment strategies by teachers to be the practice of rote learning, assisted by little reflection, over-emphasized used of grading and a tendency to use normative rather than criterion referencing. In other words, there were several projects indicating summative approaches applied by teachers in situations that a learning and development approach would clearly have been to the benefit of both the teachers' reflection and the students' learning.

I have designed this presentation on the Dewey view of evaluation in which evaluation forms a continuous circle of reflection on education. In this view, the different stages of evaluation have an important impact on the overall educational cycle to the extent that the reflections are followed up into the next reflection stage. Gaining new understanding of your own practice as a teacher based on student achievements, indications and evidence from interactive teaching activities is the heart of learning as a professional teacher. This process of evaluation is intertwined with the improvements to the benefits for future student interactions, activities and achievements. Hence, the project has been based on a formative approach to student assessment in which student assessment is a subset under the overall evaluation strategies of the teacher.

Following from this view on evaluation the overall agenda has been developed under the sociocultural view that all participants should gain from educational activities and that the teacher could gain insight into their own teaching as well as their students' learning from both formative and summative student assessment efforts. Simultaneously the teaching agenda is both formative and summative, both addressing development and control. Both summative as well as formative approaches have therefore found their place substantially. The responses from teacher to student provide feedback on learning, while the responses from student to teacher are to be considered feedback on teaching. Teachers and students are learners, learning about their own learning and learning about their own teaching. There is mutuality in the identities formed within the enterprise of education. Awareness is not a prerequisite for this mutuality, but awareness does enable conscious reorientation in this mutual relationship so benefiting for the purpose the teacher wishes to emphasize in his teaching in general and in science in specific.

The teaching of these teachers is the art merely witnessed by the researcher. The teacher is the performer, the researcher mainly recording and analyzing using one perspective out of several possibilities. I can grasp the complexity according to my chosen perspective, but that is all. The skillful teacher's reflections on complexity remain his or her possession entirely. However, I could not investigate randomly selected teachers, so hereby I turn to the next motivational aspect that formed this project.

1.1.3 Therefore a specific school subject, and why not science?

The didaktik approach emphasizes among many other questions the interpretation and implementation process of transferring the academic discipline(s) into the school subject. In the case of natural sciences at secondary school levels, this involves the interpretation and integration of biology, chemistry and physics into school science. My initial motivation comes from a personal experience that science teachers find themselves combining two different approaches to understanding the world. On the one hand, they have been trained in the natural sciences and have therefore been socialized into the scientific way of viewing phenomena in their surroundings. In this worldview, the phenomena are treated as regularities based on laws of prediction and universal, probabilistic, generalizable measures. Reality is mirrored in scientific understanding. On the other hand, they apply the scientific knowledge within a social system building learning programs for students that have not yet been socialized into the natural science way of thinking- if they actually ever will be. Education as a social system is built on a second approach for understanding the world and the mechanisms of society. This worldview is based on the culturally situated perspective that reality is relative to the context in which it is being interpreted. Science educators face a challenge in combining these two worldviews in order to develop and implement educational programs, and student assessment is a part of educational enterprise in which the combination is in particular visible.

The combination of these two worldviews is represented within the two main approaches to student assessment. *“The field of educational measurements has clung tightly to a “natural sciences”, technological model, avoiding the messiness of the “social sciences” as much as possible. In the end, assessment is always more social than technical. It involves complex, and often conflicting, personal and institutional belief systems that are embedded in interpersonal relationships.”* (Johnston, Guice, Baker, Malone, & Michelson, 1995, p.370) Summative assessment originated and developed strategies within the natural scientific paradigm of measurements as valid evidence for learning, while formative assessment originated and is continually developing within the complex context bound paradigm emphasizing indications of learning processes. Assessment in science education carries with it the challenge of combining two different worldviews with their corresponding views on knowledge, learning and assessment.

Teachers are the main instruments for educational assessment. They are humans with feelings, biases, personal beliefs and disbeliefs and they have received training in the subjects of the sciences. The combination of these two worldviews has to be integrated in the teacher in order for the teacher to work relationally within the social system of education. How does the individual science teacher address these issues? How does he or she define their identities as teachers with regard to assessment when dealing with the knowledge construction in natural sciences within the social system of education?

In the teaching and the research about teaching natural sciences, we have experienced another swinging pendulum. This pendulum has been going from one extreme emphasizing practical skills and tasks for learning of the concepts of science to the other extreme emphasizing teaching the theories needed for conceptual knowledge building. During these phases, we have looked into different strategies for assessing students, and from the point of summative assessment have arrived at a combined formative and summative strategy for the benefit of student learning quite recently. This combined assessment strategy is complicated from a theoretical point of view and even more complicated from the point of view of the teachers. Thus, we needed to emphasize the complexity from the perspective of the classroom, and therefore ethnography became the initial methodological approach.

1.1.4 What about ethnography!

The science teacher dealing with student assessment is a part of an outer educational context. There is a relationship between the structural, the institutional and the personal level within educational institutions. Within ethnography, these levels have been labeled macro-, meso- and micro (Woods, Jeffrey, Troman, & Boyle, 1997). In the case of student assessment seen from the perspective of the teacher, the different levels will consequently be interpreted as:

- **Macro-level:** The structural level consisting of national and municipal structures which are important for educational evaluation including the processes involved in formulating the mandate, the different strategic documents and the implementation strategy that education authorities formulate at all levels.
- **Meso-level:** The organization of the school itself, the co-operative culture among the teachers and all relationships between actors within the school that together form the communal understanding and practice of the dilemmas of student assessment.

- Micro-level: The individual values, commitments, identity and knowledge foundations of the teacher that he/she draws on in assessing and evaluating the students.

As stated, I have chosen to direct my main analytical focus at the individual level, that is teacher level, and therefore it is the individual experiences, actions and reflections concerning student assessment that are presented here. These personal experiences are embedded and produced socially within the meso-level, the organizational administrative routines as well as informal relationships with other teachers and the management of the school. Likewise, the structural level, the national and municipal level, influences the teacher's understanding of his identities transmitted through the mandates of curricula, guidelines, evaluation regulations.

Interrelationships exist between these levels. The different teachers will have various perceptions about these mechanisms; hence, it is the understood and experienced practices of the individual teacher that is being studied here. Some teachers find it important to justify actions according to their understanding of an implementation mandate and therefore call attention to the relationship between their level and the structural level. Some will point to their institutions, to agreement within their team of teachers in order to explain actions. Moreover, they find the relationship between the institutional level and their own level significant for their own actions. Other teachers find it important to base their rationale on actions according to a knowledge base within a subject, within pedagogical theory or entirely based on personal experience. This in sum has become the micro-ethnography of this project. Accordingly, addressing the macro- and meso-levels will be done in two ways. The first is according to the relative importance of these levels from the teacher's point of view, while the second is to be found in my interpretation of contextual, environmental factors outside the situation itself. The first is included in the cases presented, and the second forms part of a separate chapter about national mandates and a presentation of institutional data as interpretative framing in chapter 15. Ethnography has the ability to look at the interrelations between the levels in that we can describe and analyze the interaction aspects. Here the relationships between the levels will form the outer societal and institutional contexts in which the teacher finds himself, but they will not be the analytical focus.

The researcher is the main instrument in this study. I have created the field data material texts; I have carried out the analysis; and I have written the narratives. The teacher is visible in the interview transcripts. The ethnographic approach implies analytical distance as well as situational awareness. The ethnographic approach is here understood as researcher positioning combined with the methods of participant observation and semi-structured interviews. At the same time, the approach provides the opportunity to embed the single human being within their educational environment. In order to introduce rigor and systematic fieldwork and analysis into the enquiry Grounded theory has become useful as a methodology and analytical approach with its register of analytical tools. The methodology of Grounded theory complements the ethnographic approach by employing analytical tools and by its approach to combining theory and empirical indications. The two approaches meet in the visibility of the researcher, in the adjacent statements about researcher values and experiences and in the flexibility and sensitivity of enquiry. However, the two approaches hold conflicting views on central methodological issues such as the relationship between theoretical framing and empirical indications and on the importance of context in analysis. These conflicting views will be presented in the methodology chapter and revisited several times.

The relationship between theory and empirics in building knowledge of teachers' assessment practices became a crucial point in how to apply the methodology of Grounded theory. Concepts attached to theoretical frameworks were rejected due to their confirmative deductive nature. The theory generative interpretative nature of this project contrasts with the format of a dissertation in which theory and empirics are introduced as chronically linear sub-quantities of a process. The chapters about theory will therefore have to be interpreted by the reader as part of the empirical process due to the fieldwork itself highlighting these concepts as essential to understanding the reflections of the teacher. In Grounded theory, the principle of sensitizing concepts is used to guide the fieldwork and the analysis (A. Strauss & Corbin, 1997). This principle is close to how I have viewed the status of the theory in this project. The sensitizing concepts have served as mind-openers for viewing different aspects of the respondents' practices, but have not been exclusive in adding to the overall case building. Hence presenting the theory before the cases is done here in order to sensitize the reader to central issues and emphasize rather than serve as a definitive framework.

The ethnographic dilemma of making the strange familiar versus making oneself unfamiliar with the social situations we have known from childhood is a primary concern. *“Making the familiar strange will continue to be a basic problem in the anthroethnography of schooling in our own society.”* (Spindler & Spindler, 2000, p. 224) One way of meeting this concern is therefore to present the background of the researcher, for interpretative reasons of the reader and for reflective reasons for the researcher. Therefore, a presentation of the researcher will now follow.

1.1.5 Why me!

The obvious arguments are that I have a formal background within science education, have been a science teacher and thus have a fundamental belief that we can never address questions of teaching without integrating the conceptual content of the subject into our reflections about knowledge and learning. Accordingly, educational research should not discuss, evaluate and analyze educational practice without taking the nature of the school subject and academic discipline into consideration. Likewise, I think that we cannot educate without a goal, whether stated or implicit. We cannot educate without content, and there is no content without an angle put on the content. This angle will be present in the goals we commit ourselves to.

This section will include some aspects of my personal history that are relevant to the development of this research project. The initial story about myself was, however, very different from the story about me when writing this introduction. Hence, the presentation and the chronology are retrospective by nature. My main research tools are research diaries or logs. My diaries have been written continuously and the content has been influenced accordingly by some happenings or serendipities that have had major impact on how I have been living the doctoral period of my life. These research diaries contain all sorts of comments, from the strictly professional to the entirely private. Researching is for me a state of mind, not an activity that occupies a sector of my brain. Living my doctorate has been more about the learning process having implications for almost all aspects of life in an increased, deeper, widened understanding of ontological and epistemological aspects of life in general.

Converting from natural sciences to social sciences is just one factor here. Nevertheless, this factor has been highly relevant both in the school of becoming a researcher and in

addressing the controversies facing school science teacher. I then graduated from university with a masters ('hovedfag') in science education and became a researcher in science education and education in general. Participation in the Third International Mathematics and Science Study (TIMSS) and writing my masters thesis about secondary school science teachers and their implementation of the National Curriculum at that time introduced rigor into my research experience.

Participating in ISERP, the International School Effectiveness Research Project, immediately after completing my "hovedfag" in science education introduced a number of important perspectives into my experience within international educational research. (Birkemo, Grøterud, Hauge, Eggen Knutsen, & Nilsen, 1994; Reynolds, Creemers, Stringfield, Teddlie, & Schaffer, 2002) First of all this project was packed with collaborative controversies among researchers from eight countries, all with their own methodological and substantial agendas. Although it comprised qualitative, quantitative as well as mixed methodology approaches this diversity provided a tremendous opportunity to gather experiences in a multitude of techniques (Tashakkori & Teddlie, 1998). Next, this diversity influenced the international research team so that an intervisitation program was established. This program highlighted the diversity of school system and the diversity in interpreting the concept of quality. This project served me substantially as a learning experience leading into pedagogy as a field that then opened up the sociological and philosophical dimensions of education beyond the point embraced by science education at that time. International co-operation, ethical dilemmas at the intersection of policymaking, research communities and the educational sector became an issue as my involvement continued.

Above all, the necessity to look beyond your own system in search of revelations about your system is the strongest influence this experience with ISERP had on my research design thinking. This comparative aspect is not necessarily comparative in any measurable sense, but rather comparative in a limited qualitative sense. Comparisons here therefore act as a background filter for those contextual factors that have had a major impact on teachers in any country without the teachers and researchers being aware of this. This fact has been eloquently stated in the major report as follows: *"In the absence of intellectually vibrant comparative education community, the increasing tendency of educational research to be cross-national or international in focus will not be resourced, and the sub-disciplines of*

education may make the kind of intellectual and practical errors that comparative education could have warned them about.” (Reynolds et al., 2002, p.286) According to the authors, the requirements of contextualization and enculturation have not been met by international comparative research during the past 20 years. The need for smaller studies looking into the individual classes, actors and illustrating the diversity in different locations is crucial for progress in the comparative field. Participation in ISERP and other projects brought methodological awareness to my research experiences. (Eggen Knutsen, 1995)

This is therefore a story of going from science education to didaktik research both substantially and methodologically. I have been “*living the ethnographic doctorate*” (Troman, 2002). I have been emphasizing the messiness, the non-linearity, the systematic approaches, the rigor, the creativity, the imagination, and the sensitivity. I have tried to combine analytical distance and social awareness and closeness. Likewise, the ethnographic aspects of human sensitivity and theoretical meta-cognition have been combined with Grounded theory in empirical indications and theoretical framing. Systematic rigor has been equally important as preparedness for the unexpected. Have an agenda, but be prepared to diverge from it. I am continually training myself in opening an interpretative system instead of closing a confirmatory system. Piecing together a project has become a favorite metaphor. I am a quiltmaker in my spare time. Choosing a way to write up the messiness involved in an ethnographic doctorate has been similar to designing and piecing together a quilt. There are equal portions of creativity and analysis involved in all the steps of either process.

I am present in all the texts whether stated or not. I have done the fieldwork and the analysis as well as the theoretical selection. Even if the form is rather non-personal, I am there in between the lines and behind the selected words. I have for the most part chosen a neutral linear form. However, the messiness combined with my own priorities and background longs to make this messiness and the interpretative nature of the enquiry more visible in the final texts. My courage was sufficient for taking on this assignment and struggling with all the ups and down of this doctoral dissertation. However, I am sometimes sorry that it was insufficient for creating such a text.

Coming from the natural sciences and growing into the social sciences has hence involved a growing awareness of the acceptance of epistemological self-reflection involved in knowledge construction. The theory generated in this project is not only a result of me as the main research instrument in the empirical aspects of knowledge construction, but also was organized by my mind in the “theoretical” aspects of knowledge construction, with the limitations and possibilities that my formal and informal background imply. I have consequently introduced the pragmatic, skeptical and interactionist viewpoint that is found formalized in Grounded theory and that has become the main methodological approach for this project.

Within biology we have a saying that ontogenesis is a mirror image of phylogenies. The history of the development of a fetus of an individual organism is similar to that of the evolution of a species or a group. Looking back at my own assimilation into the field of qualitative research and specific ethnography, I see a mirror image of the development of the field of ethnography. First, I developed the strategy for my enquiry and then found so many authors who had developed similar strategies for their research focus facing many of the same methodical and ethical considerations.

1.2 Objectives of the dissertation

A major emphasis of qualitative research is to develop research question as a part of the project. Another major feature is the combination of empirical indications and theoretical framing in the construction of knowledge. These two factors merged imply that research focuses are formulated and reformulated according to the growing insight into the overall issues that combined fieldwork and theories open up for. Therefore, reformulations of research questions are a more or less ongoing activity throughout this project and I have made an attempt at reconstructing this development in two places in the written account. The first formulation stated as objectives can be found in this subchapter. The reformulation and specifications according to theoretical framing based on fieldwork indications constitute the research questions stated at the end of Part II. Correspondingly research questions concerning methodological framing will be reformulated at the end of Part III. Research questions or hypotheses from a Grounded theory perspective are concepts describing phenomena with statements about their interrelations. Consequently, a research journey based on Grounded theory is continuously reformulating hypotheses

about the relationship between the phenomena and developing the conceptualization. (A. Strauss & Corbin, 1998)

The project aimed initially at investigating the following question:

How do science teachers in lower secondary education construct their identities as evaluators with respect to the summative and formative purposes of student assessment?

The main question that guided the methodological and theoretical development was further deduced into the following sub-questions.

Theoretical development:

a. Concerning the description and analysis of science teachers' actions and reflections.

What are the actions in the classroom with regard to student assessment and assessment in the sciences?

How do the teachers express their reflection about their practices in evaluation and assessment?

b. Concerning the construction of identities regarding student assessment.

What is the relative importance of formative and summative student assessment procedures for teacher reflections and actions?

What are relevant theoretical framing to analyse teacher reflections and actions within?

Within the contextual setting of the classroom situation and any interaction during the period of fieldwork, what are the relevant aspects of science educational theories of importance for the teachers' professional reflections on student assessment?

c. Concerning the variety of student assessment practices and the content of reflection within science education.

Is there any variation among the participating teachers, and is it possible to categorize this variation according to certain dimensions taken selected theoretical framing into consideration?

Methodological development:

d. Concerning the ethnographic and Grounded theory methodological approaches.

What methods, combination of methods and other methodological considerations need to be developed in order to investigate science teachers' assessment reflections and actions?

What will be my corresponding researcher identity, my relationships to the respondents and our co-constructions of identities?

1.2.1 Syntheses: A hierarchy of research questions

There are some implicit or hidden assumptions about evaluation and assessment that underpin the practices and reflections of the teachers. A major part of this project has been directed at using empirical indications in order to single out some theoretical frames that would contribute to making the assumptions explicit for both the teachers and the researcher. Another aspect of the project has been to develop an ethnographic methodology needed to create valid texts about actions and teacher reflections. Two significant parts of this methodological development has been the combination of theoretical framing with empirical indications as well as the co-construction of researcher - teacher identities. Thirdly, there has been a development of analytical approaches required for combining the theoretical framing with the created texts into teacher cases.

The study deals with different kinds of questions. If I take as a starting point the three categories of confirmative, evaluative and constructive questions (Kalleberg & Holter, 1996) we see that all categories are represented. The two research questions stated under the first objective, a, are both confirmative. They ask for descriptions of present educative planning and practices. The fourth objective (d) lies on the border with an action project, but was never intended as such nor developed into that. However, there are some aspects of constructiveness in this question. The issue is how does the teacher view his/her own learning potential, and are there because of the interaction with a discourse collaborate (me) signs of changes in their actions and the content of their reflections. The second and third objective (b and c) are mainly confirmative but at a cross - case comparative analytical level in contrast to the first objective that is single case oriented. There is simultaneously an element of evaluation of the individual teacher mainly against the theory but also against each other. The evaluative norms are set by the development of the theoretical framing. There is also an internal relationship between these questions and different analytical levels involved.

Co-operation with the teachers implies having two tasks. The first is the researcher's task that will be discussed later, while the other is the teacher educator's task. Being present in schools implies that the schools and the teachers explicitly or implicitly expect to gain some new insight into the issue of student assessment. Moreover, it is our obligation, ethically as well as professionally to facilitate situations that provided opportunities for teachers to discuss their priority issues. Merging the agenda of the researcher and the

teacher is one way to do it and hence state an action research focus. Nevertheless, the preferred solution here has been to have these two processes running in parallel and consequently face the challenge of avoiding them interfering too much with each other analytically.

1.3 Delta – a teacher’s voice

The contribution of Delta in this written account of a knowledge construction process deserves some comments as a part of the guide to readers. Delta came into my project by coincidence and because of miscommunication between my department and the school. Delta was in particular eager to discuss student assessment and educational matters in general. This teacher soon obtained a midwife’s contribution in this project. In my search for theoretical framing, it was rewarding to turn to the angling and the argumentation that became our common discursive project. The ideological and epistemological as well as the combination of the two through the dilemma of summative versus formative purposes was partly born through my discourses with Delta. Delta provided the teacher’s angle on ideas that were neither articulated nor grounded in practice from my perspective. At the same time, it became difficult to use this part of the fieldwork as a case due to Delta’s teaching position. He was currently not teaching natural sciences. The detachment between the researcher and the researched was to a large degree characterized by shared understanding, by common perspectives on life in general and by a shared learning experience. The transcripts are full of “yes’s” and “no’s” signaling shared worldviews. I have for these reasons decided to allow Delta’s voice to be heard as a part of every chapter. He is hence a symbol of the hermeneutic aspects of this process. Delta signals the importance of the fieldwork in developing the theoretical framing. The quotations beginning most chapters and ending some of them are meant to act as a constant reminder of the voice of the teachers in my project. I will return to his contribution at the end of the dissertation.

Piecing together a dissertation is a process of working back and forth between many sources so adding to the overall knowledge construction. Working with Delta the teacher is one such main source for the development of this dissertation. Here is a second quotation from him that serves as the final comment to this introduction. Delta questions his own practice as well as his expectations of the tasks as assessor, and he states a lack of ideological discussions as well as reflection. The close defensive attitude from the first

quotation has been challenged and he makes way for the complexity of institutional education and student assessment. Therefore, this is the end of the beginning and at the same time the beginning of the substantial part of the report.

Delta: *“... student assessment is no topic in that in-service program. How do we measure? To what extent do we measure ourselves? To what extent do we measure progression or technical skills? What, what, what are they looking for? There is also no thinking in this school. There is no production of ideology. There is only reproduction of old facts....What is the real significance of what we are doing? Are we approaching the defined objectives or are the objectives in coordination with our possibilities and abilities? And well our time is maybe, or maybe it was no better before... but there is no self-reflection.” (21.5.01)*

PART I

Main Perspectives;

Sociocultural view on Reflective Teacher Identities

Delta: *“Understanding of the number system is crucial. When we have taught the curriculum... Teaching is a drama of truth in a moment. As a teacher I have to anticipate the feelings in the situation. When their eyes are crossing... that is when I’ve done my job... interpret and manage the drama of truth in that moment. (1.2.01)*

Delta: *“What I emphasize... I DO believe in the relational, or maybe I will rather say the lateral learning, the learning that takes place between the students, I think that is deeper. And it is manifested through communication. ... I need some indicators. If they write eagerly I will not interrupt. When they write slower, the attention is elsewhere... that is my concern that they reach the point simultaneously. It is there and then. I am waiting for the right moment. It is very de-motivating to be explained something you are not prepared for.” (21.5.01)*

This part consists of two chapters. The first chapter is about the sociocultural view on didaktik and the second chapter deals with reflective teacher identity. Delta points towards such a view of learning and teaching when he refers to teaching as being “*the drama of truth in a moment*”. He is concerned with ‘*lateral learning*’ and a ‘*relational*’ teacher identity as well as communicative practices as important for learning. His concern is to anticipate the right moment for teacher involvement in the learning activities. Anticipation of that moment is a necessity for motivating the students.

These chapters form a theoretical background to the project about student assessment using an epistemological base, a didaktik base and a view of the teaching profession. As such this part consists of perspectives on the respondents of the project - the teachers. Furthermore, this part states a principal view on teaching with a corresponding view of assessment and evaluation as being integral in all teaching activities and reflections. And finally this part presents the didaktik concept that has evolved during the process of developing the project. The sociocultural view on reflective teacher identities is merged with a structural view on teacher competencies in order to address student assessment as a specific area for analysis. This is done in a concluding section (3.5.) in ten postulates.

Delta: *“I am more concerned with the collective aspects of feedback in the classroom. I think that individual feedback and grading will be interpreted according to the context. So I think that there is no possibility for me to give individual feedback because it will be interpreted by the recipient in the setting. It is the dynamics of the group I am addressing. It is possible to succeed! When confronted with other solutions they become aware of their own strategies of solving tasks.”* (4.4.01)

2 Sociocultural view on ‘didaktik’

In this quotation, Delta is stating his challenge and his concern that assessment in the classroom is addressing individual students in a group setting. The social dimension of feedback is therefore an important consideration for him as the meaning of the feedback is created within this educational context as result of situational interpretative factors like relations to other students.

There are two implicit main perspectives on which this project has been based and that require to be made explicit. The first is the underlying view on learning and teaching (2.1) and the second is the applied concept of ‘didaktik’ (2.2). There is a clear link between the sociocultural perspective of knowledge construction and the emphasis on teacher identity presented in the next chapter. There is no similar apparent direct connection between the epistemological perspective and the ‘didaktik’ concept. I will argue that recent developments within both general ‘didaktik’ and science ‘didaktik’ considers issues about learning related to a socio-cultural epistemological perspective.

2.1 Sociocultural epistemology as main perspective

The main elements of the sociocultural view on knowledge construction are the importance of contextual and cultural factors, relations to other actors by the use of language, actions taken in social settings, mediation of knowledge by interactions and learning cultures and the formation of identity as a consequence of participating in this social world. (Lave & Wenger, 1991; Säljö, 2000; Wertsch, 1985, 1998) The term sociocultural has thus been applied to a level of analysis when dealing *“with the sociocultural situatedness of human action,*

something that derives from the fact that mediational means are part of any cultural, historical, and institutional setting” (Wertsch, 1998, p.109).

With a more specific emphasis on teachers’ thinking and practice others have summarized a sociocultural perspective as a combination of three trends in a merged linguistic, pragmatic and reflective turn. They argue that this combination is especially noted in education with the embedded applied nature of this field. The summary continues like this: “*-Language is an expression of social interaction rather than representing ‘inner thoughts’ of individuals; - language not only represents but also actually forms the world (or the objects of which it speaks); - the prominence of social practice means that cognition turn into socio-cognition and learning becomes ‘situated’; and – all knowledge is related to some practice as its invisible prerequisite.*” (Carlgren, Handal, & Vaage, 1994, p.3 in introduction)

2.1.1 On the use of sociocultural epistemology as an overall perspective

The intention here is to look at a sociocultural perspective from an epistemological viewpoint, but it is necessary to start by addressing the implicit ontological aspects. Ontological discussion with its implications for epistemological positioning could be divided into two strands. The first would argue for the merging of epistemological traditions as a consequence of the increased insight (J. R. Anderson, Greeno, Reder, & Simon, 2000; Greeno, 1997; Lave & Wenger, 1991; Packer & Goicoechea, 2000). This position is held by authors who claim it is important to build new comprehensive theories of learning embracing as many aspects of learning as possible. The other strand continues the previous separation of different theories of learning and hence uses new insight into ways of knowing and learning to add another epistemological tradition (J. R. Anderson, Reder, & Simon, 1997; Cobb & Bowers, 1999; Sfard, 1998). The main argument is that different epistemological traditions have the ability to address different aspects of learning. For pragmatic, normative and prescriptive reasons there are several arguments for including different views on learning in teacher’s educational planning and educational practice in student assessment. I will turn to this point in section 2.3. Nevertheless, epistemological positions have implicit ontological assumptions and therefore it is necessary to state one main position for the knowledge construction of this research project.

I will do so by arguing for an overall socio-cultural epistemological viewpoint for this project by addressing some of the issues raised from each of the strands mentioned above.

In a sociocultural ontology learning is a term that eliminates and exceeds a distinction made by various behaviorist and cognitive theories, in an individual understanding versus an independent objective world (Piaget, 1972; Skinner, 1958). The sociocultural perspective may be represented by this quotation: *“learning is not merely situated in practice- as if it were some independently reifiable process that just happened to be located somewhere; learning is an integral part of generative social practice in the lived-in world.”* (Lave & Wenger, 1991, p.35) Three central features of a sociocultural ontology are apparent. Firstly, from this perspective the most fundamental feature is the context and circumstances in which learning takes place. When the learning takes place in an institutional setting defined by rules, communication patterns and the different participating teachers and students, we have to consider this as an integral part of learning as it is of vital importance for the way we know. The second embedded feature is that learning is the integration of the formation of identity with these contextual factors and with social activities and vice versa. Finally, the duality of subject versus the independent world has been replaced in this view by looking at learning as a social process in which the personal identity itself is being formed. I will return to the identity concept in chapter three.

The following quotation is one attempt at grasping the complexity, and at the same time attaching some labels to the different aspects of the learning process and the importance of the actors and their relationship to one another. *“The sociocultural perspective’s nondualist ontology avoids the paradoxes of dualism, and we have articulated **six key themes of this ontology**. These six themes- that the person is constructed, in a social context, formed through practical activity, and in relationships of desire and recognition that can split the person, motivating the search for identity- clarify the sociocultural perspective’s claim about the link between learning and identity; they correct any simple equating of identity with community membership, and of learning with enculturation”*. (Packer & Goicoechea, 2000, p.239, my emphasis)

After the application of the six themes from the above quotation the sociocultural rationale behind this project about teacher reflections concerning student assessment would look like this: The particular and the specific that each teacher represents forms the proper starting point because it is the comprehension of the evaluation and assessment positions of the individual teacher that is being investigated (*"the person is constructed"*). The teacher has been selected and is reconstructed into cases by me. The teacher represents him/her self. The construction of teacher cases is based on interactions between the teacher and the researcher. Next, the teacher works within specific circumstances, teaches specific students and relates to specific other teachers (*"in a social context"*). All these factors contribute to the practices of the teacher. They contribute to the way the teacher understands the dilemmas of student assessment and to the way the teacher decides to act on his understanding. Action, understanding and reflections are intertwined processes that in sum form this teachers' identity (*"formed through practical activity"*). Then there is the specificity of the teaching situation in which the teacher acts by taking into account not only the pre-lesson planning but in addition a number of situational factors such as the emotions and attitudes of the students, occurring events, student cognitive preparation. Numerous factors add to the complexity of dealing with in - lesson student assessment that is less possible to analyze but major contributing factors for the formation of the interactive phases of instruction (*"and formed in relationship of desire and recognition"*). Subject culture is yet another specific factor that will be of importance. It has therefore been important to address only one subject mainly in order to trace the aspects of identity related to the specificities of the subject (*"that can split the person"*). Formal background and loyalty towards a subject are, however, only one of several competencies of the teacher that the teacher will use to understand the self within the social world (*"motivating the search for identity."*).

The six themes are, however, intertwined. I have attempted to illustrate how these themes are applied within the main perspective and investigating the teachers' identity formation in student assessment. In the following, I will shortly present the nondualist and the dualist sociocultural epistemological perspectives.

Nondualist sociocultural perspective

This ontological position forming the background of sociocultural theory has resulted in several parallel contributions, which to some extent are overlapping theories of learning claiming that sociocultural theories aim at comprehensiveness. (Engeström, 1999b; Engeström, Meittinen, & Punamäki, 1999; Lave & Wenger, 1991; Wenger, 1998; Wertsch, 1985, 1998) Three will be included here in short presentations.

The first tradition has an anthropological angle. Lave and Wenger introduce the term 'legitimate peripheral participation' (Lave & Wenger, 1991) as their solution to a nondualist ontological perspective on learning, and they argue that they do so in order to generate analytical terms based on a situated learning perspective. Under this label a person's learning and knowing is seen as inseparable from the social world. The four terms 'person', 'situated learning activity', 'knowing' and 'social world' become analytically distinct and hence manageable by the following definitions. A 'person' becomes a practitioner whose identity/membership is connected to a perspective of transforming the knowledge and skills according to the community, but whose knowledge and skills also form the community. 'Knowing' is connected to the development of identity in social settings that are characterized by certain practices and their artifacts, a certain organization and specific frame factors such as personal finances. The 'social world' is constituted by the social practices involved in reproduction, transformation and change or more specifically in addressing the structural character of this world, the location and organization of mastery in communities, challenges related to power and access, developmental cycles and the necessary dichotomy of stability and change. And finally the embracing term 'situated learning activity' becomes 'legitimate peripheral participation' in order to emphasize participation as a prerequisite for learning and that the authenticity and justification of knowledge is based on participation and engagement. The word 'peripheral' implies, in addition, that the single person always to some degree will be at the circumference of the responsibility of the total product and this "*suggests that are multiple, varied, more- or less –engaged and –inclusive ways of being located in the fields of participation*" (Ibid, p.36). She or he will not be totally absorbed but the 'self' is still important. The person will be distinct from the involvement, although learning is itself a consequence of involvement. Learning is approaching a more central and complete

participation. Other advocates of socio-cultural perspectives would put emphasis on the language and on communication tools (Bråten, 1998; Rieber & Carton, 1987; Säljö, 2000; Vygotsij, 2001).

‘Legitimate peripheral participation’ has been extended into the ‘communities of practice’ (Wenger, 1998) that includes the conceptualization of important aspects like identity formation and therefore has implications for teacher identification as a part of institutional practice (Section 3.1).

This sociocultural approach has much in common with a second contemporary sociocultural approach, the activity theory approach (Engeström et al., 1999; Miettinen, 1999; Scott, 1998). The roots of activity theory lie in the application of Vygotsky’s central idea of culturally oriented actions into Leont’ev’s distinction of collective activity and individual action in a triangular model of activity. Here the collective activity was initiated by an object related motive, individual actions are motivated by a goal and operations driven by the conditions set by the tools at hand (Engeström et al., 1999). The individual versus the collective as the primary unit of analysis was hence made possible within a sociocultural approach by considering actions in their historic situations.

The identification of dilemmas is a continuation of the dialectical thinking that states the necessity to look at human situated socio historical practices as tensions or contradictions. It is the tensions within the activity system that drive the processes of learning forward. Dilemmas that are targeted at the activity theory are psychic processes versus object-related activity, goal oriented action versus object related activity, instrumental tool-mediated production versus expressive sign-mediated communication, relativism versus historicity, internalization versus creation and externalization and principle of explanation versus object of study. With regard to this point a developmental approach has been derived allowing for diversity of activities in multi settings with a corresponding methodological emphasis on a combination of the theoretical conceptual research focus with an applied teacher focus. The concept of student assessment as dilemmas will within this perspective be theoretically developed in chapter 4 and empirically investigated in part IV.

The third approach, that will only be briefly mentioned, is that of mediated action (Wertsch, 1985, 1998). This sociocultural theory emphasizes the individual performance in the sociocultural setting. The actions of the single human being represent the basic unit of analysis viewed as semiotic interactions. The collective practices and the contextual factors that have already been formed and are being formed by its participants are present in the 'communities of practices' and the action theory approaches.

Roth draws on the various perspectives of socio-cultural theories in order to give pluralistic descriptions and analysis of his science classroom emphasizing classroom interaction in order to address the questions of which mediational and interactional processes leads to collaborative learning as well as the cognitive processes that are evoked by student collaboration (Roth, 1995). With this semi analytical study he has managed to illustrate individual cognitive learning as a part of interactional work in socio-cultural settings he claims has been lacking in previous research. This study is therefore an example of subject related analysis within a nondualist sociocultural perspective.

The nondualist perspective still has its advocates like represented by the following quotation: *"A high priority should be given to research that progresses toward unifying the diverse perspectives within which we currently work, both because this is scientifically important and because it will increase the usefulness of our findings for informing public debates about educational policy and practice."* (J. R. Anderson et al., 2000, p.13)

Dualist epistemological perspective

The other strand of perspectives considered the various possibilities for a parallel existence of epistemologies. A consequence of this line of argument is to look at those different epistemological positions that may contribute to ways of looking at knowledge. In the need for an overall systematic approach to the contributing factors to the various epistemological traditions Sfard (1998) argues for two opposing metaphors - the acquisition metaphor and the participation metaphor, of which the latter is the most recent addition. The dichotomy between the two metaphors is ontological in nature. The intention is to enable a classification of

theories according to a definition of the acquisition metaphor so far as knowledge, conception, schema, facts, representation and content are concerned. Likewise the participation metaphor is defined as being concerned with knowing, context, situatedness, social mediation, practice, communication and discourse. Accordingly *“theories can be classified as acquisition oriented or participation oriented only if they disclose a clear preference for one metaphorical ingredient over the other”* (Ibid, p.7).

The metaphors, she underlines, are opposites as analytical perspectives but not mutually exclusive as guidelines for educational practices. The author strongly argues against a comprehensive theory of learning and consequently concludes: *“As researchers, we are seen to be doomed to living in a reality constructed from a variety of metaphors. We have to accept the fact that the metaphors we use while theorizing may be good enough to fit small areas, but none of them will satisfy to cover the entire field. In other words we must learn to satisfy ourselves with only local sensemaking. A realistic thinker knows that he or she has to give up the hope that the little patches of coherence will eventually combine into a consistent theory. It seems that the sooner we accept the thought that our work is bound to produce a patchwork of metaphors rather than a unified, homogeneous theory of learning, the better for us and for those whose lives are likely to be affected by our work.”*(Sfard, 1998, p.12)

This brings us a step further into realizing the importance of underlining position and being selective. By introducing the acquisition and participation metaphors it is possible to both discuss the knowledge construction within a research project and at the same time allow for the integration and merging of different perspectives when analyzing teacher reflections and teacher actions. Different perspectives intend to address different aspects of learning and hence are analytically incommensurably (meaning that it is not possible to exclude one from the other empirically or analytically) but may mutually enrich each other normatively.

The discussions within a dualistic approach to epistemology embrace other important issues. Three major questions concerning what they can claim to answer concern the presuppositions of goals and outcomes of learning, secondly the presuppositions of the transfer of knowledge and thirdly the presuppositions of the abstraction of knowledge (J. R. Anderson, Reder, &

Simon, 1996; Greeno, 1997; Sfard, 1998). Concerning the first question the issue within acquisition metaphor is how to define the subject knowledge in order to achieve the best learning outcome, while the corresponding question within the participation metaphor becomes what activities or combination of activities are the best for preparing for present and future social involvement. Within the acquisition metaphor or cognitive learning theory the transfer refers to the information in itself and so the question becomes “Does knowledge transfer between tasks?” However, within the participation metaphor the possibility of transfer relates to the transfer of participatory skills. Situated learning theory does not claim that knowledge is not transferable, because socio- cognitive positioning deals with the possibility of applying skills like cooperative learning as well as different kinds of interactive skills.

In my project I am assuming that the teachers’ acquired skills and understanding of student assessment dilemmas could be transferred between different learning activities and different groups of students. The idea behind the reflective framework is that of bringing the reflections up to a level where some elements may be generalized and are therefore transferable even if the individual technique or tool may have to be adjusted. The reflections (chapter 3) and the reasoning behind the tools are the key to transferability. I will however in line with the arguments of Sfard present three different epistemological perspectives, their corresponding learning theories and assessment techniques in the next part. Assessment purposes are multifold and my claim is that different epistemological perspectives contribute incommensurable analytical foci for teacher actions and teacher statements about reflections (chapters 4 and 5) (Bråten, 2002). Anderson et al’s nondualist argument about theoretical comprehensiveness as ultimate goals to inform public and practitioners is from the perspective of the complexity of student assessment wishful thinking and analytically unachievable in my opinion.

2.1.2 ‘Culture’

So far the concept of ‘culture’ as the second half of the term ‘socio-cultural’ has not been commented on. The term culture does not equal the term social world as used by Lave and Wenger. Nor is the term analytically equivalent to the term sociopolitical. Within the sociological tradition, the concepts of culture, society and contexts are all conceptually

distinguished. The traditional view of “*society is a system of interrelationships that connects individuals together*” (Giddens, 2001). A society and a culture are mutually dependent for their existence and ability to be defined. Culture is the sum of all the aspects of a society that are learned and have developed, e.g. norms, values, traditions and shared knowledge. We also need to introduce the concept of subcultures. Subcultures have different cultural patterns and may exist in parallel in a society.

Therefore when dealing with the ‘culture’- part of the expression sociocultural we should address the plural form ‘cultures’ (Mantovani, 2000) as we are talking about the differences among cultures we should take into account when dealing with the social mechanisms. This is particularly important when considering learning as a part of a culture because this means that we have to acknowledge the multiple cultures in which teachers and students act and the fact that each of these cultures may be defined by different sets of relational rules. Teachers as well as students have to cross the borders between these cultures and hence relate to different ‘languages’ and different contextual factors. “*Culture is a boundary which we cross every time we find ourselves faced with “another” whose differences we perceive and respect.*” (Mantovani, 2000, p.87)

Wenger, in “*Communities of Practice*”, does not use the concept of culture because he finds the combination of communities and practice more useful. ‘Communities in practice’ highlights that specific institutional settings are characterized by their practices and hence the “*less tractable terms like culture, activity or structure*” (Wenger, 1998, p.72) becomes redundant. Säljö, on the other hand, is defining culture as the ideas, norms, knowledge and other recourses that we achieve through interaction with the surroundings. (Säljö, 2000)

In science education the cultural perspective has been addressed in looking at science as one form of culture that may be different than the culture in which we live our daily lives. These two cultures do not necessarily share the same norms, values and conceptual understanding. Furthermore, for most of us the knowledge and traditions we use are different in these two cultures. The consequence is that it would require crossing into the culture of science in order to achieve an understanding of the concepts of science. The concept of differences among

cultures is relative in that a culture will have to be studied in term of its own definition of the norms, values and ideas that are attached to it. Different cultures hence will be characterized by different ideologies too. Hence, the sociocultural perspective brings forward a focus on the implicit ideology of a learning culture in a specific subject area.

In this perspective of the importance of cultural diversity the teacher obviously faces the challenge of easing this transition in various degrees for different students. *“If a subculture of science generally harmonizes with a student’s life-world culture, science instruction will tend to support the student’s view of the world (‘enculturation’). On the other hand, if the subculture of science is generally at odds with a student’s life-world culture, science instruction will tend to disrupt the student’s view of the world by trying to replace it or marginalize it (‘assimilation’).”* (Aikenhead, 1996, p.5) The following discussion about sociocultural implications for this study and for the teaching of science goes deeper than the educational facilitating pointed at here. In a sense it is this crossing between cultures that comprises the necessity for the sociocultural approach and at the same time makes it so complicated. Because if our understanding is attached to the individual culture in which it is achieved and at the same time we cross borders between cultures do we acquire multiple identities and multiple knowledge bases as a consequence as well as participates in different social activity systems. We relate to different ideologies, implicitly or explicitly (Chapter 6).

The sum of these attempts at nailing the concept of culture is twofold. The first intention is to introduce some environmental and contextual factors, e.g. subcultures and culture crossing, and be able to describe this in a more varied way. The second intention is to substitute the concept of culture with concepts that work operationally like ‘communities of practice’ and corresponding implications for the specific area of science education.

2.1.3 Implications for ethnographic research on teachers

There are several implications for educational research embedded in a sociocultural view. Firstly *“we should seek to ground theories of action in empirical evidence”* (Hennessy, 1993). Secondly contextual factors have to be explicitly stated as a reference for analysis and interpretation, and thirdly relational factors like situated activity and discourse have to be

acknowledged (Greeno, 1997; Lave & Wenger, 1991). Another point is that the communicational aspects of the relation between researcher and researched have to be stated, and the conclusions limited accordingly (Säljö, 2000).

A further matter raised is the combination of this dialogical relationship with a longitudinal study in which the relationship between researcher and teacher are able to take form over some time (Engeström, 1999b). This ethnographically oriented sociocultural approach allows for enquiry about and corresponding conclusions concerning the *“practical, material generalization of novel solutions and developmental breakthroughs.”* (Ibid, p.182) Hence, in this view of cultural historical activity theory the concept of change or developments within organizations as well as the implications for the individual teacher has been introduced. As any research into schools is an intervention, the need exists for allowing for change occurring because of researcher presence or because of naturally occurring development. A developmental approach embedded in ethnographic designs may therefore address the *“contradictions of activity under scrutiny, challenge the actors to appropriate and use new conceptual tools to analyse and redesign their own practice.”* (Engeström, 2000, p.165) Contradictory dimensions later stated as dilemmas or tensions within institutional educational practices find a place within this view because *“Such a developmental ethnography of collective activity systems is particularly attuned to recording and analyzing troubles and disturbances, as well as innovative deviations from the normal scripted course of work actions.”* (Ibid, p.166) Finally then, developmental categories may be applied or generated, but they have to be dynamic of nature, meaning that the structures may be subject to change according to tests of transferability and abstraction.

This socio-cultural view of learning as identity formation has major implications for how we can view learning in educational settings such as secondary schools in the first instance and for the individual teacher in the next. Schools and institutions are relational in that all the activities of one individual exert direct or indirect influences on the other individuals. The learning and the way to know within this social world will mirror expectations and positions within the school. The formation of the identity of teachers as well as students, caretakers and principals, will be influenced by rules defined externally to the individual, but the individual's

identity will also influence the culture of the school. Within the complexity of an institution, the teacher is trapped in this ongoing 'search for identity'. The combined professional and personal identity of the teacher will be commented on in the next section¹.

The overall socio-cultural perspective on learning has implications on several levels or aspects of this project for teachers and student assessment. The specific of the school culture will also be addressed in that every teacher acts in accordance with and is influenced by the particularities of the single school. The social world of that school incorporates a set of distinct features of communication, of co-operative modes, of rules and codes that influence the teacher and that the teacher influences. In this view the teachers' task is not entirely to adjust and be socialized into the culture of the school, but to permit the construction of the individual teacher. A school is a site for the production of persons, and the persons are defined in relation to the other identities. The identity of the teacher is formed only in relation to the existence of students, and students only in relation to the existence of the identity of a teacher.

The specificity and situatedness works at two levels of fieldwork. First we need the specificity of the selected lessons to be present. Thereafter there are the specificities of the interview situations. These have been built into the comments in the research log and are probably the main contributing factors for the content of the daily logs. What was the actual situation, where we were seated, what kind of interruptions occurred did the teacher signal attitudes and do this affectively? This is build into the methodological framework. Finally, there are the chosen specificities of the cases presented. Each case is primarily a representation of a single teacher and hence has a specific significance, but at the same time the cases written in line with the theoretical framework and influenced by the attitudes and priorities of the researcher. These last two points, of methodological situatedness and representatio n in cases, require the inclusion of some comments about this ontological/epistemological perspective and the use of a Grounded theory approach in section 7.2.8.

¹ The discussion about 'profession' has embraced a professional sociological dimension in which the quantitative dimension considers teaching as a profession according to some criteria, and the qualitative dimension that does not consider teaching as a profession. In addition, this discussion has incorporated dimensions of theories of knowledge. (Summarized in Møller, 1995) I have however decided to omit this discussion from this presentation, and am hereby signaling that I am leaning towards a combination of the quantitative sociological tradition with dimensions of theories of knowledge.

2.2 ‘Didaktik’ as main perspective

The second main perspective, with implications for investigating teachers and student assessment has a substantial character, and is found in the discipline(s) of ‘didaktik’.

‘Didaktik’ or ‘didactics’ are academic disciplines that we find within academic domains, for instance in chemistry, mother tongue studies and informatics. It has, however, also been established as a sub-domain of education/pedagogy. This presentation will have to thoroughly investigate this challenge of dual existences as every definition and discussion addresses a different implication of this for theory building and for the relationship between theory building and practicing teachers. Substantial questions surrounding ‘didaktik’/‘didactics’ have been intertwined into this question of hedging the discipline(s). Hence, the discussion of the content of ‘didactics’ for each subject cannot be separated from the discussion of the discipline’s relationship to other bordering disciplines. Introducing the socio-cultural view underlines this complexity.

2.2.1 Definitions of ‘didaktik’

The first task has been to decide what term to use; didactics or didaktik. Some of the authors I will be referring to use curriculum theory in agreement with the Anglo-American tradition. Others use didactics as a translation of the German concept of ‘didaktik’, while others use the German ‘didaktik’ term within English texts. I have opted for the latter alternative in order to emphasize that it is the concept of ‘didaktik’ as originated on the European continent with its history, its content and its implications for use in education as well as research that has formed the basis of this project. The origin of the term is the old Greek word ‘didaskhein’ meaning to show something or to refer to something or maybe simply teach (Westbury, Hopmann, & Riquarts, 2000). In English the corresponding word has come to mean the science or art of instruction or education (Webster's, 2000), but may also be used in a rather conveying manner. The latter use of the term is contradictory to the way it was used by Comenius. In *Didactica Magna* ‘didaktik’ is defined as the art of teaching (Comenius, 1989, p.36). Due to the history of the two traditions of ‘didaktik’ and curriculum theory, and because they are still leading parallel lives, it is necessary to define one from the other and use the German ‘didaktik’ when referring to the philosophical traditions behind this concept (Hopmann, In progress).

Definitions of 'didaktik' have been popping up like mushrooms as a visual sign of the progressive development of the field. Some are rather short like the following two: "*Didaktik' is pedagogic reflection concerning the planning dimension.*" (Schnack, 1993, p.7) And: "*Didaktik' are questions concerning the content of 'bildung'.*" (Schnack, 2000) Looking at these definitions it becomes necessary to comment on the relationship between general didaktik, subject related didaktik and pedagogy. The first defines didaktik as a part of pedagogy, specifically the part concerned with the planning dimension of education. Secondly it has become necessary to briefly consider the term 'bildung'.

There are two main ways of looking at the relationship between didaktik and pedagogy. From the viewpoint of pedagogy we have the model that regards the subject didaktik as an integrated part of pedagogy (M. Uljens, 1997b, p.92). In this model the domains of "*general education, school education, general didactics, school didactics and subject didactics*" are used so that general education embraces all the others, while general didactics embrace school didactics that again embraces subject didactics. Hence, the interpretation of this model states that relevance of subject didactics is in accordance with existing subjects and practices in schools. The domain of subject didactics is defined as an incorporated part of the theoretical, epistemological and methodological aspects of general didactics.

One other solution to enclose subject 'didaktik' is found in a representation of the various types of knowledge of importance for work within subject 'didaktik' (Sjøberg, 2001). In this representation of examples of academic disciplines science 'didaktik' is defined as an independent academic discipline that builds on traditions taken from the natural sciences and pedagogy primary and then secondary in such sub-disciplines as the sociology of sciences, history of sciences, philosophy of sciences, curriculum theory, semiotics, educational history and sociology, comparative education and educational psychology.

The main difference, for this research project, between these two presentations of subject 'didaktik' versus other disciplines is the emphasis on the content, the processes and the history of the subject in question. The second source incorporates the specificities of the academic

disciplines of natural sciences and hence provides the frame for addressing issues like the formal subject background of the teacher, the relationship between subject and society and the ideology, epistemology and methodology of the academic discipline as relevant for instruction in schools. On the other hand, the first model addresses the complexity of present schooling that calls for an integration of various disciplines in building theories for reflecting on educational challenges. Co-operation between teachers of different subject related background, cross-curricular activities, problem based learning are just a few cues here. Therefore, the two viewpoints or solutions complement each other. When addressing teachers' actions and reflections within education and in a specific subject like the sciences we need to look at the contributing disciplines for teacher reflection, but complementarily we need to direct our attention to the communicative relational aspects of practicing the profession. In addition, they both include the important element of the theoretical framing of the practical consideration, which is at the very heart of any didaktik approach.

Returning to the presented definitions, we find the more recent one by Schnack that defines the term in relation to the German concept of 'Bildung'. The 'bildung' concept states the whole German history of educational philosophy. It originated between 1770 and 1830 as part of the enlightenment movement addressing the individual's right to a knowledge base for participation, social engagement and the fulfillment of personal potential. The original concept was rather cognitive, rational and individual. Societal, political and equality matters were not sufficiently questioned within these classical 'bildung' theories. (Klafki, 2001a) The recent development of the term 'bildung' referred to by Schnack incorporates these additional aspects, yet still addresses the general discipline of 'didaktik'. 'Bildung' is a three dimensional concept including both processes, substantial matters and products or learning results (Dale, 1992). Even within science 'bildung' is in use as this quotation from a Norwegian science educator indicates: "*Implicit in the concept of 'bildung' is the vision of an independent and autonomous human being, able to make his/her own decisions, be in control over his/her life, not willing to be manipulated, possess various knowledge and skills etc.*" (Sjøberg, 1998, p.36,

my translation) The reflective empowered human being is according to this quotation the “builted”² human being and the result of the content of the processes.

Another way of giving direct attention to the term didaktik is represented by the following definition. *‘Subject ‘didaktik’ are all **the reflections** you can attach to a **subject** and the **teaching** of the subject that can increase the knowledge about the **nature of the subject**, **legitimizing the subject** and knowledge about how the subject can **be learned, taught and developed.**’* (Lorentzen, Streitlien, Høstmark Tarrou, & Aase, 1998, p.7, my translation and emphasis) This definition can only serve as a starting point here. Looking at ‘didaktik’ within a socio-cultural view of learning implies more factors than have been included here.

‘Didaktik’ is seen as the process of reflecting about the many aspects of educational planning and execution. It incorporates the many epistemological processes mutually constituted by the dialectical relationship between comprehension seen as a communicative relational process and comprehension as an individual cognitive process. Due to the relational aspects this reflection and understanding have been defined by the institutional frames of collective norms, values and knowledge.

What is included in this definition? Firstly, it points towards two dynamic aspects of ‘didaktik’. Firstly there are the dynamics of the changed understanding of the nature of the subject (understood as academic discipline), and then there is the corresponding development of what is understood as good teaching in the subject (understood as school subject).

‘Didaktik’ is about the relationship between what constitutes the academic discipline and what constitutes the corresponding subject or subjects in schools. There is first of all a problem because the definition uses one word for the domain under study - ‘subject’, and hence it is difficult to know whether we are referring to the academic discipline or to the school subject. From several subjects’ viewpoints the need exists for considering the relationship between the academic discipline and the intended and implemented subject in schools. In the case of science, disintegration at university level contrasts with integration at the elementary school level in several countries. This has implications for teacher competencies.

² Rather archaic, but still figuratively speaking using the term ‘to build’ may be substituted for ‘bildung’.

Next, the definition investigates reflections as the main active term. According to this, 'didaktik' is a discipline that exists in order for practitioners to find tools at different levels to reflect on educational practice, but also on the subject itself. This brings us to the third point. The definition permits both normative/prescriptive and analytic/descriptive aspects of 'didaktik'. The assumed analytical aspect is found in the combination of reflection with development with necessary categories that only partly has been made explicit here in nature of the subject etc. The normative aspect is clearer in that it is in the practical teaching of the subject that the didaktik of the subject becomes relevant. The practitioner is not stated but we feel that the definition addresses the practitioner in taking the standpoint of the personal use in stating reflections as the core message. Please refer to the section about reflective practitioners.

2.2.2 'Didaktik' and curriculum theory

The two traditions of 'didaktik' have different roots, as mentioned, but have also come to embrace different issues concerning teaching and reflection on teaching. According to one analysis of the two fields the concept of 'didaktik' and 'bildung' is a wider term than the concept of curriculum theory (Fensham, 1999; Klafki, 1958). Common for the two traditions are questions about how to structure instruction and the content, that is the how and what type of questions. Likewise included are questions concerning the situations, tasks, examples, models and controversies that are appropriate for student comprehension, student application and student independence. The 'didaktik' tradition has in addition more frequently included questions about the relationship between subject/educational content and a view of the world incorporating ontological/philosophical issues such as what is the content of the subject important for in a wider sense and what are the links between the selected content and real phenomena.

The next additional question is epistemological by nature in addressing the already existing possession of experiences, knowledge and skills that is significant for the content. Moreover, the third additional question, with links to a sociological viewpoint of education, is the relevance of the content and the methods seen as a part of the competencies needed for the

future (Gundem & Hopmann, 1998). Westbury also argues that both traditions are concerned with issues or questions about methods, content, goals and the evaluation of outcome (Westbury, 1998). He claims similarly that they are “*very different intellectual system embedded in very different practical, cultural and structural contexts*” (Ibid, p.48) Curriculum theory has traditionally placed stronger emphasis on the institutional settings as defined by curricula prescribing practice. Discussions about curricula agendas (Kelly, 1999; Ross, 2000) and the origins of terms like ‘curriculum knowledge’ (Shulman, 1987) are the offspring of this emphasis. In parenthesis a small note resembling discussions has been included in the case of Norway (Bjørnsrud & Raaen, 1996; Koritzinsky, 2000).

On the other hand ‘didaktik’ texts have traditionally been more concerned with the underlying philosophy of education and the culture in which the education is embedded. These historical and present contextual factors have to a minor degree been addressed in curriculum theory. Hence one interesting conclusion is that: “*If Didaktik texts are about cultural vision, curriculum texts are about classroom minutiae.*” (Hamilton, 1998, p.81)

Current trends are moving the two traditions in the same direction. Curriculum texts like the guidelines for both Norway and Sweden contain more of the visions and historic cultural statements, but are at the same time documents used to prescribe practice as in the traditional American/British curricula. Distinctions become blurred at the level of the texts themselves. Didaktik texts and curriculum texts are subjects for interpretation within particular contexts. Parts of these processes have been implemented by reflection on the text and its relevance according to several categories like student background etc. Another important bridge between the two traditions is therefore being built by choosing reflection as the central process of ‘didaktik’ practices. Reflection is a means to implementing or realizing a didaktik text or a curriculum text. (Hamilton, 1998) (Section 3.1.) The significance of either one lies in its ability to be understood and implemented by politicians, administrators, textbook authors or teachers. Therefore their respective importance is attached to the liberation by any of these practices through the means of reflection.

2.2.3 The German ‘didaktik’ concept

Looking at the fields of didactics in the German sense we start with Comenius. The use of the three interrogatives to hedge the concept of ‘didaktik’ may be traced back to Comenius and *Didaktika Magna*. His ‘didaktik’ system is built around “what, why and how”. It embraces a view of human beings, a selection of teaching topics and methodical considerations. The unified concept of “the art of teaching” that Comenius developed has three roots, one in the tradition of rhetoric, the second in the tradition of catechisms, while the third encompasses methods. In the triangle of didaktik the first represents the teacher- content relationship, the second the teacher- student relationship and the third the student-content relationship. (Hopmann, 1997)

Comenius included the dimension of when to teach implying considerations of the maturity of the students and correspondingly necessary considerations of progression. Through the program for study and methodical ideas he also described and hence defined the different school subjects that we still see today in most curriculum planning. According to *Didaktika Magna* education at foundational level should serve two purposes: the individual ‘bildung’ and the ‘bildung’ for social participation (section 4.2.1). There are four main principles of education included in this didaktik. The content should be suited to the individual possibilities of achievement; the instruction should start by stating content targets in order for the student to consider the content within a broader view of the purposes of the teaching; the instruction should build on knowledge from the simple to the complex; the teaching should be contextual and build on and acknowledge students’ previous experiences and knowledge. In sum these aspects of his ‘didaktik’ have had an important impact on several disciplines within ‘didaktik’ during five hundred years.

Krogsmark addressed the validity of these statements about teaching in the twentieth century in the foreword to the Swedish edition. “*Didaktika Magna is a living text which foundational concepts we still need to reflect upon when attempting to develop knowledge about teaching and education. It is a text that offers present teachers and researchers a foundational starting point.*” (Comenius, 1989, p.16. my translation) On the other hand it can be argued that the universality and all-embracing didaktik of Comenius is also its major drawback. As a scholar

he is neither a philosopher, nor a theologian, nor a historian but a little bit of all of the above in stating his general ideas that a human being is not something you are born to but which you become through education, and that the ultimate goal is the acknowledgement of God's will. His eclectic attitude towards perspectives drawn from various disciplines makes him a true advocate of the interdisciplinary nature of didaktik. "*He has outlined the most complete and universal picture of upbringing both in the respect of the individual's development and bildung as well as the function of upbringing for humans and for society.*" (Grue- Sørensen, 1961, p.13, my translation.) This comprehensiveness will be substituted with paradoxes and dilemmas in section 4.1.

In the following three contributions to didaktik theory building will be presented, Klafki's critical constructive didaktik, phenomenographic didaktik and a theory about curriculum codes. These contributions are different concerning an emphasis of material matter versus an emphasis of the learner. This general fundamental didaktik consideration has its significance for the project about student assessment as it will later be theoretically scrutinized within an ideological framework looking at science education in specific (chapter 6).

2.2.4 The critical constructive didaktik

Jumping to the twentieth century, the short version of Wolfgang Klafki's theories of 'didaktik' will be presented, discussed and contrasted. There are two main reasons for making Klafki the ultimate representative of European 'didaktik'. The first is that his theory development encompasses close on a century of theories of 'bildung'. The other reason is that recent developments parallel recent development within the ontological discussions of science education. The starting point for this comparison is the duality of formal 'bildung' theories with material 'bildung' theories. The **formal** aspect emphasizes the potential of the individual student and the general 'bildung', while the **material** aspects address the significance of the content for future professional life and life challenges. The originator, Ernst Trapp (1745-1818) intended that the two aspects of the formal and the material should complement each other, but they have often been used as opposing arguments for the main principle of the selection of the content. The question of the relative weighting of the internal logic of the content on the one hand or the learning processes of the student on the other has remained one

of the important basic questions about learning processes in both general didaktik and subject didaktik. Here Klafki represents a twist towards the material part of the scale, while phenomenography represents a twist towards the formal part of the scale.

Despite of developments and extensions over a century the 'bildung' theory of Klafki stated as 5 core questions has remained. Three of these concern the relationship between the objectives of education, the context of instruction and the 'bildung' ideal. The fourth question relates to the structuring into subjects, while the fifth deals with the situations, activities and methods that serve the overall educational agenda and epistemological choices. This in total is a comprehensive system for 'didaktik' analysis. In this system the reasoning behind the education, the structuring of the content and the instructional methods should be based on contextual and sociocultural analyses of the learners and the teacher. (Hopmann, In progress)

Klafki's contribution stretches from the categorial 'bildung' theories, through the critical constructive didaktik to the recent developments in looking at the challenge of education from the societal viewpoint. There is a recurrent theme in this development in addressing new attitudes to dealing with the dilemma of the transformation of academic knowledge into educational programming based on factors external to the academic formulation arena. Firstly, categorial 'bildung' resulted from the merging of the two traditional directions of formal and material 'bildung' theories. Categorial 'bildung' is based on the mutual influence of the student on the world and the world on the student based on increased knowledge and insight. The categorial selection of content implies then that two considerations have been made. The first deals with what knowledge domain the content represents and the other consideration looks at formal challenges the content puts on the student. (Klafki, 1996) Furthermore the categorial implies the use of different rationales behind the different domains, the fundamental in the ethical and esthetical subjects, the exemplary of the natural sciences, the typical of the subject of history and social sciences, the classical of languages and the cross-subject issues of what it represents. That the natural sciences were given a rationale or a value according to a principle of the exemplary is itself an issue here that will be commented on further in next section.

Critical constructive didaktik took another important step by including the relationship between education and societal matters. The purpose contributes to a view that *“Forward looking education can and must be based on recognition of necessary link between the aptitude to perceive basic personal rights and the image of a fundamentally democratic society, a consistently liberal and social democracy.”*(Klafki, 1998, p.312) Hence ‘critical’ implies orienting the educational activities towards individual objectives like empowerment and self-determination as well as social objectives such as co-determination and solidarity. Similarly ‘constructive’ implies that the principles for selecting topics should be based on a reference to practice and increased abilities for actions and attitude. Klafki’s ‘bildung’ theory has become socio-cultural in addressing social objectives in education, relational aspects of education and schools as institutions (frame factors).

The final or present development of this strand of ‘bildung’ theories is the development into a theory of Key Problems. The common core content should be based on the global challenges defined as a part of the globalization process and the technical, economical and cultural interrelations as a part of this process. And in coordination with this the overall question for education becomes: *“ What are the epistemologies, skills and attitudes that young people need in the future, for valuable analysis and decision making when considering universal challenges and problems?”* (Klafki, 2001a, p.99, my translation) The Key Problems to be addressed in educational planning are the challenge of the duality of subjectivity versus relationship building, the possibilities and dangers of communication technology, the inequalities and multicultural perspectives of ethnic, economic, gender etc origin, world population growth in industrialized versus underdeveloped countries, environmental and ecological issues and finally the various war and peace dimensions of sociological, political, psychological and moral implications. Additional central ideas are cross-curricular competencies like communication and co-operative skills, conflict solving skills, presentation skills, empathy skills and thinking skills, e.g. reasoning, evaluating, synthesizing. Consequently, problem based teaching activities such as projects should be the heart of the instruction combined with action orientation and exemplary learning. It is important to mention that basic knowledge and instrumental learning have also been included in the overall ‘bildung’ concept from which these key problems has been deduced. Likewise included are all

the other competencies, interests and skills that are of both personal and public importance. (Klafki, 1996, 1997, 1998, 2001a)(Klafki, 2001b)

Of the two formal and material bildung theories, Klafki's has been moved in the direction of material theories. The classical concept embedded in formal bildung theories has not been abandoned, but the material bildung concept has been emphasized during the societal demands put on education. The present development is in sum socio-political. "*Questions about 'bildung' are questions about society*" (Klafki, 2001a, p.66, my translation). The focus of the analysis of the overall objectives of education, the domains of knowledge to be included and the preferred teaching activities are the requirements of society, the future competencies of work and the competencies for personal empowerment required for meeting all these challenges. The internal logic of the academic subject has an inferior contribution in comparison to the logic based on the demands of the global and local society as well as the utilization of knowledge in work and life. It is therefore cultural societal reflection that decides the content, the structuring and the methods.

A criticism has been raised against Klafki for not making the teacher the central actor in 'didaktik' planning and execution. Teacher identity, from this perspective of 'didaktik', is first of all attached to his/her choice of teaching methods. In this perspective the teacher becomes the implementer of visions and intentions stated by the public. It is to a great extent the didaktik of the intentional planning in contrast to two other options, either a 'didaktik' of the teacher or a 'didaktik' of the learner (reform pedagogy). This again is due to the developments within 'didaktik' as a discipline. It is slowly growing analytical perspectives and theoretical framing that consequently make it less easily accessible for the teachers (Hopmann, In progress). Reform pedagogy was responsible for the learning psychology turn of didaktik, while Klafki represents the educational philosophical continuation of German didaktik. Reform pedagogy's foremost concern is the abilities of the learner and hence addresses epistemological issues and the corresponding positioning of the teacher (3.2). Both of the development strands moved didaktik away from the teacher. Other recent developments have incorporated teacher perspectives by including normative 'didaktik' elements. (Englund, 1997; Jank & Meyer, 1997)

In the curriculum theory tradition Schwab, with his “*Science, curriculum and liberal education*”, emphasizes the teacher identity in a way that complements the position taken by Klafki. He also stresses the objectives of the empowerment of students, and presents a view on curriculum based on the practical field and on a progressive teacher identity. (Schwab, 1978) I will return to this in chapter 3.

Because of the material twist this sum of Klafki’s ideas of bildung for the future will be contrasted with a major emphasis on the formal aspects and a minor emphasis on the material aspects, or rather another combination of formal and material theories, by employing the ideas of bildung based on ‘bildung’ theory. In categorial ‘bildung’ the basic unit of analysis is the phenomenon (and in a societal value of the phenomenon), while in the phenomenography the unit of analysis is the persons comprehension of the phenomenon.

2.2.5 The didaktik within the phenomenographic tradition

The basic idea behind phenomenography is that different people have different ways of looking at a phenomenon. There is, however, a different limited qualitative perception of the same phenomenon, and this fact makes an inquiry possible (Marton, 1989, 1997). This didaktik approach is based on a view of knowledge in which knowledge is seen as a consequence of the relationship between the single human and the phenomenon. The inquiry into possible perceptions of humans resulting in some defined categories does have implications for educational planning and for the teaching of the phenomena. Hence this approach to didaktik is a formal one stating a specific view of the learner as the focal point. (Booth, 1992) Phenomenographic research has an ambition of being used for curricula planning, and educational implications are therefore a part of the most frequently used research designs. The preferred position of one of the originators is that “*Educational research is becoming relevant to educational practice. In recent years, different understandings of many content domains have been depicted, and this research is highly relevant to educational practice.*” (Marton, 1989, p.1) But it is further stated that in order for this to happen the research will have to address the limitations of the single phenomenon and the kind of students that are included in the survey. The claim from “*Didaktika Magna*” to “*Learn everybody*

everything” is debated within phenomenography, and their claim is not “*to have found the stone of the wise*”. Instead they do claim that “*by studying how the learners think about some phenomenon we will be better equipped in our teaching about the phenomena*” (Marton, 1997, p.114, my translation). The goal of the approach is then to understand and apply this understanding in instruction in accordance with “*A skills structure refers to the qualities of performing a task that are necessary to arrive at a certain outcome as well as the relationships between these qualities.*” (Ibid, p.20) Furthermore, theoretical and purposive sampling procedures, semi structured interviews, researcher interpretation and sensitivity and ecological validity are research techniques similar to Grounded theory (See chapter 7).

2.2.6 Curriculum codes as didaktik approach

Ulf P. Lundgren has clarified the different roots of curriculum planning or emphasis found during different historic periods (Lundgren, 1979). This corresponds in part to the dualism described above, but it also addresses other ‘didaktik’ issues. The classical curriculum code, from the Greek until the eighteenth century, was concerned with education based on the key idea that ‘bildung’ should deal with the basic classical ideals of the formation of western civilization. The next period is the realistic curriculum code until 1900 that was basically concerned with the general importance and applicability of theoretical empirical and scientific knowledge for building a society. The third curriculum code, the moral code, is however based on the idea that education should primarily address the topics and emphasis that are important for individual growth, understood to be reading and writing, combined with the individual’s possibility of building society and its corresponding norms. The educational curriculum agenda developed into a rationalistic curriculum code under the influence of pragmatism, individualism and rationalism. This final code is then a combination of the other three and we may regard the swinging pendulum for each topic as a consequence of the different weighting of the three codes. “*The rational curriculum code focusing on the individual became functional because of a growing comprehensive educational system for the lower grades and a growing differentiation for the upper grades.*” (Lundgren, 1979, p.101, my translation)

The rational curriculum code had then the ability to work as rationale and reasoning behind specialization as well as general bildung. This combined code is however not static, but highly

flexible- it is a code used to describe and analyze the negotiations embedded in curriculum development and curriculum implementation. Developing curriculum understanding like this have two major aspects. The first and minor in this project is the necessity at an intended level of negotiating curriculum content and raising societal, political issues due to the increasing number of students attending institutionalized educational programs (Hopmann, In progress). The other aspect covers the various emphases, during formulation and implementation, that may be put on a rationale which places academic content at the center, a rationale that places the learner at the center or a rationale that places society's needs at the center.

“In every education there are apparently two parallel processes running, to learn what is worth learning and to learn the social value of this knowledge.” (Lundgren, 1979, p.18, my translation)

This duality of academic contra principles for selecting content and for selecting teaching principles has also been addressed within the next domain to be presented, the field of science education. Frequent return visits will be made to this overarching phenomenon of 'didaktik'. The development of subject related didaktik became an important field due to the possibilities of addressing all issues related to the combination of the content with methodical considerations, student and teacher background. This has brought new life to the field of didaktik since the 60's. Subject related didaktik is bringing the discipline of didaktik back to the teacher and the learner. Subject didaktik enables the strengths of the formal psychological turn in reform-pedagogy to be combined with the strengths of the material philosophical twist of German didaktik. The possibility of combination within subject related didaktik is due to the practical concerns that are addressed therein. The didaktik of the single subject exists as a consequence of and due to another duality, the duality of theoretical reflection and practical application.

Didaktik is the sub-discipline investigating different emphasis and corresponding positions that can be taken within the basic triangle of subject matter, learner and teacher. This positioning is present in all educational planning and practices including student assessment. Accordingly, I will use the principal dualism of material versus formal theories in developing

an ideological approach into investigating teacher positioning concerning student assessment in the following part II. Critical constructive didaktik and phenomenography as presented here carry two different solutions to theoretical framing of positioning within this triangle.

Therefore, I will claim that they may co-exist in educational practices. The third contribution is also addressing this duality but in an historic analysis. I will in the forthcoming chapters argue for a multifold didaktik analytical framework in order to investigate the diversity and complexity of student assessment purposes. This complexity is represented in the ideological framing of science didaktik considerations in chapter 6. In order to reach this point a short presentation of relevant perspectives within the sub-discipline of science education is necessary.

2.2.7 Science education

After presenting the broader perspective of general didaktik it is time to concentrate on the didaktik discipline in question for the purposes of this research project. Science didaktik is referred to as science education in most sources. This has become the official label implicitly implying the independence of both the roots of German ‘didaktik’ and Anglo-American curriculum theory. To a large extent the field of science education has intentionally been using this label in order to define the area, but at the same time ‘bildung’ in a specific science context as well as in a more general use has also been incorporated. Science education has come to embrace not only questions of legitimizing the content and processes of the subject itself, but also science as a part of the overall purpose of education (Sjøberg, 1998; Ødegaard, 2001). Here, however, stating the hedging of science education is the focus. A second focus becomes important, namely considering the hedging of science education in light of a socio-cultural perspective. Both of these focuses will be running in parallel.

“The foundational questions in subject ‘didaktik’ are: What? Why? How? For whom?”

(Sjøberg, 1998, my translation) Furthermore in this statement lie questions concerning the development of the school subject itself, what are legitimate reasons for including the subject, particularities such as academic discipline, specific concepts and processes of the subject, implicit norms and values, the single subject in light of the different objectives for schooling in general, facilitating for learning – all examples of questions to be raised in science

education. The socio-cultural message comes through in the following quotation: “*Every discussion about the content of schooling has to be situated in a particular connection or context, whether social, cultural, historic, linguistic, national etc. The answers to questions about objectives, meaning and content will consequently be different in different countries.*” (Ibid, p.33, my translation)

Another way of viewing the discipline of science education is to look at the topics presented in books, in journals, in conferences and all other arenas where scholars convene to discuss issues that relate to the overall definition of subject related ‘didaktik’.

Here are a few examples of topics that signal recent developments in science education. The importance of students’ and teachers’ worldview in general, and as preconditions for learning and teaching, have been addressed (Cobern, 1996; Holton, 1992). Students increasing possibilities for learning science by regarding scientific knowledge as a subculture they may visit by border crossing from their own world is a further topic (Aikenhead, 1996; Ødegaard, 2001). Yet another that I will be returning to in greater detail is the importance of implicit ideologies in textbooks, in curricula and as a part of personal luggage (Fensham, 1999; Knain, 1999). Recent studies have also considered science knowledge as a contributing factor for participating in societal decision making processes or how to deal with the teaching of sciences when including political and ethical empowerment and purposes (Kolstø, 2001; Östman, 1995). Among other issues we can find situated cognition (Hennessy, 1993), ethical consideration (Fullick & Ratcliffe, 1996; Reiss, 1999), the universality and multicultural challenge of science (Harding, 1994), communication as a determining factor for understanding and applying scientific reasoning (Jakobsson, 2001; Schoultz, 2000), and the nature of human activity as a prerequisite for the development of sciences (Fensham, 1999). A final point, and one that I will be returning to, relates to the mutual reflections of the two fields of science education and general ‘didaktik’ (Knain, 1999; Sjøberg, 2001; Östman, 1995).

All these examples, or rather the sum of them, represent a turn within science education, a turn from the constructivist (Solomon, 1994) to sociopolitical approach of a “*sociopolitical framework for science education*” (Fensham, 1988, 1999). This sociopolitical framework has included several of the issues mentioned above. In addition, it is worth mentioning the

incorporation of the sociolinguistic turn of language skills as a determining factor for scientific reasoning and learning. *“What is needed is a boot-strap approach using science to introduce pupils to higher language skills which in turn could be used for better science education.”* (Kulkarni, 1988). Some main ideas can be traced as implications of science on society, implications of the universality of scientific concepts, implications due to the western imperialism of scientific processes and products and the significant impact of political and economic factors on all education including the natural sciences. Within this framework a science class as a part of a school system is influenced by a number of factors external to the traditional science communities and external to the emphasis on traditional science education. The boundaries between the communities of science teachers and researchers have (or maybe should) opened up, and the horizons have been extended beyond the combination of theories of individual cognition (constructivism) and natural sciences as a closed system. That is why this approach is represented here. It has a slightly different nature than the socio-cultural approach to learning but states some of the same factors as being important. A later development of this approach has been a project analyzing the social/societal challenges of the students basing the content and activities on this analysis. This “Four-city” project employs a socio-pragmatic angle to look at the challenges of humans living in the four cities. (Fensham, 2001)

The label of science, technology and society (STS) has embraced issues ranging from teaching practices to philosophy of the sciences (Solomon & Aikenhead, 1994). Curriculum planning, educational programming and teaching methods have been reviewed under this movement(s). The effect has been felt both in class room and laboratory activities (as changed under the influence of the movement), but most of all it has been opening up teaching to contacts with working places, environmental organizations and so on. The movement has in large been a bottom-up approach to renewing teaching in sciences.

In addition to the practical educational aspects of the approach, a renewal of epistemological nature and of philosophical nature has been the consequence of the STS movements. The heart of it is close to the sociopolitical already mentioned. The overall philosophical agenda of the science, technology and society approach to science education seems to have become an

attempt at reconvening the “*two cultures*” (Snow, 1993), and bringing the values of the non-science culture in contact with the values of the science culture. It is explicitly stated as being concerned with citizen participation and citizen actions and incorporates consequently the relationship between attitudes and actions. Just as much as a societal agenda there is also the agenda of gender issues in combination with empowerment issues. Another frequently addressed issue is the importance of cultural diversity not only for education but also for intercultural contact.

There are two main issues embedded in the movements mentioned above. The first one is epistemological in nature. The other one is ontological. The worldview has changed as a part of renewed understanding of the necessity for incorporating and acknowledging concepts and epistemology from social sciences and humanities into scientific development and science teaching as application of this. The attempt has been looking at ways of dealing with increased insight into learning as relational but individual, personal but social, factual but progressive, universal but situated, related to products but also processes, institutional but societal within science education. I will be returning to this in detail under the heading “Ideologies in science education” (Chapter 6). In this chapter the didaktik approach will be elaborated as an analytical approach for interpreting the subject didaktik position of the teacher specifically concerning student assessment.

2.3 ‘Didaktik’ within socio-cultural epistemology

The didaktik concept from a socio-cultural epistemological position will have to be relational and address the various aspects and importance of culture and context. This will be the starting point rather than the more universal keywords of ‘what, how and why’. The socio-cultural point is that of making the relational and communicative aspects of teaching as well as contextual factors the primary one in the analysis of educational programming. Secondary in this analysis is consequently the relevance of the content, the educational activities and the reasoning behind the selected combination of content and processes. The next difficult issue is then how we limit the topics that should find their place within the ‘didaktik’ research paradigm. As there are a number of sources we limit them to the how, why and what questions. Comenius included a ‘when’ in his concept of ‘didaktik’ (Comenius, 1989). Recent

sources have included questions of where and who. (Afdal, Haakedal, & Leganger-Krogstad, 1997)

Looking at the definition from a socio-cultural angle there are some aspects that are lacking or not stated. As an attempt to incorporate socio-cultural aspects in the definition of the **hedging** of 'didaktik' the list was extended from the previously stated definitions to encompass the following list of themes that should be acknowledged/definition for practices. According to this, 'didaktik' theory has to be able to incorporate intentionality, student-teacher interaction, cultural content, content and methods, which in even greater detail incorporates who is to learn, what is to be learned, when to learn, with whom to learn, where to learn, how to learn, why learn, by what means does one learn and for what reasons does one learn. (Jank & Meyer, 1997; M. Uljens, 1997b) The eagerness to widen the boundaries of moments to take 'didaktik' reasoning into consideration has had a dual effect. As analytical categories of practices, it has a message to give to teachers and researchers alike. Concerning the hedging of disciplines, on the other hand, the mutual constitution of disciplines becomes blurred. Yet more important is the commitment to an epistemological basis. It is therefore tempting to conclude in harmony with the following: *"Even if teaching is logically independent of learning, teaching practices always intend to influence learning. This intentionality has to do with teachers' reflection on how they could facilitate the study process in order to affect learning. As a theory of didactics is assumed to be an instrument in teachers' pedagogical reflection, this theory must be explicit concerning what role learning theory has in the theory of didactics."* (M. Uljens, 1997b, p.43)

Another aspect of the discussion of didaktik is the content of the general 'bildung' concept. A socio-cultural definition of the content could be long the lines of Klafki's when he states that there are three significant meanings attached to the concept. The first is connected to the equality issue; education should provide possibilities for all citizens to be 'built'. Secondly they should be 'built' according to content frames set by the public in principles of consensus. Thirdly, 'bildung' should be concerned with all dimensions of human interests and capacities. In this view individual 'bildung' is connected to the possibilities of democratic participation and solidarity. (Klafki, 2001a)

Others have called attention to the ongoing shift from a structural to a post-structural perspective within didaktik research (Englund, 1998b; Säljö, 2000; Östman, 1995). They see this as a shift away from a perspective of opening up the previously defined borders of didaktik (set by an internal logic) in order to include and look at the development of content and curriculum from a citizenship sociological viewpoint. Here curriculum questions imply ethical and political considerations from a societal perspective in addition to the relationship between the academic disciplines and the school subject and other historical and social factors that have been forming the definition of the content. They think of this approach as “*an attempt to rethink teaching as a moral act while at the same time conceptualizing schooling as part of the process of creating a public, a public identity and of creating citizens.*” (Englund, 1998b, p.217)

In the following quotation Delta addresses the importance of always being aware of the context in which responses are given. This quotation hereby brings the situated nature of educational assessment in contact with the presented view on sociocultural didaktik. Delta is here the appetizer for what is to come in part II.

Delta: *“If the children are not able to use the knowledge in a context... that means to me that the testing of knowledge has to be through a dialogue. It does not work with the monologue that a test represents... because you do not have any possibilities to adjust your feedback. And you are made unable to deepen statements according to the recipient. So if they do a test, there is a cold recipient. And they know that. So there are cold facts, cold form and there is no life.” (21.5.01)*

Delta: *“It is not the interaction in the classroom itself that is important, but the triggering of personal reflection.” (5.12.00)*

Delta: *“To reflect upon one’s own practices is for the few. What is sad is that it often happens in connection with failures... that you reflect. In other periods we are storming forward. Everything is fine.” (4.4.01)*

3 The reflective teacher identity

The identity of the teacher and the reflective practitioner are two central concepts in this chapter. According to the two quotations, Delta is concerned with the dimension of reflection as part of his teacher identity. He is concerned with classroom interaction as a basis for personal reflection, and his worry is that reflective practices are rare among teachers. Reflection occurs in situations of dissatisfaction.

It is the individual teacher that is focused in the fieldwork of this project. The methodology of the fieldwork involves reflective discourses. The substantial analysis will also dwell on the reflections of the teachers. This chapter thus serves the dual purposes of defining the methodological and substantial background concerning reflective practices and identity. The concepts of identity and reflection have separate traditions, and these will be presented. Thereafter identity and reflection will be merged within the socio-cultural view on learning as a collective practice. These theoretical main perspectives have a significant impact on the teacher when seen in relation to the learner and fellow teachers as well as the identity of the individual teacher. The outlined concept of ‘didaktik’ serves to frame possible ways for the teacher to interpret her/his identity and hence the content of the identity of the reflective teacher.

As its starting point the chapter takes a view of the teacher, in which he or she is seen as a continuous learner of a profession. The first step will be to discuss the concepts of identity in general, then of teacher identity and finally of the identity of the reflective teacher (3.1. and 3.2.). These discussions will be succeeded by a section presenting approaches to teacher competencies (3.3.). Here the viewpoint is the ‘didaktik’ approach and the intention is to address the content of the reflective practices. The last section in the chapter will summarize

the view of the teaching profession that forms the background for this project (3.5.). This last section will also serve as a bridge to part II in which student assessment dilemmas will be presented first, and, following from the relational nature of the fieldwork, epistemological and ideological aspects of assessment presented second.

3.1 Teacher identity

Professional development among teachers has been considered from a multitude of perspectives. The multi-faceted identities of the teachers are reflected in the multi-faceted research into teachers. I will start by highlighting definitions of identity, thereafter teacher identity and then dwell on the different traditions of research into the reflective practices of teachers.

3.1.1 Identity concept.

In the tradition set by sociology 'identity' refers to two forms related to each other, but according to symbolic interactionism they are analytically distinct. "*Social identity refers to the characteristics that are attributed to an individual by others.*" "*Self-identity refers to the process of self-development which we formulate a unique sense of ourselves and our relationship to the world around us.*" (Giddens, 2001, p.29)

Ideally however, we are humans with integrated personalities. Teachers as humans have numerous tasks both professionally and in other areas of their lives, but we consider self-identity as one comprehensive concept. Self-identity is a non-static concept. Under changing circumstances individuals have the ability to change aspects of their identity under the influence of increased knowledge and training and under the impact of social organizations and alternating professional mandates.

As a consequence of this view self-identity is not seen as given, but in constant creation. This view requires an active reflective awareness of the individual. "*It is the self as reflexively understood by the person in terms of her or his biography*" (Giddens, 1991, p.53) that forms the basis for the individual ontological understanding of oneself. Therefore "*A person's identity is not to be found in behaviour, nor – important though this is- in the reactions of*

others, but in the capacity to keep a particular narrative going” (Ibid, p.54). According to this position the actions we take and the reactions from the circumstances are important factors for how we relate, understand and define our identity. However, the self-identity analytically is connected to the person’s verbalization of his/her factors that constitute teacher identity. We may therefore contextually comprehend the information and use teaching situations to frame the topics raised, but the primary source analytically will have to be the statements of the teacher. The teachers must “*continually integrate events which occur in the external world, and sort them into the ongoing ‘story’ about the self*” (Ibid, p.54). The individual perception of identity is ontological due to the ability to master challenges whether personal or collective by nature being based on our self-perception. Existential bases for identity formation has been divided into four basic parameters of an acceptance of the reality of things, of being from nature but a human by the means of reflective reasoning, the interpretation of the other individuals and the persistent feeling of personhood.

3.1.2 Identity in sociocultural theories.

The sociocultural view of knowledge formation embraces an identity concept that emphasizes the interdependence of learning and individuals, and hence the subject is not distinct from the objective world. Within this ontological position social identity is reflected in self-identity and vice versa. According to the view of the identity of a person held by Lave and Wenger, ‘self’ and ‘the world’ are mutually dependent on each other, but self is not totally absorbed by the social world (Lave & Wenger, 1991). Identity is in this tradition “*a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities*” (Wenger, 1998, p.5). There are four dimensions to learning, learning as doing (practice), learning as experience (meaning), learning as belonging (community) and finally learning as becoming which is the identity. There is a slight difference between how identity is viewed in these two main perspectives represented by Giddens’ sociological approach and by Wenger’s sociocultural approach.

The sociocultural view on learning as a cooperative enterprise has resulted in an identity concept which includes an integrated view of the person, the identity and learning. This identity concept builds on a duality of work related processes labeled identification and

negotiability. Basically the identification aspect has to do with the investment made in the self but seen in relation to co-operative factors such as association and differentiation, while negotiability is the work invested in the relationships that enable us to master and control our investments. The following definitions of identification and negotiability have resulted in a 'social ecology of identity' (Wenger, 1998). The work of identification "*is about focusing social energy, inclusion and exclusion, commitment, affinity, differentiation, allegiance, solidarity, togetherness, stereotypes, paradigmatic trajectories, trust, shared histories, forgiveness, defining boundaries, acceptance, inspiration, stories of identity, and so on.*" (Ibid, p.210) Identification is subjective and collective yet static and dynamic at the same time. The work of negotiability likewise concerns "*opening access to information, listening to other perspectives, explaining the reason why, making organizational policies and processes more transparent, seeking control, inviting contributions, defining individual rights, centralizing or distributing authority, negotiating and enforcing shared standards, opening decision processes, argumentation, sharing responsibilities, confrontation, voting, challenging boundaries, and so forth.*" (Ibid, p.210) Negotiability is both defined according to the social structures that we formally or informally belong to, but also to the meanings that we attach to these memberships. Identification is connected to the form of membership we have within a group, while negotiability is connected to the meaning we attach to this membership and hence the degree to which we have ownership of the social structures.

There is a constant interplay between the two processes. Both identification work and negotiability work can be characterized as either participatory or non-participatory. Identity formation is work done in relation to participation, whether it is in active cooperation or not. The relational dimension is, regardless of the degree of active involvement, a major factor in how we form our identity. The choice of participation versus non-participation impacts on how we position and perceive ourselves as colleagues and members of a faculty, but it also has a major impact on the perceptions we have of ourselves. This relational character of the identity concept, in relation or out of relation, makes the socio-cultural view on identity formation distinctly different from the previously presented view of identity. Both identification and negotiation possess subjective as well as collective aspects. This duality no longer represents the internal mechanisms of the 'self' versus the external mechanisms of the

social world, but a duality of the meanings that we attach to the various processes we are involved in.

The metaphorical terminology of the following quotation serves well in summarizing the duality that I will use as a tool for creating the texts about the teachers as well as for visualizing the interconnectedness: *“Identification gives us material to assert our identities; negotiability enables us to use this material to assert our identities as productive of meaning; and we weave these two threads into the social fabric of our identities.”*(Wenger, 1998, p.208)

3.1.3 The teacher identity within a sociocultural epistemology

The ‘social ecology concept’ of identity has become important when working with and analyzing the teachers individually due to the overall relational character of their educational practices. According to Wenger in his most recent book the identity concept has six basic constituents (Ibid, p.211). They are: Dimensions of practice as dimensions of identity, relations of participations versus non-participation, modes of belonging - providing for various forms of social configurations at various levels of aggregation, dual processes of identity formation – identification and negotiability, dual aspects of social structure – communities and economies of meaning, and dual aspects of social status – membership and ownership of meaning.

In total this means that the teachers are both socially constructed yet are also located in analytically distinct categories. In short, teacher identity according to the socio-cultural perspective means that its formation depends on learning to become a teacher. The teaching profession is not something you are born into or become formally qualified for through certification procedures and formal teacher training. A teacher’s identity is something you are constantly becoming as a part of forming your teacher identity in relationship to students and other teachers.

The formation of teacher identity formation comes with practice. The certification processes are institutional formalization processes connected to societal control mechanisms, but not necessarily to the process of identity formation. Of course, becoming a teacher and forming

your identity as a teacher can start during teacher education or even before. Becoming a teacher starts, as a formation process, when you are first exposed to supervision by parents and teachers and when you start thinking about the mutual constitutive elements of these identities of teacher and learner.

This concept gives us a tool for viewing teacher identity as the product of dual functions because it has been applied to the teaching profession. The identity of the teacher will accordingly be in constant development and under the ongoing influence of the practices he or she is involved in. Identity consciousness is related to awareness of the identification and negotiation work being done. The dual processes of identity formation are not dependent on this awareness. Making them explicit and visible is however a prerequisite for active reflection on the importance of learning and acting individually as well as collectively and being able to make the desired changes. The teacher's identity is formed as a consequence of whether the teacher actively participates and defines him/her as important for building the collective structures and their content within the organization of a school. The contrary may also be true - the teacher decides to stand outside of the relational aspects and hence does not directly influence the institutional agenda. Both positions will have an impact on the way the teacher interprets his/her identity as a teacher (and it will influence the way others view him as a teacher). In the terminology presented this means the teacher will through identification work chose a form of membership through identification work and correspondingly through negotiability work chose the ownership of meaning within the social structures that a school can be for him/her.

Another strand of sociocultural perspective, the activity theory puts it this way. *“The assumption that identity development is more than a dialectic between ontogeny and phylogeny is crucial to this argument: It is a triadic interaction in which ontogenetic and phylogenetic influences are constantly refracted and reconstructed through and in socioculturally mediated joint interaction.”* (Carpay & Van Oers, 1999, p.305) From the sociological position this coincides with the view of identity formation as an ongoing fundamental process influenced by traditions and culture which may read as educational historical factors and the internal and external culture of a school. *“Tradition hence is a*

medium of identity. Whether personal or collective, identity presumes meaning; but it also presumes the constant process of recapitulation and reinterpretation noted earlier. Identity is the creation of constancy over time, that very bringing of the past into conjunction with an anticipated future. In all societies the maintenance of personal identity, and its connection to wider social identities, is a prime requisite of ontological security.” (Beck, Giddens, & Lash, 1994, p.80)

Sociocultural view on learning and identity formation points to a view of teacher identity where learning within the social world of the school is a major factor for the identity as teachers. Lave and Wenger’s approach to identity can be traced to Vygotskij. (Lave & Wenger, 1991; Wenger, 1998) Teacher identity within the Vygotskij tradition requires competencies like knowledge about the psychology of the individual and a previous understanding of every student; the social dynamics characterized by educational settings and familiarity with pedagogical tools that may ease the mediation and internalization processes (Bråten, 1998). The sociocultural view has also brought about the reintroduction of the term apprentice – master relationship used rather metaphorically and synonymously for a teacher – student relationship (Lave & Wenger, 1991; Säljö, 2000). Facilitated learning is seen as processes mediated by the more skilled and experienced for the benefit for the less skilled and experienced and implies some form of statement about authority, about differences in social expectations and different tasks in the institutional setting. The autonomous teacher in this view is not the totally independent teacher, but rather the teacher whose identity is formed in relational situations, who takes on the challenges of co-operation and deals with the institutional mandates as well as participates in their formulation. The socio-cultural teacher ideally is aware of the significance of his/her school culture, the culture of the subject, identity formation and the relational factors of education and reflects continually on its importance for forming his/her identity as teacher. This view of the teacher will be discussed in this section. The term ‘reflective practitioner’ has been deduced from this view of the teacher.

There is also a direct line from identity, through reflection, relational factors and institutional settings and arriving at an overall view on student assessment. Hereby the focus has been changed from the overarching epistemological and ontological main perspective to the next

issue of dealing with the teacher as the learner. *“Possibly the single most important variable is the individual personality of the teacher”* (Barrow, 1984, p.26). This view is supported by the individual experiences we all carry with us that influence our judgments of the ability of others and our self to perform as teachers. This highly relevant, but less researchable claim states that acting as a teacher involves the whole personality of the teacher. The teacher acts as an integrated person with an amalgam of skills, experiences, and attitudes, affective and cognitive abilities obtained in a number of contexts, in relation to different people or in solitude and through the different stages of life. Reducing teaching or the teacher to a limited number of areas of skills is on the one hand equivalent to committing an act of violence on the respected complex life of teaching. However, on the other hand defining some areas of skills or competencies is important for making the act of teaching and the identity of the teacher manageable analytically. It may very well be that the claim that *“personality, character and commitment are as important as the specific knowledge and skills that are used in the day –to-day tasks of teaching”* (Ibid, p.27) is valid, but we still have to argue for specific knowledge domains in order to increase our understanding of how these domains might contribute to educational programming both in teacher training and secondary education. For all the participating teachers and reading teachers I will simultaneously say that I do this with the uttermost respect for the understanding of the complexity of the real teaching you communicate, which in most cases is superior to the reconstruction based on a mere analytic understanding of what theoretically is achievable.

3.1.4 Teacher identity in a structural view

We still need to draw attention to the specific competencies that are required for meaningful professional teacher development. At this juncture the sociocultural reflective teacher identity is challenged by a structural necessity of formulating specific competencies. Barrow (1994) suggested four areas that would together increase the autonomy of the teaching profession in a structural tradition. Implicit in these areas is the principal view of the teacher as the reflective and active participant in the creation of a learning educational environment. Firstly, he mentions the ability to participate in discussions about different educational agendas of education, the present and future purposes of education. He highlights the philosophy of education. Thereafter, as a second point, issues concerning areas of specialization or subject

are raised. The importance here is to reflect on the content of the subject, the reasons for including it in educational programs at any level and how the subject ought to be presented to the students. All in all, this represents the classical view of 'didaktik'. To this subject related content knowledge has been added the aspect of reflecting on individual subjects in light of what they represent in combination with or in relation to all the other subjects in a student's education. Individual subjects have a relevance of their own, but at the same time they are relevant in accordance with educational philosophy as a whole. This represents the general 'didaktik' competence of the teacher. Barrow's third point is that the teacher should have a thorough understanding of the multifaceted aspects of learning that are valid across subjects. This represents the epistemological reasoning of the teacher. Fourthly the dilemmas of student assessment are underlined as an area of particular importance for teachers in that they "*need to consider, not rules and mechanisms for assessment and evaluation, but the nature of assessment, the problems of assessment, and the different requirements in terms of assessment that different activities may lead to*" (Barrow, 1984, p.268).

These four areas of the philosophy of education, the combination of subject related 'didaktik' and general 'didaktik', epistemology and the dilemmas of student assessment represent the sum total of the armor necessary for making sound judgments concerning daily educational activities as well for evaluating curriculum proposals and other educational reforms. Integral to these competencies is the advocacy for a problem based teacher education as a combined theoretical -practical approach involving in-service education, linked to specific classroom experiences and teacher participation as the respondents to particular research topics. In the discussion of centralized standard setting versus teacher autonomy the position defended here is that of a bottom-up approach. In line with a number of others the author is arguing for teacher driven developmental processes (Goodlad, 1979; Schwab, 1978; Skilbeck, 1976; Stenhouse, 1975).

This coincides with the principal point of this project. The teacher is the single most important factor, but only if teaching is considered to be a learning profession. This argument has increased its validity as a contradiction to the implicitly expected teacher identity that has resulted from the increased number of countries developing national curricula reforms. The

next generation of argumentation within this educational landscape hence still lends attention to the importance of not regarding teachers as solely implementers, but as creators of educational programs through defining their own identity as humans and as teachers (Darling-Hammond & Sykes, 1999; Day, Fernandez, Hauge, & Møller, 2000; I. Goodson, 1988; I. F. Goodson, 2000; Kelly, 1999; Ross, 2000).

In conclusion, of this section the identity concept I will be working with analytically will primarily focus on the self-identity form. Hence, it is the individual identity as defined by the teacher that has been the focus of the fieldwork and the development of the framework for interpreting the teacher statements. The information is based on the teachers' own perspective in the way they define the importance of the interaction with society, with other teachers, students and so on. The environment is an important factor in shaping teacher identity, but the fieldwork and the analysis will be based on the teacher perception of these factors. The unit of analysis is deciding the extent to which the relational aspects of identity formation are focused on. Comparisons to identity social roles are static, regarded as facts and therefore not changeable with regard to knowledge foundations, experiences and changing circumstances.

3.2 The reflective teacher identity

Research into teacher reflection has embraced a number of substantial focuses, research methodologies and implicit perspectives on learning and teaching ideologies. The nature of reflection and the relationship between reflection and action are key issues in the internal and external discussions about teacher thinking. Zeichner made this a topic for a keynote address that was later published, and he outlined five research focuses within this tradition in United States of America (Zeichner, 1994). The first is an 'academic tradition' in which subject matter knowledge is promoted as a means of increasing educational quality (Shulman, 1987). Next, the 'social-efficiency tradition' emphasizes the construction and implementation of teacher education curricula based on the study of various other teachers (Driver, 1994; Driver, Leach, Millar, & Scott, 1996). The focus in the third tradition is the learner, the developmental growth of the student and reflection as a means of increasing knowledge and skills. In the 'social-reconstructionist tradition' reflection is viewed as a way to deliberate over the teacher by addressing the social and political implications of teaching (Carr & Kemmis, 1986). The

final tradition, the 'generic', emphasizes reflection for the sake of reflection without giving it a value according to the substance, the intentions defined by others or any other reference point outside the teacher.³

According to the author, a common tendency in all these traditions is their descriptive nature. This is a result of the tendency towards a dichotomy between research and teacher practice. Recent research has questioned this dichotomy. Research is in itself a practice involving implementing intentions and hence resembles educational practice. Teacher research is therefore a meeting point between two practices represented by two languages. A joint agenda in the fields of research and educational practices is preferred. The traditions are different due to the substantial focus, but they also differ in how they address the teacher's identity. In the final two traditions, teachers are seen as active participants in forming their own teaching agenda, the culture of teaching and the societal implications of teaching, while in the previous three the teachers are merely subjects for studying. The final tradition presented (the 'generic') is interesting due to its links to the German 'didaktik' tradition, because here we see the growing focus on philosophical and ideological issues deeply rooted in teacher research without linking the research to the teacher's mandate within the educational system. However, just as much as the traditions take different standpoints on a teacher's participation in research and corresponding views on teacher autonomy, these traditions also promote different concepts of reflection.

The perspectives presented here are therefore by no means exhaustive, yet they do emphasize the current trends in teacher education research. The natural starting point is the concept of reflection. What does it mean to be reflective? What are the adjacent connotations of being reflective as a professional? Reflection is a continuous process, but also based on some content. We reflect within frames set by experiences and by knowledge. This is closely related to the competences needed for teaching within a domain or subject. I will investigate categories of teacher competencies and contributions to the field of teacher identity research represented within this tradition.

³ References included in this paragraph are mainly based on research done in science education with equal and similar focus to the traditions mentioned in Zeichner.

3.2.1 Reflection and action

In order to put a frame round the discussion about teacher planning and instruction processes the key concept of reflection for action will be the starting point. Reflection has enjoyed a revival, but is of course not a new concept. In “An Essay concerning Human Understanding” John Locke (1632-1704) established reflection and sensing as the two main sources of human understanding that should form the necessary background for empirical evidence and knowledge construction (Locke, 1964). This formed together with induction the foundation of scientific reasoning and scientific methodology and became the 17th century’s solution to the difficult challenge of legitimizing the natural sciences or rather natural philosophies in contrast to the philosophical religious foundation (Bacon, 1934). Reflection as a human activity with importance for comprehensive understanding, theory building and knowledge as a part of the natural sciences has been more implicitly than explicitly debated. Reintroducing reflection is therefore a turn in addressing the problematic field of reflection itself.

In section 2.3 the didaktik concept was elaborated. Here it is necessary to introduce an additional categorization of didaktik theories (Laursen, 1994). The theories already presented as well as those that follow are representatives of reflective didaktik theories (Giddens, 1991; Schön, 1991a). This is in contrast to two other categories. Firstly, there were the prescriptive theories whose only function was to give exact guidelines for planning, instruction and student assessment. Secondly, rationalistic theories included a rationalistic view of learning in addition to being prescriptive (Tyler, 1949). The reflective wave of didaktik theories, starting with Dewey on one continent and drawing the German philosophical didaktik on the other continent, has embraced the prescriptive emphasis to some extent, but included theoretical framing as something important for teacher professionalism, the importance of practical teaching theories and hence integrated and extended the didaktik approach. Reflective didaktik approaches are, however, different when it comes to the relative importance of individual versus collective processes, and therefore to the significance of external influences on didaktik reasoning and reflection.

3.2.2 Dewey and reflection

Dewey defined and elaborated the concept of reflection in relation to the more general term of thinking in “How we think”. “*Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends, constitutes reflective thought.*” (Dewey, 1991, p.6) Dewey is also in this classical text pointing at the pain of reflection by stating that “*Reflective thinking is always more or less troublesome because it involves overcoming inertia that inclines one to accept suggestions at their face value, it involves willingness to endure a condition of mental unrest and disturbance.*” (Dewey, 1991, p.13) Hence, it involves doubts and hesitations as well as searching and hunting for new comprehension. Reflective thinking is a messy and nonlinear enterprise in which teachers draw on their own experience, but also on other external sources. Reflection has five phases according to Dewey, namely **suggestions, problems, hypothesis, reasoning and testing**. These five stages comprise a reflective cycle. Reflective practices are dependent on three attitudes called open-mindedness, responsibility and wholeheartedness. The first is a dedication and willingness to include alternative interpretations and possibilities. The second has to do with including considerations of the consequences of educational actions. By the third, open-mindedness, he meant that the teacher must demonstrate a continuous commitment to the other two. Reflection for educational practices has to be like breathing air for the body according to Dewey.

Loughran used the five stages in a survey where he studied a number of teacher-students in order to detect the presence of the stages, the degree to which the participants were aware of reflecting and to analyze the issues of reflection. Implementing the concept contextually and in line with Dewey, he defines reflection as “*the deliberate and purposeful act of thinking*” that “*aims at a conclusion*” (Loughran, 1996, p.14); both the understanding and the solving of the problem form integral parts of this process. Interestingly enough most entries in the quantitative part of the study defined the problem, followed by hypothesis generation, then suggestions and reasoning and finally testing. Teacher reflections in this study were also analyzed according to the three central attitudes of open-mindedness, responsibility and wholeheartedness. The conclusions here seem straightforward in that the attitude of open-mindedness is important for recognizing a problem, for suggestions and for hypotheses. There

was a similar close relationship between responsibility and phase of reasoning, and between wholeheartedness and testing. In sum this “*signals the emergence of the development of reflective practitioners*” (Loughran, 1996, p.190). His overall conclusion points to the teacher-students initially using the first three stages, then gradually with experience incorporating the final two stages and finally using all five in various orders according to the situation.

3.2.3 Reflection in – action and on - action

Reflection as a means to increased teacher knowledge and increased insight into one’s own identity in order to improve teaching skills and educational programming is the essence of reflection for action. Therefore reflection for action implies several elements, both collective and individual, together with language or terminology implications (Dale, 1993; Schön, 1991a; M. Uljens, 1997a). Reflection is important and necessary for actions to be rational. But even more importantly, reflection is necessary in order for one to be aware of one’s own identity as a professional teacher. Reflection as a topic for teacher education and research on teachers was developed as a consequence of or reaction to the limited view of teachers as implementers, teachers as technicians or an instrumental teacher identity. This alternative bottom-up approach to developing the teaching profession addresses identity formation and conscious teaching practices and is hence connected to the different processes that may in sum be called reflection. Another central issue in the movement has been to address the necessary processes from the perspective of the teachers rather than entirely from the perspective of the teacher trainer or researcher. A third aspect of the reflective turn considers life-long commitment to learning and development as professionals within education. (Zeichner, 1994)

The starting point for the reflection processes according to the concept of the reflective practitioner and the corresponding concept of knowledge- in- action is the experience. In line with this Schön in his “*Reflective practitioner*” described two forms of reflective practices (Schön, 1991a). These are ‘reflection- on – action’ and ‘reflection- in – action’, but it is the reflection- in- action that matters for professional development according to Schön. The reason for this is that the concept of ‘reflection- in- action’ entails doing and thinking as complementary processes continuously feeding each other. The heart of the matter is then the encouragement of the expressing of various aspects of the experience, reflecting on the

different factors that add to our understanding of the experiences and using this new comprehension to formulate new insight into teaching practices. This has been called the teacher theory of practices. Schön describes this new way of knowing as follows: *“When someone reflects-in –action, he becomes the researcher in the practical context. He is not dependent on the categories of established theory and technique, but constructs a new theory of the unique case.”* (Schön, 1991a, p.68) Reflection- on-action does not require this intimate relationship between doing and thinking. Reflection-on-action is looking from the outside and in on the practices without having a real involvement in and ownership of the actions themselves. Alternatively, it is the in- retrospect- thinking, evalua ting and judging of previous experiences, but not within the continuous flow of new actions to be taken within the same total setting.

There are question marks attached to these two terms. They concern the timeframes and the participators. In emphasizing reflection-in-action Schön puts the practitioner in the central position. In his texts in- practice can mean everything from a single activity to an extended period of time. Hence this concept covers the changing of situations, conditions and contexts as long as there are some factors that tie these situations together. A reflective practice in- action for a teacher therefore covers in-class activity as well as the planning and discussion that takes place under other physical circumstances and that includes other actors. This in sum is teacher practice and therefore in-action related. Reflection- on- action in contrast is therefore connected to outsiders’ reflecting and thinking that are not mirrored in some way by actions. These question marks are worth the attention because the concept of reflective practitioners is only to a limited degree directed at the teaching profession. It is more a general theory of professional reflective practice. (Laursen, 1994)

The dichotomy embedded in these terms implies a danger of becoming more limiting for understanding the multifaceted nature of teacher reflections (Shulman, 1988). This is therefore a serious argument that points towards the necessity of including a multidimensional framework for teacher thinking in order to do the teachers some justice in representing their actions and reflections. Another perspective that has raised discussions is the emphasis on the technical rationality (3.4.). In addition to this theory it therefore becomes important to include

the didaktik approach of others that specifically address the teaching profession, the institutional setting of education in our century and the specific amalgam of teachers' knowledge domains.

However, reflection- in-action has some consequences that to a limited degree make it appropriate for the teaching profession (Zeichner & Liston, 1996). One aspect is the collective discursive practice of teaching. Schön's concept of reflection- in- action is a rather solitary process in that it involves the individual teacher debating with him/herself. Accordingly the social aspects of teaching are not sufficiently addressed; nor are the societal aspects such as the constant interactions between the educational processes in institutions and the corresponding processes outside the institutions that have a bearing on teaching. On the other hand, and incorporated in the view of reflecting in practices, there is the effect of enabling the teacher to deal with conflicting views like theoretical dilemmas and value conflicts. Encouraging the development of reflections in actions therefore increases the ability to acknowledge different views and positions. From this view situations involving uncertainty and instability are not a threat but a possibility to make sound judgments and base actions on insight into various positions. The complementary processes of doing and thinking require substance and feeding of new dimensions or theoretical framing. This brings us to the other practices involved in educational research, those of the researcher. Here the concepts of reflection- in -action and reflection- on-action become important as methodological devices for use in reflection about researcher- respondent positioning (Schön, 1991b) (Part III).

An expansion of the reflection- in-action concept has been the result of some studies within teacher education. One of these concludes that the analysis of what constitutes reflection must take the specific context and the specific subject into consideration (3.3.). We are now approaching the socio-cultural perspective on teacher identity. (Zeichner, 1994)

3.2.4 Reflection in a sociocultural view applied on this project

The natural starting point is of course the Vygotsky volume of Thought and Language from 1962. For Vygotsky, as for Dewey, language is crucial for reflection, reflection is the continuous interplay between word and thought, thought and word. Furthermore, for Vygotsky

reflection cannot be trivial nor a ritual because it involves both scientific thinking and spontaneous thinking. Overemphasizing the structural scientific aspects is as much a pitfall as is putting too much emphasis on spontaneous individual judgment. Reflection is also relational. Reflective thinking is formed through dialogues taking place between participants in educational situations and is mediated both through the use of scientific and spontaneous concepts.

The institutional setting of education, the language and collective elements of professional practice, and the contextual cultural implications for teacher identity, as outlined in a socio-cultural approach to education, bring us to the reflective approach as defined by Bourdieu (Bourdieu & Passeron, 1990). Bourdieu's message that is of importance here states that the institutional setting serves as possible communication arenas, but at the same time acts as a constraint on reflective practice due to limitations in the awareness of the frames set by the institutions. Giddens' message is an individual stating the social reproduction of knowledge and comprehension that takes place in educational institutions (Giddens, 1991). The two opposite tasks of institutions, as an area for open communications and collective reflective practices on one hand, and the conservation and reproduction mechanisms on the other, do have an impact on the individual. However, as a consequence of the emphasis on self-identity the way Giddens expresses it, "*the self as reflexively understood by the person in terms of her or his biography*" (Giddens, 1991, p.53), institutional constraints are one of several factors that influence reflective practices.

Professional development and 'didaktik' planning and execution aim at an increasing degree of rational and reflected student assessments. Reflection for action is also dependent on its own language and terminology in order for oneself to be able to, in communication with others, express the issues and the dilemmas of student assessment. "*The language is the main factor in the reflections of actions.*" (Dale, 1993, p.28., my translation) The individual teacher who lacks terms and concepts covering different issues of education is not able to form opinions about these issues. They will also lack the ability to generalize their experiences and knowledge. In order to develop 'didaktik' practices it is crucial to construct personal meanings attached to the concepts, to be able to express those meanings. Development of practices is

learning from previous experience; comprehend this learning into a suitable terminology and evaluating its significance in other teaching situations and in other educational contexts.

The teacher's ability to express evaluation and assessment issues and address the dilemmas and corresponding choices of student assessment practices are also their main tool for faculty interactions and developing joint student assessment procedures. Open dialogues are a prerequisite for institutionalized educational planning and execution. Teachers do have different attitudes and abilities for becoming involved in co-operative planning and student assessment. Within the teaching profession the terminology of teacher planning has the dual importance of both individual reflection and collective summarization of knowledge and experiences.

Terminology, the meaning attached to a term and the relationship between different terms are also crucial factors for a dialogue project with teachers. “ ... *that while language is not thought it is necessary for thinking as well as for its communication... we must recall that language includes much more than oral and written speech. Gestures, pictures, monuments, visual images, finger movements – anything consciously employed as a sign is, logically, language.*” (Dewey, 1991, p.170) There are two possible routes to follow. One possibility would be to state the development of a mutual and common terminology as an objective of the research project. Another possibility would be to state an objective of illuminating the terminology the teacher uses. In practice, however, as a part of a fieldwork the researcher ends up doing both. Every interview situation or informal discourse is based on being understood, getting a message or a question or a statement through to the other person. There will be an implicit mutual understanding of the terms used or there will be explicit statements about the attached meanings of the terms. Adjacent meanings of concepts like summative assessment, tests, marking and student involvement will more or less be directly expressed, but during a period of fieldwork a common understanding is likely to occur.

Addressing reflection can be one way to recognize teachers and “give teaching back to the teachers” (Barrow, 1984). “*Ideologically, viewing teachers as active agents in the development of their own practice, as decision-makers using their specialist knowledge to*

guide their actions in particular situations, underlined the autonomous, responsible aspects of teachers' work, and provided an appealing rationale for considering teaching as a worthy, complex, demanding profession, especially when contrasted with the previously dominant view of teaching as the mastery of a series of effective teaching behaviours." (Calderhead, 1987, p.5) Nevertheless, the extent to which emphasizing reflection actually empowers the individual teacher is up for discussion. Unfortunately the deliberation process may also make teachers subservient. Four pitfalls can briefly be outlined that may disable the teacher rather than empower them. These are attempts at replicating results drawn from within a different situation, neglect of questions concerning values and objectives of education set outside the room of interactive teaching, ignoring the co-operative dimension as well as external relations. (Zeichner & Liston, 1996)

The empowerment of teachers through projects emphasizing reflection has to be based on the situation and the circumstances under which the individual teacher is acting, has to look at the relational character of the reflection processes as well as at education as a part of a societal affair. Within such a perspective addressing reflection is a way to make explicit the ideas, values, principles, experiences and beliefs of the teacher and recognize their importance for the teacher him/herself. Yet discourse does not equal reflection. Discourse is action in itself and therefore a tool facilitating or giving opportunities for reflection rather than the actual reflection. *"To equate discourse with reflection on action, instead of action itself, would be to fall prey to the very structural views that Lave and Wenger undermine in their approach to learning."* (Lave & Wenger, 1991, p.22, foreword by Hanks, W.). The intention is accordingly to facilitate arenas for communications in order to make the implicit visible through dialogues. We can draw attention to all these elements that actually form and influence the educational decisions and the instructional actions of teachers. The socio-cultural approach to teacher identity has implications for the concept of reflection that point towards empowerment, socialization, practices and statements as formation agents. There are some similarities between this reflection concept and the reflection-in-action concept of Schön. They both incorporate the relational nature. They address the importance of situated actions or practices as the starting points as well as the formation and creation of reflection.

The sociocultural overall view gives us in addition a terminology for the finer connections between reflection and identity creation. Identity formation is one of four modes of learning and consists of the two mutual working processes of identification and negotiability. When identity formation continues as an integrated part of community practices there are three corresponding modes or ways of belonging in the community in which we learn. They are engagement, imagination and alignment (Wenger, 1998). Engagement is the direct experience of the world and connects to others, while imagination is the images we are able to create about the world that makes it possible for us to be visiting different contexts and alignment is our autonomy to direct our energy and emphasis to specific interests, tasks, actions and so on.

Reflection is here seen as a tool used in the mode of imagination and for the benefit of expanding our understanding beyond the situation and the given circumstances. Because *“it takes imagination in order to encompass and deal with a broader context”* we need reflection as *“models and representations of patterns; facilities for comparisons with other practices; retreats, time off, conversations, sabbaticals, and other breaks in the rhythm”* (Ibid, p.238). Here the term reflection itself is given a content that draws us to reflection- on –action rather than in- action reflection. The term is used to signal that we are withdrawing from the actual happening and are using our imaginative mode to understand the happenings, but also to frame the happenings in a theoretical context represented by a pattern. We are reflecting when breaking the rhythm. Teaching is about doing that, but also about being in the daily rhythm of events and still to be reflective about the events that take place. On the other hand, from the same book the following quotation can be included. *“Such a (reflective) practice combines the ability both to engage and to distance – to identify with an enterprise as well as to view it in a context, with the eye of an outsider.”* (Wenger, 1998, p.217) This balance between distance and closeness equals the balance between reflection- in- action and reflection- on –action. However, it also equals the balance between being completely there and drawing on tacit implicit skills and knowledge and reflecting in it as well as being able to view actions within theoretical frames beyond the situation in itself- see it in a theoretical context and reflect on those terms. Yet another place reflection is used in this embracive way is the bridge between practice and theory in order to *“explore opinions and engage in a process of reflection”* (Ibid, p.48).

This section has introduced the duality of reflection- in- action and reflection- on- action as well as reflection as a subcategory of the mode of imagination within communities of practice. An attempt has been made to compare the two concepts of reflection and apply them more specifically to the teaching profession. They originate in different periods and under different theoretical influences. Yet, they definitely partially cover the same phenomenon. They are both stated clearly, but at the same time contain some hidden messages that prevent the automatic application at least analytically. Another attempt at framing the reflection of teachers has been the following approach to leveling of reflection.

3.2.5 Application of ‘levels’ of didaktik reflection?

One attempt at categorizing reflection was to divide reflection into the three spheres of technical, practical and critical reflections (Carr & Kemmis, 1986). Here reflection was firstly considered from the concern of the actions, given a technical or a rational legitimacy from an efficiency point of view. At this level the content and the methods are given, while the task is to fulfill the stated objectives. This in itself is a limited ‘black-box’ view of education. The second sphere was concerned with the practical aspects of justifying the teaching activities and other logical reasoning behind educational programming. In this sphere, the reflections are connected not only to the subject itself but also to the general ideas of the worth of education. This practical sphere has often been labeled ‘didaktik’ reasoning in the Scandinavian ‘didaktik’ approach when referring to models like the ‘didaktik relational planning model’. Here we are encouraged to see the relationship between the students’ learning suppositions, the teachers’ presuppositions, the economic frames, the objectives, the content of the subject, and the student assessment of the learner (Bjørndal & Lieberg, 1978; Ulstrup-Engelsen, 1997). The third sphere includes a critical approach to educational programming and incorporates the ethical and moral discussions of education as well as the value of educational goals and educational content. This sphere requires a frame for reflection beyond the single subject, the general ideologies of education as addressed in the German ‘didaktik’ concept.

Reflection has been looked at from different perspectives and divided into different levels as well as content. In 2.2.1. some definitions of didaktik were presented and discussed. In some

of these definitions the term reflection was used as it is frequently used in present didaktik approaches. In many of these models of didaktik, regardless of a descriptive or normative nature, the intention is to point at reflection as considerations concerning didaktik categories, e.g. student background, teaching material, objectives, content, and teacher background. This didaktik approach to reflections has been important in order to give the reflections a content dimension, but also to frame a more pragmatic action oriented reflection concept. This concept does not oppose the previously presented reflection concepts. Due to their prescriptive normative nature they may challenge the applicability of the others, but most of all they function as a different theoretical framing. The reflection-on-action and reflection-in-action duality as well as the sociocultural attempt at pinpointing reflections may work at a philosophical level of addressing teacher reflections. Models that are prescriptively theoretical are more appropriate for communicating reflective issues to teachers. Hence, this perspective has been important methodologically in defining the interaction between the researcher and the teacher.

Three levels of reflection and its application in teacher research

The professional reflection of the teacher has a content dimension as well as a dimension of theoretical framing within different theoretical levels, and there is a relationship between these two dimensions of reflection. Therefore, in addition to the content of 'didaktik' reflection processes, three levels of reflection competence will be presented. In principle, there is a correspondence between the three levels of "the didactic reasoning" and the three levels of reflection for rational actions as well as the division into a technical, a practical and a critical sphere. (Dale, 1993; M. Uljens, 1997a). They are labeled the level of practice or K1, the level of 'didaktik' theory or K2 and the level of theory of science or K3. I will use these three levels to frame the further practical and theoretical reflection of the teacher.

At all these levels there are meeting points between the personal practical theory of the teacher and other imposed theories. The practical theory of the teachers serves as a frame initially for the teacher. Handal and Lauvås (1987) have created a subdivision of three components, namely personal experience, transmitted knowledge, and experience and values. Practical theory is in itself a combination of personal experience and external influence. However, the

practical theory *“differs also in its degree of elaboration, as well as in the extent to which it is consciously held by the teacher concerned.”*(Handal & Lauvås, 1987, p.17) Often it does exist as tacit knowledge. Communicating with teachers at these levels intends to illuminate this individual knowledge and values, their situational significance and justifications for their actions. Practical theories may also be resistant to change. Making them explicit, spoken of and expressed is a prerequisite for reflective identity formation.

The first level is defined as the level of practice (Dale, 1993) representing instructional interaction and the meeting point between the students and the teacher. At this level we find the situational and practical reflection about different categories of ‘didaktik’, but not with the intention and awareness of theoretical framing. This is the level of actions taken as a consequence of experiences and adventures, looking at intentions and drawing conclusions for new actions based on reflecting about these. This level covers probably both the technical and practical sphere.

The second level is that of ‘didaktik’ theory and consists of the pre-and post-planning activities, construction of educational programs and associated reflections. This level constitutes reflection on the instructional units and the learning of the students. The important aspect here is the reflection on the interrelationship between the students’ learning activities and results as well as the content of the instruction and the significance of student assessment for the progress of the teaching and learning. Reflection at this level has to be constituted within some theoretical model or conceptual frames, stated or implicit. The teacher will evaluate the significance of the model in light of his or her practice. The normative relevance of pedagogic or ‘didaktik’ models will be tested, and the result may be the development of a personal subjective theory. Consequently, this level is the meeting point between practical knowledge and theoretical model building. At this level teachers will develop their understanding of different aspects of teaching and learning and the corresponding terminology so as to express and comprehend the achieved knowledge and skills. The teacher’s personal theory building does not necessarily correspond to the theory building of the researcher. In most cases, the theories will have a different value due to an emphasis on the prescriptive/normative and descriptive/analytical respectively. Simultaneously at this level the

personal or practical theory of the teacher will be challenged by confrontations by alternative theories and explanations. As a result, the teacher's internal consistency will be questioned. An imbalance may also occur due to external theoretical influences. In sum these internal and external contradictions and conflicts imposed on the teacher represent the learning potential of the teacher.

The third level, that of the theory of science, is the level at which didactic reflection like the critical discussion of teaching and learning from a societal perspective as well as the significance of evaluation seen in relation to a multitude of didactic and pedagogic processes. At this level we find the teacher's ability for developing theoretical perspectives to frame reflections and actions. Reflections at this level presuppose theoretical concepts taken from subject related 'didaktik' like science education and of an epistemological nature. Why is learning this topic necessary for the student, and what ideologies and ontological positions can be traced in the teachers' emphasis during instruction and discourse? Questioning and challenging the 'didaktik' theory within the frames of theories of science and theories of knowledge lies at the heart of reflection at this level.

The three levels are not in any sense hierarchical. For the reflective teacher being able to reflect at all levels is probably a presupposition for their actions in the classroom, actions and co-operation with other teachers and professional development. The key is therefore to be able to alternate between the levels of reflection according to the requirements of a situation. If there is a hierarchical structure it is rather like three cogwheels whose cogs mesh with each other. Every turn of one of the cogwheels or one of the levels of reflection will require the other wheels to turn and imply adjustments of the theoretical framing at the other levels. For the reflective practitioner this model implies a constant revision of their comprehension of the relationship between practice and corresponding framing, explanations and the rationale behind practice. *"An inner relation between a critical discussion of the teaching (K3), planning of teaching (K2) and execution (K1), evolves when the concepts, the principles and the criteria of the discipline are analytically discussed in a problem-oriented manner as a frame of reference for the teacher."* (Dale, 1993, p.25, my translation)

There is a borderline between reflection for action and teacher practice and reflection in the research process. In the communicative meetings with teachers and other professional we do, however, challenge this borderline. The rationale behind the fieldwork of this project involves being present during instruction and hence analyzing the interactions between student and teacher with a bearing on student assessment. The meeting points between teachers and researcher are foremost at the K2 and K3 levels. At these levels the discourse will take place, and a position is taken between the theoretical framing and the practical framing of the issues of student assessment. Here we find the merging of the action-based reflections and the reflective research in science education. Even more importantly we find the merging points of the normative and prescriptive functions of 'didaktik' and also the descriptive and analytical functions.⁴ As a researcher in this field who continually meets teachers, I will have to draw a fine balance between these two different agendas in education.

A meeting point is embedded between the personal individual theory of the teacher, the 'teacher theory of practices' with a public, qualified theory of 'didaktik', of pedagogy and of the subject. This meeting point is of particular interest. When reasoning or reflecting on their own practice the teacher will sometimes refer to personal arguments and sometimes to official theory in order to justify or explain their actions. There is also a timeframe built into the three levels of reflection. Their immediate and instinctive reflections will probably differ from the review of a situation with respect to the content of the reflection as well as the theoretical framing of the reflection. In as much as "*every teacher possesses a practical theory of teaching which is subjectively the strongest determining factor in her educational practice*" (Handal & Lauvås, 1987, p.29) discourses with teachers must use this practical theory as a starting point. This is necessary in order to "*foster its conscious articulation and aiming to elaborate it and make it susceptible to change*" (Ibid).

⁴ The present discussion between subject related didaktik and general didaktik centers on who owns the K3 level. The traditional content of science education etc may be defined as K1 and K2, but the K3 level is much disputed. Ontological, epistemological issues are necessary for the constitution of the single subject's didaktik, but whether an individual subject should develop epistemological theories remains unsolved.

3.2.6 Reflective theory of didaktik

Another attempt at capturing the reflective teacher is a “*reflective theory of didactics*” (M. Uljens, 1997b). This model of a school didaktik incorporates reflection as a major process as stated here. “*An important aim for educational theory is to provide teachers with a conceptual instrument enabling them to reflect on and communicate their pedagogical experiences in a consistent manner.*” (Ibid, p.20) The model includes the traditional steps of pre-, in - action and post- planning as well as reflection in all these stages. Secondly, it includes the relations of teaching, the teacher relationship with other teachers and with students. Planning and execution are seen as both individual and collective enterprises. Thirdly, it incorporates the external context as well as the internal context of the institution. Finally, it includes a situated student assessment view also seen as collective and individual. In other words, the model incorporates many of the socio-cultural perspectives and addresses both reflection as an ongoing in - action and after - action evaluation of instruction and the results of instruction. The terms of reflection and evaluation are intertwined in this model. “*The most fundamental reason why teaching requires evaluative reflection is that this activity (instruction) as such does not guarantee learning. Therefore pedagogical planning and teaching are rather meaningless without evaluation.*” (M. Uljens, 1997b, p.61)

This didaktik model should be considered in combination with the three levels of reflection. Furthermore, in this model reflection is given an overall importance as well as a more specific directed significance. In sum, this didaktik approach represented by the model for reflective practices combines three objectives. The first is to provide reflective tools for the teacher, the second is to provide the researcher with a model to be applied in the paradigm of teacher research in which the teacher is an active participant in setting the research agenda, and thirdly to build teacher education programs where the socio-cultural context of education defines the focus. It therefore works both descriptively and normatively. It is a model in the midway position between the entire empowerment position and the entire normative position of goal - oriented models. On the one hand, it addresses critical reflection, yet on the other hand, it realizes the normative position of stating values as necessary for educational purposes. It combines the prescriptive with the reflective approach to didaktik, and may include a pinch of a rationalistic approach (Laursen, 1994). The strength of the model lies in the institutional

perspective of looking at practical and theoretical teacher activities and planning from a relational as well as an individual perspective. *“Reflective theories of teaching must simply start with a critical analysis of the actual routinized practices of teaching going on in our schools.”* (Ibid, 134) However, another of its strengths lies in the fact that it attempts to overcome the weaknesses of the prescriptive tradition and the corresponding weaknesses of the reflective traditions. The limitations of the prescriptive traditions in this discussion deal with the submissive instrumental teacher identity. *“The flaw in the implicit logic of the prescriptive approach is the assumption that general value principles will ‘filter down’ through the different levels of decisions about teaching and ultimately guide the actual teaching practice in the classroom.”* (Ibid, p.127) The reflective approach on the other hand *“underestimates the institutionalized and routinized character of teaching and it overestimates the possibilities of relevant feedback.”* (Ibid) The addressee of this critic is primarily the reflective perspective of Schön.

Both of these points, the meeting points of practices and theory individually and collectively, will presently be stated explicitly as a part of the socio cultural view on learning in communities. It is therefore apparent that the reflective theory of didaktik aims at including these perspectives of education into a combined reflective and prescriptive model. The sociocultural view on practices has been extended beyond the doing itself, practices are *“doing in a historical and social content that gives structure and meaning to what we do...practice is always social practice”* (Wenger, 1998,p.47) Here too, the relationship between the terms ‘practices’ and ‘theory’ is not a dichotomy. Social settings are the meeting places or communities in which our own theories and ways of understanding are formed. That is valid for perceptions of the world in general as well as for issues of education such as the dilemmas of student assessment. Building theory for the educational researcher is a goal in itself, but is also produced in specific contexts. Therefore, the distinction between practices and theory understood as distinctions between enterprises cannot be disregarded.

The task of the teacher educator, or in this case researcher, is to introduce alternative interpretations and theoretical frames according to the comprehension of the practical theory of the teacher and an understanding of the teacher’s ability to incorporate the alternatives into

their own framework. We have to understand the “*structure of their awareness*” (Marton, 1994). The result may be a revised practical theory for the teacher. The ideal is for the teacher to be able to draw on the practical theory at all three levels in order to develop an integrated teacher identity. Reflection has to be based on the actions, the personal theory as well as on external theories. Professional teacher identity is therefore a combination of all three levels of reflective practice. Due to the equal importance of the levels, it may be more fruitful to refer to them as reflection domains. We use other words, but the challenge is still the same - the incorporation of the ‘routine action’ and ‘reflective actions’ (Dewey, 1991).

The next issue to be considered is the content of teacher reflection. What constitutes the reflections and what are the links between this content and the levels of reflection? Reflection is not merely a process for identity formation. Reflection within educational settings is also tied to the goals of education. Furthermore, it is tied to the content of education. Thus, in order to bridge the gap between the concept of the reflective teacher and the specificities of education, we have to address the actual content on which we base the programming. The next section will look at different ways of framing the content, reflections from a substantial point of view, the categories of issues concerned or what is often called teacher competencies.

3.3 The content of reflection; Teacher competencies

Reflective practice aims at an increased awareness of practically all topics with relevance to educating others as well as to the interrelationship between these topics. Reflective practices should illuminate the interactive aspects of teaching by building practical theories. It also aims at an awareness of philosophical and ontological questions in education beyond the actual point of implementation. Therefore, addressing complementary content domains has to be undertaken stepwise according to the different approaches and their corresponding theoretical levels. The ‘didaktik’ approach has traditionally looked at competencies from a practical angle understood as pragmatic and prescriptive. Hence, by pointing back to section 2.2, this is the starting point here too. Gradually this limited structural view of teacher competencies will be dissolved and reintroduced in order to accommodate the newer socio-cultural approach to teacher identity and consequently the corresponding teacher qualifications.

Science teachers' reflective practice involves two levels or arenas. They reflect as teachers, but they reflect as scientists because they are "*also representatives of canonical science in the classroom*" (Roth, 1995, p.9). Teachers are science practitioners situated within a science environment bordering on the communication codes and processes of scientific communities themselves. Therefore as scientists they reflect in action as they also consider how to model the problem solving activity of science in order to set examples for the students and to communicate the processes of scientific enterprises. Hence looking at teacher competencies from the aspect of science education has to be included in the reflective teacher. From this perspective the identity of the teacher includes the transformation from being a scientist to communicating science and addresses all the competencies necessary for achieving an identity combining the reflective practices of a teacher with those of a scientist. For a science teacher this transformation may have major ideological, philosophical and epistemological implications.

The content of reflection draws on two perspectives. Firstly, the structural perspective will be presented, and thereafter a sociocultural perspective will be presented. I will however argue that within science education there is a necessity to allow for the merging of these two perspectives.

3.3.1 The four commonplaces

Schwab introduced in "*The practical*" the 'four commonplaces' of schooling that he labeled teachers, learners, subject matter and context. This angle has to be evaluated in the light of the contemporary tendency within education to direct teachers' attention towards theories of the curriculum and of teaching that, according to Schwab, "*cannot alone tell us what and how to teach, because questions of what and how to teach arise in concrete situations loaded with concrete particulars of time, place, person, and circumstance*" (Schwab, 1978, p.322). Based on the study of teachers and their practical knowledge Elbaz concluded that teachers themselves are concerned with knowledge of the self, of the environment or context of schooling, of subject matter, curriculum development and instruction (Elbaz, 1983). In as much as these results converge with Schwab's perspective of the teacher they also include knowledge based on educational practices outside their daily arena like importance factors for

the development of their official mandate as teachers and hence for education set within a wider societal context.

Another important perspective of developing teacher practice analyzed the knowledge bases that a professional teacher needs to master. In order to build educational programs it is necessary that the teacher know the subject matter in many different ways or from many different perspectives. Reflective practice founded on sound judgment is based on flexibility, and flexibility for teachers is based on experience as well as on various emphases on the topics. One teacher was cited as follows, *“You have to be able to handle 150 approaches to it because you have to be able to handle every student’s approach.”* (Wilson, Shulman, & Richert, 1987, p.104) Handling 150 approaches draws on numerous knowledge resources, and so the agenda has been set for how to define these knowledge foundations or these competencies of the teacher.

3.3.2 Pedagogical content knowledge

In 1987 Lee Shulman defined several knowledge bases in his legendary article “Knowledge and Teaching; Foundations of a new reform” (Shulman, 1987). An important concept within the Anglo- American curriculum theory tradition is that of pedagogical content knowledge (PCK). This concept is one of seven developed by Shulman and his group of researchers at Stanford. The other six concepts are content knowledge, general pedagogical knowledge, curriculum knowledge, knowledge of learners and their characteristics, knowledge of educational contexts and finally knowledge of educational ends, purposes and values. This initial attempt to theoretically frame and describe the knowledge bases crucial for the development of professional teaching within a subject has become useful for a number of studies, some in the field of science education. A number of studies based entirely on the PCK concept have been conducted in this field (De Jong, 2001; Gess-Newsome & N.G., 1999), but without necessarily addressing the range of knowledge bases or the relationship between them.

One of the more relevant conclusions, based on the PCK research tradition, can be found in a study by Kennedy where she concludes that pedagogical content knowledge has to be embedded in a wider concept of subject matter knowledge (Kennedy, 1998). This new concept

embraces as well as PCK, the conceptual understanding of the subject itself, beliefs about the nature of working in science, attitudes to science and actual teaching practices. Within this concept the necessity becomes apparent to look at the teacher's understanding of why the teaching of the subject is important and hence the ideological arguments the teacher uses or practices. The second study was conducted by Dutch science educators and stresses the transformation of the PCK into classroom interaction; they describe three aspects of Kennedy's concept (van Driel, Verloop, & de Vos, 1998). These are the transformation of subject matter knowledge so that it can be used effectively and flexibly in the communication process in classrooms, knowledge of comprehensible representations of subject matter, and knowledge of content-related learning difficulties. They see their contribution as a source for the interactive phase of teaching, while regarding knowledge of the subject matter as a concept mainly for the reflection and planning phases of education. These two approaches are therefore complementary and may be used in order to describe what knowledge bases constitute the different stages of educational planning and execution. Even if these projects seem to be concerned with very different perspectives of the combination of the P, the C and the K they have in common an understanding that a particular topic has to be addressed and that PCK is significantly different from the content knowledge itself. Apart from that what is the relevant content of the P and likewise the combination of the P with CK is still to be discussed. This is an interesting conclusion from the field of science education because it points towards issues of how to incorporate this specific amalgam of pedagogy and content knowledge.

The focus is however somewhat contrary to the origin of the concept. The intention was that the existence and relevance of the different knowledge bases had to be viewed and evaluated according to the entire framework. *"The knowledge base for teaching is not fixed and final"* (Shulman, 1987, p.12). Pedagogical content knowledge is of particular interest due to the specific blending of the subject of a content specialist with pedagogical theory as tools for comprehension and reflection. *"Those who hold with bifurcating content and teaching processes have once again introduced into policy what had been merely an act of scholarly convenience and simplification of the research."* (Ibid, p.6) Even more importantly, Shulman combines this framework of content, the knowledge bases, with *"A model for pedagogic*

reasoning and action”. In this model the stages of pedagogic reasoning are labeled: 1. comprehension of purposes, subject matter –2. transformation of this comprehension in four stages of preparation, representation, selection and adaptation to student characteristics – 3. instruction as the student-teacher interactions – 4. **evaluation understood as assessing student understanding during interactive teaching as well as at the end of teaching a topic and evaluating one’s own performance – reflection understood as reviewing, reconstructing and critically analyzing teacher and student performance-** (emphasis due to relevance for this project) 5. finally attaining a new comprehension of purpose, subject matter, students, teaching and self. *“The activities of comprehension, transformation, evaluation, and reflection continue to occur during active teaching. Teaching itself becomes a stimulus for thoughtfulness as well as for action.”* (Ibid, p.17)

Reflection within this model has a different value or status than the previously presented reflection concept. On the one hand the last quotation points towards reflection- in- action, but on the other hand reflective practices have been given an overall status covering all the above mentioned stages and even more. The same is true for the way evaluation here is used. Later on, an evaluation concept will be introduced that covers more educational issues and more reflective stages than this inferior concept. Both reflection and evaluation have been given superior contributions within recent development.

Yet another addition to this research program suggests that science teachers utilize four kinds of knowledge: academic and research knowledge, pedagogical content knowledge, professional knowledge, and classroom knowledge (Barnett & Hodson, 2001). These are then the different elements of the *“pedagogical context knowledge”* concept. In this article the PCK concept, by stating the four under-elements, has again been redefined as one of several competencies. Pedagogical context knowledge consists here of issues from the educational knowledge as well as the societal knowledge landscape. In this approach, in comparison to Shulman, the pieces of the puzzle have been moved around again. The situated contextual view has, however, been underlined. The competencies of the science educator have been broken down into a number of subcategories. Academic and research knowledge contain science content knowledge, knowledge about the nature of science, child development,

learning theory and motivational theory. The PCK concept is defined as a set of considerations about how to set goals, sequencing topics, methodical choices according to the students' background and the actual circumstances. The PCK concept within this contextual understanding nearly equals the concept of didaktik as stated by the German didaktik tradition. Within a sociocultural view of teacher identity this framing manages to address issues such as the dynamic aspects of sociology and the philosophy of science, the relationship between scientific communities and general society, the identity of teachers as a consequence of situated co-operative practice and a reflective critical attitude to educational programming. Here too the knowledge bases are seen as flexible, both in their content and in the relevance of the content according to the specific situation. *"The pedagogical context knowledge framework sees teachers traveling from one "place" to another on the landscape – modeling scientific thinking and inquiring at one time, and lecturing formally at another; showing appropriate higher performance at that student at another; being a union member concerned with salaries and benefits in one instance, and making personal sacrifice for students in another."*(Barnett & Hodson, 2001, p.439)

3.3.3 Content of reflection in a sociocultural view

I have so far introduced two different perspectives of significance for the practical world of teaching as well as the theoretical world of science education into my review of teachers' qualifications. Both of these traditions regard the interrelationship between practical experience and theoretically based reflection as being important for the professional development of the teacher. The first tradition specifies the necessary levels of reflection, while the other tradition constructs a framework for knowledge bases, but in addition integrates knowledge domains with a model for reflection. This fact makes it possible to merge the two traditions and build a framework for teacher competence and knowledge bases at different levels. The first tradition is a post structural one which emphasizes the importance of the actual educational context, the institutional setting and the situation in question. Shulman's theory started out as a more or less grand theory or a structural approach to teacher qualifications, but recent discussions had illuminated the contextual importance and extended the framework into a cultural specific as well as institutional specific framing of teacher knowledge bases. I will return to the question and the discussion of situated cognition later. A

few more words need to be said about the merging of the two previously presented perspectives from the structural versus post structural viewpoints.

In both traditions the “why, how and what” concept is important. In the PCK tradition it may very well be stated like this: “*Pedagogical content knowledge is a teacher's understanding of how to help students understand specific subject matter. It includes knowledge of how particular subject matter topics, problems and issues can be organized, represented, and adapted to the diverse interests and abilities of learners, and then presented for instruction*” (Magnusson, Krajcik, & Borko, 1999, p.96). By highlighting the more recent debate concerning the use of Shulman’s framework, we are also reviewing an example of theory development going from the structural to a post structural debate on teaching. I will later introduce an additional framework for mapping teacher ideological emphases.

According to Carlsen’s (Carlsen, 1999) analysis of a number of studies, the original PCK concept still remains much of a structural concept, but the possibility for extending it depends on four premises. These are the exclusion of “fixed knowledge”, the inclusion of the interdependency of knowledge and power, the placement of the individual teacher at the center of inquiry, and finally the adequate consideration of the historical and cultural dimensions of knowledge. He concludes by stating that “*If teacher knowledge is more-- rather than less— context-dependant, individualistic, and historically contingent, then clearly we cannot avoid struggling with some difficult questions. For example, by studying what expert teachers know, we cannot automatically answer the question, “What should novice teachers know?” And the “wisdom of practice” discovered in affluent schools offers few simple lessons for teaching in general. Contingencies persist.*” (Ibid, p.140) We are hereby offered the combination of challenge and support in developing the field using the original concept. We are beyond the “Why, how and what”. Instead we are using the “when and where and who” when arguing within a post structural view of teaching.

Arguing within a socio-cultural view it is the historical, present and future contexts in which the practice takes place that form the starting point for learning, for the formation of identity as a part of the learning and for reflection as crucial processes for identity formation. When

the 'where', 'when' and the 'who' become the starting point for educational programming we are in need of a 'didaktik' concept more in the line of a formation than a material emphasis speaking non-dualistic (2.2.4), or alternatively, in dualist terms including both. Furthermore, a new duality of the identity concept emerges. Similar to social and self-identity, in this new duality identification and negotiability processes are mutually dependent on each other. However, identification and negotiability are processes or pieces of work that feed each other in a symbiotic manner rather than representing a view of identity seen from internal versus external points, as was the case with the identity concepts firstly introduced.

The previously mentioned studies of teacher knowledge bases have all employed a wide perspective, and their aim has been to analyze teacher practical knowledge bases in general. Teacher competencies and teachers reflecting specifically on the dilemmas and issues of evaluation and assessment represent a narrower perspective of looking at teacher competencies. This will be developed as theoretical framing in the next part.

3.4 Teachers as entirely rational?

Reflection is here seen as highly rational and this again has to do with the technical rationality embedded in the term reflection as defined by Schön. There is a (sometimes hidden) message that rationality and awareness in action and reflection should be the driving force behind professional development individually and collectively. There are, however, several examples of studies that have addressed less cognitive aspects of teacher thinking. One project looked at the relationship between reflection and intentionality from a phenomenographic point of view using a method of stimulated recall to facilitate discussions and to remind the teachers of the actual instructional events and hopefully their reflections during the events (Alexandersson, 1994). The conclusions were that the teachers directed their consciousness at three perspectives of teaching, namely the activities themselves, the general objectives of teaching, and the specific content of the lesson. Nevertheless, they did so in qualitatively different ways. The driving forces behind the actions were neither the specific nor content nor goal statements nor similar technical rational factors.

Another study investigated the differences between the intentions and actions of the teacher (Fischler, 1994). The more or less expected result was that these physics teachers did not follow general pedagogical and subject related theories in making their decisions during instruction. Hence, they were not able to correct their existing theories about instruction in the light of the practices they were involved in. As a consequence of this gap, their theoretically informed stated intentions and their intuitive actions were to some extent influenced by their own former teachers. The ethical dimension of teacher professionalism is also an issue within teacher research that has been classified as belonging to the less rational because *‘To the moral consideration we attach emotions, intuition and value considerations.’* (Dale, 1997, p.11, my translation) The typical attitudes and moral actions are often labeled ethos. A final example here is the issue of creativity in pedagogical styles. In one study teachers were classified as innovators and adaptors based on cognitive structures that were apparent in their behavior and accorded with their statements about their reflections (Sanchez, 1994).

All of these studies involving issues of intuition, ethical dimensions, intentionality and creativity have been attempts at rationalizing and structuring aspects of teacher practices whose potential for conceptualization seems less possible or even beneficial for practicing teachers, policymakers and researchers. Rationality is not the ultimate solution, nor are rationalistic didaktik approaches. The integrated, reflective, prescriptive models give us the institutional, cultural and normative combinations but fail to provide us with terminology for the intuitive act of teaching, the intuitive judgments and the importance of listening and trusting gut feeling in dealing with humans.

What then about that intuition that repels many teaching actions and those teachers would refer to as exercising judgment based on previous experience or estimating students’ results based on a complete picture of these students’ abilities? In these cases the criteria for judgment or estimation are not stated. There may be an agreement about the criteria but they have not been explicitly communicated. They are commonly understood. Intuition in teaching has its own value because so many decisions are taken there and then. Rationality and reflection cannot be the ultimate requirement of quality in educational actions. Likewise the awareness of language or the terms employed to express educational issues cannot be a

fundamental demand, even if we appreciate its essential importance. When we consider what teachers do we are all fully aware of the quality hidden in teaching and learning activities and that these qualities do not rest on the ability to analyze them and to always explain the rational behind them.

Intuition is significant in teaching, a significance that may be investigated in view of the citation that “ *the importance of deliberate, conscious articulation of knowledge, whether other’s or one’s own, may in the current intellectual climate be overestimated, while intuitive forms of knowledge and ways of knowing have tended to be ignored and under-theorized*” (T. Atkinson & Claxton, 2000, p.2). Exploring the relationship between the elements that are explicit and articulated and those that are implicit and inarticulate as well as highlighting the practical aspects of intuition of pedagogic significance formed the aims of a project looking at the “*value of not always knowing what one is doing*”, to quotation the title of the report (T. Atkinson & Claxton, 2000). One of its editors, Claxton, outlines a framework or ‘anatomy’ of intuition comprising six ways of knowing that are varieties of intuition. These are “*expertise (the unreflective execution of intricate skilled performances), implicit learning (the acquisition of such expertise by non-conscious or non-conceptual means), judgement (making accurate decisions and categorizations without, at the time, being able to explain or justify them), sensitivity (a heightened attentiveness, both conscious and non-conscious to details of a situation), creativity (the use of incubation and reverie to enhance problem-solving) and rumination (the process of ‘chewing the cud’ of experience in order to extract its meanings and its implications)*” (Claxton, 2000, p.40). All these six varieties of intuition are competencies that we consider important for teaching. Hence, they must be important for assessment.

The concept of intuition and the intuitive aspects of instruction are of particular importance in assessment. From the perspective of educational systems, assessment looks mainly at the summative aspects of student assessment with regard to grading, marking, stated criteria and corresponding measures like indicators and statistical information. Validity is defined according to criteria stated nationally or internationally, while reliability becomes important for objectivity and selection etc. From the teaching, learning and counseling perspectives

assessment possesses values beyond the measurable units of knowledge and for formative purposes ipsative scales and ipsative criteria works⁵. In these aspects of assessment, intuition and situated judgment become crucial for the benefit of the ongoing feedback to the individual student. There is no rationale behind these judgments that has an objective or reason or any rationale beyond the act or fact itself, ipso facto. Dwelling on private judgment becomes important in order to see the intertwining of formative assessment with overall teacher evaluation of instructional units. Intuition is a driving force that influences planning, execution and learning from experience and hence has to be regarded as valuable in discourses with teachers. The measurable aspects of assessment are just one part, and therefore assessment and evaluation as teaching activities or strategies have to be approached as teacher reflection and teacher decision-making processes. Even with this approach, we have to restrict ourselves to analyzing those aspects that are clearly stated. We may appreciate intuition and respect its place in teaching, but describing and empirically dwelling on it does have some limitations.

Curtis, Weeden and Winter have looked into the significance of intuition in assessment in the three subjects, i.e. art, mathematics and geography (Curtis, Weeden, & Winter, 2000). Their starting point is the rigor and accountability built into the assessment system in Wales and England as part of implementing the strategy for the National Curriculum (NC). Additionally there is a growing feeling of disempowerment among teachers as a result of objective criteria for assessment and the requirement for evidence. The six varieties of knowing and professional expertise stated as aspects of intuition are not easily measurable. In the case of mathematics teachers it was indicated that the teachers used a wide range of sources as bases for their judgments and that they were confident of their judgments even if they were not able to provide supporting evidence. With regard to all three subjects the point is made that assessing factual knowledge according to the targets defined is uncomplicated. The challenges are assessing performance according to NC criteria in that aspects such as how to deal with contextual factors, how to deal with achievement that is significant but not part of the stated criteria, the risk of face value or bias in judgments and how to deal with the teachers' experience. The authors point here at the dilemma of the NC in that it on the one hand it does

⁵ 'Ipsative', ipse for self, defined as the principle that it is an individual's performance in a particular topic or subject at a given time that is judged in relation to other performances by the same individual.

offer terminology for criteria and statements for achievements and may consequently be used to focus the teacher's attention and give devices for developing evaluation expertise. However, on the other hand they claim that it can never be exhaustive. As much as it may focus the attention, it may also restrict the attention of the teacher and limit assessment procedures and criteria to those stated instead of the ones required from the context or situation. This claim has a degree of validity beyond the geographical implementation areas of England and Wales. Any evaluation regulation given externally to the teacher, at any level within the educational system, will point to this main dilemma (see section 1.2).

The other main message is that aspects of intuition in evaluation can never be eliminated due to their situative character, in connection with education itself, and due to their prominence in making holistic judgments. Holistic judgments are task of the teacher, and this has to be based on more than the sum of the achievements of pieces of knowledge, skills and attitudes. The intuition and the judgments based on sensitivity, expertise and creativity are the glue that makes the different measurable pieces stick together.

I cannot resist the temptation to include the following warning about the specific consequences for educational evaluation: *“The first step is to measure whatever can be easily measured. This is OK as far as it goes. The second step is to disregard that which can't easily be measured or to give it an arbitrary quantitative value. This is artificial and misleading. The third step is to presume that what can't be measured easily really isn't important. This is blindness. The fourth step is to say that what can't easily be measured really doesn't exist. This is suicide.”* (T. Atkinson & Claxton, 2000) And Delta says that education is to capture the significance of that particular moment and build on that. That is judgmental and intuitive practice based on experience and human intuition beyond the rational reflective competencies outlined.

3.5 The sociocultural reflective teacher identity combined with the content related teacher identity

The concept of identity has been presented from point of view of the sociological and sociocultural traditions. The duality of self-identity and social identity remains, but the additional duality of the identification and negotiation processes explains the formation process. Reflection has been presented as both an overall term addressing considerations and directed thinking in general similar to the Dewey understanding of the term. It has also been presented as the more specifically defined term of didactic reflection, reflective practitioners and reflective teachers. Different approaches to nail the concept of reflection have built on both the overall embracive content of the term as well as given it specific significance within that approach.

The intention of addressing and discussing these concepts has been to set the stage for the upcoming theoretical framework, and hence to create the backdrop that in sum provides the main perspectives on the teacher profession. Drawing this backdrop corresponds to giving the stage to the case representation of the teachers. These main perspectives, the patches of the stage curtain, will be summarized in the following ten postulates. In stating them it is essential to underline that their nature implies that they are not meant to undergo empirical verification or have their validity tested. Their status is to frame the view of the teacher identity as well as the research process.

1. To teach is to be in a constant learning process. The teacher becomes a teacher when involving him/herself in learning the profession. To learn taking a socio-cultural approach means practicing, belonging to a community, to find meaning in experiences and becoming an identity. Learning for the teacher takes place in a community, most often a regular school. In this setting there are individuals and collective activities. There is history and there is an ongoing process of educational agenda setting.

2. Forming a teacher's identity implies a mutual constitution of that particular identity in relation to the other identities. The students' identity is also formed in relation to the teacher

identity. The principal identity is formed in relation to the teacher. The flexibility of this approach enables us to view the different participants from different angles according to the circumstances. The identification and negotiation processes label the two main processes as well as frame the different modes of belonging.

3. A sociocultural dialectical view on educational practices brings forward the possibility to view educational practices as dilemmas as a part of dialectical thinking. Dilemmas are tensions within social activity systems.

4. Reflective teacher practice is, within the socio-cultural approach, a part of the imagination process of illuminating the observation as participants and is therefore connected to the Dewey combination of participation versus imagination. "*Observation supplies the near, imagination the remote.*" (Dewey, 1991).

5. The socio-cultural approach gives us the language for merging the identity concept with the processes of the reflective practitioner. Identity is relational in itself and in educational settings understood as a creation specific to the individual but resting on the collective. As in other traditions there is no identity awareness without reflection on the learning processes.

6. The sociocultural approach does not however provide us with the content of reflection, the means of education. The more normative structural position of didaktik and science education plays that role. The identity of the individual teacher also rests upon reflections about the content of education given through didaktik and science education emphasis as well as teaching and learning in general. The internal life of the school and the individual teacher raises institutional agendas, some of which have an influence and some which have to be implemented through a mandate given by educational authorities. Teacher competencies are important both for reflecting on this mandate and on the subject content in view of the history of this subject and in the next line for making sound decisions about educational activities based on these reflections.

7. Identity awareness empowers the teacher. Empowering the teacher gives the teacher an autonomy that enables her/him to reflect upon educational issues, among them evaluation and assessment. Educational and didaktik reflection is dependent on the competencies of the teacher. The teacher and the researcher need to use a language that labels the different competencies. Teacher autonomy is identity formation by means of active reflective participation both as an individual and collective practice. Teacher autonomy is the ability to draw on observation, participation and practical knowledge in reflecting, but simultaneously to reflect these experiences in theory at the level of didaktik theory and the theory of science. This content dimension of autonomous teacher reflection is the focus of chapter 4, 5 and 6.

8. Teacher identity is not fixed in time or place. The preferred teacher identity concept considers the possibility of a teacher of undertaking several positions according to the situational and institutional environment. Therefore, the identity concept embraces the possibility of multiple identities or one multi-faceted identity just as the dynamic identity concept implies continuous identity reorientation. Changing institutional settings interferes with the teacher's understanding of her/his identity in relation to other participants. Consequently these positions will chapters be addressed in the forthcoming as epistemological and ideological positions within the frames of dilemmas/tensions (chapters 4, 5 and 6).

9. What people do, including saying and writing, provides an indication of their identity. The ethnographic approach, focusing on discourses between researcher and teacher, follows from this as described in chapters 7, 8 and 9.

10. Constructing stories about teachers' identities implies interpretation according to the selected dimensions. The representations of the teachers are therefore presented in reconstructions labeled 'cases'. These cases are based mainly on single-case analyses but have been selected according to theoretical variations in line with the theoretical dimensions outlined. They are therefore typologies. Each individual case represents one particular teacher, but the analysis has found one specific core message that a teacher may contribute in comparison to the other teachers due to a specific variation in his/her preferred positioning.

Schleiermacher states, *“Practical experience has its own value independent of theory, theory has the ability to become more conscious about the practical matters”* (Schleiermacher, 1959). There are two messages embedded here that are important when approaching teachers. Firstly, the experiences they possess are important in their own right independent of whether they verify theoretical understanding or not. Secondly, in educational research we may inform our theoretical understanding by including the perspectives of the practitioner.

Delta’s contribution here is to sum up the significance of a sociocultural, situated perspective of learning for assessment. Assessment for learning has to be manifested in the contextual factors of the situation itself. According to Delta’s reflections, this implies judgmental and intuitional references for assessment. Delta’s concern is that teaching in a situation that draws on all the information he can take in has its own worth. The sociocultural view of knowledge and learning, calls for irrational and judgmental openness in addition to the rational structural view on assessment. Student assessment is not, however, entirely for the process of learning, and so this quotation is in addition signaling other purposes of student assessment further elaborated in part II.

Delta: *“When student assessment is for the process of learning, the prerequisite is that you are handling the situation itself and therefore there has to be some judgment in the actual situation that will provide the premises for the student assessment there and then. The concept of judgment is for me the same as intuition in the actual situation. And the persons that are participating and therefore forming the situation.” (8.5.01)*

PART II

Substantial Framing;

Epistemological and Ideological aspects of

Teacher Reflections concerning Student Assessment

Delta: *“I dislike sorting students and that is what we, to some extent, have been told to do. That is our mandate. On the one hand, we are caretakers and on the other hand, we are butchers. That is a dilemma.” (4.4.01)*

In the following chapters, I will elucidate the development of the theoretical framework for teacher reflections and actions concerning student evaluation and assessment. I have chosen to do this in three chapters. The first chapter will present student assessment as a theoretical field. This presentation is partly historic and partly based on the identification of the dilemmas of assessment. The second and third chapters will set the analytical theoretical frames for addressing and analyzing the participating teachers according to epistemological positioning and to ideologies in science education respectively.

The overall theoretical references consist of three conceptual systems, dilemmas of student assessment, epistemologies and science ideologies. I will firstly present the rationales behind each one of the systems, and then secondly argue for their applicability taking the research questions into consideration. The conceptual systems serve the multi- purposes of describing, analyzing as well as framing the representation of the teachers’ reflective identity with respect to student assessment. Because the theoretical framing is presented before the methodological approach and presentation of the respondents in the study, it is necessary to emphasize that, in line with the abductive and generative methodology of Grounded theory applied in this project, the theoretical approaches to the understanding and presentation of the teachers were developed during the fieldwork and as a consequence of the in- field analysis. Furthermore, in line with the combination of theory with empirics in Grounded theory, the theoretical framing has to be viewed as *“mini-frameworks or conceptual diagrams”* (A. Strauss & Corbin, 1998, p.141) that are meant to be open systems of theories to be applied rather than a closed all-

embrative framework. Delta's comments and quotations included in each of the chapters are in line with this Grounded theory approach. Heading this part is a statement concerning experienced dilemmas of combining an institutional societal teacher mandate with situational emphasis of individual counseling.

Among the numerous topics covered in the discourses and formal interviews there were two topics/challenges that became increasingly important in order to understand the educational positions of the teacher regarding student assessment, use this understanding to bring new perspectives into the communication and consequently to describe the teacher. The first topic was what the teacher thinks about learning, what the important factors are important for the student in order to understand a concept. This frequently came up as a part of discussing why we evaluate, what kind of evaluation and assessment routines may improve the students learning and what routines might improve the teacher's comprehension of student learning. This part of student assessment reflections, labeled epistemological positioning, addresses then the reasoning behind the chosen procedures for student assessment as a part of the overall teaching strategy. However, it also addresses the view of knowledge and learning that was embedded in the assessment strategies of the teacher.

The other topic was why the teacher finds it important to teach and to learn natural sciences and how one should accordingly emphasize the subject. Similarly this came up frequently when discussing what aspects of the learning to evaluate, how to assess the single concept, when to assess and what in sum the student assessment tells us about her/his comprehension of the subject. The teacher's statements about reflection concerning student assessment in a particular subject could be understood as ideological positioning emphasizing different perspectives of the importance of scientific knowledge, scientific reasoning and scientific worldviews. The various epistemological positions (chap. 5) and different science ideological positioning (chap. 6) will be discussed with specific significance to student assessment and assessment. Working theoretically and empirically with these two dimensions of student assessment reflections as well as previously validated sub-dimensions entailed categories that combined a view of learning with a corresponding view of the subject. After the presentation of the three main theoretical pillars, the specific case of the epistemobgical and ideological

aspects of assessing practical work in the laboratory will be illuminated. The significance of this section is to address the particularities of science processes from a theoretical perspective.

These theoretical angles do however only bring the comprehensive view on the reflective assessor to a point of theoretically informed apprehension. In order to ground the entailment further in teacher practices the empirical indications have to be included. Even if the teachers represent themselves, only the representation of the teacher possesses some possibilities of generalization that enables the interpretation of the single teacher's positioning beyond the particularities, and hence includes the empirical analysis in the entailment of a frame of reference representing the evaluative practices of the secondary school science teacher. Therefore, the application of the theoretical frames is briefly discussed at the end of the chapter 6. This part is summed up in the research questions that the substantial analysis of the teachers is based upon (6.8.).

Delta: *"Concerning the process there is one law that counts, and concerning the results there is another law that counts. The learning situation is one thing, there are humans, content and so on, and I need to use my judgment in order to push the learning process forward. For the results, it is important that they are reliable and therefore there are other laws that count for how to think about assessment... Yes, and that fragmented we have to live with. That is how it is. That is why I dislike tests. Portfolios are better. Using portfolios we can support the learning process."* (4.4.01)

4 Student assessment as reflections within dilemmas

The quotations from Delta, at the top of this part and the chapter, are two examples of statements addressing dilemmas of assessment. Delta prefers the caretaker identity to the butcher identity, but he simultaneously recognizes the significance of both as purposes of student assessment. His teacher identity involves reflections concerning this dilemma of assessment. As a butcher he implements assessment strategies defined for him as reliable standards and grading procedures, while as a caretaker he draws on individual judgmental in situ objectives and references for student assessment. These statements were crucial in defining the framing of how to present the different purposes of assessment and the corresponding assessment referencing as well as the history of assessment.

Elucidating student assessment will be done according to the dilemmas that are involved. Application of dilemmas follows from a dialectic sociocultural perspective. The use of dilemmas also points to an overall paradox of education. This paradox is present in the student assessment history of the past century with an increasing visibility, and different aspects of the paradox are represented in the various dilemmas. The sociocultural view in general and its implications for didaktik result in a view of the teacher in which the teachers' identity is constituted by means of reflection in and on his practices. Because of this, student assessment is seen as an ongoing process of reflections based on the actual situation. This reflective evaluative practice involves some thinking strategies. Reflection implies within a situated perspective that student assessment has to be considered as decisions taken according to a multitude of contextual factors and hence the concept of dilemmas. For this reason the concept of dilemmas in education will be presented first (section 4.1). Thereafter the history of student assessment will be elaborated from the angle of growing complexity (4.2). This complexity has resulted in the dilemmas of student assessment existing in the educational system today

(4.3.) The final section will draw some conclusions about the integration of the student assessment dilemmas and reflection (4.4).

Within Grounded theory, there are different analytical tools and techniques. One important interpretative technique is to scrutinize the material by looking at the extremes of different dimensions. *“We look at opposites or extremes to bring out significant properties”* (A. Strauss & Corbin, 1998, p.94) These extremes of properties correspond to the outer positions of a dilemma. The idea is that addressing extremes makes the variations in some properties clearer to the analyst. The dilemmas, again in Grounded theory terminology, are in themselves small frameworks or conceptual diagrams that assist the interpretation of the teachers. They have been developed as a consequence of discussions with the teachers.

4.1 Dilemmas in education

The concept of dilemmas has been addressed under the label of dilemmas, tensions, paradoxes, controversies and constrains. The term dilemma is preferred here in accordance with the following definition. One of the sources that will be referred to under 4.3.2 states that *“The word ‘dilemmas’ is used as there was no obvious solution to the situation and the decision made in response to each situation would depend on contextual features and the teacher and students concerned. Unlike problems which can be solved, dilemmas are managed and this management relies heavily on the professional judgement of teachers.”* (B Bell & Cowie, 2001b, p.79)

Emphasis on dilemmas and tensions as recourses for teacher reflection goes beyond the core-issues of student assessment. In section 2.1.1 tensions or controversies were introduced as one aspect of the sociocultural approach to learning within institutional historic situations as a part of activity theory (Engeström et al., 1999). This main perspective is continued in the forthcoming presentation. Some studies within a broader educational frame than mine have presented interesting aspects and discussions about the use of dilemmas and will therefore shortly be presented before specifically turning to the student assessment dilemmas. The overall dilemma of education is addressing the philosophical issue of establishing educational principles within a social frame when the individual to be educated has their own freedom to

choose the agenda for his/her education (4.1.1). The forthcoming framework of Berlak and Berlak elaborates this overall paradox (4.1.2).

4.1.1 The overall paradox of education

The dilemma concept is based on a number of philosophers who have addressed the everlasting paradox of education and upbringing. Humans are free, but humans are also set free by educational enterprises. Rousseau (Rousseau, 1962) first emphasized this paradox of recognizing the free reflective human being as a base for their possible development into a socially reflective and educated human being. Rousseau points here also to the identity of the teacher as being based on solid individual competencies and maturity as well as authoritative attitudes. According to Rousseau this teacher individuality is a prerequisite for facilitating the building of students' individual strengths and common sense. Others have added to the original paradox by emphasizing different aspects. They have looked at freedom versus constraints and the cardinal pedagogical point which states that insight is based on self-reflection and hence ethical considerations (Kant, 2000). They have considered the significance of theoretical versus practical experiences in a human being's ability to inform practices by theory and that the time factor is important for this reflective practice (Schleiermacher, 1959); reflexivity as a factor enabling humans to live the paradox in an internal and external dialogue (Grue- Sørensen, 1950); or finally normative versus emancipatory elements of education (Benner, 1991). Schleiermacher also points towards the teacher's identity when he introduces the concept of a contract between generations and the fact that, according to the circumstances of modern life, the identity of the teacher will have to be constantly reviewed. This contract has to be based on a personal authority or participation according to the content of its significance for the individual. In his wonderful synthesis of the different perspectives of this paradox von Oettingen claims that the overall paradox embraces the acknowledgement of two principles, firstly that of individual emancipation based on reflective practices and secondly that of *bildung* for social awareness. He adds to this point about the significance of paradoxes by saying that: "*Paradoxical explanations are superficial antagonisms. We formulate and address them in order to express the fact that a phenomenon or an educational happening does not immediately find its (unilateral) reasons.*" (von Oettingen, 2001, p. 165-168, my translation)

An overall paradox states that the premise for seeking knowledge is that we need to know the secrets of knowledge; it assumes a reflecting human in order to educate a reflecting human (M Uljens, 2001). Applied to teachers, on the one hand, they are free, have the ability to seek knowledge, and are reflective human beings. On the other hand teacher training and development as well as research projects are based on the basic thought that teachers need to be educated to be set free, they need to be educated in what directions and within which dimensions or content to reflect. Combined these form the primary bases for their overall achievements as educators. Therefore, the extreme positions of the paradox represent two equally important or equally true aspects of educational enterprises. Educational reflections acknowledge this and challenge educational reasoning within the paradox.

4.1.2 The use of dilemmas in educational research

With these introductory comments about the philosophical anchor combining the paradox with a teacher's identity and reflective practices, it is time to introduce dilemmas as a concept and thereafter the dilemmas of education. The overall paradox has also been labeled dilemmas of education. This dilemma concept was first addressed within education in the book *"Dilemmas of schooling. Teaching and social change"*. (Berlak & Berlak, 1981) Here the authors saw their terminology as a *"contribution to the understanding of the relationship of macro to micro, of everyday school life to social change"*, in order to conceptualize the *"cross-currents of the competing arguments of the government officials and professionals"* (Ibid, p.25). **The dilemmas are therefore a means to capture the tensions and contradictions as assets of education as a whole. The extremes of dilemmas are seen as neither good nor bad, they have equal value ideologically.** The authors see this in combination with the different epistemological, ideological and perspectives of human beings that teachers possess and that in combination influence educational actions. Three sets of dilemmas, totaling sixteen, were identified and labeled control, curriculum and societal. These will be presented and their relevance discussed not only for student assessment but also for the forthcoming construction of theoretical frame of references.

A control dilemma, the first main type of dilemma, consists of four sub-dilemmas that consider control of the classroom environment either as child controlled or teacher controlled. The first of these contrasts the child as a student within a particular subject with a view that education deals with a child as a whole or an integrated identity. This fragmented versus integrated perspective is also found in the different student assessment and evaluation traditions. The following three aspects concern the time, the operations and the standards. An operational dilemma is interesting because it focuses on who owns the teaching agenda and the learning processes, who defines the progress and whose knowledge construction sets the frames of the learning processes. This has an implication concerning both the epistemological and the ideological positioning of the teacher. A standard dilemma focuses on who sets standards and who maintains standards. They may be set either by the teacher or by the student, and they may be maintained either by the teacher or by the student. Controlling the standards equals controlling the criteria on which the learning processes and the learning outcome are measured. This aspect of control over the educational agenda will here be interpreted as positioning within epistemology. If the child participates in the standard setting, we use an ipsative strategy combined with a socio-cultural approach to teaching. The other opposite would imply the teacher or some external body defining the standards that then accordingly will be referenced or group based and within a behaviorist approach to learning. In between these extreme positions, there are others. Out of the four aspects of the control dilemma, three have specific relevance for student assessment issues placing emphasis on the teaching of science, focusing on the whole child versus the subject, the operational/educational activities and the standards.

The second set of dilemmas relates to the effort to describe the tensions and contradictions involved in ways of learning and knowing as part of the transmission of knowledge. In this category, there are eight dilemmas; Personal versus public knowledge; (Knowledge as accumulated traditions that should be passed down or knowledge as owned and constructed by the individual in relationship to others or alone.) Knowledge as process versus content; (Knowledge as organized bodies of facts, theories etc or knowledge as reasoning, thinking and other skills.) Knowledge as given or as problematical; (Knowledge as transmitted though agents, institutions and teachers or knowledge as problematic requiring a critical and

analytical student evaluation of its significance, relevance and truth.) Motivation as intrinsic versus extrinsic; (Motivation for learning should be found within the learner or it requires teacher initiated feedback.) Learning as holistic or as molecular; (The holistic implies the active construction of the meaning of the person while the molecular implies pieces or elements of knowledge like building blocks.) Unique or shared characteristics of the children; (Addressing content and applying activities based on differences or based on similarities shared by the learners.) Learning as social versus individual; (Learning as a private encounter mediated through texts and teachers or learning as social construction based on relational interactions.) The learner as a person or as a client. (The learner as subject actively involved or an object that has to be diagnosed and classified.)

The societal dilemmas, which make up the third main category, are likewise an attempt at capturing the controversies of education that have to do with equal opportunities for access to education, juridical aspects and societal relationships between different groups. Within this cluster of dilemmas views of childhood as continuous and therefore similar to adult life as well as views of childhood as unique and different from adult learning processes is stated. Next, there is a view on the allocation of resources as equal or evenly distributed or differentiated according to the evaluation of the needs and abilities of the learners. Thirdly, there is the juridical aspect of education in the dilemma of equal treatment or of ad hoc treatment according to individual needs. Finally, the dilemma of culture addresses the controversy of building education on common cultural factors or on sub-groups' cultural backgrounds.

As stated in the conclusion to the introduction of the dilemmas *"we may use each dilemma as a separate lens to portray a teacher's or a group of teachers' behavior and how it changes over time, using each dilemma as a separate lens distorts by fragmenting the integrated flux of classroom life. A teacher's every act signifies multiple meanings to them and to children."* (Berlak & Berlak, 1981, p.164) We can then manage to illuminate selected aspects of teaching, but there is always the danger of *"distorting and obscuring"* (Ibid). Taking all aspects of education into consideration is not the intention, the grandness of the theory is present in this quotation, but there is also an opening for using some of the dilemmas in

addressing specific issues. The concept of dilemma allows for a diversity of beliefs, of practices and of interpretation of the teaching profession. This is the diversity that the overall paradox of education calls for. The overall paradox has the major implication that every decision has to be taken within the actual situation, as there is no one-size-fits-all solution in education in general and in student assessment in particular.

4.2 The history of dilemmas of evaluation and student assessment

The overall paradox of education and upbringing states that in order to seek knowledge humans have to possess the knowledge. Dewey points towards the dilemma core of evaluation and student assessment in the following statement that focuses on the tension of stating an objective when a person has only a vague understanding of the constituents of the objective as well as the methods that will bring the learner towards that objective. *“Strict Herbartians generally lay it down that statement – by the teacher – of the aim of a lesson is an indispensable part of preparation....To the teacher the statement of an end is significant, because he has already been at the end; from a pupil’s standpoint the statement of what he is going to learn is something of an Irish bull. If the statement of the aim is taken too seriously by the instructor, as meaning more than a signal to attention, its probable result is forestalling the pupil’s own reaction, relieving him of the responsibility of developing a problem and thus arresting his mental initiative.”*(Dewey, 1991, p.208)

Embedded in this quotation is the identity of the teachers versus the identity of the students in stating aims. This participation aspect of student assessment can also be interpreted as a tension between the individual influencing the student assessment agenda versus the collective participating in setting the student assessment agenda. Furthermore, this quotation includes the duality of statements of aims as direction for all actions including student assessment versus considerations along the learning path. This can be interpreted as focusing on the product versus focusing on the process.

The history of evaluation and student assessment within education is about one hundred years old if we consider forms or practices of evaluation and student assessment and discussions about evaluation and student assessment similar to the current practice (Guba & Lincoln,

1988). The last century of evaluative theory represents on the one hand a corresponding development within educational practices in general and therefore an increasing complexity. This is in particular the case since the 70s in that “*evaluation has moved toward greater theoretical breadth and sophistication over the last two decades*” (Shadish, Cook, & Levinton, 1991, p.20). The complexity that the field is facing today is a consequence of the existence of many parallel epistemological and ideological solutions to the overall paradox of upbringing. Evaluation are a multitude of practices in which these parallel and sometimes conflicting views become visible due to the status of evaluation as a communication tool between educational institutions and society in general. Also within the school and manifested in teacher practices, the complexity of education becomes in particular visible when evaluation and student assessment is on the agenda. The historical roots of evaluation and student assessment dilemmas will be presented first.

4.2.1 Norway in last century- the history of evaluation and assessment

The dilemmas of evaluation and student assessment and the challenge for the education system to struggle and juggle the dimensions are ongoing processes. This never-ending story has to find its place at all levels within the education system and is hence just as important at the national level as within the classroom. The debate about evaluative practice has swung back and forth between the extremes of tensions as shown by this example of the issues discussed in Norwegian elementary education about one hundred years ago among the teachers in a teacher union (Lysne, 1999, p.61, my translation):

- *“What are the specific requirements for a unified use of grading in elementary schooling in order to serve the purpose as a reliable instrument for admittance into higher education?”*
- *Do teachers possess the required training for and positive attitude towards objective evaluation?*
- *Is the final examination of elementary education sufficiently just and valid in order to serve as entrance examination for higher education?*
- *To what extent should higher education set the content and the degree of difficulties of the elementary education examination?*

- *How would the elementary examination understood as an admittance requirement influence the teaching activities and the content in elementary education?”*

These evaluation issues represent in sum the view of student assessment that states first of all the importance of objective and reliable measurements of student achievement as a part of examination procedures and advancement. Teacher qualifications in evaluation and student assessment were seen as being equal to their ability to administer such procedures. This is the starting point of this short historical journey.

4.2.2 From Tyler to a multitude of perspectives in evaluation

Evaluation and student assessment practices during the last hundred years have taken different forms, but according to one synthesis there had, until that point, been six major characteristics of the theories of evaluation and their practices (Guba & Lincoln, 1988):

- Evaluation and measurements have been virtually interchangeable concepts.
- Evaluation and measurements were inextricably tied to the scientific paradigm of inquiry.
- Evaluation and measurements were focused on individual differences and on a narrow range of subject matter content.
- Evaluation and measurements had little relationship to school programs and curricula.
- Evaluation was oriented to standardized and objective measurements that were norm referenced. Establishing norms, adequate sampling, and identical conditions under testing, and predetermined administrative routines became aspects of required objectivity and hence the focus for the development of evaluation procedures.
- Evaluation and measurements were highly influenced by an industrial metaphor and the ideology of modernization seen from a market economic viewpoint.

This focus of evaluation had its peak with the birth of the highly influential “Basic Principles of Curriculum and Instruction” (Tyler, 1949). These principles have to be interpreted in this historic context. In this rationale, evaluation becomes the process for determining the degree to which certain predetermined changes in behavior has found place. In order to build a comprehensive view of teaching with this aim in mind a corresponding view of curricula has

to be based on objectives. These objectives were the basis for educational planning, for guiding the teachers in choosing activities and choosing content as well as for the preparation and execution of tests. Student assessment in this system equals the degree to which the student has met the objectives stated, and it is possible to measure this objectively, based reliably on well-developed examination procedures. The validity of the tests is found in the degree to which the content of the tests are represented in the written curricula.

The four Tyler questions, of educational purposes, appropriate educational experiences and their organization and degree of attainment appealed to educational planners at all levels due to their internal logic, simplicity and embraced “*virtually all the evaluation contingencies that were recognized at the time of its statements*” (Guba & Lincoln, 1988, p.5). From the historical context viewpoint, the combination of evaluation with curricula as specific for education in contrast to the industrial mechanical language of evaluation must be viewed as a significantly important contribution. A whole movement of curricular and instructional improvement was born through addressing this relationship between curricula and evaluation. This meant a separation between evaluation and the purest form of measurements. Evaluation was hence formally included in the landscape of didaktik or curriculum theory. From this point, measurements are tools for evaluation, and evaluation criteria are set by the school mandate or the curricula.

However, in retrospect the internal logic has been viewed as the major disadvantage of the rationale. As a closed system the objectives in themselves were not the subject of investigation. The implicit philosophical and ideological basis could not stand the trial over the years. Questions about the mechanisms behind curricula and the teachers’ autonomy were not able to fit into this closed internally logical system. In order to do this the system would have had to open up for external explicit scrutiny. Educational evaluation as a theoretical field has from this point existed as a multitude of models approaching the multidimensional aspects of evaluation with different emphases. The models emphasized the importance of explicit values and standards (countenance models), the necessity for awareness of judgments (connoisseurship models), a goal free model emphasizing all effects whether intended or unintended, and finally the necessity for focus on utilitarian aspects (responsive models).

The last model, the responsive model, can be seen as contradictory to some aspects of Tyler's rationale. The responsive model includes aspects of the others mentioned in building on a view on evaluation that "*orients more directly to program activities than to program intents, responds to audience requirements for information, and if the different value perspectives present are referred to on reporting the success and failure of the program*" (Guba & Lincoln, 1988, p.24). The procedures within the model are inductive and based on the actual agenda of the participants, and they acknowledge the human evaluator as the major instrument. With this dual perspective, the model was a contribution to a methodological approach as well as an evaluation model (Stake, 1998). Tyler's model is contrary to this responsive model on features such as being deductive whereas this last one is inductive, in ignoring the variety of practices and the ownership of these practices while the responsive model acknowledges the perspective of the users of an educational program. The responsive model focuses on the processes of education while Tyler directs his focus at the products of education. Hereby the duality of products versus processes has been introduced.

Still within this development the evaluation models this far had failed to permit questions like the growing awareness of diversity in educational system and the corresponding influence on diversity of values, the school as a part of the political agenda and general societal concern and the internal relational aspects among humans in education. (Guba & Lincoln, 1988; Mc Laughlin & Phillips, 1991; Shadish et al., 1991)

In sum, these were evaluation models to be applied to educational programs rather than actual student assessment models. Still they generate a view of student assessment and the identity of the teacher as an evaluator. Models or theories for student assessment and teacher participation have existed at the intersections of a multitude of academic fields in addition to this program evaluation, but without having its own defined hedging.

4.2.3 Multiple perspectives of evaluation and assessment; Definitions

Because of the multiple perspectives and models of evaluation that developed during the 70s through 90s, the terms of evaluation and assessment have come to mean something particular

in order to distinguish the overall programs from the particularities of the measurements of educational outcome. Evaluation in English terminology is used to address the content validity of an educational program, strategies of teaching and instructional techniques (Lysne, 1999). It represents therefore some degree of judgment of some norms and values involved in all educational evaluation. Assessment is a more specific term addressing the measurements and the judgments of the learning outcome based on instruction and learning activities.

I will use evaluation as an overall term referring to a number of activities, strategies and reflections that may be illustrated as an ongoing and continuous evaluative reflective cycle. Assessment will have the specific and limited use of judgments and strategies of evaluating students learning processes and learning outcomes. Assessment will therefore refer to the complete process of stating objectives; define referencing; collecting documentation; judging the documentation as well as communicating feedback to the students in form of grading, written and oral statements.⁶ This distinction is important for this project. In addressing the teachers' actions and statements about reflections it is the teacher's assumptions about student assessment as well as assumptions about evaluation in general that is being investigated. In accordance with the grounded perspective, neither one in particular is focused intentionally, but the way both of them are used by the teacher signals epistemological and ideological viewpoints. However, over the course of the fieldwork reflections concerning student assessment came to be more in focus than the overall evaluative reflections.

The decision of applying this distinction between assessment and evaluation has been taken by referring to the English use of these terms in a number of sources. (P. Black, 1998a; P. Black, 1998b, 2001; Broadfoot, 1996; Cullingford, 1997; Lysne, 1999; Murphy, 1999) Moreover, there is one more aspect of this choice. That is the distinction of evaluation as a pedagogic tool

⁶ We do not have similar well defined terminology in Norwegian. The term "vurdering" and the term "evaluation" have been used interchangeably both politically and within educational practice and research. As a part of the reform of the 90's "vurdering" was established politically as the preferred term when discussing technical aspects of student assessment in specific as well as the overall considerations about student assessment.

of reflection and evaluation of programs. (Guba & Lincoln, 1988; House, 1993; Mc Laughlin & Phillips, 1991; Shadish et al., 1991)

Aikenhead on the other hand refers to assessment as the collection of student work, while the judgment of the students work is named evaluation. He does this in accordance with the requirements of the educational authorities of Canada. The overall considerations demand that there are different aspects of validity involved in the two processes of collecting and interpreting the value of students work. The student's ability to participate is different. (Aikenhead, 1997)

Evaluation as an overall process can be viewed as individual actions and reflection. Evaluation could also be seen as a part of the interactions and communication that take place in a group of teachers, either formally constituted or by teacher choice only. Thirdly, evaluation related activities and reflection could be seen as part of the three stages of educational planning of the pre-instructional, the execution of instruction, and the post- instructional. In order to frame competencies we need to address all three spheres of evaluation practices or reflection. All these spheres of reflection have been included in a normative/prescriptive model for school 'didaktik' (M. Uljens, 1997a, 1997b).

Concerning assessment and the monitoring and judgment of students' work, a number of terms have been used to label different strategies. **Placement assessment** refers to student performance at the beginning of an educational program and for the purposes of deciding what specific educational program to participate in or at which ability level. **Diagnostic assessment** is used to diagnose learning difficulties or possibilities during instruction. **Formative assessment** is a term to describe the process of monitoring learning progress during the course of an educational program. Finally, **summative assessment** is used to assess student achievement at the end of the educational program. **Formative and summative evaluation will have a specific focus from here on in this project.** They differ in the tasks and purposes they have but not necessarily in techniques.

All of the above are assessment strategies that may or may not be available to different teachers and may or may not be considered appropriate to use. The appropriateness or applicability do have something to do with systemic limitations, but from the individual teacher's viewpoint it has even more to do with what they define as important for learning in general and what they believe important for learning science in specific.

The summative-formative dualities of evaluation take their basis from the pre-Tyler and Tyler rationale versus the responsive evaluation and were formulated by Scriven in 1967 like this:

“Formative evaluation is evaluation designed, done, and intended to support the process of improvement, and normally commissioned or done by, and delivered to, somebody who can make improvements.”

“Summative evaluation is the rest of evaluation: in terms of intentions, it is evaluation done for, or by, any observers or decision makers (by contrast with developers) who need evaluative conclusions for any other reasons beside development.” (Scriven, 1991, p.20)

The term formative assessment carries with it a contradiction. If assessment in itself implies some measurement along some defined scale, formative assessment involving inductive procedures of objective statements and ipsative referencing would be impossible to implement. The term has however been widely used and has come to mean something like the following definition: *“Formative assessment is an integral part of the teaching and learning process. It is used to provide the student with feedback to enhance learning and to help the teacher understand student's learning. It helps build a picture of a students' progress, and informs decisions about the next steps in teaching and learning.”* (B Bell & Cowie, 2001b, p.4) (Quotation based on statement by the New Zealand Ministry of Education.)

This development of summative versus formative evaluation strategies is in time contemporary with another significant contribution. The controversy of assessing and evaluating from an outsiders' perspective or from an insiders' perspective is represented in the basic idea that the evaluator has to be an educator. According to this view, stated by Cronbach in 1963, the teacher and the student should together discuss and judge the goals and the degree of attainment as well as the overall intention for the evaluation. Within this view of evaluation

there are some important aspects; feedback to the students is the means by which the student can understand and develop skills, behavior and knowledge; evaluation should be concerned with the reinforcements of the learning effect; the evaluation should generate information to be used for teacher- student consultation; the evaluation should inform the teacher about appropriate teaching methods according to the students outcome and prior knowledge; And finally the evaluation should serve the function of access to further education. (Lysne, 1999; Mc Laughlin & Phillips, 1991)

The complexities of evaluation issues are definitely on the agenda. The last addition represents the basic views of formative assessment. The important contribution in retrospect is however that the principal lines have been drawn concerning the important aspect of ownership to the processes of assessment. The perspective of the insider, meaning the participants of the teaching- learning processes, is compared to the contribution of the perspective of the outsider, meaning a visitor with an agenda different from the pure constituents of the student-teacher relationship. These perspectives are qualitatively different, but could also be considered as complementing perspectives.

4.2.4 Norway one hundred years later; A comprehensive system.

One hundred years after the discussion in the Norwegian teacher union, the discussion about elementary evaluation issues in Norway according to different ministerial sources relates to (KUF, 1996a, 1996b, 1997b, 1998a, 1999):

“The main reason for student assessment is to assist learning and individual development”
(KUF, 1996a, p.79, my translation).

- Corresponding reasons for student assessment are stated as:
 - To assist the learning and development of the student; To motivate achievements and efforts of students according to their abilities; To document the final results and competencies the students have attained; To give feedback and counseling according to the working process and the results; Give information and develop a relationship between the school and the student’s home; Assist the school and the teacher in

improving the teaching and in adapting the teaching according to the needs of the students. (KUF, 1997b)

- The object of assessment including what subjects and competencies to assess.
- The criteria for assessment. In the curriculum guide for elementary education it is stated that the different forms of assessment of students “*should be based on the objectives, the content and the principles stated in the national curriculum*” (KUF, 1996a, p.79, my translation). In the guide to teachers about student assessment an individual based criteria is combined with this objectively stated criteria (KUF, 1998a).
- Different forms of documentation of learning and teaching processes defined as observation notes, logs, portfolios and tests including open-book tests, oral tests, regular written tests and tests generated by the students.
- The communication of assessment by the use of grading systems for specific subject domains and for conduct, oral and written statements from the teacher, discourse with students and parents,
- The scale of the grading system and the definitions of competencies required at different grade levels.
- Final examination, its use, and the development of the items in the examination.
- The combination of grades and examination results as criteria for admittance into upper-secondary and higher education
- The relationship between societal demands on evaluation as a mean to select students for different courses in upper secondary education.
- Assessment as one of several didaktik competencies of the teacher.
- The relationship between student assessment and system evaluation and consequently the need for feedback mechanisms from student level up until national level.

Focus has been directed at the processes, counseling and student participation, and simultaneously at the teachers’ ability to evaluate objectively. On the one hand evaluation should represent the criteria stated in the curricula, but at the same time, it should be in accordance with the teaching activities themselves. The grading system is given as a regulation, but alternatives should be considered. (KUF, 1998a)

It is no longer a matter of a one-size-fits-all assessment entirely. Attention has been drawn towards the learner's abilities, needs and learning processes. However, this has been combined with the objective technicalities assisting a mechanic view of evaluation. Therefore, there is rather a demand for multi focuses at the same time. A comprehensive system of evaluation has developed and most of the perspectives of evaluation and student assessment during the last century have been integrated. The stated expectations of the implementation of this comprehensive evaluation system have included issues of evaluation and student assessment that have been added during one hundred years of evaluation history. The complexity of evaluation and student assessment has been manifested within the education system and mandated to the teachers. Hence, the dilemmas of evaluation and student assessment have become regulations to be implemented at all educational levels including the teachers.

Multiple purposes of evaluation and assessment raise the issue of whether one assessment task, tool or technique can provide the wanted, required or desired information or whether the multiple purposes of evaluation demand corresponding multiple assessment tasks, tools and techniques. (B Bell & Cowie, 2001b; P. Black, 1998a)

4.3 Dilemmas of student assessment

Thus, the complexity of educational student assessment within schooling today and consequently the challenges facing the teacher has been introduced. Hereafter, the specific dilemmas of significance for the teacher's perspective will be discussed. Student assessment practice within institutions is, first of all, facing the dilemma of individualized versus collectively stated criteria and objectives (4.3.1). One aspect of this was raised by Dewey in the quotation where he points towards the participation of the teacher and the student. In the dilemmas stated by Berlak and Berlak (1981), the dimensions of unique or shared characteristics and learning as social versus learning as individual were mentioned under the curriculum set of dilemmas. In this understanding, the educational dilemmas point towards either having the specific characteristics of the individual student or the common characteristics of a whole group as the main agenda for teaching.

The next main dilemma is student assessment seen entirely as systemic control or entirely as motivation for development and knowledge growth (4.3.2.). This represents the duality of summative and formative elements in the student assessment practice (Helle, 2000; Scriven, 1991). The other alternative, as represented in the quotation of Dewey, is the duality of focusing on the products of student assessment versus focusing on the processes of student assessment. Formative versus summative dimensions in student assessment could also be referred to, as in Berlak's language, as the learning content as process versus the knowledge content as product.

The last main dilemma is the teacher's identity in combining on the one hand the implementation of national goals and standards set for student assessment and on the other hand her or his main focus for teaching a subject (P. Black, 1998b) (4.3.3.). This is raised as the consequence of the increased institutionalized agenda of student assessment and evaluation. Evaluation has found its place as a steering means by national, county and municipal authorities. Political steering has resulted in both curricula and evaluation and assessment regulations that are mandated. The underlying ideology behind these steering documents may or may not be in conflict with the teachers' own educational ideology.

So far, the focus on all dilemmas in education has been argued from a dialectic and sociocultural epistemological perspective as well as from empirical indications, represented by Delta. The sociocultural identity concept of teacher professionalism as continuously being formed in relation to other educational participants and in relation to institutional agendas is in particular present in the third dilemma. However the participation of different actors is commented on throughout the presentation and is hence an implicit perspective following from a sociocultural approach.

All these assessment dilemmas include the viewpoints in a number of fields like learning theory, scientific methods and pedagogical preferences. The three dilemmas stated here are not mutually exclusive. On the one hand, they emphasize different aspects of student assessment, but they may also be combined into two- or three-dimensional frameworks for evaluative practice (4.3.4. and 4.3.5.). However, they are also substitutes for the same overall dilemma,

and therefore I will use this framing of student assessment pointing at two perspectives of student assessment. The first continues the main questions of evaluative educational practice, and the second builds the complexity bottom up starting with one dilemma and incorporating that into the next dilemma.

4.3.1 The individual versus the collective

The individual versus the collective in student assessment refers first of all to the criteria set for student assessment. However, there are other aspects of student assessment that can be discussed or viewed within this dilemma. If the overall perspective is the establishment of student assessment practices, in general the dilemma can be stated as the individual overall contribution to the student assessment process versus the collective contribution and participation in this process. Therefore within this perspective of student assessment as an ongoing process in all stages of instruction and at all levels of the educational system the dilemma of learning as social versus learning as individual becomes the main dilemma, while unique or shared characteristics are subordinate to this. This represents the overall view of student assessment and gives therefore the technical solutions to evaluation and assessment procedure a subordinate position.

In addition to the individual versus the collective as a starting point for setting the standards the individual versus the collective are visible in who sets the standards, the planning process, and who participates in the communication concerning the outcome of the teaching. The individual versus the collective aspects of student assessment can thus be seen as an autocratic process versus a democratic process. Despite this the technicalities of student assessment, seen strictly as the individual or the group of students as the reference point for setting standards, will have to be dealt with at some point that I will do here.

A democratic collective involvement is a question of the quality of various competences and the attitude to their relative contributions. The parents have the competence of their knowledge of the student from a wider perspective than the school activities and hence may see the individual's need from a family societal viewpoint. The students possess the competence of having or gaining substantial and methodical self-consciousness, and thus the possible use of

student assessment for further insight into his/her learning strategies and subject content. Active involvement from these individuals may therefore have dual effect of influencing the standards and criteria as well as getting to understand the school student assessment agenda. The technical solutions to this democratic involvement have traditionally been teacher-student- parent discourses, parents meetings and written communication like regular newsletters, planning documents and school home reports. This sub-dilemma of collective or individual involvement in standard setting was addressed specifically in the Berlak framework as a part of controlling the learning environment. The involvement of the student is in addition referred to as the learner as a client or as a person.

Referencing

Technically the individual versus the collective dimension of student assessment has focused on individual learning possibilities as the stated criteria for assessment versus individual assessment according to comparison with other students. In the first case, it is the individual process as well as learning outcomes that form the reference, while in the second case, it is the expected or actual outcome and the processes of a defined group of students that form the reference. This ipsative versus group as the reference point for student assessment will naturally be used differently in different stages of the educational program. Group referencing is interchangeably referred to as norm referencing. Basically these two terms state that measuring knowledge, knowledge gain or the learning process are based on the mean achievement of a group and this establishes the norm for the student assessment of the individual as well as for the group.

A third reference for student assessment is frequently used, namely the reference to a stated goal/objective/target. This may be used for both individual and collective purposes and also be combined with an ipsative or group reference. Goal achievement can be based on the individual need, competence or expected learning potential if the goal stated has this individual perspective embedded in the goal statements. Alternatively, goal achievement can be based on definitions of objectives that are stated for a group of students sharing a common factor like age, gender, ability level or class level/year of schooling. (P. Black, 1998b; Helle, 2000)

Of particular interest is the development of curriculum-based-assessment in which the references for assessment are goal statements/objectives/aims stated in curricula, whether national or locally developed/adapted. Instructional decisions are valid according to the same statements. The approach is more often individual than collective. In order to work effectively curriculum based assessment has to be followed up with frequent testing. Norway, Sweden and England have implemented different varieties of curricula based assessment system. (Chapter 9.)

Grading or not grading?

How do we communicate the assessment to the students? In order to finish the technical considerations of student assessment the question of reporting learning outcomes has to be mentioned. This question concerns two main decisions. The first is the question of whether or not to use grading as the main feedback, or differently stated what the appropriate or preferred expressions of learning outcome are. The other question is how to define the grading system to be applied. Both of these questions include, however, considerations about individual and collective criteria. They cover the appropriateness of referring to students as the receiver, parents as the receiver as well as internal and external information within the school system. Embedded here are consequently specific issues concerning the validity and the reliability of different grading or the expression of a more open student assessment.

Grading is just one way to report assessment and evaluation, but the whole discussion about student assessment is often focused on this rather narrow issue (Lysne, 1999). This is a symptom of the grading systems' significance for society, for certification and for the labor market. Nevertheless, concerning again the first question, grading or not, we still have to state some criteria for student assessment. That is to say, we implicitly or explicitly use some form of reference when we assess. Regardless of this decision, we face the challenge of defining an expected learning outcome or an expected learning path. Criteria serve the dual function of making it explicit to oneself as a teacher as well as making expectations, activities and content explicit to the students. In the case of not using grading, we therefore need to be conscious of

how to give the feedback, in what form and with what content. The strength of this feedback form lies in the possibility to point at several dimensions such as the specific.

Concerning the second sub-question about how to define a grading system, the principal point of departure was the Jesuitical definition of a grading system for placing a student and for the internal promotion of the students. They defined for this purpose a number scale from “1” to “6”, with “1” being the best grade. In this scale the “1” through “5” referred to stated norms, but “6” referred to a minimum standard that had to be met and hence referred to a goal statement. (Lysne, 1999)

The teachers involved in this project work within three different national educational systems. They have, in order to adhere to their national mandate, three different grading systems to implement at least for some activities. The Norwegian, the Swedish and the English systems have different traditions and solutions to numbering grading levels and labeling grades, but more importantly in how these grading levels are defined as competence demands (see the case-chapters).

Equity or equality, differentiating or integrating

The use of ipsative versus group referencing has also been discussed under ideological labels like equity in education. (Lindensjö & Lundgren, 2000) Equity in elementary education has at least two aspects. The first is that of equal possibilities or opportunities for learning. Politically ideologically this means equal access to the educational system, with regard to the facilitating for learning processes prepared by the institutional and the teacher. The idea is here that fairness in education systems is understood as the systems’ ability to distribute financial and economic resources in order to meet the need of all the users in a way that provides equal opportunities to use the system for knowledge acquisition. The second aspect of equity, which is more complex due to the values, attitudes and social mechanisms involved, concerns equality as individuals. Equality at the individual level addresses the diversity among students and therefore the necessity for unequal treatment in order to meet individual learning abilities. The equity concept in this understanding requires unequal treatment to achieve equity. As an example of this aspect, one hundred years of educational policy in Norway can be summarized

as “*equity through equality*” and there is hope for a change to “*equity through diversity*” (Solstad, 1994). This change would have major implications for views of learning, views of the individual identity formation and views of student assessment. The duality of group versus ipsative referencing and the turn towards ipsative student assessment procedures is one such educational ideological implication.

Lindensjö and Lundgren (2000) point at this complexity by summarizing the dual tasks of the educational system of representing the values of society on one hand and creating new values by establishing emancipatory programs for the students on the other. The ultimate goals for education are to pass on accepted knowledge and provide an individual base for critical attitudes to this knowledge. “*The dilemma of modern educational institutions, as developed throughout the 19th century, is that the two mandates are in important aspects contradictory. One is the need to provide knowledge for society and working life - the utilitarian societal mandate. The other is to create equality through equal opportunities for all students. This means that school has to reflect and reproduce the knowledge and values of society...Equal opportunities are therefore not sufficient. Equality requires compensation due to the change in society.*” In addition, “*Equality through equal opportunities requires that resources are allocated according to individual needs. This is where equality through compensations begins to be stated as equity.*” (Ibid, p.58 and p.121, my translation)⁷ Within a perspective of school-society relationship the ideological aspect of the dilemma is represented in this combined utilitarian and critical mandate. In order to work towards these two goals the schools have to develop student assessment procedures that acknowledge the collectively accepted knowledge foundation, and simultaneously motivate students beyond this point by rewarding critical individual thinking. Furthermore, appreciating individual rights in education means including the individual right and freedom to choose educational programs and educational evaluation.

Another way of viewing this student assessment dilemma is to discuss the relative importance of student assessment as a consequence of integration/inclusion versus differentiation. Student

⁷ The corresponding terms in Norwegian/Swedish would be “rettferdighet/jävnlighet” and “likeverd”. Both of these terms may be understood as synonymous, yet the first with the technical, just and fair connotation and the other with the perspective equal of human value.

assessment procedures as a part of inclusion have been regarded during the past 100 years as giving all students equal educational opportunities. Procedures have therefore included group referencing. However, when differentiation was introduced as a pedagogic tool ipsative references became the solution. Just and equal procedures for student assessment mean on the one hand reassurance through valid and reliable grading and on the other hand individual support to obtain the desired grades or fulfill potential. The continuation of this dilemma is accordingly the duality of control versus guidance. This will be discussed below.

The individual versus the collective as an overall student assessment consideration becomes an epistemological issue under which the technical challenges will find their solutions. There is here consequently a breaking point between the epistemological positioning that addresses individual learning outcomes or processes as the combined behaviorism/individual cognitive theories versus the collective found within the social constructivist and socio-cultural approaches. This epistemological implicitness of the dilemma is further illuminated in chapter 5.

4.3.2 Guidance versus control

Emphasizing controlling the outcomes of learning processes equals the summative aspects of student assessment as defined in a previous section. On the other hand, emphasis on guidance of the learning processes themselves equals the formative aspects of student assessment. When it comes to this dilemma or duality of summation or formation there has been a gradual tendency towards a focus on the formative student assessment strategies as described in section 4.2. However, the summative aspects have remained important as societal control of the school system and its outcomes. The comprehensive mandate involves both. Also, from the teaching perspective, they both have their value. Evaluative teaching practices may be a swinging pendulum between summative and formative student assessment, or mainly based on either one.

Formative assessment has been put on the research as well as the teaching agenda both within the science education research communities and within the communities of didaktik of natural sciences. That is to say, there has been a growing awareness of its importance more than there

has actually been research conducted with utilizing focus. (P. Black & Harrison, 2000) The beauty of formative assessment is the possibility of bridging a gap between the teacher's reflections upon subject related practice and the conclusions drawn up about the students learning according to a multitude of learning activities that more or less are defined as assessment or evaluation activities. (B. Bell & Cowie, 2001a) Within science education communities throughout the world more emphasis has however been put on the summative aspects of student assessment (Fensham, 1999). A majority of research projects have been concerned with the construction of tests focusing mainly on validity and reliability for comparative purposes rather than test construction for diagnostic purposes. It is therefore important at this point to raise the question of how to discuss and investigate student assessment issues so that practicing teachers may benefit from the research. (Andersson, 2000)

The duality of formative and summative approaches will be discussed under the view that they also complement each other into the total field of assessment. *"It is inevitable that all will be involved, one way or the other, in working to both purposes, and if an optimum balance is not sought, formative work will always be insecure because of the treat of renewed dominance by the summative."* (P. Black, J. & William, 1998c, p.59)

Summative strategies

The characteristics of summative student assessment in its original form was entirely concerned with objectivity and how to find measurements of students outcomes that were accurate enough in order to evaluate all students using the same standards. The objective measured had to rely on objectives that were stated outside the context of the teaching activities themselves. They had to work across school contexts and specific agendas of the individual teacher. Valid criteria were hence objectives stated nationally for a group of students, while the grading used was founded according to similar standardized procedures. Standardized testing along these lines, for example IQ-testing and SAT-testing⁸ were designed and implemented widely within the sciences in USA due to an assumed embedded rational of sciences that could be used as a way to organize education, select students for

⁸ Intelligence Testing and Scholastic Aptitude Testing often in the form of multiple choice testing.

different educational tracks, allot scholarships and access higher education. In this traditional form, the purposes were as they still are - review, transfer and certification as well as accountability to society in general and the educational authorities. (P. Black, 1998b)

Summative student assessment from a teacher perspective may also be used to transfer students between age levels and/or ability levels. The main portion of summative student assessment within teacher practices is however, the student assessment that is entirely concerned with controlling some outcome of the learning process. The summative focus is, when it comes to referencing, closely tied to group and criteria references and that aspect of collectivity of student assessment. Even if that is the reference point, the intention is to grade and test individually so that the result of summative student assessment is individually interpreted too.

Formative strategies

Formative student assessment possesses some specific characteristics according to a study that focused on teachers and students in the subject of science. This study was contracted by the New Zealand Ministry of Education under its mandate to investigate classroom-based assessment in science education from the ages of 11 through 14. The characteristics identified in this project are that formative assessment is seen as a responsive; the sources are nonverbal as well as verbal information from a multitude of information strategies; it is often a tacit process; it relies on student disclosure; it uses professional knowledge and experience; it is an integral part of teaching and learning; it is carried out by teachers and students; the purpose is to inform the students' learning and their teaching; it is a highly contextualized process, and it involves the management of dilemmas. (B. Bell & Cowie, 1999; B Bell & Cowie, 2001b)

Furthermore, this project produced some interesting results concerning responsiveness and student disclosure. Regarding responsiveness formative assessment must include some degree of responsiveness in order to be formative. There are some characteristics that determine the quality and degree of responsiveness. It has to be on going, progressive and interactive. Students have to take active participation in formulating the feedback and the criteria for feedback. They can take part individually or as a group. It can be recorded or unrecorded, and

it can be planned or unplanned. This in-action-decision making renders the formative student assessment highly unpredictable for all students and teachers involved and have therefore also been labeled as taking risks. Teachers in this study would hence apply words like professional confidence, uncertainty, discernment, tacit and intuition to their identity and corresponding reflection.

Concerning the second main point from the New Zealand study, “*disclosure relates to the extent to which a task or activity produces evidence of student performance or thinking*” (B Bell & Cowie, 2001b, p.66), disclosure is stated as equally crucial in order to label student assessment as formative. The students had specific perceptions of the teachers’ strategies that sometimes limited their disclosure. Exposing critique was also seen as important in order to move through a cycle of assessment. Students did however open up to a wide range of comments, including relational, social, cognitive and affective aspects of teaching. Participation in the formative processes was also influenced by anticipated expectations and prior experience of openness in similar settings. The teachers were to various degrees suited to fulfilling this identity of easing relationships in formative evaluative situations. Corresponding feelings that the teachers had to be aware of were serious affective reactions such as fairness and the students’ pointing out the teachers’ ability to build an environment based on mutual trust.

In closing, the authors made the following remark about the teacher’s identity: “*The important and complex task for the teacher is therefore to mediate the social context of the classroom to ensure that the risk to students of disclosing is minimized. For this, the teacher’s ability to monitor and use the power and authority relationship in the classroom is crucial.*” (Ibid, p.74) The discursive sociocultural aspects of formative student assessment will be continued in chapter 5.

Black has underlined the importance of formative approaches in several of his articles and books (P. Black, 1998a; P. Black, 1998b, 2001; P. Black & Harrison, 2000; P. Black, J. & William, 1998c; P. J. Black, 1993). The list of the advantages of formative strategies includes epistemological and classroom practices innovation, increased student participation, reception,

self-perception and responsiveness by self-assessment, increased student co-operation by peer-assessment and increased teacher co-operation by means of discourses about criteria, tools (included tests) and strategies. The heart of formative approaches is the existence and the quality of feedback given as part of the strategy.

Feedback was defined as “*information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way.*” (Ramaprasad, 1983, p.4) The point of reference determines the individual or collective nature of the feedback. Grading as a feedback tool would only improve learning if it were accompanied by statements about improvement possibilities on an individual basis. (Ames, 1992) In which case there is a combination of ipsative referencing and criteria or group referencing.

Quality of feedback is the key feature of formative strategies. This feedback principle requires that the teachers break away from the norm referenced student assessment of students (see below). The validity of the feedback is situational. However, some studies have looked into specific feedback strategies in order to define the critical factors of feedback quality. Ames claims that feedback should be given according to one of two goal achievement systems; the combination of tasks and the student assessment of tasks should either be mastery oriented (effort and outcome co-vary as intrinsic self-referenced values of learning) or performance oriented (ability as extrinsically competitive according to a group reference). Mixing the two causes confusion for the students, as there is no motivational pattern to follow. In other words, setting goals and evaluating goal achievement has to be either individual or collective. Mastery goal orientation is preferred in this article for its ability to assist students in their self-management, in self-monitoring of goal achievement, in defining self-referenced goals and hence a continuous focus on individual improvement. This is therefore stated as the main feedback principle. (Ames, 1992) “*In other words, assessment is formative only when comparison of actual and reference levels yields information which is then used to alter the gap.*” (P. Black, J. & William, 1998c, p.53)

Formative assessment has the ability to combine ipsative referencing with criterion referencing. The criteria may be predefined as traditional criterion referencing. Alternatively, they may actually be developed as a part of the learning activities, in which case they are a true combination of the two. In both cases, the links between the teaching activities, content and emphasis is strengthened. The results of formative assessment have therefore the ability to represent the learning processes. In addition, the results will have to be interpreted according to the context and situation under which they have been derived.

Summative versus formative

The differences between formative and summative assessment has been blurred in that assessment strategies may be used both formatively and summatively. However, it is probably still right to claim that some strategies can still only be used in a formative manner. The principal difference between formative and summative assessment is not whether it takes place during or after instruction, but **whether actions are taken to inform students about their learning**. Therefore, the ongoing business of repeated testing during teaching of a topic is formative depending on the kind of feedback mechanisms that are undertaken by the teacher. It is in the intention of the assessment as being genuinely guiding learning or genuinely informing the teacher about learning that makes the assessment respectively formative and summative.

As stated, there is no clear-cut line between the two main strategies. *“The two functions are two ends of the same spectrum and there is no sharp difference. If the two functions are separated the teachers’ assessment work will be devalued.”* (P. Black, 1998b, p.34) The value of student assessment is the combination of the two, even if it is not possible to combine the two in the same evaluative activities. Summative purposes make reliability crucial and all procedures have to be geared towards creating reliable results. Validity on the other hand is more complex. In summative assessment the content validity relies on content stated outside the educational setting and classroom situation itself, but in formative assessment the content validity can be defined within the actual teaching situation and the activities in the educational program under which the learning took place. Choosing the one will therefore be at the expense of the other as in all true dilemmas.

A summary of the two purposes of assessment may be carried out under the labels of curriculum based and problem solving assessments, here understood as summative and formative respectively. (Shinn & Good III, 1992) This summary characterizes summative assessment as criterion related, collective, possessing an external validity (both in terms of placement and in terms of transferability across contexts), measuring the students' level of knowledge according to curricula and identifying problems according to this external reference only. Formative purposes are correspondingly characterized as ipsative, as valid according to adequate and appropriate educational actions, measuring the students' level as well as gains according to the curriculum and the actual instruction given while identifying solutions for the individual student. Understated in this summary is, however, the duality of the epistemological view embedded in the two purposes.

Teachers who puts all their emphasis on the individual guidance of the individual student and who accordingly will formulate individual learning objectives, use ipsative reference points and assess the student based on individual learning gain represent one extreme of this dilemma. The teacher will adopt a developmental approach and be entirely concerned with the processes of learning. This teacher wants to be the individual student's counselor for the benefit of the growth and development of individual learning skills, attitudes and knowledge. The other extreme is the teacher who is entirely concerned with controlling the students' outcome or the results of the teaching and learning processes. This outcome control is traditionally and basically oriented towards acquired subject knowledge and skills. This control, based on results will need reference points beyond the individual student, often in some prior defined criteria or group reference. The first teacher is concerned with the mechanisms of formation of the individual, while the other is concerned with the summation of learning outcomes. Therefore the duality of formative versus summative may result in fruitful concepts representing the extreme dimensions involved in this dilemma.

This dilemma points towards the aspect of epistemological positioning that considers pieces of knowledge as the main assessment agenda as happens within behaviorism versus the positioning that considers the individual process of cognition as the phenomenon we have to

capture when assessing versus the social participation as the ultimate goal of assessing students' learning processes.

4.3.3 Institutionalized mandate versus teacher developed criteria

This dilemma has not been dealt with in the previously mentioned dilemmas of control, curriculum and society in the Berlak dilemma framework. The societal and political processes behind the development of curricula are not the issue within that framework. This dilemma in the systemic educational approach to definition of standards is however important for the perspective of the individual teacher whose professional life takes place within institutional frames set by society in general and educational policy in particular. The teacher has a mandate from the educational authorities. The challenge is to merge this mandate with his/her formal background and experience. These two aspects, the mandate and their own professional priorities may contradict each other or they may be in co-ordinance with each other. The teacher may reflect upon the mandate in terms of finding similarities with their own ideological platform or of identifying differences with own ideological platform. For the individual teacher a degree of resemblance will therefore arise between their positioning and the institutionalized mandate.

This dilemma points back to the development outlined in 4.3.4 and the corresponding development in other national educational systems. This dilemma also refers to previous discussions about education in institutions. The concept of reflective teacher identity formation as part of the social dimension and of implementing the agenda of society in general and the school in particular has been found in both the sociocultural and the newer sociological identity concepts. Here, however, focus has been directed at the combination or tension between an individual motivation and the official mandate for student assessment.

As concluded by Johnston et al in an article reviewing US teachers' assessment strategies: *“Most teachers were caught in conflicts among belief systems, and institutional structures, agendas, and values. The point of friction among these conflicts was assessment, which was associated with very powerful feelings of being overwhelmed, and of insecurity, guilt, frustration and anger... This study suggests that assessment, as it occurs in schools, is far from*

a merely technical problem. Rather it is deeply social and personal." (Johnston et al., 1995, p.359)

A presentation of the three national educational systems is done in a separate chapter as this is also a methodological concern in this project (chapter 9).

4.3.4 Combination of dilemmas

Dilemmas in student assessment have been a way to deal with the complexity of student assessment by stating some issues specific to particular aspects of student assessment within particular tensions. The didaktik practice, however, deals with the whole range of evaluative issues and most dilemmas of student assessment simultaneously. Now it is time to reintroduce the complexity and merge the dilemmas.

Combination of summative/formative with individual/collective referencing.

Considering the combination of guidance versus control with the individual versus collective, some lines have to be drawn between the two. The first dilemma addresses the intention behind the student assessment from a teaching perspective. The other addresses the standards on which the assessment is based (in addition to participation in the evaluation procedure). It is therefore possible to combine the two. The result would be four sectors. The presented terminology can be placed within these four sectors.

The first sector would be the combination of the individual referencing with an emphasis on the products of learning. Ipsative referencing could be the major reference tool here. However, most often group referencing is due to the applicability of student assessment results for other purposes like advancement and transfer in which the individual competes with other students. Summative approaches directing at the individual student. The second sector would be the combination of the individual referencing with the emphasis on the processes of learning. Here ipsative referencing would be the ultimate reference tool. Formative approaches directed at individual students are the asset of diagnostic testing as well as all individual learning activities. The third sector would represent the collective referencing combined with the product dimension of learning. This is the typical situation where group referencing would

apply. Summative approaches directed at groups of students are the sector most often used and, unfortunately, in situations where it should not apply. The fourth sector would be the combination of the collective referencing with the process dimension of learning. Group referencing could apply. In a nutshell, formative approaches directed at groups of students are the same as classroom instruction. This is a complicated sector and practices within project related activities include all these challenges.

Another set of terms has been used in evaluation and student assessment issues that address this complexity. That is the formal/informal. The originator defined these terms within the frames of the countenance and the responsive models as

“Informal evaluation is recognized by its dependence on casual observation, implicit goals, intuitive norms, and subjective judgment.”

“Formal evaluation of education is recognized by its dependence on checklists, structured visitation by peers, controlled comparisons, and standardized testing of students.” (Guba & Lincoln, 1988, p.29)

To say that it represented either the duality of processes versus products is too simple. So is to say that it represents the duality of guidance versus control. The informal versus the formal represents rather two sides of the teacher practice that the researcher has to consider when talking to a teacher. Formal/informal is thus a combination of the two dilemmas. They are more inaccurate as directing attention to specific aspects of student assessment theoretically. However, they can be used descriptively during teaching practice if the limitations of the terms are considered.⁹ The existence of written accords for the purposes of recording and reporting makes formal. **Formal assessment** is recognized by the explicitness of criteria, structured documentation, stated objectives, intentional comparison and an overall objective

⁹ Unfortunately these terms have been used as ‘uformell’ and ‘formell’ evaluation in Norwegian, but they have become to mean something different. ‘U formell’ has been used when not issuing grades and ‘formell’ when grades are issued (Bjørnsrud & Raaen, 1996; Fuglestad, Lillejord, & Tobiassen, 1999; KUF, 1996b). In this case they single out the evaluation statements that are given to the students/parents and not the processes of evaluation itself as intended by originator. In some instances they refer entirely to the existence or non-existence of documentation.

aim of assessment. **Informal assessment** on the other hand is most often referred to as an ongoing process without written accounts or with written accounts for the teacher's use only. Corresponding characteristics are unstructured accounts and implicit or vaguely stated objectives and intentions. Therefore, informal assessment is seen as subjective and casual with a high degree of intuition.

Combination of processes/products with institutionalized mandate/teacher autonomy

There is always a tension between society and educational institutions. Society gains expertise for the future from educating beyond the limitations presently set. Society simultaneously needs to be able to control who gains access to working arenas as well as educational institutions. There are two main dimensions built into dilemmas. Firstly, the tension lies in the duality of external control and demands and internal autonomy. This has also been stated a direct control-mechanisms versus indirect control mechanisms. The direct refers to steering by explicit statements, and the indirect to steering by the use of the competencies of the teachers. The tools of direct steering would typically be programmatic planning, detailed syllabuses and nationally stated student assessment criteria. Likewise, the implementation strategy for indirect steering would involve curricula guidelines, locally stated criteria and emphasis on locally developed syllabuses. Secondly, there is the dimension of looking at the products of education versus looking at the processes of education. (Hopmann, 2001)

The first dimension of direct and indirect steering in the process aspect addresses the teacher profession. The indirect approach has traditionally been the approach of didaktik and teacher reasoning/reflection emphasizing facilitating educational processes, activities and learning from various didaktik analytical positions. The combination of processes and direct control however represents the educational governments and therefore reflects the educational societal processes. Schools on the one hand build a society and hence are a major contributing factor to developments of numerous mechanisms among them by delivering the expertise that society needs currently and in the future. On the other hand, school reflects society in that many internal school affairs have been subject to the (democratic) processes of decision making outside school. These decision-making processes result in mandates formulated in strategic documents like curricula and student assessment guidelines or more strictly in regulations.

This mandate is subject thereafter to interpretation and implementation by the teachers. On the other hand, teachers have their own ideological and epistemological standpoints that may be in conflict with the official mandate which represents internal autonomy.

4.4 Applicability of dilemmas for a reflective teacher identity

Dealing with evaluation and assessment means also dealing with a complexity of factors, e.g. control mechanisms, the status of curricula and the mutual influence of society on schools and vice versa. There are several possible ways of dealing with this complexity. Even from the individual point of view complexity may be treated as constraints, as possibilities, as controversies or as dilemmas. Investigating dilemmas is closely connected to a reflective teacher identity within a sociocultural perspective.

Questioning the applicability of dilemmas as a valuable approach to addressing the controversies for the teacher and the appropriateness according to changing conditions have been done by Woods et al in their project concerning stress in restructuring institutions (Woods et al., 1997). These authors question applicability due to the curriculum, content and process related mandates imposed on teachers and which are in conflict with the implicit curriculum view of the sixteen dilemmas. It is therefore a possibility that teachers will not discover that they have the opportunity to act according to their individual priorities and hence the sixteen aspects of teaching. They find themselves within a restricted educational environment and institutional setting in which their room for action and reflection is restricted due to imposed constraints. In addition, they argue the closed predefined categories that are used. These dilemmas will have to be adjusted, tested, refined and rebuilt according to the actual teachers involved in any project. Hence, this approach needs to be complemented by an approach of grounding the theory in the practices of the teachers and in their statements about individual reflections. In this study by Woods et al four categories of teachers were identified according to how they interpreted their new teacher identity and the degree to which they found professional development in the new situation and the new tensions and dilemmas arising from it. The four categories were first the enhanced teachers, then the compliant teachers, the non-compliant teachers and finally diminished teachers.

From a sociological viewpoint, addressing the combination of reflection and dilemmas can be stated in the same way as Beck and Giddens did in *Reflexive Modernization* where they introduced the controversies of building societies based on individual self-confrontation. Here they do not consider individual reflection as the means to identity formation alone, but as a necessity to be confronted via social dynamics in order to build identity within social frames - *“reflexivity includes reflection”* (Beck et al., 1994, p.201) and *“reflexive modernization means self-confrontation”* (Ibid, 6) as a necessary result of modern society, in this source referred to as a risk society. Reflection is primarily an individual enterprise while reflexivity is an individual process based on, embedded in and dependent on collective and social practices. *“Institutional reflexivity is the regularized use of knowledge about circumstances of social life as a constitutive element in its organization and transformation.”* (Giddens, 1991, p.20) This view coincides with the socio-cultural view of Wenger, but from a sociological angle.

A central key to the reflexive process is knowledge, awareness and language skills. This new identity concept is a possible way of including the controversies and power relations built into institutionalized settings. Social life in general and the educative business in particular take place in institutions in such a way that teachers are formed by the institutional agenda as well as teachers forming the institutional agenda. Reflexive modernization has become an attempt at including this into a concept of reflective identity. For this project, I will to some extent draw on the social factors for the reflective practices of the individual teacher, but for pragmatic reasons retain the term reflective practices.

The institutional aspect of evaluation involves in the modern and postmodern society aspects of continuation or ritualized evaluation (Dahler-Larsen, 2001). In these cases the evaluation is formative in the sense of feedback loops in order to understand the mechanisms of the institutional practices in themselves. It is ritualized both in frequency and in substance. The externally established objectives are neither the sole reference point for the importance of evaluation nor the sole criteria for the success of evaluation. For the educational institution, this is interesting due to the necessity for the institution to constantly evaluate its own internal life. Evaluation in itself builds the identity of the individual in relationship to the other

individuals in the educational institution. In education, evaluation has the ongoing purpose of constituting practices as well as forming identity as a part of these practices.

Delta works within the educational system in Norway. He finds that this system builds on two conflicting agendas, the one outlined in the national curriculum (L-97) and the other outlined in national testing. The dilemmas stated at the start of this chapter are those for the teacher to deal with in education. When dilemmas are manifested in his teaching mandate, he finds himself drawn between the two identities. He finds that he cannot simultaneously satisfy the criteria and standards of the formative and the summative student assessment. The classroom dialogue is supporting the individual conceptual learning, but fails to meet the standards set by summative assessment. The value of his preferences as classroom facilitators is vulnerable due to insignificance for summative testing procedures. He claims that assessment is combination of opposing purposes, and that these purposes are in conflict with each other as they build on conflicting view on what learning is, on what knowledge is possible to measure and on what aspects of learning that is important to measure. In order to further illuminate these tensions the epistemological and ideological aspects of reflection became the issues of the discourses with the teachers.

Delta: *“Our project of education is hopeless. These things are not coordinated. The exams and the L-97 concern two different things. So this is really a hopeless project. L-97 presupposes co-operation and physical terms that we do not have. Then it is the testing that does not coordinate with the content. This characterizes all of our system.”(21.5.01)*

Delta: *“When I feel like I am succeeding as a teacher, the more vulnerable is the summative student assessment. The more dialogue, the more satisfied well being, the less drilling. But I am completely sure that the students that continue with mathematics will gain from the formative variation that I prefer.” (21.5.01)*

Delta: *“I believe, so to speak, that there is nothing wrong with instrumental learning when we talk about the practice of technical skills for limited areas. I sort of like Skinner and response learning.” (5.12.00)*

Delta: *“I am very concerned with participation and involvement and the atmosphere in the classroom and work with that as an aim. I measure this against whether the talking is about the subject... It is motivating to show some other student what you can do and the learning effect is better than solving ten items! When they talk their awareness increases and they have to express the content. While tests- they can show the technical execution, but not comprehension.” (6.12.00)*

5 Epistemological theories and implications for teacher identity and student assessment

In the above quotations, Delta is signaling two different views of knowledge and learning. In the first situation, he is an advocate of a behaviorist view and claims that some skills are achieved by the use of rote learning. The next day he advocates the sociocultural view that can be recognized from the previous quotations. In this situation he is favoring the communicative relational formation of conceptual understanding. Two teaching situations, and the two subsequent interview situations, compel reflections and reasoning drawn on two epistemological positions. Delta is defending a situative perspective on assessment. There are according to him different solutions to assessment depending on the actual teaching situation.

This presentation will be classified around the three perspectives of behaviorist/emperist view, an individual cognitive view and a sociocultural view of knowing, learning as well as their corresponding views of assessment and teaching. In accordance with the overall situative perspective presented by Delta I will at the same time take the main perspective represented by the following: *“We propose that the situative perspective provides functional analyses of intact activity systems and that cognitive and behaviorist analyses characterize mechanisms that support the achievement functions.” (Greeno & MSMTAPG, 1998)* The analytical approach therefore proposes that the three epistemological views and their assessment implications are equally important with regard to the total of formative and summative purposes of assessment.

Briefly, what constitutes the three different views of learning when the focus is on student assessment? A behaviorist view of learning includes the whole package of designing the tests that map a person's register of skills and knowledge transmitted during instruction. This requires an analysis of the necessary pieces of knowledge, according to the equality of test administration, and it concerns reliability and validity in order to achieve objective measurements of achievements. Another important aspect of learning seen from this empirist view is the combination of goal/aims/objectives formulations as important for the learning activities as well as for assessment criteria. (Greeno, Collins, & Resnick, 1996) According to this concept, the feedback built into teaching activities should also be based on these goal statements and the corresponding criteria.

This behaviorist view of student assessment is of significant importance for the tradition of individual cognitive learning theory. However, the substantial aspects have now been extended to include performances, projects and other learning strategies that result in further construction of understanding. Emphasis on learning environments for the purpose of increased understanding and the analysis of learning activities to meet the individual student's abilities are the keys to this view of learning. Assessment in this concept includes elements like understanding and reasoning and provides information about increased knowledge and skills as well as forming a basis for developing further student activities according to the analysis of their abilities.

These two traditions, behaviorist and cognitive, do not give sufficient answers to the complexity and many dimensions of learning activities that are collective more than individual, affective in addition to cognitive, and that contain several academic disciplines. The sociocultural perspective has the ambition of achieving that, namely assessing students within the social relational practices that is fundamental for their knowledge acquisition. This requires the incorporation of the observations of student's participation and active involvement in learning activities into the teachers' list of actions. This view of assessment requires student participation and the definition of student assessment standards and references is a joint and continuous activity. A third factor is that this platform generates the view that student assessment has become an integrated part of student assessment system in which we

do not evaluate only for the purpose of labeling students. In addition, the intention of the feedback is to help the teachers learn for the benefit of other students or any future planning of educational practices. Evaluation and student assessment are a part of the continuous reflection process on student learning and teaching activities.

The overall socio-cultural epistemological view gave the rationale for dilemmas in that teacher practices are situationally determined. However, the educational context may call for positivist as well as cognitive and sociocultural strategies for student assessment. Within the language of dilemmas of student assessment, going from a behaviorist epistemology, via an individual cognitive position and arriving at a sociocultural viewpoint represents the gradually changed positioning from an individualist to a collective reference as stated in the first dilemma of student assessment. Simultaneously it equals a gradual development from a control perspective towards a guidance perspective or from a summative emphasis to a formative emphasis as stated in the second main dilemma of student assessment. The development of assessment purposes as outlined in the previous chapter follows a similar pattern, as will also this presentation of the epistemological implications for assessment.

The three epistemological beliefs will be presented with an emphasis firstly on a brief description of the views of knowing and learning, secondly on transfer and motivation within the paradigm, thirdly on practical conceptualizations like testing design and curricula design, and fourthly on the view of assessment as finally corresponding to teacher's identities.

5.1 Behaviorist / empirist theories and assessment

Behaviorist learning theories were dominant during a greater part of the last century. (Pressley & Mc Cormick, 1995) The basics of these theories are beliefs that knowledge exists regardless of a learner and that it therefore can be prepared for learning by splitting it into small bits of information. Learning results from the carefully planned sequencing of knowledge. Teaching and learning are not only intertwined processes but also inherent processes - having taught equals having learned. A response - stimuli model is combined with a hierarchical model of competencies into testing procedures that in the next step produces information about individual acquiring of knowledge at specific levels. Transfer of knowledge

requires a high degree of similarity between situations. Motivation for learning is organized around the principle of positive and negative reinforcement as external stimuli. This atomistic view of learning followed by a sequenced view of teaching can be implemented by curricula characterized by behavioral objectives and classification of knowledge according to specific subject areas and classification of competencies according to predefined levels of difficulty. (Bloom, 1956; Gagné, 1965; Greeno et al., 1996; Skinner, 1958; Tyler, 1949)

5.1.1 Behaviorist view of knowing, learning and instruction

To the extent that human knowing is of concern for the behaviorist paradigm, knowing in this tradition is closely connected to observed behavior. *“Knowledge refers to a controlling relation between behavior and discriminate stimuli. The response may be skilled, but we are concerned primarily with whether it will be made upon the proper occasion.”* (Skinner, 1953, p.408) It is probably right to claim that behaviorism is more concerned with knowledge rather than knowing in that knowledge may to some extent be acquired by studying behavior.

Complex knowledge and skills may be built up based on structured hierarchies of information. The traditional way of sequencing instructional units will be based on a brick building process during which the learning of one concept or skill is based on the existence of the acquisition of what is considered concepts or skills that are more elementary. Accumulation of knowledge is a result of adding atomistic bits of knowledge. This hierarchical knowledge structure must find its correspondence in hierarchically sequenced teaching and instruction. As the transfer of knowledge is limited to one concept or skill at a time the result is that each knowledge object receives individual attention; one object at a time. The instruction has to be broken down into objectives, and the teacher will use these as guidelines in order to follow a predefined sequencing during instruction. Secondly, instruction has to be based on the students’ abilities following the predefined measures. Hence, tracking, differentiating and streaming according to ability testing are considered appropriate for instruction to be efficient in the case of the majority of students.

Behaviorist theories view learning as changes in behavior. In Watson’s and Thorndike’s world of behaviorism learning is a process of conditioning responses through the substitution of one

stimulus for another. The connectionism of Thorndike, following from this view on learning, is a classical behavioral theory concerning the connections between responses and stimuli as learning. In these theories, therefore, a connection is a bond formed as a result of a person trying different responses to one stimulus until one response leads to a solution. Skinner's reinforcement approach within operant conditioning and under the labels of radical behaviorism and associationism followed in these steps. Learning in Skinner's approach using reinforcement is a result of the associations formed as a consequence of a reinforcement given to a response. The cause-effect bond of Thorndike has been modified in the radical behaviorist theories. Positive reinforcers and negative reinforcers may result in positive and negative reinforcements respectively of a specific response. Positive reinforcers are added to the situation as a reward, while negative reinforcers are removed from the situation as a relief. (Lefrancois, 1997; Pressley & Mc Cormick, 1995)

Furthermore within the behaviorist paradigm the information provided was directly transmitted to students, and testing created situations under which the optimal items would just retrieve the knowledge being stored in the brain. This black box approach resulted in testing traditions that turned out to be very resistant to later theories about learning due to their validity and reliability. Objectivity in grading and assessment procedures calls for such cross cultural and non-situational approaches to assessment. Therefore, testing procedures originated in this tradition are still important as summative approaches. To the extent that they have been implemented they may influence the understanding teachers have of assessment procedures.

In this approach the structure of the knowledge, seen as given, is the most important aspect of curriculum planning. This fixed notion of content in education results in corresponding testing in which there is a fixed knowledge foundation that has to undergo student assessment. This fixed knowledge therefore has to be broken down into exact concepts. The concepts may be tested separately, and finally the result of the testing is the sum of the pieces of knowledge. This sum of knowledge may be labeled by issuing points or marks and grades corresponding to a grading scale. Connections between concepts and skills will consequently disrupt this systematic stepwise acquisition of knowledge. Another result is that the teacher can only

challenge the evaluation of knowledge acquisition, thinking and reasoning at higher levels once the fundamental knowledge has been mastered.

The influence of the Skinnerian tradition on effective humane classroom management and reinforced individual learning has been significant. (Pressley & Mc Cormick, 1995) Skinner himself came to question the application of his theories within educational schooling. He claims that *“Behaviorism is not the science of human behavior; it is the philosophy of that science.”* (Skinner, 1974, p.3) Therefore as in the following quotation, Skinner also points towards the danger of the education system in learning for the system rather than learning for life. *“The conditioned reinforcers of the educational agency may be made more effective by pointing up the connection with natural contingencies to be encountered later. By informing the student of the advantages to be gained from education, education itself may be given reinforcing value.”* (Skinner, 1953, p.407) Skinner follows up this warning by adding, *“Many educational institutions have therefore turned to counseling and various forms of therapy as auxiliary techniques.”* (Ibid) He signals that he had become aware of the application of his theories limiting the intentional individual reinforcement strategies and favoring collective summative strategies based on the requirement of the accountability of educational systems. Consequently, it became necessary to complement educational practices by formative strategies built on cognitive epistemological theories. In a middle position between behaviorism and cognitive theories we find Bandura whose social learning theory has been labeled behaviorist (Carpenter, 1974) and social cognitive theory (Lefrancois, 1997). Contemporary behaviorism or social learning theory emphasizes that behavioral model of observing the learner within a social setting which influences the observation and the learning. (Bandura, 1997)

5.1.2 Behaviorism and assessment

The response-stimuli approach to learning results in an assessment approach in which there was a direct causality between the input during the instruction and the output during the testing situation. This cause effect model of feedback was slightly modified by Skinner into a feedback principle stating that learning will take place if reinforcements are provided in small steps. Positive reinforcement is also basically the motivating force for the student to involve in

further learning. The principle is instrumental conditioning, where the effect of instruction depends on the ability to reinforce specific defined responses. *“When people’s knowledge is viewed as their having associations between ideas or stimuli and responses, learning is the formation, strengthening, and adjustment of those associations.”* (Greeno et al., 1996, p.17)

Tyler (see section 4.2.2.) continues this behavior approach; assessing learning states that the aim of evaluation is to draw conclusions concerning the relationship between the stated objectives and competencies met by the learner by observing behavioral patterns. *“Since educational objectives are essentially changes in human beings, that is, the objectives aimed at are to produce certain desirable changes in the behavioral patterns of the student, then evaluation is the process for determining the degree to which these changes in behavior are actually taking place.”* (Tyler, 1949, p.106) The contribution was hence that the reference for learning is the criteria defined by objectives, and these objectives do not necessarily address the individual’s abilities, but more commonly group objectives.

Tyler himself argued for multiple sources of evaluation in addition to testing and the use of appropriate situations according to the objectives to be evaluated. *“The next step in evaluation procedure is to identify the situations which will give the students the chance to express the behavior that is implied in the educational objectives.”* (Tyler, 1949, p.111) The limitation of evaluation within this paradigm was a concern. *“...there are some educational objectives for which no available evaluation instruments can properly be used.”* (Ibid, p.114) Tyler here is still arguing that obtaining evidence about achievements concerning these objectives is important. His concern is the evaluation of the effectiveness of educational programming and therefore not the assessment for the purposes of individual learning processes. This, however, has been used for the measurements of individual achievement products. Nevertheless, Tyler has in mind the relationship between the evaluation of educational programs by the use of definitions of objectives and individual learning results. He claims that such information may be used for further insight into individual guidance of students. *“Evaluation procedures also have great importance in the individual guidance of pupils. It is not only valuable to know about students’ background but also to know about their achievement of various kinds of objectives in order to have a better notion of both their needs and their capabilities. Any*

comprehensive evaluation program provides information about individual students that can be of great value." (Tyler, 1949, p.124) Evaluation during an educational program is emphasized as important for guiding students in the direction of the objectives stated.

Therefore despite individual intentions such as the feedback principle student assessment within this approach has increasingly been based on the products of learning more than the learning processes, on group more than individual referencing and, correspondingly, on control mechanisms more than on counseling approaches. These in sum have become the summative approaches to student assessment. Their purpose is furthermore competitively understood as ability leveling within the education system or transferring to other systems. *"The assumption is that knowledge can be represented by accumulation of bits of information and that there is one right answer"* (Champagne & Newell, 1992, p.846) Transfer of knowledge is limited to the degree to which the situations are similar and requires similar associations. In order for transfer of knowledge to occur the pieces of information learned will have to match the circumstances of the new situation, and the associations are valid only if and when this fit exists. Motivation as a result of response-stimuli models as well as external the division of knowledge into bits and levels is genuinely extrinsic. Positive and negative reinforcements as feedback as well as rewards and punishments, carrots and whips have become extrinsically motivational techniques that result in learning if used systematically by the teacher.

Testing is of vital importance within this paradigm. Testing and learning also feed on each other through positive reinforcement. Testing basic skills and basic conceptual understanding must take place by proceeding to these higher-order learning strategies. In addition, testing knowledge ensures that learning has taken place and is a signal that the next teaching sequence may begin. Testing results is isomorphic with learning. Testing development has to reflect teaching content and vice versa. Learning is reflected in testing and testing is isomorphic to teaching. Hence, teaching to the test is not a relevant critic as the test itself represents learning.

The testing that developed was influenced by intelligence testing (Pressley & Mc Cormick, 1995) in addition to the Tyler rationale. Testing has traditionally been a strategy of testing

specific skills and pieces of knowledge under the assumption that the students' total knowledge is the sum of the pieces of knowledge represented in the items. According to this view of testing a synthesis of about 40 studies showed that results improved with frequent testing up to a certain level. Beyond this saturation point, there was a negative effect from the continuous frequency of testing. (P. Black, J. & William, 1998c) However, these analyses do not dwell on the aims, structure and competence levels included in the test items. In the coming section on cognitive strategies, these aspects of testing will be illuminated via constructivism and its impact on testing procedures in science education. Within this paradigm the ability testing based on IQ measures were born. These as well as other testing is seen as objective measurements of achievements, and these objective measures are therefore valid for two purposes. The first purpose is the provision of feedback to the learner while the other purpose represents planning for future learning activities. The applications of differentiation are to be found among the results of these testing procedures.

Furthermore, the testing procedures within this paradigm are fair measurements of acquired knowledge across students, and hence group and norm referencing are considered valid measures for individual learning with corresponding individual placements in ability groups. *“Tests of elementary components of knowledge can be administered and scored fairly and efficiently, and can be evaluated rigorously regarding statistical properties of reliability and validity for predicting other performance that can be measured objectively.”* (Greeno et al., 1996, p.27) The test design most commonly used is the standardized achievements testing based on intelligence testing. A total score for these tests is a meaningful representation of the total knowledge of the student in the specific concept of domain of subject tested.

Standardized testing as traditional assessment serves the task of selecting students not only for further education and the labor market but also for ability grouping within an educational institution. Hence, they may be used for differentiating according to achievement level both as a part of an educational program and as admittance requirements. This point towards the strengths and market values of standardized testing within the frame of an external society, but that these strengths may promote implementation within the educational institution too.

5.1.3 Behaviorism and teacher identity

The identity of the teacher was also considered programmatic as a consequence of this programmed instruction based on detailed curricula and syllabi. The teacher administers curricula that have been planned in such detail that his professional identity is to manage the instructional unit according to this program and to test the students accordingly. Quite often detailed objective based curricula followed up by objective and criteria referenced testing were his or her task to administer.

The teacher competencies of stating clearly defined objectives and issuing feedback and reinforcements accordingly are central competencies that they need to be trained for. The teacher has to master his or her academic studies in order to be able to develop or manage this implementation and sequencing of substantial matter. A teacher has to commit himself to assessment techniques that take care of the atomistic testing of knowledge and skills and correct and mark the tests issuing points, likewise atomistic. Moreover, he or she will possess an ideal of teaching sequences consisting of questioning, summarizing, clarifying and predicting as constituents of reciprocal teaching and reciprocal student assessment. In all the classroom activities consist of well-organized routines, lesson planning according to objectives and student assessment of classroom interaction according to planning. Training and drilling skills are appropriate teaching techniques. Finally, the efficiency of activities relies on available and consistent information about the sequencing of subject matter and activities.

5.2 Individual cognitive theories and assessment

Contrary to the behaviorist paradigm the fundamental notion here is that all human knowledge is constructed by the individuals using active interpretation, organization and problem solving. From this point of view knowing becomes the central issue in addition to knowledge.

Knowing is the individual actively constructing structures and patterns that undergo processes of recognition, refutation and changes in order to include new information. Cognitivism therefore emphasizes the study of mental events rather than human behavior. (Lefrancois, 1997) *“The essential feature of discovery learning, whether concept formation or rote problem-solving, is that the principal content of what is to be learned is not given but must be*

discovered by the learner before he can incorporate it meaningfully into his cognitive structure.” (Ausubel, Novak, & Hanesian, 1968, p.18) Ausubel’s position in this presentation can be attributed to the close relationship between his theories and the application of practice in the classroom.

The Piagetian notion that a learners’ capacity to comprehend concepts was limited to a certain level of logicodeductive development, as defined in the four stages of cognitive development, was one contribution. Cognitive growth and knowing is in Piagetian terms a process of assimilation and accommodation, two processes caused by a cognitive conflict in resuming equilibrium. Despite the failure to operationalize these theories in order for them to undergo empirical verification, they have had an important impact on theories of learning and teaching. Another contribution was the numerous research programs emphasizing the transfer of previous knowledge and conceptual understanding into a newer and more academically qualified understanding. This tradition states mainly that the intuitive or present understanding of the concept is the main basis for providing a new insight into conceptual knowledge. Among the Multiple metaphorical theories of cognition are Ausubel’s cognitive theory emphasizing advance organizers that should provide cognitive structures, Gagné conditions of learning by stages including short-term and long-term memories, and finally Bruner’s concept of discovery learning. All in all, these notions have been labeled constructivism, and according to constructivism, cognitive activity is means for the growth of conceptual development and abilities. (Ausubel et al., 1968; Lefrancois, 1997; Piaget, 1972; Pressley & Mc Cormick, 1995; Vuyk, 1981)

5.2.1 Cognitive view of knowing, learning and instruction

This paradigm has been concerned with procedures for learning, problem-solving activities, self-conscious learning or awareness of metacognitive processes and students’ insight into their own epistemological beliefs. Concerning the transfer of knowledge, cognitive theories in general emphasize that it depends on the development of a mental representation of the concept or phenomena valid for the individual across situations. In addition, productive transferable learning is most likely to occur when subject matters are presented in the form of examples and in social environments in which processes of explaining, formulating questions

and argumentation take place. The corresponding view of motivation is that students are by nature motivated to learn. This intrinsic motivation needs only to be fostered by designing activities that challenge their pre-existing ideas of a phenomenon. For the student inconsistency between previous understanding and newly presented conceptual ideas triggers their motivation by creating an intrinsic cognitive conflict. (Greeno et al., 1996)

“The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.” (Ausubel et al., 1968, p.vi) Ausubel distinguishes between three basic forms of meaningful learning: representational learning (what a symbol represents), propositional learning (ideas expressed by groups of words) and conceptual learning. Furthermore, he argues that ‘knowledge of results’ of future meaningful learning is sparse concerning both effects and mechanisms. Ausubel argues however for ‘knowledge of results’ to have cognitive effects on learning in addition to the Skinnerian reinforcements and motivational mechanisms of response stimuli. These cognitive effects embrace appropriate meanings and associations, correcting errors, clarifying misconceptions and indicating the relative adequacy of mastering learning tasks according to a given standard. Ausubel includes both extrinsic and intrinsic references as standards for these effect measures. His main argument is that the traditional understanding of feedback is more important for rote learning than for meaningful discovery learning and more important for less able students.

Piaget’s contribution of the cognitive strategies of assimilation and accommodation, built on the biological apprehension of cognitive stages, has been further developed into a neo-Piagetian explanation of reflecting capacity. (Pressley & Mc Cormick, 1995)

It is possible to organize knowledge and skill in hierarchical structures within individual cognitive theories. Therefore, the relationships between the concepts of particular fields of knowledge can be divided into low-order and high-order skills. These relationships form a network that allows the learner to perform complex problems within the specific knowledge domain or across knowledge domains. The introduction of metacognitive skills gave the cluster of theories a language for the learner’s possibility to gain insight into his/her own learning strategies.

Under the influence of Piaget, Ausubel and other cognitive theorists, the constructive positioning within science education emerged. (Driver & Oldham, 1986) Here learning is seen as creating meaning when the reorganization of the psychological structures within the framing of the academic disciplines of natural sciences. Contrary to behaviorism, an individual constructivist view of knowing and learning has been bringing the educationalists closer to the science education domain. Hence, the continuation here is a presentation of the science education perspectives of the individual cognitive paradigm.

The main constructivist epistemological approach within science education did take different forms but the emphasis on student conceptions has been a driving force for the assessment strategies within the approach. A constructivist approach to curriculum development was the structured constructivist teaching sequence as outlined by Driver and her associates. This structure consisted of the stages of eliciting ideas, restructuring ideas, application ideas, reviewing changes in ideas and renewing elicitation. (Driver & Oldham, 1986) A corresponding strategy of cognitive conflicts was developed during the same period. In this teaching strategy, the identity of the teacher is to create a situation during which the students will have to mentally and orally retrieve their conceptual frameworks. The conflict will be created by teacher-initiated discussions of the pros and cons of the different student and scientific explanations, and finally support for selection of the most generalizable alternative. (Gilbert & Watts, 1983) Yet another model based on the same constructivist approach was the generative learning model (Osborne & Wittrock, 1985).

Alternative conceptions or student conceptions has become the accepted terminology for conceptions that deviate from those held by the scientific communities. (Gilbert & Watts, 1983) The step from looking at misconceptions to alternative conceptions has had major implications for how to develop corresponding assessment strategies. (P. Black, J. & William, 1998c) Misconceptions had to be corrected according to a fixed truth held by the science community. Alternative conceptions have to be explored and acknowledged as valuable for personal motivation to learn. Alternative conceptual understanding may continue to exist parallel to the official concepts or they may be altered. Alternative conceptions are therefore

the starting point to understand students' present ideas. Exploring ideas and building instruction based on these require diagnostic/formative assessment as the reference for assessment must be the starting points of the individual student.

5.2.2 Assessment strategies in cognitive traditions

Ausubel has drawn on the Tyler notion of evaluation in stating that evaluation is mainly the process of evaluating the students' outcome against some predefined objectives, but evaluation should occur at the beginning, during and at the end of an instruction unit. This is due to the possible modification of objectives and instruction as additional advantages to evaluation processes. Examination is an important factor in what is considered important to teach, and therefore teachers should emphasize the objectives that any examination is built on. Within this view of evaluation, Ausubel also addresses the possible learning effects of the examination itself, the motivational aspect of an examination as well as evaluation as enhancing achievements by self-evaluation.

Guidance is for Ausubel the natural assistance accompanying discovery learning. While in remote learning assistance *"takes the forms of prompting during test trials."* (Ausubel et al., 1968, p.302) This individualized approach is further emphasized in stating that the guidance of the individual student should be based on the current knowledge level. Ausubel therefore favors application of testing based on external, e.g. national objectives and standards and testing based on locally adapted objectives. Evaluation, understood here as testing and student assessment, is crucial and cannot be avoided in any educational environments. *"Nevertheless, a reasonable degree of evaluation is still absolutely essential not only for monitoring and motivating learning but also for setting necessary and desirable standards of critical and original thinking. In a completely nonevaluative setting, creative effort is dissipated in amorphous, undirected, and undisciplined output."* (Ausubel et al., 1968, p.572) In line with the dual purposes of evaluation of educational programming and individual guidance group referencing, criterion referencing as well as student referencing are emphasized as three equally significant validation criteria.

The constructivist approach to the development of multiple choice testing procedures has been to develop test items and responses that reflect the current knowledge of alternative conceptual understandings found within science education research. This approach has been extended into testing which is more diagnostic¹⁰ in nature than summative, meaning that the responses may give the teacher information about conceptual understanding of the students and hence inform the decisions about teaching activities. Immediacy of feedback is an important additional principle. Such an assessment procedure requires analyses of content statements and internal conceptual relations, thereafter development of the responses using existing research literature and interviewing and finally development of instruments including both different options for answer and reasons. (Treagust, 1995) This diagnostic assessment recipe will inform the teacher of education authorities provided that the options given are valid for the student tested, but the assessment procedure fails to include feedback strategies to the student in order to be considered formative.

Assessment strategies following from this paradigm include simple knowledge (recall), comprehension (translation, interpretation, extrapolation), application, analysis (of elements, of relationships and of organizational principles), synthesis (production of unique communication, production of a plan or proposed set of operations and derivation of a set of abstract relations), and evaluation tasks (judgments in terms of internal evidence and of external criteria). These form the levels within a hierarchy of knowledge. (Reilly & Lewis, 1983) Therefore tests could be designed with extended items covering more concepts and combining different subjects and skills into comprehensive tasks covering several competencies or knowledge skills at several levels. Performance tasks, projects and long-answer items have been considered appropriate techniques for eliciting students' extended competencies for assessment purposes. Such strategies are appropriate for eliciting complex knowledge according to an analysis of the relationship between different skills in the knowledge domain. These competencies embrace multiple ways of knowing and understanding besides the purely cognitive. Interview techniques have been applied in order to uncover the conceptual understanding or misconceptions behind the answers.

¹⁰ Diagnostic assessment here refers to techniques of assessment that are a part of the curricular and instructional planning process.

Performance assessment was introduced because of the criticism of assessment as a driving force for what is covered in instruction and how this is taught. Performance assessment therefore became, under the influence of cognitive theories, a means of designing tests containing the embedded learning abilities that are defined as objectives. Testing is still a driving force for instructional activities and content, but now the force changes instruction according to a cognitive view of learning and meaning. Portfolios have also been considered as a form of long-term performance assessment. (Darling- Hammond & Sykes, 1999; Pressley & Mc Cormick, 1995) I will, however turn to portfolios under the sociocultural assessment strategies.

Testing within individual cognitive theories may be criterion referenced, group referenced or individually referenced depending on the use of the test results. Formative as well as summative strategies are therefore intentionally legitimate as long as specific and defined levels of knowledge skills are applied. However, several studies highlighted the conclusion that *“task-oriented evaluation is more effective than ego-oriented evaluation.”* (Summarized in Black, 1998c). These studies therefore prefer student assessment to be goal oriented and that process goals be as effective as product goals if the students continuously communicate their learning gains according to the overall stated goals for instruction. General motivation to offer praise had negative effects when not linked to objective student assessment about the tasks due to the interpretation of the possibilities of general praise. To summarize, these studies therefore point towards individual feedback based on the cognitive view that the core of assessment strategies should be to understand the starting point of the student, the student’s model of problem solving and the correspondingly required self-assessment of the students. However, the same review raises a main obstacle here. *“The difficulty here is that many teachers do not have a good model of problem solving and of effective reasoning to transmit, and therefore lack both the theoretical framework within which to interpret the evidence by students and the model to direct them in the development of their own self-assessment criteria.”* (P. Black, J. & William, 1998c, p.30)

5.2.3 Cognitive traditions and its view of teacher identity

Ausubel emphasizes those specific characteristics of teachers that are necessary competencies for the application of a cognitive view of learning. Firstly, teachers need to possess a “*comprehensive and cogent grasp of his subject-matter field*” (Ausubel et al., 1968, p.449) Thereafter he mentions abilities to present, organize and explain subject matter according to the cognitive maturity and the sophistication of the subject matter of the students. Another important aspect is the personal commitment to the cognitive development of the students. Evaluation, still within the Tyler rationale, has the advantage of “*encouraging the teachers to formulate and clarify their objectives and to communicate their expectations to the students.*”(Ibid, p.568)

Within this theory, the teacher’s identity is becoming very complex. He or she needs to recognize the varieties of learning abilities among students as well as being able to recognize differences in learning outcomes. Consequently, teachers need to develop Multiple teaching techniques and instructional approaches. The awareness of how to organize knowledge skills according to students’ abilities, and previous knowledge is hence a key to professionalism here.

The teacher’s identity according to a cognitive paradigm is to sequence the instruction according to an expected conceptual development of the students. The teacher needs to identify the present status of their knowledge and teach accordingly. The curriculum, both activities and content, should therefore be designed and customized to the particular student or group of students according to cognitive abilities and conceptual understanding. Problem solving activities and interactive communicative reasoning challenge the students preexisting ideas and metacognitive techniques foster their ability to learn content specific topics and general insight into learning strategies. In sum, the teacher’s identity here is more that of a facilitator, the teacher that facilitates and organizes the learning environment and activities so that the students are enabled so as to involve themselves in a variety of activities depending on their own conceptual starting point. This teacher is the guide in a classroom environment of multiple activities that challenge cognitive reasoning. Based on a study of students learning in laboratories the following conclusion was reached concerning the identity of the teacher. “*It is*

improbable that students will construct scientific knowledge in laboratory activities unless they possess an appropriate interpretative framework and receive guidance from somebody who already knows the science.” (Tobin, 1998, p.204)

This teacher needs the competence to recognize the importance of individual differences among students concerning both cognitive, social and interest abilities. These students are themselves resources in their own learning process as well as for other students, and the classroom environment is enriched by heterogeneous groups of students.

5.3 Sociocultural theories and assessment

However, despite the two previously presented views, individual learning is also a result of social interaction, and therefore we cannot reason about the learning of the individual with an emphasis on assessment without looking at the social context and the social relations that the individual participates in.

5.3.1 Knowing and learning in sociocultural theories

Knowing is in this sociocultural tradition focusing on the way knowledge is distributed among individuals, the way different texts and tools are used to build knowledge and the way individuals communicate and share practices in order to build individual apprehension.

Knowing is therefore a relational process and learning takes place in communication with tools and other human beings as a part of activity systems. Knowledge amounts therefore to both substantial knowledge and abilities to take part in social interactions to build collective knowledge and to build individual knowledge. (Engeström, 2000; Engeström et al., 1999; Lave & Wenger, 1991; Vygotsij, 2001; Vygotsky, 1978; Wenger, 1998; Wertsch, 1985, 1998) Many of these sources focus on different aspects of sociocultural learning and are elaborating their views in different but not necessarily mutually exclusive terminology. (B Bell & Cowie, 2001b) While this discussion lies beyond this dissertation, I will again emphasize assessment strategies as outlined in a few sources.

Learning takes place when the environment is designed for participatory learning activities so that individuals may engage in activities that are challenging and therefore strengthen their

practice and communicative understanding within a classroom environment. Participation in learning activities builds individual identity continuously within communities of practice.

(2.1.1.) Participatory abilities have to be trained in order for learning to take place. Oral activities, extended collaborative projects, problem solving in groups, practical collective laboratory tasks and extended classroom discussions represent those instructional classroom practices that are believed to support the learning of participatory abilities as well as individual conceptual learning.

Transfer of knowledge within this paradigm is problematic, as it requires an analysis of the constraints and affordances supporting the learning activities in the initial situation compared to the constraints and affordances that supports the learning or application in the next situation. *“For transfer to be possible there must be some constraints and or affordances that are invariant under the transformations that change the learning situation into the transfer situation. For transfer to occur, the learner must become attuned to those invariants in his or her initial learning.”* (Greeno et al., 1996, p.24)

The extrinsic motivation of the behaviorist paradigm and the intrinsic motivation of the individual cognitive paradigm have been substituted in this paradigm by a more complex concept of motivation. We have been moving from a paradigm mainly concerned with the products of education, over a paradigm that is concerned with both products and processes of education and into this paradigm that is concerned with products, processes as well as the contexts of education. The motivational aspects of learning are thus seen in combination with the view that learning takes place in social settings, and hence students are motivated by the participation in learning supportive environments designed according to individual needs. Relational identity formation in learning communities corresponds to a motivation to learn the values and practices of the actual community. Responsibility for one’s own learning processes and insight are motivational emphases that one has to consider in the context in which the learning takes place.

The concept of scaffolding relates to the zone of proximal development when specifying the kind of support the teacher may give the learner in order to reach a desired level of

understanding, competence or knowledge. The zone of proximal development takes its origin from Vygotsky (Vygotsky, 1978), but the term scaffolding was introduced later (Wood, Bruner, & Ross, 1976). *“The zone of proximal development is the distance between the actual developmental level as determined by the independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.”* (Ibid, p.86) The internal developmental processes awaken when interacting with teachers and fellow students. In the next line they become internalized and a part of the child’s independent achievement. Scaffolding refers to the teacher guidance functions required to support this overall learning process.

Vygotsky introduced the duality of the intermental versus the intramental into the discussion about the relationship between individual learning and motivational processes and collective learning and motivational processes. His message was however to regard these two processes as feeding on each other rather than being in conflict with each other. *“Essential to Vygotsky’s formulation of the intermental and the intramental planes is that they are inherently related. Indeed the boundaries between social and individual functioning are quite permeable in his account, and his emphasis was on the transformations between intermental and intramental processes rather than on the gulf that separates them.”*(Wertsch, 1998, p.110) When *“intersubjectivity concerns the degree to which interlocutors in a communicative situation share a perspective”* (Ibid, p.111) the necessary focus within education becomes the instructional discourse in itself as well as the mediational means that influence and shape the instructional discourse, e.g. textbooks, curricula, technical equipment including ICT and, particularly in science, the use of laboratory equipment and models of animals and human body etc.

5.3.2 Assessment strategies

In student assessment, the corresponding focus will consequently be on the formative aspects of student assessment, on student assessment as a part of the interaction and discourse in the classroom and on tools for student assessment in which the attention is drawn to the relational interactive aspect of learning. Groups in interaction, project developing and laboratory activity are such activities with long traditions in science. These traditions have not necessarily

included traditions of evaluating their relevance from a learning perspective of neither communication, nor understanding the processes of science through these activities.

Accordingly, sociocultural situatedness and student assessment require the inclusion of other levels of understanding. The use of portfolios has been labeled authentic assessment where authentic means that the validity of the assessment is found in the actual instructional situation itself. Assessment procedures and criteria should therefore be derived from the content, instructional methods and participants that together form the instructional setting in the classroom.¹¹ Authentic assessment has been defined as an approach to student assessment that is close to formative assessment both in intentions and in the toolkit. (Cole, Ryan, & Kick, 1995)

Educational discourse including discourse for student assessment purposes correspondingly incorporates an ideal in open-ended questions, sometimes referred to as authentic questions, questions that do not have a unilaterally right answer and during which the learner's understanding, comprehension and application are challenged. In these situations, control is not entirely with the teacher or the questioner; rather it is the dialogue that constitutes the knowledge. Therefore, the criteria for student assessment have to be derived from the instructional activity itself. What goes on in the classroom and how they create the background for how to evaluate and assess.

The opposite situation is created when it is the question that defines and controls the situation by closed questions, test-questions with only one right answer. In these situations, the learner has no possibility to contribute to a dialogue or to address different understandings of the same phenomena. The situation in which this questioning takes place is of no importance and hence a redundant perspective of student assessment.

The duality of authentic questioning versus test questioning, and the middle position of quasi-authentic questioning is particularly important in science because of tradition within the

¹¹ The terms of authentic and test questioning have been taken from Wertsch, 'Mind as Action'.

sciences being, on the one hand, traditionally fact-based in elementary education. This runs contrary to the emphasis on the cultural, situational, historical and collective enterprise of science itself. Teacher initiated questioning using closed factual test questions (I-R-E sequencing) contains aspects of the teacher being the authority and owner of the right knowledge. It has acquired the efficiently label under the assumption that the student is intended to reach a predefined knowledge foundation, while the teacher's task is to predefine the steps to take in order to acknowledge the understanding held by her/him. In this case, the identity of the teacher is constituted according to student expectations of the teacher.

Assessment as a part of classroom interaction is another aspect of student assessment that underlines a teacher's capabilities of assessing as part of the situational setting of the instruction. The main concern of the sources that have reviewed specific science interactions has been the interpretation of the teacher's identity as assisting the students in acquiring a deeper conceptual understanding while moving away from the contents and terminology of their daily life, in exploring their prior knowledge of the students and in addressing meta cognitive activities. (Duschl & Gitomer, 1997; Roth & Roychoudhury, 1994) However, the situation becomes less intriguing when it comes to classroom interaction and the higher order of thinking skills. A review article claims that 65% of the questions related to recall and only 17% to inferential and deductive reasoning. (P. Black, J. & William, 1998c)

The teacher's identity according to this paradigm is to organize learning environments that support the interactive communicative participation in joint learning activities. The main emphasis in educational planning and instruction should be on fostering students' abilities to formulate questions, problems, argumentation and inquiries to be investigated. The learning environment should also foster their ability to use multiple sources for their investigations including social relations. Individual effort is seen as part of collective effort. Curriculum design must accordingly concern itself with issues that can undergo comprehensive investigations. Problem solving activities that take these perspectives into consideration will accordingly be regarded as interdisciplinary or as integrated. Hence we are looking at curricula and planning in which the traditional academic disciplines do not necessarily represent the organizing principle.

Adult guidance or the teachers' assistance in students' achievements according to their potential, labeled zone of proximal development, is called scaffolding techniques. There is a cycle of actions involved in this process of diagnosing the students' abilities and learning potential and providing the appropriate learning opportunities. This cycle consists firstly of actions analyzing the learner's situation (present knowledge base and future knowledge goals), secondly actions taken to assist the student in the learning process (various tools for feedback and guidance) and thirdly activities for monitoring the learning of the student as well as the learning outcome.

From this short introduction it is clear that within the socio-cultural view on knowledge construction and learning student assessment is a continuous concern, intertwined with practically all educational activities. Major student assessment purposes are formative rather than summative. Student assessment in a sociocultural view on learning therefore incorporates actions taken and responses given by the teacher as a part of the scaffolding process.

In order to build a bridge to a sociocultural perspective on didaktik the following quotation from one of the previously quoted sources is included here: “*The individual and the competition oriented performance have to be substituted by a concept of performance in which the solution of a common task according to principles of solidarity within a social setting is the core. The individual achievement will be evaluated according to how the individual person contributes to the solution of the common tasks and simultaneously individual performance adds to the learning of all the other participants in the group... criteria and evaluation should to a higher degree be based on processes...*” (Klafki, 2001a, p.95, my translation)

5.3.3 Statements on learning or objectives

In a sociocultural perspective, the reference point for student assessment is collective and therefore group and/or objective related. It will also have a process dimension as a part of classroom practice in collective learning activities. A part of the practice involves setting objectives by negotiated understanding of the products and processes of the activity. This co-operative aspect may be collaborative or adversarial. In the case of collective goals, either

collective or adversarial processes may advance the learning activity. While in the case of adversarial goals, only collective processes may advance the activity. (Roth, 1995) Within formative approaches to evaluating students' achievements, these aspects of collective goal negotiations become important as criteria for assessment of the process as well as the results. Even in summative approaches to a social learning activity, the objectives formed in the process may be taken into consideration. Hence, the summative approach in behaviorist paradigms and the formative addition by the cognitive paradigm has been extended within this paradigm. The extension consists mainly of formative elements such as formulating the objective and deciding within what educational context it will be formulated. We are one step further in defining assessment as integrated into all educational activities.

A number of assessment strategies have been developed in order to meet the growing awareness of the importance of the individual and collective processes of thinking and learning and hence the higher order thinking skills. Some of these strategies investigate thinking strategies in general, while others also include the specific information, the conceptual knowledge of the subject. In science the two main formative strategies of portfolio assessment and performance assessment have been focused on. (Treagust, 1995) Teacher-student- parent discourses are yet another assessment strategy.

5.3.4 Portfolios

Portfolios may be viewed primarily as an assessment tool. From the definition of portfolios as *"A cumulative and ongoing collection of entries that are selected following a given framework, and reflected upon by the student, to assess his or her development of a specific but complex competency."* (Simon & Forgette-Giroux, 2000, p.87) can be derived both formative and summative purposes of such portfolios. The developmental dimension does however signify mainly formative intentions, therefore, with reference to criteria and standards rather than norm and group referencing. Applied individually portfolios are suited to student reflection on learning strategies as well as student's possibilities of active involvement in the assessment procedures. The requirement for accountability becomes a challenge for portfolio strategies however used as the only assessment tool. In this case the combination of

both summative and formative purposes is combined with a possible threat to the formative aspects. (P. Black, J. & William, 1998c)

Portfolios may also be viewed as an overall approach to the combination of teaching and student assessment, and in that case extended beyond the tools of student assessment themselves. Viewed as such, educational planning builds on a 'portfolio culture' (Gitomer & Duschl, 1995) that involves major changes in three categories. They have been stated as "*changing conceptions of science, science thinking, and goals for science education, changing conceptions of students learning and appropriate instruction and changing the role and practice of assessment.*" (Ibid, p.300)

Within this extended use of the term, portfolios have produced a number of topics that are relevant to how and what teachers evaluate. Concerning the first point related to the use of portfolios some studies have concluded that teachers are drawn between the assessment in itself and the communication of a learning cycle. When the emphasis is on communicating results, the portfolio format and the order of entries have to be based on assumptions about various formats possibilities to communicate the process in retrospect to the addressee.

Such diverse competencies as cognitive, affective, behavioral, meta-cognitive and developmental have been reported in connection with the second point relating to which portfolios have been found useful in evaluating. (Simon & Forgette-Giroux, 2000) Within a more holistic view of learning cross-curricular competencies, an integration of assessment and curricular planning and instructional execution occurs. Assessment takes place in all stages and with all participating students and teachers. One major consequence is the assessment conversation in the classroom, while another is the continuous development of assessment criteria.

Assessment conversations in the classrooms will serve the purpose of calling attention to the individual as well as the collective understanding. Communicative assessment strategies build on the balance between presenting ideas, knowledge and skills and evaluating their relevance.

Evaluating their relevance requires criteria which, due to their complexity, have to be open ended rather than fixed.

Within a formative student assessment approach features that represent a learning classroom environment require specific criteria. An example here is the following features formulated as a portfolio culture in science classrooms emphasizing the necessity for portfolios to contribute to the accountability system of an argumentative, reflective, process-oriented epistemology. Within such an overall intention for portfolio assessment the criteria have to be scientifically consistent, meaning that they must reflect the values present in science classrooms. Secondly, the criteria must be dynamic, meaning that criteria may be changed at any point in the continuous planning/execution flow of education. Thereafter the criteria must be made public, or stated differently the criteria may be developed collectively and must be stated explicitly to the students. *“As the students learn the criteria... they also learn what is valued in the scientific discipline.”*(Gitomer & Duschl, 1995, p.315) To some extent, the criteria must be capable of generalizing beyond the specific task or concept/content area.

A portfolio learning culture is intriguing from the perspective of its ability to mirror the actual collective, dynamic and inquiry oriented nature of scientific communities. The students are presented to written account traditions within science, but portfolio thinking enables the teacher as well as the student to look at the reports in an accumulative manner. Reporting laboratory work, fieldwork and task solving share strong traditions as documentation of learning processes and products. Developing this into a portfolio culture requires strategies involving continuous individual feedback in which the criteria for feedback are added according to previous feedback and the student progress. And in addition, a portfolio culture is seen as a means to develop an awareness of values and ideas that are embedded in natural sciences, as scientific enterprise as well as school subjects. This rational is, within a sociocultural perspective, bringing the ideology of the scientific culture in a possible contact with the ideology of the learning culture. Ideologies are in this dissertation presented separate in the next chapter.

Specific teacher qualifications in the field of assessment as well as curriculum planning and conceptual knowledge in science are needed in order to implement portfolio strategies. Implementing these strategies is far more than implementing assessment tools. It represents an epistemological and ideological shift in the way teachers think about learning and assessment in order for the strategy to move beyond the stage of the rhetoric of reflection and become actual practice. (Calfée & Perfumo, 1996) As a teaching approach in addition to an assessment tool it may be claimed that *“Teachers need opportunity to build assessment knowledge, enrich their content knowledge and hone their pedagogical skills.”* (Herman, Gearhart, & Aschbacher, 1996) On the other hand developing portfolio strategies allows for parallel teacher reflection, use of other teachers as support and feedback and other in-service training strategies for the intertwining of epistemological, substantial and assessment reflection. (Ellmin, 2000; Yancey, 1996)

5.3.5 Student- teacher discourse

Student-teacher discourse may be formalized and even mandated (as is the case in Norway) or it may be defined as the continuous communication going on between the actors as a part of everyday activities with a specific emphasis on assessing. (B. Bell, 1995) Within a sociocultural view, the communication between students and teachers is emphasized as taking on the form of participating in defining objectives as well as evaluating the objectives according to assessment results. Students are the main participators in problem solving activities, group work and projects and therefore should also participate in assessing their contribution to these activities as a part of the interactive learning activities. Assessment has to serve the function of giving feedback on the assessment process itself.

Joint efforts into defining objectives require merged agendas, those of the teacher and the learner. Consequently the question arises of who defines the knowledge to be emphasized in assessment and in objectives as well as during the interactional activities. As much as this is an implicit part of the relational social cultural paradigm, it is not made explicit as controversial issues. The empowerment of students is an overarching aim also within sociocultural paradigms in that it is moving power away from the teacher. However, within a critical paradigm this emphasis on power relations in agenda setting and assessment underlines

the ethical dimensions in addition to the more traditional dimensions of validity, referencing and objectivity, reliability concerns. The contextual and situational aspects of sociocultural views therefore have to include the ethical and moral aspects of assessment if assessment is to happen when framing the paradigm. Aikenhead has emphasized the ethical and moral aspects of assessment. (Aikenhead, 1997)

Assessment within a situated relational perspective on learning activities is genuinely formatively, because assessment here is tied to the process of learning activity. The formative approach does not entirely consider the processes of learning in order to improve the learner's processes, but does include the factors from the educational situations themselves. (B Bell & Cowie, 2001b) The sociocultural paradigm is concerned with the meaning of the individual and the collective and therefore formative assessment in this paradigm has to address meaning created in the situation for the individual. Formative assessment is in itself a socially formed practice, and formative assessment is formed within the social and cultural norms of the classroom as negotiated practices involving all the participants. When formative assessment is in itself a discursive practice, one implication involves looking at the relationship between teacher and student as that which establishes the norms of the assessment. Assessment is seen as integrated in all learning activities and hence the norms that are established are valid beyond the assessment practice.

5.4 Epistemological theories as a menu

What I have described now is a continuous menu of development more than just exclusive categories of assessment views. There are some reasons for this, for example they are not mutually exclusive in that they do not consist of alternative answers to the same questions. They answer different questions in landscape of knowledge, knowing, learning and meaning as well as the implications for views and purposes of student assessment. Theoretically, we can deal with that because we have chosen an analytical position, and in educational programming we can deal with that because we make rather pragmatic choices according to situation, subject or the purpose of assessment. In research on teaching practices, one or the other clear cut position becomes insufficient for describing and analyzing the teachers with regard to their actions and reasoning, and for the normative/prescriptive agenda of our

meetings. This dualistic perspective to application of epistemological theories is in line with the following quotation. “A *sociocultural perspective on teaching and learning rejects the overly simplistic one-size-fits-all approach to enacting a curriculum and cautions against technical adherence to rules about what does and does not work in promoting the learning of science*”. (Tobin, 1998, p.210)

It seems appropriate at this point to include a note on the terminology related to communicating student assessment issues. The terminology of student assessment is partly based on behaviorist traditions. The term originated in a behaviorist view of learning and is hence regarded first and foremost as a summative term. Lately the term formative assessment has become frequently used. The idea behind formative assessment is very closely linked to a sociocultural view on learning, and the term may therefore represent a contradiction. The terminology signals the paradigmatic change from behaviorist, over cognitive into a socio cognitive, sociocultural, and socio-historic view on learning. This heritage is embedded in the field of education. Theoretical frameworks such as levels of understanding and stages of conceptualization originated within the cognitive tradition. Furthermore, the term scaffolding represents different positions in socio-cultural epistemology. The terms are used interchangeably. With most of the terminology set within behaviorist thinking and individual cognitive thinking there is a lack of expressions related to student assessment as a part of interactive communicative situated teaching processes. The question exists whether the dilemmas of student assessment have been so influenced by these terms that in themselves they restrict our understanding and the practices of student assessment. This point also signals another important aspect, that of crossing the border between theoretical framing of the understanding of the multifaceted dilemmas of student assessment into practical or educational implications.

Another, but somewhat synonymous framework for the understanding of the implicit emphasis of student assessment and assessment builds on Habermas’s three orientations (Aikenhead, 1997; Habermas, 1971; Ryan, 1988). This framework consists of three paradigms, the empirical analytic, the interpretive and the critical theoretic. “1. *Empirical-analytic: Western technical rationalism embodied in logical positivist origins. This amounts to*

the traditional standardized approach to assessment and evaluation. 2. Interpretive: understanding students' language, concepts, and actions from the point of view of the student. Alternative assessment techniques such as portfolios and concept mapping illustrate this paradigm. 3. Critical-theoretic: the elimination of oppressive human relationships (oppressive is defined in terms of forced assimilation). Two examples would be: assessment rubrics for thoughtful decision making developed collaboratively between teacher and students, and student self-evaluation. “(Aikenhead, 1997, p.2) If we omit the examples of techniques from this definition these three paradigms then represent the basic ideas behind the behaviorist, the cognitive and the sociocultural epistemological framework applied here. The classification of techniques like concept mapping and portfolios depends on the implementation of these techniques combined with the identities of the students in each case. This framework results in the corresponding focuses on outcomes of educational systems in that the empirical addresses products as the outcome and hence is purely summative, the interpretive both products and processes (combines formative and summative purposes) and the critical-theoretic contextual factors in addition. They represent consequently three different approaches to the validity of student assessment. In the first case the validity is psychometric and the aim social control; in the second the validity is pedagogic and relies on the teacher's judgment of sound programming, execution as criteria for student assessment; and in the third paradigm the validity is based on social, cultural and political factors of education like empowerment, equity, racial, gender, ethical and power related issues of education. Therefore again, they are not alternatives but rather cumulative as classification systems in addition to representing the history of student assessment.

At the beginning of this chapter, two quotations were used to illustrate Delta's situative epistemological positioning. When confronted with this seemingly conflicting views on knowledge and learning Delta claims that several perspectives of learning and assessment need to exist in parallel in order for him to sufficiently teach and assess the different competencies and concepts of his subjects and in order for him to keep both formative and summative purposes as part of his teaching agenda. He claims that he has to be fragmented in order to be complete as a professional teacher. Delta takes the dualist epistemological perspective as a practitioner that has to include all assessment purposes and multifold

educational objectives. He resists my attempts in our discourses at reaching comprehensiveness in epistemological reasoning.

Delta: *“Here I am a fragmented human being. I have been thinking about what we have talked about concerning the relationship between how we assess and the view we have on the students and their learning. I think I have reached the temporary conclusion that I will have to be that fragmented.” (6.12.00)*

Sigma: “*We need to find new aspects of science, what is it that we want with this education.*” (4.4.01)

6 Ideologies in science education and the implications for teacher identity and student assessment

Sigma heads this chapter with a statement that tells us that it is important for her to sort out the reasons for teaching natural sciences. She moreover states that we have to find new aspects and new reasons, as this is for her an ongoing reflective process.

From the field of didaktik we can find the following quotation pointing in the same direction. *“I wish to see different educational philosophies, didactic typologies and curriculum emphases for school subjects, etc. given names, substance, and a social context. If this is done analytically, the choices constantly being made within these processes, and their consequences, can be located and made open to comparison. One of the central tasks of educational research should be the development of a language for these choices.”* (Englund, 1998b, p.219) The practices of teacher Sigma are coordinated with the concern of the scholar Englund. In order to address the choices made by teachers when presenting a subject a language is required that addresses these choices here seen as philosophies, typologies or emphasis.

It is in correspondence with this explicitly stated challenge to educational research and its implications for educational practice that investigating teacher positioning within the ideologies of science education has been analytically operationalized as “curriculum emphases” (Roberts, 1988). ‘Curriculum emphasis’ represents one attempt at approaching the question of what counts as science education. The overall sociocultural viewpoint here is that teaching is a kind of moral and social action implying different forms of explicitly stated or implicitly understood choices. As a consequence of this view, it is of growing importance to state possible perspectives of the ‘didaktik’ reasoning of why and how to teach science.

What counts as science education will also produce different answers according to what educational level the actual practice is concerned with. The curriculum planner, the textbook author and the teacher as well as the student will approach this issue differently. In order to meet these different arenas of science educational practices the framework of curriculum emphases has included four views, namely those of science, the learner, the teacher and society. These different views will be included in the text here in order to address both externally and internally, from the teacher's point of view, factors that are embedded in the overall framework. Statements of possible positions may in the next round be used to analyze other teachers if we always include inductive elements in our analysis. In order to do this we need a variety of practices, social and political realities, and of educational contexts. Lengthy fieldwork and theoretical sampling become important methodological tools (Part III).

The relevance of ideological aspects of translating scientific knowledge into school subjects has been mentioned in connection with the socio-cultural view on participatory assessment practices. Regardless of this apparent and stated relevance translation and implementation processes implies choice of specific angling of content and processes within all epistemological positions. Therefore the starting point here is the general application of ideological frameworks in education. However, the main part of this chapter will emphasize the didaktik perspective in my quilt makers approach to teacher identities.

6.1 Ideologies in education

What are the systems of ideas' underlying the education system in general, and what here are the corresponding systems of ideas' underlying the teaching of science? Before turning to the specific system of ideologies stated as curriculum emphasis it is necessary to briefly look at the contribution of educational ideologies from philosophy of education.

Education as an academic field and as practice is dealing with ideology. Ausubel illustrates the relationship between the selection of ideology, normativeness and the selection of epistemologies in the following statement. *'Education is applied science because it is concerned with the realization of certain practical ends which have social value. To some individuals the function of education is to transmit the ideology of the culture and a core body*

of knowledge and intellectual skills. To others, education is primarily concerned with the optimal development of potentiality for growth and achievement- not only with respect to cognitive abilities, but also with respect to personality goals and adjustment.” (Ausubel et al., 1968, p.15)

The terms educational ideologies and educational philosophies have been used interchangeably. However, the preferred use here is educational ideology in harmony with *“it suggests not an inert body of knowledge, but a somewhat more specific and dynamic pattern of general ideas which serve to direct social action”* (O'Neill, 1981, p.19). Even more specifically in another source ideology it is defined as a *“sociological concept which describes a group philosophy, and it may be defined as: ‘a broad interlocked set of ideas and beliefs about the world held by a group of people that they demonstrate in both behaviour and conversation to various audiences”* (Cross & Orminston- Smith, 1996, p.664). This sociological approach to ideology defines various ideological positions of relevance depending on groups of people. These definitions of ideologies are however similar in that they address ideology as specific systems of ideas rooted in social ethics: they direct social action and develop and change as a consequence of social interaction. Educational philosophy is central, while educational ideology will actually determine actions; they have a normative aspect and are evaluated according to their normative validity¹². *“Educational ideologies are important in determining what individuals will do with respect to educational matters, but they are not all-informing.”* (O'Neill, 1981, p.21) In an overview of educational ideologies, six different ideologies are described. Within the strand of conservative ideologies are fundamentalism, intellectualism and conservatism. Within the other strand of liberal ideologies are liberalism, liberationism and anarchism.

The general characteristic of the conservative ideologies are that truth is an intrinsic value, education is an orientation to life in general, the focus is on classicism and therefore classical education should be based on the western intellectual tradition. This is a closed ideological system in which the emphasis is on the intellectual discipline over the practical applications of

¹² “Normative behavior is behavior that is either implicitly or explicitly directed by some idea with respect to what is generally good or desirable.” (O'Neill, 1981, p.29)

daily life. The teacher is the carrier of the truth and intellectual wisdom and hence has superior contribution by virtue of her/his authority. The view of the learner is that students are predisposed toward knowledge but in varying degrees according to the natural inequality of abilities. The assessment of factual knowledge, specific skills and information within an emphasis on individual cognition is consequently allowed for. The control purpose is the core of assessment as grading and marking using reliable measures stated as the main tools. (O'Neill, 1981)

The general characteristics of liberal ideologies are on the other hand knowledge important for social reforms, man is a cultural product and the aim of education is to fulfill personal potential. This is an open ideological system in which the emphasis is placed on personal development, self-understanding, social action and the practical application of intellectual and academic knowledge. The teacher represents authority based on social involvement, pedagogical skills and intellectual acuity. The students are unequal by nature, but ethically equal, and hence emphasizing differences in educational programming allows for individual and societal possibilities of learning. Assessment should involve cognitive and affective aspects, include analytical skills, abstract thinking and be based on real life situations. The counseling purpose should be conducted in schools as a form of social learning. (O'Neill, 1981)

This short presentation of educational ideologies will be visible in the forthcoming discussion about ideologies in science education in general as well as the following framework presented in order to address the same issues specifically for the subjects of natural sciences.

6.2 Ideologies in science education

So the next question becomes: Can this combined sociological and general educational approach be made valid in a science classroom? There are two opposing views embedded in this question as stated by Fourez in the following quotation. *“We will be concerned here with what is happening in a science class that can in no way be related to usual scientific rationality. My assumption is that science classes, like every other teaching situation, carry ideas, values, projections, and worldviews. Said otherwise, I claim that they are conditioning*

people ideologically and ethically. And I believe that these nonscientific elements present in science teaching cannot be avoided. They cannot be dissociated from the scientific language.” (Fourez, 1988, p.269) On the one hand, science as a school subject is an applied interpretation of the academic disciplines of the natural sciences and is therefore not a direct application of scientific rationality. On the other hand, science as a school subject cannot be separated from the values and ideas of the educator and these are again a result of the scientific communities in which the educator has been educated. Even if Fourez here uses the terms scientific and non-scientific elements he is arguing that ideological and ethical concerns are integrated in scientific rational and language as a carrier of this rationale independent of the participators awareness.

Fourez claims furthermore that ideologies possess three significant aspects. Ideologies are firstly fundamental worldviews, they are socially and relationally constructed and they exist and develop as a part of communicational practices. They are constructed within communities of practice to the extent that they give meaning to the participating teachers. Concerning the language, it is not possible to separate scientific language from the language of science teaching. The socially constructed relational aspects and the integrated didaktik concept point back to those sections which have dealt with socio-cultural epistemology and reflective identity construction. Fourez introduces the term worldview slightly differently from the term ideology. As mentioned in section 2.2.3., the concept of worldview and its importance as a precondition for science comprehension has been focused on somewhat during the past ten years. The principal difference between ideology, as stated in the following and worldview is that worldviews (as treated within science education) have become a term for addressing the individual while ideology has a specific social dimension.

These definitions are also stated in coordination with the origin of the framework of curriculum emphasis and with Östman when he expresses the relationship between didaktik and ideology. *“Every educational situation consists of choices; choices of content and instruction methods. These choices always include specific evaluations, criteria e.g. – an ideology. Choice concerning content implies statements about some issues and exclusion of others. If several teachers, policy makers e.g. make the same choices or differently stated if*

many teachers, policy makers e.g. represent a specific tradition that in a specific timeframe the educational outcome is directed by rules.” (Östman, 1995, p.27, my translation) It is not possible to teach without an implicit or explicit reason for teaching, for choosing that content or that method. These reasons are embedded in the ideas and beliefs and hence the ideology of the science teacher. More specific, it is not possible to teach science without choosing an emphasis that either involves a viewpoint on evaluation and assessment or a viewpoint on evaluation and assessment is directly stated.

Ideologies are here understood as:

- *Comprehensive structures in an individual and cultural relational worldview. They are cognitive and influence the individual conceptions. They guide individual evaluations concerning meaningful and valid knowledge as well as meaningful and valid instruction.*
- *Ideologies are cultural embedded. They are shared by a group that forms a subculture (2.1.2.). Simultaneously they form identities through social interaction. Ideologies are not static, because they are produced and reproduced. They are formed within a context, but to a certain degree transferable between contexts.*
- *Ideologies are implicit or explicit present in all educational activities of planning and involvement through actions, verbal or non-verbal.*

(Knain, 1999, p.52) (Translated and adopted for this project.)

Concerning transferability of ideologies, it has to be underlined that there is another aspect of changing conditions for teachers that makes it necessary to address ideologies. When teachers find that major contributing factors to how they define their teacher identity are changing their ideological foundation is questioned. Changing externally imposed conditions like new curricula, new textbooks, information technology, new head teacher or colleagues, grading system or examination assessment procedures implies ideologically reorientation. Even changing conditions like having children, doing another academic degree or experiencing personal difficulties rock the worldview foundation and result in redefining ideological positions.

Ideologies are formed as a part of the culture of scientific communities and ideologies are formed as a part of the culture of educational community. Teachers are often part of both cultures and therefore the ideologies formed within one culture must be seen in relation to the ideology formed in the other culture. The translation process from scientific enterprises and knowledge construction to educational enterprises and knowledge construction involves ideological framing and/or reframing of the content and the processes of natural sciences.

In order to build a bridge from the epistemological positions to the subject related discussion of science it is natural to start by stating a vision for how to deal with science as one of several valuable domains of education. *“... the vision that the school and the subjects in the school should promote ‘bildung’ implies that the school should contribute to the individual growth of the students who as a consequence should be able to participate in the society in an independent, reflected and critical manner... the task is to show how the natural sciences can contribute to achieve these overall objectives for schools, upbringing and education.”*

(Sjøberg, 1998, p.36, my translation)

This focus on the didaktik of the single subject is interesting in this project because the subject is seen in combination with other subjects in order to build the individual identity. It is the distinctive characteristics of science view within a broader perspective on learning that gives science its legitimacy within the program of education or the curriculum. In addition, it is as part of the overall objectives of education science may contribute to the individual development and self-comprehension. From a practical pragmatic point of view, the challenge lies in the need to organize instruction according to frame factors like teacher qualifications, available resources (time, financial, classrooms etc) and teaching materials. The structure of curricula and textbooks are significant contributing factors. However, the real challenge of ‘bildung’ is multi subject concern. This concern exists on a theoretical level in epistemological ideological considerations. It also exists on an intended curricular level as overall statements for education. Moreover- it exists (therefore) on a planning and execution level in co-operation and problem based learning programs. (Beane, 1999)

In line with Habermas's viewpoint (Habermas, 1971) that underneath all knowledge claims there lays an ideology that signals claims about ethical, political and even ontological interests, others have argued that teachers need to reflect on their own ideological position. (Geddis, 1991) Knowledge is here seen as ideology that implies an ideological framework for teaching and for the contextual factors of instruction. Among the factors elaborated on are the epistemological context and the teachers' awareness of ideological angling combined with the explicitness of employed epistemology. *"Teachers need to reflect on whose interests are being served by the teaching of particular knowledge, and on the effects that such teaching may have on the personal knowledge of the students."* (Ibid, p.171) Within the overall view of assessment as integrated into all learning and teaching activities, ideologies also influence the subject content and emphasis rendered visible during student assessment.

6.3 Ideologies as curricula emphases

Curriculum emphases are an attempt at tracing ideologically valid views on science as a school subject. This is a classification of ideologically valid positions according to a study of US and Canadian curricula. Intentionally they were meant to capture the underlying philosophy, reasoning and ideology of a science course according to the written sources of the curricula, teacher guides and textbooks. There was, however, no attempt at describing the processes resulting in the written documents even if these processes were regarded as important for the results.

Behind the concept 'curriculum emphases' Roberts puts the meaning of *"a coherent set of messages to the student about science (rather than within science). Such messages constitute objectives which go beyond learning the facts, principles, laws, and theories of the subject matter itself – objectives which provide an answer to the student question: "Why am I learning this?"* (Roberts & Östman, 1998, p.7)

The field of science education has added an important theoretical perspective corresponding to the extended pedagogical content knowledge into the pedagogical context knowledge concept (chapter 2). Based on a study of curricula Roberts developed a set of science education emphases which can be used in order to trace the ideological bases on which the teacher builds

his instruction (Roberts, 1988). These emphases are: **Everyday coping, Structure of science, Science, Technology and Decisions, Scientific Skill Development, Correct Explanations, Self as Explainer and Solid Foundation**. The emphasis will be fully presented in table 2, but their origin, and the actual sources they emerged from in the inductive analysis by Roberts will be presented first due to the forthcoming application of the emphases.

1. 'Everyday coping' was the focus of textbooks and curricula from 1910 to 1950 in the United States. According to these textbooks and curricula, there is a need to present the content of sciences in everyday contexts, objects and events in order to recognize their significance for and applicability to daily life.

2. 'Structure of science' with its internal logic as an enclosed intellectual enterprise can be found in the American curricula, as well as the English and Scandinavian from the late 1960s. This was the big 'back to basics' movement that swept through western civilization as a reaction to the failure of science courses to meet the requirement of focusing on basic science knowledge, basic skills and teaching the concepts themselves. The intention within this emphasis is to understand science as an intellectual enterprise, both the processes and the products, and hence emphasize the relationship between evidence and theory, the adequacy of a given model and the self-correcting ways of cumulative science within the scientific discipline.

3. 'Science, technology, decisions' bring out the interrelations between the explanations produced in the scientific communities with the problem solving and decision making taking place in society. In addition, the application of science by technology is included in this emphasis. Therefore, the way in which values influence scientific knowledge as well as the relative significance of theoretical and practical aspects is considered in this emphasis. It has been added as the consequence of the science, technology and society movements throughout the 80s and 90s. (Solomon & Aikenhead, 1994)

4. 'Scientific skill development' emphasizes in particular the means of scientific inquiry by looking at the processes of inquiry as the main objectives for learning science. Within such an

emphasis, the scientific methods of inquiry will be the emphasis of both instructional processes and products. The main message is that using the accepted processes correctly will produce reliable knowledge.

5. 'Correct explanations' on the other hand emphasizes the products of scientific inquiry. Here the scientific explanations of phenomena are taken as correct, and the students are therefore presented with a corresponding authoritative statement. They should learn the scientific way of thinking due to its objective correctness, and questioning the authority of the teacher is questioning the authorization of sciences. Science presents a correct explanation of phenomena in the world.

6. 'Self as explainer' emphasizes the students' apprehension of phenomena by exposing the conceptual understanding of the scientists. The students' perception forms a meeting point with the scientist's perception, and this meeting point is the source of insight into scientific reasoning. The human enterprise is in focus. Links are made between the concept or idea in science and the scientific and cultural framework in which the idea or concept was developed. Different worldviews explaining the same phenomenon will be addressed in this emphasis as possible explanations and their validity discussed. The human processes behind the conceptual explanations frame the judgment of the ideas. Within this emphasis, the active construction of knowledge both by scientists and students comes under consideration.

7. 'Solid foundation' finally emphasizes the necessity to build knowledge at various steps of education. This knowledge is presented because of its significance for undergoing **science education** at the next level. This emphasis is concerned with the structure of education itself, and would use this as an argument for both the processes and the products. Knowledge building is viewed as a set of cumulative enterprises.

(Roberts, 1983, 1988; Roberts & Östman, 1998)

This initial curricula perspective does not include perspectives of developing strategic documents nor do they include implementation perspectives. Fensham, who included another three emphases, has further extended this framework of curricula emphases. (Fensham, 1999)

The three additional emphases were labeled science in application, science as nurturing and science through technology.

In Scandinavia, this approach to ideological analysis has been used as either a main or a minor theoretical framework in three different contexts. Firstly, the approach was used within *“analysis of the political and environmental-ethical dimensions of science education at lower secondary level of Swedish comprehensive schools”* (Östman, 1995, p.195). Secondly as a part of the theoretical framework for the analysis of ideologies in the national curriculum and the textbooks used in elementary education in Norway (Knain, 1999). Finally, it was used to *“explore adolescents’ decision making on social issues with a science dimension”* (Kolstø, 2001). The ideological analysis of aspects of scientific topics has been a growing field both within institutional educational settings and as a part of the general societal debate. In all these studies, the meeting points between, on the one hand, the more general scientific literacy required for participating in public discourse, understanding and relating to matters of public importance, and, on the other hand, the specific scientific knowledge and skills required for careers within scientific related professions are key issues.

I intend to use this approach in order to understand the underlying attitudes or ideologies of teachers that influence their understanding of the importance of teaching science and hence what they emphasize as reasons for choosing specific learning activities. This rather implicit ideological emphasis will, therefore, also be important for how to plan and execute the learning activities that are of importance for either the summative aspects of student assessment, the formative aspects of student assessment or by forming the context in which the learning and the assessment takes place.

The four commonplaces (Schwab, 1978) form the starting point for the four views of what counts as science education. The meaning of any curriculum is constituted according to the identity and relational character of the professional identity. Hence, the researcher, the teacher, the learner and society will each separately form an identity regarding the science content according to where they put emphasis in the subject. The relational aspect of identity formation regarding the subject of science is a part of the ideological basis for the teacher.

The following table outlines in detail the seven curriculum emphases with the corresponding view of science, teacher, learner and society.

Table 1; Curriculum emphases of science education¹³.

Curriculum emphasis	View of science	View of teacher	View of learner	View of society
1. Everyday coping	A system of meanings necessary for understanding and therefore controlling everyday objects and events.	Someone who regularly explains natural and manmade objects and events by appropriate scientific principles.	Needs to master the best explanations available for comfortable, competent explanations of natural events, and control of mechanical objects and personal affairs.	Autonomous, knowledgeable individuals who can do mechanical things well, who are entrepreneurial, and who look after them, are highly valued members of the social order.
2. Structure of science	A conceptual system for explaining naturally occurring objects and events, which is cumulative and self-correcting.	Comfortably analyzes the subject matter as a conceptual system, understands it as such, and sees the viewpoint as important.	One who needs an accurate understanding of how this powerful conceptual system works.	Society needs an elite of philosophically informed scientists who really understand how that conceptual system works.
3. Science, technology and decisions	An expression of the wish to control the environment and ourselves.	One who develops both knowledge of and commitment to the complex interrelationships among science, technology and decisions.	Needs to become an intelligent, willing decision maker who understands the scientific basis for technology, and the practical basis for defensible decisions.	Society needs to keep itself from destroying itself by developing in the general public (and the scientists as well) a sophisticated, operational view of the way decisions are made about science-based societal problems.
4. Scientific skill development	Consists of the outcome of the correct usage of certain physical and conceptual processes.	One who encourages learners to practice the processes in many different contexts of science subject matter.	An increasingly competent performer of the processes.	Society needs people who approach problems with a successful arsenal of scientific tools and skills.

¹³ The table is a direct reproduction from Roberts (1988, p.45) except that the view of the teacher and view of science has been placed adjacent to emphasis due to the focus of this project.

5. Correct explanations	The best-meaning system ever developed for getting at the truth about natural objects and events.	One responsible for identifying and correcting the errors in student thinking.	Someone whose preconceptions need to be replaced and corrected.	Society needs true believers in the meaning system most appropriate for natural objects and events.
6. Self as explainer	A conceptual system whose development is influenced by the ideas of the times, the conceptual principles used, and the personal intent to explain.	Someone deeply committed to the concept of liberal education as a means of exposing the grounds for what we know.	One who needs the intellectual freedom gained by knowing as many of the influences on scientific thought as possible.	Society needs members who have had a liberal education – that is, who know where knowledge comes from.
7. Solid foundation	A vast and complex meaning system which takes many years to master.	One who is responsible to winnow out the most capable potential scientists.	An individual who wants and needs the whole of a science, eventually.	Society needs scientists.

6.4 Curricula emphases applied to teachers

The matrix can be used both to analyze the basis of the reflections of a teacher and prescriptively in teacher education. In the initial papers, the identity concept is discussed as teacher loyalties, and the three main positions of an academic loyalty, a utilitarian loyalty or a pedagogic loyalty are important for interpretation and implementation of curricula (I. Goodson, 1987). “*Solid Foundation, Correct Explanations, Nature of Science and Scientific Skill Development all fit the academic tradition, while Everyday Coping fits the utilitarian tradition, and Self as Explainer and Science-Technology –Decisions (both with a heavier emphasis on the learner than on the subject) fit the pedagogic tradition.*” (Roberts, 1988, p.49)

The seven original emphases incorporate a complexity due to the more or less hidden messages about science. The hidden messages are ideological, epistemological and pragmatic. The invitation to develop the emphases was politically pragmatic and should form a basis for political educational decision-making (Roberts, 1983). The result, however, after analyzing curricula is a complex framework consisting of the merging of viewpoints on what to learn, how we learn, the relationship between scientific enterprises and learning, and the relationship between scientific knowledge as an object of learning and the student as the subject of learning. Various positions can be taken in either of these underlying dimensions of this

framework. The application of this framework for analytical purposes has to look at the complexity embedded here. We will find all the following theoretical levels represented, ontological theories and epistemological theories, theories about learning, models for teaching and didactic theories. Every statement about what should be thought and how to organize learning activities also carries such a complexity of hidden messages. As these messages are hidden or implicit, 'companion meaning' has been introduced as an embracing term to cover all additional messages that are included in every statement about teaching in science. (Roberts & Östman, 1998) The intention of this term is, contrary to the Grounded theory approach, to look at the different aspects of language as creating and communicating scientific meanings.

In a study conducted with physics teachers a gap between educational intentions and instructional actions was noted (Fischler, 1994) (Mentioned in 3.3.). One attempt at explaining this gap concentrated on the teacher's perceptions concerning the philosophy of science. This was considered a necessary precondition for pedagogical reorientation. In other words, the teacher has to understand the sociological and historic factors of their own subject in order to build educational programs for students. When looking at the subject from a static point of view the possibilities of addressing the complexity became limited. Hence, there is a connection between the teacher's ability to see his subject in a meta perspective and the ability to follow and understand the students' perceptions of the concepts of the subject. They point at a relationship between the philosophy of science and the philosophy of education. They both involve epistemological comprehension. *"The rigid conceptions about the philosophy of science of the teacher ... hinder his pedagogical access to the subject to be taught."* (Fischler, 1994, p.179)

Understanding and applying sciences is a prerequisite for teaching, and this assimilation into the scientific communities' bounded logic is a hindrance to teaching. The main dilemma becomes that of on the one hand becoming scientific and on the other hand relearning the scientific language and codes. Underlying here is the hidden messages of a subject and of what is not stated, yet perceived as an important aspect of the subject. The companion meaning is thus another important aspect of the implicit ideology of a subject. For example many teachers

urge their students to always ask questions, but in their responses to the many questions the additional message returned is that there are really only qualified questions within the more or less defined science domain that are accepted in the science classroom. Hence, the communicative mode of the teacher signals the emphasis as much as the statements themselves.

Concerning teachers, the phrase that ‘saying nothing is actually saying something’ becomes handy here. The not verbally communicated companion meanings attached to the teaching mode and in particular to the assessment carry strong messages to the students about worldviews and the ideas of human discernment as a part of scientific enterprises. Students learn to decode what is not said, but still communicated through statements about achievements. These statements, whether written or verbal, include ideological companion meanings that become important factors in how the students come to view the validity of science knowledge. Based on this they will draw conclusions as to the relevance of scientific knowledge. When teachers say nothing about how they view science and evaluate scientific knowledge in comparison to other explanations, the possible interpretations are multifold. What they say may be that they take some accepted scientific model and commit themselves to it or they are not aware of different possible positions in the landscape of how to emphasize their subject. Statements about achievements in student assessment are strong messages about learning and learning potential and incorporate companion meanings about what system of ideas science presents.

The bearer of science ideas in secondary school education is first of all the teacher. With the teacher in focus it becomes significant to analyze what hidden messages or companion meanings he or she is signaling in student assessment activities. The teachers’ cultural and interaction identity are implicit as ideological messages in assessment statements. As such, the ideological companion meaning is one of many aspects of the identity of the secondary school science teacher.

6.5 Dualism of essentialism versus progressivism

A brief look at the seven emphases underlines the duality of academic structure as an emphasis for learning science or the challenges of society and the individual as emphasis for learning science. Roberts recognized this dualism by characterizing some emphases as academic, others as pedagogic and one as utilitarian. Education has also been stated in different ways through considering the dualism of the essentialistic versus the progressivist. (Englund, 1986, 1998a; Lundgren, 1979) The basic message is whether teachers regard this as a principle for the organization or division of subjects based on academic disciplines in which case he or she is basically an essentialist. Alternatively, whether the basic principle represents a view of learning rooted in the challenges of life in general, in the personal needs of the students and in personal empowerment. In this latter case, the teacher is a progressivist. This dualism may be viewed from a philosophical point of view, from an epistemological point of view and fused/incorporated into these also from science education and 'didaktik' points of view.

This dualism of transmitting the processes and contents as well as the knowledge construction mechanisms of the scientific disciplines versus the facilitating learning processes for the benefit of individual development and social empowerment is similar to the two main strands of conservative and liberal ideologies respectively (6.1.). The liberal ideologies take care of the emphases that put the learner and society into focus, while the conservative ideologies take care of the emphases that put the academic subject into focus.

When Dewey addresses this duality of whether it is the subject or the child that matters he combines the two positions, as would be expected within a pragmatic view, in a text from 1902 entitled "*The Child and the Curriculum*" (Hickman & Alexander, 1998). He integrates the best elements from both positions by stating firstly that when putting emphasis first on the subject matter and logical subdivision into topics, then on the lessons, and lastly on facts and formulae we "*furnishes the end, and that determines the methods*" (Ibid, p.238). On the other hand when the self-realization of the child is the goal we take a second position, and "*the development and growth of the child alone furnishes the standard*" (Ibid, p.238). The first position is logical and the second psychological; therefore we need to combine the two in

educational programming. Out of the duality numerous controversies or dilemmas arise, which we need to be aware of considering when reflecting. We can not end up, according to Dewey, in one of the pigeonholes by emphasizing one of the two watchwords: “*Discipline*” is the watchword of those who magnify the course of study; “*interest*” that of those who blazon “*The Child*” upon their banner” (Ibid, p.238). However, Dewey also concludes, “*The case is the Child. It is his present powers, which are to assert themselves; his present capacities which are to be exercised; his present attitudes which are to be realized. But save as the teacher knows, knows wisely and thoroughly, the race-experience which is embodied in that thing we call the Curriculum, the teacher knows neither what the present power, capacity, or attitude is, nor yet how it is to be asserted, exercised, and realized.*” (Ibid, p.245)

On the progressivist – essentialist scale Dewey has been, due to this standpoint, the ultimate advocate of naming the child as the main reference point for educational programming and student assessment that during a century have given legitimacy to problem based and project oriented educational programming. One study investigating the extent to which teachers’ believe teaching and learning in science to be consistent with the philosophy underlying the educational reforms in science in the USA found one overarching belief emerging. The teachers acted and discussed their teaching approaches stating that the teaching and learning of science should be student centered. (Levitt, 2001)

Epistemologically speaking this dualism represents two opposite but still complementary views on knowing. In the first case, the essentialist strand of curriculum emphases, it represents a combination of behaviorism and individual cognition. In the second strand of progressivist emphasis, it represents a socio-cultural view on knowing. In other terms, the acquisition metaphor versus the participatory metaphor as two epistemological positions (Sfard, 1998).

In science education terminology, this signals a duality that maintains that the transmission of scientific knowledge as the primary objective or an opposite position would view science as one of several means of ‘bildung’. The concept ‘allmenndannelse’ covers the second position

in the Norwegian context.¹⁴ As stated, *“Few would argue against considerations of the nature of science having a significant influence on the science curriculum. Perhaps the error was in making this the major, and in some cases the only influence.”* (Hodson, 1985, p.48) The author here questions the fruitfulness of basing educational planning and practices entirely on one strand of emphasis.

From a philosophical point of view, the duality could be presented as the dual contributions attached to The Nature as a part of scientific reasoning. The realistic science perspective would be the one in which nature bears the message of knowledge because all controversies have been ended. The Nature would give us the answer, and the nature of science would be presented as static. *“They believe that representations are sorted out by what really is outside, by the only independent referee there is, Nature”* (Latour, 1987, p.98). In this philosophical position, building on accepted knowledge and academic disciplines would be the only way to increased understanding of sciences. The results is the academic sciences being the ultimate knowledge in themselves and in the constitution of the accepted. Here this means possessing ‘bildung’ signals that have achieved the structure of sciences and have incorporated information based on this structure. The other position would mean questioning the fundamentals of the structure and introducing into the teaching the controversies of sciences. In this position, science is a progressing activity and as a part of the activities several issues or controversies will be debated. These controversies continue as a part of the academic fields, but the teachers’ view of the students’ ability to understand them and hence the arguments used for addressing controversies as a part of instruction form the basics of these two positions. (Eggen & Knain, 2003)

¹⁴ This concept has been translated into ‘liberal education’ (Ødegaard, 2001) with reference to connotations with critical thinking, personal development and societal awareness. The term ‘allmenndannelse’ carries then a similar ideological message as progressivism or liberal ideologies.

6.6 Student assessment in science education; assessing laboratory work.

In science, knowledge is built through theoretical studies, problem solving and laboratory activities. There are at least three different aspects of experimental work as a learning activity. Each of these aspects, the purpose of the experiment, the procedure and the results had specific pedagogic functions and therefore different emphases in the different epistemological approaches. (Hodson, 1985) The assessment of laboratory work and of the written accounts/reports are therefore important aspects of assessing students' learning processes in science. (Bryce & Robertsen, 1985) The question of teachers evaluating competencies that are not subject to national assessment versus the possibility of administering practical examination procedures is the corresponding systemic dilemma (Stark, 1999). The presentation will be organized according to the three views on knowledge construction and their implications for learning and assessment as in ch. 5.

6.6.1 The inductive positivist approach to laboratory skills; from a product approach to a process approach in the same paradigm

Addressing practical competencies has been subject to major changes within the past 40 years. During the 1960s the dominant inductive empiricist approach assumed that students could learn science by doing science. This was a child-centered period built on a notion that children's natural curiosity may be used to the benefit of learning science and hence the slogan became 'discovery learning'. Discovery learning meant that the discovery of conceptual scientific knowledge was possible by designing practical work in a way that represented the scientific investigations of science communities. By way of these activities, students could rediscover the laws of science in school laboratories. The underlying belief was that science starts with observations; that observations are reliable and unprejudiced; they produce objective value-free data; facts and laws emerge from these data; principles and theories may be induced from generalizations; and explanations and theories may be further confirmed by extended observations and experiments. Procedures for laboratory experiments were designed based on these beliefs of scientific enquiry. (Hodson, 1985, 1996)

During the late 60s and 70s, this approach to laboratory learning activities was substituted within the science education communities by a process approach. (Millar & Driver, 1987) The main criticism of the inductivist learning emphasis was that “*You cannot discover something that you are conceptually unprepared for*” (Hodson, 1996, p.118). The doing was so heavily emphasized that the education failed to provide the students with conceptual understanding due to misinterpretation of results and inability to come up with the expected results. Teacher - guided laboratory experiments were the temporary answer to this challenge. However, the next wave hit school science laboratories. This process approach had extended the emphasis on scientific enquiry for learning. However, the goal for activities in the laboratory was no longer the learning of the content of the sciences but rather the skills and techniques of scientific enquiry - the processes. This process approach became the legitimating argument for science in elementary education. It was by the learning of the logic of the scientific processes that the subject itself could contribute to the *bildung* of the individual because the processes of science were valid beyond science as an academic discipline and as a school subject. They were transferable. The assumptions underlying the legitimacy of science and signaling a corresponding view on scientific knowledge were “*The processes of science are identifiable and characterize the pursuit of science. The processes are generalisable across domains of knowledge/experience. That we obtain reliable knowledge of the natural world only through experience with the physical environment, scientific theories are derived inductively from sense experiments.*” (Millar & Driver, 1987, p.37)

The implications of the process approach for teaching and its importance within the school system was further underlined by the development of assessment procedures. The assessment of scientific inquiry as a learning method was pushed by both curriculum development and standard formulations. In order to achieve this assessment a hierarchy of process skills was formulated. Process skills were divided into basic skills such as observing, measuring, inferring, predicting, classifying, collecting and recording data, and integrated skills like interpreting data, controlling variables, defining operationally and formulating hypotheses. (Gagné, 1965)

The empirist inductive philosophy of science was still the viewpoint. Applied to educational programming this meant that observations and inductive approaches emphasizing processes of inquiry resulted in learning about the scientific investigations and skills that are context independent and transferable. The assessment procedures are based on the notion that performance skills can be broken down into several isolated discrete parts of processes. The sum of these different processes results in scientific process knowledge. The teacher's identity is to observe and measure the different aspects of the process, and the sum is the performance assessment. (Hodson, 1996)

In this process approach, the learning of the content and concepts of science was pushed into the background. A theoretical framing and interpretation based on previous knowledge within the field was therefore necessary. The arguments against the process approach were threefold. They were based on cognitive epistemology, secondly on pedagogy and thirdly on the philosophy of science. The first line of argument resulted in the next approach of constructivism. Students do not only learn from activities arranged for them, but they bring experiences and conceptions to the learning situations. Therefore, the learning processes of a student cannot mirror scientific inquiry. Learning is context dependent. (Millar & Driver, 1987)

The lack of theoretical framing resulted in a closed logic of assessment. Assessing the student had to be done according to their own reasoning within the linear acts of inquiry. Two problems arose, firstly whether it is possible to assess the processes undertaken during the laboratory experiment or whether we are mainly assessing a written or oral account of the exercise in which case it is the result that is being assessed. The other problem is the assumed independency of the actual context and content taken in addressing the general process skills. (Millar & Driver, 1987; Roth & Roychoudhury, 1993)

Recognizing the theory as important for scientific inquiry in all contexts results in the statement that "*Being able to carry out one, or several, de-contextualized tasks focusing on observation, classification or measurements says little about one's capacity to conduct a real scientific investigation.*" (Hodson, 1996, p.125) Embedded in this quotation is also a question

of the assumption of transferability as a part of the process approach. Emphasizing transferability considers a student's ability to generalize the different activities of observing, measuring etc. in order to organize their knowledge around the processes of science. Moreover, in the next stage teachers use this organization of knowledge to make links between science experiments in the laboratory and experiences in other life situations. (Millar & Driver, 1987)

Another line of argument against this process approach, along the dimension of philosophy of science, states that the processes of science are not unique to science, and scientific processes may therefore not legitimize science as a school subject alone. *"They are in fact characteristic of any human endeavour."* (Millar & Driver, 1987, p.45) It may also be argued that there is no single scientific method to be applied in classroom instruction. To teach the method of science does not give any real picture of scientific enterprise.

6.6.2 The individual cognitive/constructivist approach to cognition as a part of laboratory experiences; mainly a conceptual product approach

This criticism of the significance of theory for sound scientific inquiry in learning activities as well as the context free process learning resulted in a change that during the third period, the 80s and 90s, emphasized the previously individual theoretical understanding of the concepts of science. There was now a cry for moving 'beyond processes' (Millar & Driver, 1987). From the rote learning of concepts science education had moved to an opposite child centered emphasis. Returning to a conceptual focus at this time meant merging content with processes in the view that *"knowledge is personally and socially constructed, rather than 'objective' and revealed; theories are provisional, not absolute."* (Ibid, p.57) The single most important factor is what the student already knows, and this has to be acknowledged in order to build educational programs that enable teachers to teach according to their students' prior understanding. (Ausubel et al., 1968) During this period the curriculum and criteria drew heavily on students' previous subject understanding or conceptions as the analytical basis for the design of the experiments in the laboratory. (Driver, 1983) This constructivist approach to learning in the laboratory was to build on the student's ideas and views in order to create opportunities to test their own preconceptions. The teacher identity is to analyze the previous

understandings- during that time often referred to as 'misconceptions'- in order to provide the right stimuli for the student to adjust their conceptions. This conceptual change involved in the learning processes represented a reconstruction of their own ideas in light of the theoretical framing established by the teacher.

Conceptual knowledge is a result of combined theoretical and practical instruction. Ausubel is largely concerned with the practical implications of his cognitive view of learning. *"Before students can "discover" generalizations reasonably efficiently, problems must be structured for them in such a way as to make ultimate discovery almost inevitable."* (Ausubel et al., 1968, p.304) He is therefore the advocate of assisted yet autonomous discovery of practical laboratory work in order to acquire skills and conceptual meaning

The framework used in the Third International Mathematics and Science Study Performance Assessment project (TIMSS PA) includes five main categories. The first of these categories of understanding was divided into simple, complex and thematic information. The next category covered theorizing, analyzing and solving problems, while the third category, that of 'using tools, routine procedures and science processes,' has the following sub- categories: Using apparatus, equipment and computers, conducting routine experimental operations, gathering data, organizing and representing data and interpreting data. The fourth - 'investigating the natural world' - included the following sub- categories: Identifying questions to investigate/understand and interpret the frame of the tasks and the tasks themselves, designing investigations/understanding necessary manipulations, conducting investigations, interpreting investigations/understanding and applying relevant ideas in science and formulating conclusions/understanding of how to evaluate and collect evidence. The final category of communication comprised two sub- categories of accessing and processing information and sharing information. The five main categories are not considered linear, but combined they represent a circular model for students' investigative work in science. However, in TIMSS they were used as a linear model to analyze results. (Kind, 1996, p.84; Kind, Kjærnsli, Lie, & Turmo, 1999) These categories may be applied to teacher student assessment of the laboratory work both in the classroom situation and in reports if applied as a circular model. The model has one limitation when applied to classroom practice and that is its individual

cognitive nature. A further emphasis on the collective social aspects of laboratory work has to be included, e.g. the collective elements of sharing ideas, participation and co-operation. The development of process skills in science has to be integrated with conceptual development and in meaningful contexts (Roth & Roychoudhury, 1993).

According to one theoretical overview three different, but overlapping, dimensions may be used in order to deal with performance abilities (Kind, 1996). The first one is practical work understood as conducting the actual scientific hands-on activity. The second dimension is the scientific investigations using some specific scientific methods to investigate nature and solve problems. Thirdly, the dimension of scientific behavior or performance includes the handling of scientific knowledge and solving scientific problems more generally. They all include potentially, but in varying degrees, the various aspects of products, processes and scientific enterprise (Sjøberg, 1998). The product aspect focuses on knowledge bases, and the process aspect on skills, while the third introduces the social dimension.

Various methods have been or may be used to assess practical performance in science. These are continuous assessment made by the teacher based on systematic observations and records, student assessment of laboratory reports written by the students and based on their work in the laboratory, individual student projects applied to practical skills, paper and pencil test items pertaining to laboratory experiences and related issues and practical examinations. The first three alternatives are more commonly used formative and summative assessment strategies by the teacher. These may include all three aspects of knowledge bases, skill bases and social aspects and may therefore be individually or collectively oriented during assessment. The latter two are summative approaches more commonly used by international testing or in some countries by the national testing board. They typically include the knowledge and skill aspects and hence address an individual cognitive tradition in science testing in addition to a summative achievement approach (Kind, 1996). A major finding in the TIMSS PA project related to problems in identifying specific skills across the tasks. An even bigger influence on their behavior was a lack of understanding of the purposes of scientific investigations. The students' responses, to the extent that they were conceptually to the point, were therefore "ritualistic" rather than insights into the processes of science. This clearly leaves the teachers

of elementary science with a challenge of increasing their scientific skills and the students' understanding of these skills as part of the processes of science and scientific enterprise as well as foundations for conceptual knowledge building.

Thus the concept of science as historically accumulated knowledge and the progression of scientific enterprise as based on combined theoretical and empirical evidence has found its place in science education. This emphasis on the individual conceptual change fails however to address several other issues of scientific enquiry such as the standards and criteria for science, the ways in which the cultural social aspects is contributing in both the products and processes of science, and the contribution of scientific enterprise outside the scientific communities in relation to society in general. These aspects of scientific enterprise had to find their way into educational programming in order to communicate the external as well as internal processes of science.

The integrated perspectives of content and processes as merged learning objectives call for research that investigates the experiments conducted in authentic contexts. (Roth & Roychoudhury, 1993) Scripted or fixed laboratory activities have obvious limitations, and therefore more open-ended inquiries have been introduced. In one project emphasizing open-ended inquiry, it was found that students were able to relate to both the conceptual knowledge building and to the laboratory skills. They were able to identify and define variables, interpret and analyze data, plan experiments and formulate hypotheses. Open-ended laboratory work has therefore received attention, but challenges remain as concluded in the following quotation. *“Yet laboratory experiments, for the most part, have remained cookbook activities designed to verify well-established principles and laws. Part of the problem lies in the excessive demands that open-ended laboratory activities impose on teachers.”* (Ibid, p.148) One such demand or challenge is the management of the laboratory as a consequence of several activities going on simultaneously (Tiberghien, Veillard, Le Marechal, Buty, & Millar, 2001). Development of assessment procedures is another demand called for in order to fulfill a learning circle.

The open-ended inquiry mentioned in the last paragraph represents laboratory activities as problem solving activities. Others have proposed extended projects and investigations as the means to further emphasizing the actual scientific enterprise. (Tiberghien et al., 2001) An integrated content, processes of science, student involvement and student interaction map was applied in several European countries in order to analyze the frequency of different laboratory activities. One finding related to the striking similarity between countries. In most cases, ranging between 80 and 100% teachers defined and specified the questions to be investigated. After the task had been distributed and the content and procedures set, the students in about 90% of the lab-work situations were expected to interact. In most cases, therefore, the team of researchers was struck by the degree of closed or scripted laboratory work. The teachers interpreted their identity as that of giving directions such that the students would be expected to include a small range of objects, observations and corresponding theoretical explanatory models. As a consequence, there was little emphasis on the relationship between different possible theoretical framings and the objects and phenomena studied. The students are *“supposed to either discover the new relations or the concepts by themselves or to use theory that has already been taught.”* (Tiberghien et al., 2001, p.503)

6.6.3 Towards a sociocultural approach to laboratory practices; the merging of the process with the product and adding a scientific enterprise approach

The next approach was an answer to these objections to the necessary focus on the context of laboratory learning combined with the merged agenda of conceptual and procedural knowledge. An extension into the social factors of research communities as objectives for teaching science finds its way into the complexity of learning activities in the laboratory. However, different solutions to the integration of the scientific enterprises occurred.

In this approach, a certain degree of methodological reflection had to take place. Learning activities in the laboratory should therefore consist of phases of questioning and designing experiments, of conducting the experimental procedures, of reflecting upon the results in light of theoretical perspectives and of recording and communicating the results in oral and written reports. A circle of continuous planning and evaluating of experimental procedures and theoretical illumination is the result of this approach - science is dynamic. This tradition

combines the enquiry skills of the purely empiricist tradition with situational conceptual understanding. The teacher's corresponding challenge is to be a model for the students' practice and guide the students to perform and apply scientific skills in other contexts. The apprenticeship relationship between teacher and students involves reflectivity. Learning the processes of science has been substituted by learning the meta-processes of science.

"Reflections like these, and the requirements to discuss them with the teacher, help to give the students the insight into the idiosyncratic and reflexive nature of scientific investigation that constitutes a major aspect of learning about science." (Hodson, 1996, p.131) Hereby the social dimension, the interactive aspect of scientific enquiry is introduced into science laboratories.

Science laboratory work as a teaching activity as well as in scientific communities is social by nature. This complexity is further discussed in the many varieties of science, technology and society approaches (STS). These curriculum approaches take on the whole range of political aspects of science as well as the ethical issues, philosophical positioning, application of scientific results, the interrelation of technology with science and relations between society with the sciences.

The ability within school science to mirror scientific enterprise has also been questioned. (Chinn & Malhotra, 2002). Inquiry tasks used in school have necessarily different epistemological bases from the epistemology of authentic science. The previous approaches to scientific inquiry in schools have fostered and reinforced beliefs that scientific reasoning is cognitive, linear, algorithmic and individual. This can be prevented by a further emphasis on authentic inquiry in which the complex relationship between theory and empirics is elicited. For this reason the assessment of a student's achievements in the science laboratory has to address dimensions such as methodological mistakes in the laboratory, how to combine results and findings from different experiments, and more complex issues of control. These additional assessment criteria will address the differences between a laboratory as a learning environment and genuine scientific enterprise in that a single activity is related to continuous learning experiences. In addition, the students should consider and evaluate the reporting of scientific experiments.

With this approach, the assessment of laboratory practices resembles the ideas behind portfolios. *“Good portfolio practice requires fundamental changes in conceptions of science and science teaching, in ideas about learners and learning and of course in the practice of and function of assessment. Taken together, these changes manifest themselves in a rethinking of the purpose and nature of curriculum, leading to what we have called a portfolio culture.”* (Gitomer & Duschl, 1995, p.299) The duality of emphasizing the scientific processes or emphasizing the conceptual knowledge has disappeared here. In a portfolio, classroom and culture are mutually dependent on each other. This intertwined perspective on the products and scientific processes requires a continuous development of the criteria for assessment and for the conversational part of the classroom practice.

The sociocultural perspective on science teaching in laboratories has two dimensions. The first dimension is the philosophy of science view that scientific enterprise is a collective phenomenon incorporating the corresponding didaktik positioning that science teaching should illustrate the aspect of knowledge construction within scientific communities. The second aspect is the epistemological position that addresses the relative importance of knowledge construction based on individual versus social or collective contributions. It is the first dimension that is specific to science as a subject.

However, the combined epistemological view of science education underpinning a sociocultural approach would involve the following elements of processes, significance of theory, individual theoretical understanding, laboratory practices and learning environment. Processes, from formulating hypotheses and questions to conclusions should be informed by theory. Theory, understood as scientific knowledge, is dynamic and subject to change. Individual theoretical understanding is a combination of previous conceptions, new experiences and theoretical framing. Alternatively a learning outcome may be seen as acknowledging the parallel existence of two explanatory models and corresponding terminology for the same objective phenomena. The laboratory practices must follow the accepted rules for practice, but also involve reflection on the significance of empirical indications. The learning environment has to be designed for the purposes of merging the

methods of teaching, with the scientific theory and situated formulated objectives.
(Aikenhead, 1996; Gitomer & Duschl, 1995; Klein, 1998)

Within science education there has been a growing acceptance for the parallel existence of scientific enterprise and science learning in the laboratory. The processes of learning science take place in the second situation in which the possibility of mirroring the processes of scientific enterprises exists only to a limited degree. There are, however, explicit statements that the students should learn about the processes embedded in the scientific enterprises. The processes of learning science are singled out from the processes of learning about sciences. The processes of learning science draw on personal experience and understanding, known as proximal knowledge. The nature of science understood as the different epistemological and philosophical positions in scientific communities have been labeled distal knowledge. (Hogan, 2000) This distinction is necessary in order to assess students in practical work situations. *“But because some students might acquire detailed knowledge about the enterprise of science without internalizing the standards of the scientific community for their own, it is crucial that our techniques for measuring student’s knowledge of the nature of science help us distinguish between students declarative knowledge and personal perspectives.”* (Ibid, p.64)

A collective activity theory related view of science investigations in classrooms and student assessments of the investigations implies discursive elements, negotiation of meanings and the relative importance of collective and individual ideas. Written accounts in the field of science may be individual or collective. In either case, the social versus the individual contribution to the text may be questioned. The discourse aspect of laboratory practices have enjoyed limited empirical focus (Ivanic, 1998; Roth, 1999). The sociocultural and collective contribution to the students’ knowledge construction in laboratories has been acknowledged, and results have shown the importance of including written materials, oral communication as well as non-verbal communication in order to investigate the significance of the relative contribution of the individual versus the collective contribution to the students’ understanding and their written accounts. Simultaneously the written accounts of laboratory work have been questioned as to their potential for students to write their learning process and the shaping of their knowledge into the laboratory reports. (Knain, 2003)

In this final tradition, the context specific factors of what constitutes the learning environment that is a laboratory has become important. The authenticities of the learning environment as well as of the corresponding assessment procedures have been addressed. Formative approaches have been introduced into the assessment of practical work. The dichotomy of learning the processes of science and learning about the processes in scientific communities has resulted in a renewal of a process approach but for different reasons. From its physical appearance a school laboratory resembles the combination of a science laboratory and a classroom. Thereby the future may illuminate the integration of the sociocultural perspective of scientific enterprise with a sociocultural epistemological view of laboratory practice in schooling for students' conceptual understanding in science.

6.7 Application of theoretical framing

Chapters 4, 5 and 6 have presented three frames for addressing the identity formation of science teachers concerning reflections connected to student assessment. The individual teachers' actions and stated reflections will be mapped according to the implicit or explicit scientific ideological emphasis, epistemological positions and assessment dilemmas. This mapping will result in teacher characters, typologies or archetypes. The typology will diminish the appearance of a real person behind the case reconstruction, but could, nevertheless, be applied in teacher training as case material for discussions. This strategy of describing and analyzing teachers' stands in contrast to the situational character of the fieldwork and the socio-cultural approach to teaching and to research. Identity formation is a result of the relational nature of teaching, and forming typologies works contradictory to identity formation.

There are three alternative analytical foci (Jeffrey & Keynes, 2002). The first employs opposing behavior, practices and perspectives in the way "*they exist between individuals, between groups and between communities*" in order to identify "*polarization or distancing of a specific relationship in values, beliefs and practices*". (Ibid, p.2). The second analytical focus could be to include multiple behaviors, practices and perspectives in order to attain the coping strategies that teachers would draw upon. This would take into account both the

situational character of the teaching, fieldwork, social structures, and culture in which it is embedded. This approach allows for different actions and behavior, and hence draws on a different explanatory framework as well as perspectives and values according to the situation. However, multiple perspectives and explanations may also signal inconsistency, and therefore a third analytical focus uses the contradictory behavior, practices and perspectives of the individual teacher.

There are reasons in favor of including two or more foci in analysis due to the complex nature of a teacher's identity. *'Teachers have multi-faceted, rather than fragmented, selves, and they demonstrate considerable skill at developing and employing strategies first situations. This apparent strategically switching is best explained, we argue, through the concept of 'positioning'.*" (Ibid, p.11) Teacher competencies, experiences, intuitions and creativity switch between alternative references, hence positioning him or her according to the different perspectives are required. As researchers, we are closest to the situational challenges of the teachers when attempting to illustrate the diversity, whether they are oppositional, multiple or contradictory.

The conclusion of this project about student assessment is therefore to illuminate the diversity of the individual teacher by using multiple instructional units, multiple educational settings and multiple contexts as a part of the sampling events for fieldwork and sampling events to be analyzed. Thereafter the multiple events and corresponding teacher reasoning will illustrate the apparently contradictory internal logic of student assessment and evaluation. Dealing with student assessment involves dealing with dilemmas and making choices within frameworks of educational, epistemological and ideological involves dealing with contradictions, tensions and dilemmas as well. Hence, the search for consistency means searching for fixed identities. Fixed identities equal a universal rather than a situational attitude to education. The cases represent archetypes, typologies and reconstructed teachers, each maintaining multiple positions, some representing dilemmas at the periphery, some more internal consistence, some highly contradictory. Nevertheless, they will each illuminate a specific teacher and the specific combination of reflective strategies that this teacher draws upon in order to understand his/her own student assessment practice.

The sociocultural main perspective of this dissertation is based on the integration of Wenger's identity concept (based on the two processes of identification and negotiation that are both relational and individual) with the concepts of dilemmas (as a consequence of the dialectics) and basic beliefs of the teacher stated as ideologies and epistemologies. Within such a framing, the reformulation of the objectives of the dissertation stated in 1.2., must be considered as questions whose intention is to illustrate different perspectives of the same core educational phenomenon, students assessment. Theoretical triangulation is hence not a process of validation here but an alternative to validation by investigating the phenomenon from different theoretical angles, crystallization.

I have laid out a number of theoretical pieces that can make up the quilt and accordingly come together to form a complete picture of the individual teacher's assessment actions and reflections. However the pieces of the quilt and the theories may be pieced together in numerous possible variations. Thereby each teacher will be presented by a separate solution to his or her finished quilt-top. Qualitative interpretative inquiry is similarly to quilt making attempting at representing some aspects of the complexity of educational practices. I see this project as one such attempt and has therefore rejected in chronological order the use of hypotheses as a set of assumptions accepted for investigation and research questions as comprehensive but tentative explanations of relationships between phenomena and identity meaning formation. These concepts are both based on some degree of assumed internal logic. Investigating teachers within this complex theoretical main perspective and according to a menu of theories has been more like a process of elaborating on research challenges and teacher challenges by the means of discursive methods of investigation. However the term 'research question' has regained a qualitative relevance with this approach. *"For the qualitative researcher, the questions cannot be entirely separated from the method, in the same way the dancer cannot be separated from the dance..."*. (Janesick, 2000, p.382) And I will add- or the same way as the process of quilting can be separated from the quilter and from the final product of the quilt. Within Grounded theory research questions has been likewise defined as *"The specific query to be addressed by this research that sets the parameters of the project and suggests the methods to be used for data gathering and analysis."* (A. Strauss &

Corbin, 1998, p.35) Research questions are identifying phenomena to be studied, they are setting the boundaries of what and how these phenomena will be studied. Interpretative inquiry allow for continuous narrowing down of these boundaries.

6.8 Research questions related to the theoretical framing of the construction of teacher identity regarding student assessment.

In chapter one, the aim of this project was stated; *“How do science teachers in lower secondary education construct their identities as evaluators with respect to the summative and formative purposes of student assessment?”*

Chapters two through six have introduced the concepts of sociocultural didaktik, relational identity formation, didaktik reflection, student assessment dilemmas, epistemological positioning and science ideological positioning. In light of the theoretical framing, the main question can be stated:

Within an overall sociocultural view on reflective identity formation what are the assessment dilemmas, epistemological and science ideological viewpoints that constitute the science teacher’s student assessment practices and corresponding reflections?

The main research question is deduced into three corresponding groups of sub-questions. These research questions will have to be considered in combination with the fourth set of research questions at the end of Part III.

A. Research questions concerning the science teacher actions and reflections as studied by participant observation, interviewing and the analytical techniques of Grounded theory:

What are the teachers’ implicit and explicit epistemological and ideological assessment dilemmas?

What are the current actions taken by the teacher in the classroom with regard to student assessment in sciences with specific emphasis on assessment dilemmas, epistemological and science ideological dimensions?

How does the teacher express his/her reflections about their practices in student assessment with specific emphasis on the dilemmas of assessment, and on epistemological and science ideological dimensions?

B. Research questions regarding the development of reflection:

What specific epistemological and ideological dilemmas can be identified as a part of the teacher’s identity in the single education situation and during the course of the fieldwork?

There are two levels to this question, a situational level and a developmental level.

Situational:

How is the identity of the teacher formed through the evaluative practice in the classroom situation and the corresponding reflections concerning the three theoretical frames?

What significance does the teacher put on the interrelationship between reflection and student assessment concerning the same three theoretical frames?

Developmental:

Over the course of the fieldwork, what changes occur in the practices and verbal expressions concerning student assessment within the dilemma, the epistemological and the science ideological frames?

C. Research questions pertaining to the varieties of identities within science education as analyzed within Grounded theory :

What are the different epistemological and ideological assessment dilemmas that can be identified using constant comparative cross-case analytical methods among the participating teachers?

What are the varieties of practices and stated reflections among the participating teachers in the project when it comes to the assessment dilemmas, epistemological and science ideological aspects of student assessment?

How can these diverse practices and stated reflections be presented as various positioning among the participating teachers in form of typologies?

PART III

Methodological Framing;

Grounded theory and Ethnography

From my research log with Delta:

“We are in the teacher lounge with a mug of coffee each. (My stomach dislikes this coffee. I have to be careful with the coffee at this school) I use few words. Delta is very eager to talk. I contribute with some key words, but few whole sentences. It occurs to me that my contributions are important for my own thinking entirely and not for the discourse itself. Delta has his own agenda and thoughts he wishes to communicate or discuss with me. I am fighting to keep the discussion in focus and centered round student assessment. At the same time, it strikes me how sad that I have to hold on to this focus. There are so many important aspects of education to dwell on with Delta. There are so many issues running parallel in our discussions. What are the relationship between these issues and student assessment? How do I continue conversations in order to keep Delta and myself focused as well as having the open mind to what aspects of student assessment is important for Delta?” (1.2.01)

This part serves the dual purposes of describing the development of the methodological framing as well as relating this description to the methodical choices of the fieldwork and analysis. The first chapter will have a major emphasis on the first, elaborating on Grounded theory and ethnography as methodologies, while the second chapter will focus in particular on design of the study. However, integrated in the first chapter are also the experiences based on a pilot study and their implications for fieldwork progress and methodological considerations. The final chapter in this part, chapter nine, is presenting the educational national contexts of three countries with particular emphasis on assessment and curricular reform strategies. I have chosen to reflect on the national contexts of the participating teachers within these methodological frames due to the preferred methodological analytical unit; the individual teacher. The sociocultural relational discursive perspective outlined in part II is discussed within the methodological framing of Grounded theory. The quotation from my log with Delta heading this part is an example of in field reflections on communication with teachers that in retrospect had significant impact on substantial as well as methodological development of the project.

7 Methodology; considerations, discussions and ethical implications

In this chapter, the methodological background for the project will be presented and discussed. The main focus will be on the two contributing perspectives of ethnography (7.3) and Grounded theory, of which Grounded theory has had a superior contribution (7.2). I started out doing ethnography and have continually been “living the ethnographic” doctoral project. Important contributions from this perspective have been developing methods in field as establishing and continuing the relationship to the teachers. However, ethnographic methodology did not give me the necessary analytical rigor and therefore the additional methodological perspectives of Grounded theory were introduced. From Grounded theory methodical considerations like relationship between theoretical and empirical indications, persuasiveness and sampling was derived as well as analytical tools as consequence of these considerations. Another important aspect of conducting this study has been considering and verbalizing the ethics of educational research with teachers (7.4.). This is connected to the status of the researcher in qualitative fieldwork. The chapter will end with a section discussing qualitative approaches (7.5.).

In addition to the methodological approaches, the actual practical development of the project will be described. In order to develop the methodology approach a pilot study was designed (7.1). This pilot study had major impact on methods, on selection of participating teachers and on modes of teacher co-operation. Among other factors playing a significant but minor contribution in developing the methodological approach have been discussions within various educational research communities and previous research experience and therefore these factors find their place in the various subsections. A natural consequence of methodological considerations is the development of the strategy for overall analysis and this will be continued in the next chapter.

The sociocultural view on knowledge construction as a situated relational practice has in addition to the Grounded theory approach been important when designing the research project including the methods, the combination of methods and application of them. The methodological considerations concerning the relationship between the teacher and the researcher are important aspects due to the view on the reflective teacher identity that have

also had major impact on communication with the teacher. Doing qualitative ethnographic research implies creating meeting points between teacher reflections and researcher reflections. The formation of the teacher identity is in these meeting points constituted in relation to the formation of the researcher and vice versa. This sociocultural view on identity formation signals that all the teacher-researcher relationships were different. The circumstances under which we met influenced the development of the relationship as well as the content of the research agenda. The reflective teacher meets the reflective researcher, but it is mainly the teacher reflections that undergo systematic substantial analysis.

In search for the even more specific features of ethnographic inquiries I will turn to the methodology of Grounded theory, but I will also discuss methodological considerations from the perspective of ethics in research that do have recommendations for how to relate to the researched when in field. The expected conduct of the fieldworker may be put into dilemmas or along dimensions for reflection and conscious choice making, but getting beyond such guidelines and develop statements for mechanical applications is impossible due to the situated nature of the inquiry itself. (Ellen, 1984). Grounded theory has been important for its strategies of analysis and its different methodological aspects like theoretical indications versus empirical indications.

There are a number of features that make up a qualitative methodology. There is primarily the crucial relationship between theory and data, and hence the degree of the mutual illumination for building evidence or indicate possible findings. The next is the way language and contextual factors are made explicit, given importance or stated as the focus of study. Thereafter there are the researcher's awareness of her positioning when it comes to the respondents, the data and theoretical framing. The interpretation levels of qualitative research as a part of premises for the process as well as for the reader of the findings is yet another one. The last important factor is the application or implications of research in addition to the status of the results themselves. Unavoidable is also the methodological approach's answers to the traditional yet quantitative topics of validity, reliability, the status of hypotheses, triangulation and sampling. Each of these features of a qualitative methodology will be commented on in the light of Grounded theory, but I will also give historical overview of the development of Grounded theory up to the point where the tradition(s) is at the turn of the century.

7.1 Conducting a pilot

During the spring of 2000, I conducted a pilot study. This pilot was intentionally meant to serve two main purposes. The first purpose was to develop research questions that were researchable considering necessary precautions in co-operating with teachers in Norwegian elementary education within specific institutional settings. The second purpose was to develop a methodological approach in which I took the same considerations.

7.1.1 Selecting teachers and methods used

During this first phase, one school was selected. Three teachers at this school agreed to work with me. The teachers were selected in co-operation with the management of the school. They were all teaching a combination of mathematics and natural sciences, but one in grade eight, one in grade nine and one in grade ten. This was my preferred choice in order to be addressing the range of student assessment topics during junior high school. It was apparent that the management of the school had their reasons for selecting particular teachers, but I made it clear that I wanted to meet and get to know the teachers without this evaluation influencing my communication with the teachers. The vice-principal was appointed as my contact with the school's administration.

The methods I decided to use for the pilot were in the particular order they were conducted the following:

- A. Participatory observations. Alternating field-notes and video recording.
- B. Continuing and informal discourse. Field-notes.
- C. Interviews after every day of instruction based on videotaping and field notes.
Audio taping and notes.
- D. Interview at the end of fieldwork period. Based on first analysis of all the field notes and previous interviews. Audio taping and notes.

The different methods were seen as subsequent phases, and there was no methodological reasoning behind the combination of methods and their relative analytical importance. The content of the interview as well as focus for observations were planned according to previous observations and interviewing. The plan required microanalysis of field notes

parallel to fieldwork (A. Strauss & Corbin, 1998). One day in the school consisted therefore of three main phases, observation, discourse and writing up.

During the pilot and the first half-year of fieldwork, I played around with different kinds of instrumentation. Eventually I landed on using three forms; one for observation notes, one for general impressions during instruction as well as my evaluation of the instruction and finally one for different methodological dilemmas I experienced while in school. Hence, the micro analytical approach was build into the instrumentation. I did not however use all instruments on all occasions. Due to the flow of the fieldwork in subsequent phases, my main written material for an overall analysis is the log. The logs, one for each teacher, contain data at different levels and for that reason; I had to develop my own system to explain for the readers as well as myself the status of the data. I did make it a point to write up my field notes the same day or the day after in order not to have all different kinds of interactions, thinking or verbalization in the time between being in the field and writing it up.

7.1.2 Initial methodological considerations

In this section, I will be turning to the second purpose of the pilot study that is the substantial purpose. I learned that it was necessary to adjust my preconceptions about the teachers understanding of the issues of student assessment, their terminology when it comes to student assessment and their definitions of the teacher's identity. The general substantial findings, based on work with three teachers and one week each, goes as follows:

- I. The teachers find student assessment to be one of the most difficult aspects of their profession. (all three)
- II. They communicated an awareness of the complexity. (2 teachers)
- III. The teachers lack a well-developed and well-defined terminology that they may use for addressing the issues. (all three)
- IV. The teachers did to some extent use the terminology stated by the national governments and the Ministry of Education and implemented through laws, curricula, regulations and circulars. (all three) The degree to which they had assimilated the intentions and meanings was varying.

- V. The teachers had a narrow sense of student assessment meaning that they mainly spoke about summative aspects and that they accordingly interpreted my intention as to investigate tests and other typical summative elements. (two teachers)
- VI. The teachers did not communicate to me any viewpoints that indicated a understanding of the interrelations between student assessment and other main issues of education like subject content, choice of teaching methods, learning theory etc. (two teachers)
- VII. Two of the teachers did not consider student assessment as being important for the three stages of planning, executing and after-work.
- VIII. Two of the teachers did not give me any information about their reflections that indicated that they are aware of the relation between student assessments used as information about own practice in order to refine instruction units.

Despite of the apparent normative and incomplete analysis these experiences in sum told me that the teachers felt strained by my topic (but not by my presence) and therefore somewhat apprehensive to involve in lengthy communication. I realized from that point that it was crucial to my project and in order to dig deeper into their understanding that I took on the following main perspectives for my co-operation with the teachers.

1. Use some time to find out what constitutes the teacher's own agenda and what the teacher finds being most important in elementary education.
2. Build on that perspective in order to reach assessment issues.
3. Emphasize the development of the teacher's vocabulary in order to address the issues thoroughly and to reach a stage of common language in communication.
4. Building bridges between teacher activity and assessment of the activity.
5. Use examples taken from their own classrooms activities to facilitate the interviews.
6. Building bridges between student assessment and teaching activities.

Among the major conclusions of my pilot study were the findings that the teachers had few words and concepts to express their experiences and opinions of the significance of assessment. The terminology they used was rather inconsistent and that they lacked the finer vocabulary address the issues to the extent that they were pleased. They lacked the

understanding of the terms used. Overall, they expressed that they saw student assessment as one of the rather complicated and challenging fields, but they signaled frustration due to the lack of a correspondingly sufficient language. Their ability to express the dilemmas of student assessment in specific and subject didaktik in general was strongly inhibited by this fact.

My main project will therefore have to deal with the challenge for how to describe the aspects of student assessment that is more implicit in the teacher statements and in their actions. Development of the teacher competence in student assessment issues, and as a part of this the language competence and terminology will be an additional agenda running parallel to my project. It is also important for the project that we build a common understanding of the content of the terms. The key question to be drawn from this is what is the teacher's language competence for reflection concerning student assessment issues and what language and didaktik terminology does the teacher need in order to express his or her dilemmas?

Just evaluating the language, we see three objections; the building of the teacher comprehension, the building of the common understanding of the dilemmas of student assessment and finally the corresponding building of the researcher comprehension. These three processes are intertwined and mutually dependent on each other. We are talking about two parallel processes with their epistemological distinct characters and several meeting points between the two. Consequently, the relationship between the researcher and the individual teacher becomes an important topic.

It will therefore be important to describe a methodology that draws on a merged perspective that is a perspective between the extremes of true intervention and true conceptualization. True intervention in the sense of action research with an emphasis on emancipation was rejected (Carr & Kemmis, 1986). True conceptualization was rejected due to both ethical (7.4) and methodological considerations (7.2 and 7.3). *“Instead of forming experimentally skills and mental functions in the students, the researchers will be engaged in forming socially new artifacts and forms of practice jointly with their subjects.”* (Engeström, 1999a, p.36) The practical validity, understood as the meaning created for the teacher in participating, formulating and in addressing issues of student assessment, is consequently an ongoing concern of the researcher.

During the first part of my fieldwork I soon discovered that my initial categories became saturated, meaning that they had little room for discovering the deeper intentions and positioning of the teachers in their student assessment practice. I was therefore searching for opportunities to work with teachers that had various ideas about evaluation and assessment. Theoretically, as outlined in the previous part, this became to mean epistemologically and ideologically positioning within student assessment dilemmas. With this experience in mind, I also had to evaluate methodological approaches that gave me the necessary relationship between the teacher and the researcher and between this theoretical framing and the empirical indications. The solution became to be the following of Grounded theory merged with the original ethnographic methodology.

7.2 Methodological considerations applied on Grounded theory

In Grounded theory methodology is defined as “*a way of thinking about and studying social reality*” (A. Strauss & Corbin, 1998, p.3). The other originator of Grounded theory states this slightly different in “*Methodology is the theory of methods, and in this case, the Grounded theory methodology is itself a theory which is generated alongside the substantive theory it is generating*” (B. G. Glaser, 1992, p.7). There is, according to these quotations, a relationship between a specific phenomena and the way we choose to study, describe and represent it in our research reports. Grounded theory presents itself in the various forms of it as a methodology carrying analytical procedures, but with no preferences for methods used for data collection. On the contrary, Grounded theory can be applied to a number of texts, whether created by the researcher herself or by others. The methods can range from interviews, observation records, textbooks, official documents and they are all sources within educational research on which Grounded theory may be applied if the focus is the phenomena likely to be revealed by the analytical tools provided within Grounded theory. The heart of the approach is “*to develop an empirically Grounded theory through observations and interviews*” (Kvale, 1996, p 98).

7.2.1 The roots of Grounded theory.

Grounded theory was born within the discipline of sociology. It was defined and summarized by Glaser and Strauss in the sixties and the most influential book from this period was “The discovery of Grounded theory” (B. Glaser & Strauss, 1967). In the

preface to this book Glaser and Strauss communicates their motivation for establishing a new tradition. There is an opportunity to “*close the embarrassing gap between theory and empirical research*” by pointing at “*improving social scientists’ capacities for generating theory that will be relevant to their research*”. They see then Grounded theory as “*developing canons more suited to the discovery of theory*” instead of the quantitative verification tools of “*sampling, coding, reliability, validity, indicators, frequency distributions, conceptual formulations, construction of hypotheses, and presentation of evidence.*” (B. Glaser & Strauss, 1967 p. vii-viii)

This approach was seen as a necessary alternative to the grand theory approaches within sociology, and this is their attempt to close this gap between theory and empirics by introducing a different theory concept and by formulating principles of comparative analysis. All theory is middle range and Grounded theory approach may facilitate the understanding of the diversity of human practices through comparison within the context interpreted and explained to the reader. The emphasis is on empirics, but theory plays also an important contribution in the knowledge construction within this approach. Embedded in this approach to knowledge construction is also that an understanding of the scientific community is a prerequisite for the judgment/validity of the results. Another important aspect is the there is a distinction between everyday knowledge and scientific knowledge and yet Grounded theory has a major focus on application of scientific knowledge within everyday settings.

Grounded theory has the main intention of giving status to the empirics, and has several roots. The first root is symbolic interactionism. Another aspect build into Grounded theory is the practical applicability with roots from American pragmatism. These two aspects of Grounded theory is combined in the way the meanings or interpretations are partly based on the practitioners’ viewpoints. Building theory for practical purposes in order to inform professional development is hence both intentions and issue for implications and application. There is an ideal of objectivity and predictability as well as a dual relationship between theory and empirics buried in Grounded theory that may signal links to post-positivism. (Alvesson & Skjöldberg, 1994; M. J. Smith, 1998; A. Strauss, 1987)

There are also obvious links to German hermeneutics in the combined emphasis on theory and empirics. Even if Grounded theory do have a specific system for constant comparison

the fundamental recognition of the basics of the hermeneutic circles are apparent. The interpretations are also within Grounded theory based on acknowledging that the specific parts may only be understood as a part of a whole and vice versa. The overall process is based on previous knowledge and theory of the phenomena as well as the pendulum between understanding and explaining. However, Grounded theory and hermeneutics do part on one important aspect, that of the status of empirics. Other authors have traced the roots to phenomenology (Mjøset, 2002) with the main emphasis that it is the matters themselves that decides the methods used in order to understand the phenomena from within by the means of interpretation colored by the researcher. Hence, there are obvious similarities between hermeneutics and phenomenology (Moran, 2001). Finally, the last root to be mentioned is the ideographic and case oriented paradigm. (Alvesson & Skjöldberg 1994; M. J. Smith, 1998)

The theory concept that the Grounded theory is building on consists of five elements: ability to predict and explain behavior, theoretical development in the academic discipline, practical applicable in the sense of ability to inform the understanding of the practitioner, provide a perspective on behavior applicable towards data and guide and provide a style of research. (B. Glaser & Strauss, 1967, p. 3) There is a situated perspective build into this theory concept. The theory should fit the situation being researched, inform the participants as well as inform theory building within the academic field. This attempt to build gaps between theory to inform practice and theory for academic purpose, makes the theory concept applicable in educational research in general and ‘didaktik’ in special. The very label “Grounded theory” makes it necessary to underline with its founders the following: *“Our position, we hasten to add, does not at all imply that the generation of new theory should proceed in isolation from existing Grounded theory”* (B. Glaser & Strauss, 1967, p.6). Furthermore, the fundamental base of the book is that both qualitative and quantitative methods may be used for theory building. Simultaneously they see their contribution as mainly qualitative and introducing comparative analysis as a strategy to meet these five requirements for a theory.

The heart of Grounded theory analysis is the constant comparative method. The initial significance of constant comparative analysis was to apply ‘explicit coding and analytic procedures’. This was seen as necessary in order to create an alternative to the confirmative paradigm in which most qualitative data was converted to quantitative

measures. Moreover- as an alternative to the qualitative generative research strategies oriented towards the search for new dimensions or new properties in the data that informs theoretical categories. By picking the best from both traditions, the systematic aspect from the first and the generative aspect from the second, comparative analyses should bring the field of qualitative inquiry one step further.

The four steps of the constant comparative method are comparing incidents applicable to each category, integrating categories and their properties, delimiting the theory and writing the new empirically informed theory.

The comparative element lies in the continuous coding combined with comparing the incidents coding in the same category. Parallel to this activity runs the activity of memo writing, taking notes of ideas. The merging of these two activities is crucial as the rationale behind the integration of categories that could also be seen as the first step of theory building and finally attaching status to the theory developed.

In sum Grounded theory, both in the initial stages and later formalizations is a genuine attempt to develop interpretation guided by theory of observations, formal interviewing and informal conversations. In order to achieve this continuous coding, recoding of the data is required both in field and after fieldwork has terminated through the manner of microanalysis and structured coding procedures. I will now turn to a discussion of the methodological features of Grounded theory before embarking at a presentation of the coding procedures relevant for the micro- and overall analysis of this project.

The originators of the initial Grounded theory separated on core methodological issues. I will in the forthcoming use the version of Grounded theory formulated by Strauss and Corbin.

7.2.2 The relative importance of theory versus empirics

The constant comparative method is a combined theoretical and empirical analytical process. It is therefore a meeting point between the inductive empirical process and the deductive theory informed part of the process. *“Although the text provides clues about how categories relate, the actual linking takes place not descriptively but rather at a conceptual level.”* (A. Strauss & Corbin, 1998, p.125)

The debate concerning Grounded theory has been centered round the status of theoretical evidence or indications versus the status of empirical evidence or indications in building new knowledge. Grounded theory carries with it an approach for how to theorize when conducting fieldwork as well as for the final analysis of the data generated from fieldwork. The more recent development in the Strauss and Corbin version as stated in "*Basics of Qualitative Research*" states the interrelations of theory and data the following way. "*Theory: A set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena.*" (A. Strauss & Corbin, 1998, p.15) Theory is here seen as having both inductive and deductive contributions. Then "*Theorizing is the act of **constructing** from data an explanatory scheme that systematically integrates various concepts through statements of relationship.*" (Ibid, p.25) There are two elements in these quotations that requires further comments; firstly the visibility of the researcher in the task of constructing theory and secondly the normative and implication element indicated by the use of the term prediction which is also seen as providing guides for action.

The importance of stating contextual factors is important within Grounded theory for data analysis, for researcher positioning and for the interpretation as well as drawing conclusions of implications and application. Peoples understanding of the world is important within Grounded theory. Even more so- the context that set the limitations and possibilities under which people are acting, reflecting and learning. All human action and interaction has to be studied and therefore analyzed taking the particularities of their situation, their context or under which circumstances they are acting into consideration. In as much as the context set criteria for the individual so much do we as researchers describe the individuals and their actions. Whenever there is an action to be studied, verbal or physical in nature, there is a corresponding setting. There are also limited intentions within this methodology to generalize beyond the selected respondents. The contextual or situated prevents us from true generalizations. However, there are possibilities for applying results. Possible application is dependent on the reader's interpretation and according the descriptions given as a part of the analysis. Implications or predictions beyond the hedge of the study are in particular interesting in educational research. This, on the one hand context-bounded approach, is on the other hand somewhat disregarded in the constant comparative method.

7.2.3 Researcher positioning

The researcher identity within Grounded theory can be introduced by the quotation “*The researcher is shaped by the data just as the data are shaped by the researcher.*” (A. Strauss & Corbin, 1998, p. 42) The difficult identity of the qualitative researcher is the balance of both keeping a distance and getting involved or “*immerse oneself in the data and still maintain a balance between objectivity and sensitivity*” (Ibid).

Grounded theory embraces several different and apparently opposite human cognitive and affective thinking skills like systematic analytical cognition, creativity and sensitivity. Creativity in coding and creativity in questions asked to the texts should work parallel to the cognitive and theory influenced reduction of data and data analysis. In much the same manner sensitivity to the respondents and sensitivity to the messages of written material should go alongside critical analytical and objective distance to the data and the humans represented in it. There is an implicit message in Grounded theory methodology. The core of this message is connected to the saying that in qualitative research the researcher herself is the main instrument. It takes experience to acquire the skills necessary to apply the methodology to its full potential. The variety of personal competencies involved calls for a comprehensive body, mind and heart commitment to the entire research process. In line with this the coding language has been developed into open coding, selective coding and axial coding in order to signal the different steps and the different thinking skills involved in a researchers process.

The comprehensiveness and the multitude human skills involved was emphasized by Juliet Corbin in stating the following list that form the 12 golden rules of Grounded theory: Use your imagination and abstract thinking, researchers previous knowledge within the field should foster and not hinder analytic processes, enjoy research, capitalize natural curiosity, take risks, see patterns and connections in stepping back, think process, develop the habit of thinking about what they see and hear, remain alert and sensitive to the unexpected and to respondents, have independent minds, be devoted and allow for absorption, beware of own perspectives, attitudes and biases, know how to give and receive criticism and be flexible. (Corbin, in lecture, 2000).

A personal note seems appropriate at this point. How do I see myself as a researcher within the field of education and in the light of Grounded theory? When I was introduced to Grounded theory, the methodology seemed so obvious. I took some turns of reflection about research experience before arriving at the conclusion. Grounded theory for me was the natural systematic approach for a qualitative researcher because it coincided with my thinking strategies developed as a consequence of participating in qualitative educational research without having the formal background of methodological traditions stated within the social sciences. In a way, I was already assimilated in a tradition without being aware of its formalizations. The tools of Grounded theory, the rather hermeneutic approach to knowledge construction and the researcher versus respondent relationship had all seemed appropriate and rewarding in previous projects (Birkemo et al., 1994; Eggen Knutsen, 1997; Hauge, Eggen, Grøterud, & Nilsen, 2002; OECD, 1995; Reynolds et al., 2002) I started out this project based on the same ideas. During the piloting process of setting the fieldwork procedures, and of finding the adequate analyzing and theorizing approaches I was introduced to the basics of Grounded theory. I immediately integrated the vocabulary as a part of my research language in order to describe the different steps of fieldwork and analysis. For most qualitative methodological strategies, it takes some time, effort and rigor to become fully socialized. My previous experiences and accompanying meta cognition eased this process of working it into my backbones. However, it is also important to emphasize that within my research community there are little bordering to none experiences of this qualitative research strategy. Finding my methodological ways has therefore been quite a lonely but adventurous journey. I will return to this aspect of qualitative research during the development of my own research project.

7.2.4 Persuasiveness and interpretation

The persuasiveness of the findings in qualitative research has to be based on alternative concepts to validity (external and internal), reliability and objectivity. Alternatives have been introduced and I will base my discussion of internal validity, external validity and reliability on a couple of these alternatives. The key question is how we as qualitative researchers can establish trustworthiness. This key question embraces four sub-questions. In the case of the internal validity the issue is how can we establish confidence of the value of persuasiveness and the key word becomes credibility. In the case of external validity the issue is not entirely generalization but in addition, what aspects of the results may be applied or transferred to other actors, situations and cases. The key word becomes

transferability and applicability. In the case of reliability, the issue is ability to repeat the study and draw similar conclusions, and the corresponding preferred concept becomes consistency. Finally, in the case of objectivity the issue is errors and deviations due to subjective factors like biases, interests and specific perspectives. The term then becomes neutrality. (Y. S. Lincoln & Guba, 1985)

Credibility

The credibility of Grounded theory as a general approach as well as the results is dependent on the researcher. *“When the researcher is convinced that his conceptual framework forms a systematic theory, that it is reasonably accurate statement of the matters studied, that is couched in a form possible for others to use in studying a similar area, and that he can publish his results with confidence, then he is near the end of the research. He believes in his own knowledgeable and sees no reason to change that belief.”* (B. Glaser & Strauss, 1967 p. 224-225) This focus on the researcher however requires a thorough presentation of the analytical and interpretative strategies used. Stated slightly different but with the same intention of increasing credibility we have to be very specific about interpretations build into the fieldwork and analysis. I will therefore include at this point my own strategy for reflection about the substantial and methodological interpretation at different levels.

The first level is the interpretations done while conducting the fieldwork. Among the more important strategies for interpretations in field are reflects around what situations were selected including which topics were raised for informal discourse and for formal interviewing. Baked into these reflections were a process of increased awareness of interpretations of teacher statements, interpretations of the communicative patterns between me and the teacher (positioning), interpretation of teacher subject related interests and preferred teaching and planning activities and interpretation of teacher motivation for participation. In order to trace this foundation for interpretation use of logs and immediate recording are important. In this recording process, additional interpretations are included. These are interpretations like what the teacher decides to comment and discuss and what he chooses not to dwell on, interpretations of hidden motives for participation, interpretation of participation as a mean for professional understanding and possible increased ‘didaktik’ reflection. Another aspect is my interpretation of the teacher ability and eagerness to

verbalize dilemmas of evaluation and assessment. Internal validity and concept validity are based on the interpretation of researcher identity and there are numerous evaluative and interpretative processes going on which are important for judging the credibility or persuasiveness of ethnographic research.

Transferability

Qualitative inquiry builds on two notions. The first idea is that “*the general resides in the particular*” (Merriam, 1998, p.210). The other notion is that of obtaining an in depth understanding of the particularities of a case. There is a tension between these two notions in that emphasizing the in depth understanding will override the possibilities for generalization. In the case of external validity or transferability, we have to apply possible strategies for evaluating whether the results can be generalized beyond the respondents selected. Applying techniques to express aspects of transferability is therefore important. Three strategies for improving the transferability are firstly providing thick descriptions in order for the reader to judge transferability. The second is establishing how typical the case construction is in comparison with other cases, and the third illuminating the single case in light of the other cases in a combination of multisite design and a cross-case analysis (Merriam, 1998). However, all these techniques could be applied by the researcher but are means for reader or user transferability.

Another attempt at attacking the issue of designing studies for increased transferability resulted in stating three targets for transferability with corresponding techniques. The three targets of transferability are here to address what is, what may be and what could be (Schofield, 1993). Corresponding strategies are for ‘what is’ to study the typical and performing multisite studies. In studying ‘what may be’ techniques like choosing respondents at the edge of change or the atypical, pointing at factors that may illuminate the possible development and conducting long time studies could be helpful. Studying ‘what could be’ is meaningful in phenomena were the exceptional of the unusual may point at practices that either shed light on the other practices or points towards possible solutions in the future. The first category here corresponds to the former strategy of providing thick descriptions in the sense of richness and depth. There are also some overlap between the ‘what may be’ and the ‘what could be’ categories with the strategies of comparing cases and multisite designs. The categories of ‘what is’, ‘what may be’ and ‘what could be’ are

however interesting because they give motivations for dealing with specific aspects of a research design within qualitative inquiry.

Applying transferability from the ‘what is’, ‘what may be’ and ‘what could be’ approach is interesting from ‘didaktik’ perspective. Hidden in science education as well as all other subject related pedagogies there are elements of normative or prescriptive persuasiveness as well as analytical or descriptive persuasiveness. The ‘what is’ category relates mainly to the analytical or descriptive persuasiveness of a research project. On the other hand, the ‘what may be’ and ‘what could be’ relates to the prescriptive and normative persuasiveness of the results. These categories will therefore be used for investigating implications raised not as findings of the research project, but more as consequences in the aftermath of the research project. I will return to this point in the final chapter.

A final point concerning persuasiveness in qualitative research is investigating transferability from the point of research mediation. Mediation of qualitative research depends on the actual text and the messages hidden in the text. On the one hand, we need to convince the reader that the findings and results represent the respondents and at the same time indicate applicability beyond the selected respondent. On the other hand, we do not want to construct evidence. We are walking a fine line between “*assault and conversation*” in “*seduction*” because “*an alliance is formed between the author and the reader, and this special relationship is underlined by the fact that they as first person never meet the third person*” (Bjerrum Nielsen, 1995, p 5).

Consistency and objectivity

Turning to the third criteria of persuasiveness, we see from the following that increased reliability or consistency has not been the goal for the systematic analysis of Grounded theory. “*Still dependent of the skills and sensitivities of the analyst, the constant comparative method is not designed to guarantee that two analysts working independently with the same data will achieve the same results; it is designed to allow, with discipline, for some of the vagueness and flexibility that aid the creative generation of theory.*” (B. Glaser & Strauss, 1967, p.103) In general most studies are dependent on the respondents and their situation. Replicability is hence in most cases rejected but dependability may be

reduced or discussed as part of revisions or the strategy of an audit trail (Y. S. Lincoln & Guba, 1985).

The fourth and last sub question, that of objectivity or neutrality is likewise of less importance in Grounded theory as well as ethnography. The researcher is present in all stages of the process and biases will have to be stated and increased awareness of their significance for relationship in field and for analysis is a part of the reflection process that have to be documented and accounted for as a part of the report. The strategy of including other researchers in the analysis has unfortunately not been possible in this project.

Triangulation or crystallization

Another approach for increased persuasiveness within qualitative research has been that of triangulation. The concept of triangulation is problematic epistemologically, but still a possible strategy for increased persuasiveness. The problem of triangulation has to do with the limitations in using different methods, different researchers or different theories in order to arrive at more valid conclusions. Applying different methods like observation and interview does always imply different angles into the phenomenon. ‘Crystallization’ becomes the validating criteria because the crystal “*combines symmetry and substance with an infinite variety of shapes, substances, transmutations, multidimensionalities, and angles of approach*” (Richardson, 1998, p.358) Interviews are intercommunicate and constituted by at least two human beings perspectives. Observations on the other hand are basically the researchers’ viewpoints. Texts developed in the two strategies are therefore not equal. There are different voices represented and the texts have to be analyzed accordingly. Researcher triangulation is problematic because different researchers will see different perspectives in the same text and different theories will illuminate quite different aspects of the material. The concept of persuasiveness implicit in the strategy of triangulation is that of applying an overall or holistic picture of reality as a goal for the qualitative inquiry. This epistemological position is contrary to the situated perspective and to the perspective that the persuasiveness lies in the specific angle, the specific glasses or the specific theoretical frames used. Persuasiveness is in stating very explicit the preferred perspective rather than applying multiple perspectives. (Silverman, 2000)

In this project several methods or strategies has been used to gather information about the teachers. Obviously, observation and interview as well as the informal discourses will investigate different evaluation and assessment practices and the rational behind them. My pragmatic strategy has been to use the source of information that was available to me. Some teachers were eager to share documents, others to develop exploratory conversations, and others again would be more visible in actions. There are differences among the cases when it comes to the status of the various sources of information. I have not used them according to the traditional concept of triangulation for comprehensive interpretation. But- instead I have been analyzing the material in each case that will give the richest information about the student assessment procedures of that teacher. In depth descriptions has been the ultimate goal. Another important aspect is that observations and discourses have mainly served the purpose of giving the back information for situating the interview. Hence the observations and discourse note has mainly an in field analytic status. There are subsequent steps involved rather than triangulation.

Respondent validation

Respondent validation is yet another strategy frequently used by qualitative researchers, but mainly within a naturalistic paradigm (Woods, 1999). Grounded theory carry with it a message that goes like this: *“Another way to validate is to actually tell the story to respondents or ask them to read it and then request that they comment on how well it seems to fit their cases. They should be able to perceive it as a reasonable explanation of what is going on even if not every detail quite fits their cases.”* (A. Strauss & Corbin, 1998, p.159) They use the expression ‘recognizable to participants’ and hence moderate the concept of ‘fit’. More important within Grounded theory is however validation by analyzing the data again in the perspective of the developed categories.

Respondent validation as a general principle is however as problematic as triangulation and for the same reasons. By using respondent validation, we assume that the teacher would be able to validate his/her statements in another situation, at a later time and within different circumstances. Using respondent validation for verifying previous statements is hence based on the idea that teacher opinions and experiences are consistent over time. Which of course they are not! Going back to the same teacher creates new set of data based on that particular situation and the instructional activities involved. In my project being specific

has been the aim rather than being general in order to bring forth ideas about student assessment and assessment. Even if the teacher do have general ideas about student assessment these ideas comes to live in the manner that they are implemented according to the 'didaktik' in that unit of instruction. Written accounts of fieldwork as well as reports are texts created by the researcher and have the researcher priorities, theoretical framing and addressing audiences other than the teacher. Respondent validation is not a suitable strategy, and returning to the same respondent implies adding new data. My approach here is coherent with the following quotation. *"They do generate further data which, while not validating the research report, often suggests interesting paths for further analysis."* (Silverman, 2001, p. 236)

7.2.5 Theoretical and purposive sampling according to Grounded theory

Sampling within Grounded theory is presented as theoretical (A. Strauss & Corbin, 1998). Sampling is occurring in several steps of the research process and evolves as a part of the process. Theoretical sampling is of specific importance in new research areas because it allows for sampling according to variety along the different dimensions and properties. The benefit of this sampling procedure is to develop the empirical material in relation to the theoretical understanding of the phenomena. By not defining all the procedures when embarking, we allow for flexibility in the fieldwork. Within this sampling approach we may investigate the instructional units, add topics, teaching projects etc depending on the planning of the teachers. We are able to work with the flow of the events in the actual school. This requires an alertness of possible incidents and activities as well as ongoing selection or sampling of the instructional activities that are most likely to give information about student assessment strategies of the teacher.

When sampling theoretically according to variety of events and respondents the opportunities for including respondents that have a variation of positions and actions within the specific phenomena we are studying are maximized. The process is therefore cumulative. This ongoing sampling process must be seen in combination with the micro analytic approach, the close examination of texts at the beginning of a study. *"The aim of theoretical sampling is to maximize opportunities to compare events, incidents, or happenings to determine how a category varies in terms of its properties and dimensions."* (A. Strauss & Corbin, 1998, p.202) Micro-analysis has therefore been an in-field technique applied to the benefit for sampling events as well as selecting respondents.

Selecting teachers from Norway, Sweden and England falls into this thinking. By including three different educational political and educational historical contexts there was a possibility of getting variety of practices among science teachers. The process of sampling here was done over the course of one year. The need for investigating assessment strategies within different contexts was raised due to saturation of categories and dimensions within the Norwegian respondents. Parallel to this micro analytic result funding for conducting fieldwork among some Swedish and English teachers was made available. Teacher selection is the initial process. However, selection of teachers does have implications of the selection of incidents and events that the individual teacher is involved in and hence sampling of texts for analysis is integrated processes. In order to reach a maximum of variety it became natural to select teaching activities based on experience of the specter of teaching activities involving interesting assessment and evaluation events.

There is also an aspect of purposive sampling (Denzin & Lincoln, 1998; B. Glaser, 1998; Hammersley & Atkinson, 1983; Silverman, 2000) in most qualitative projects within education. Most often, there are limited possibilities of sampling according to the absolute ideal of theory informed sampling. Purposiveness is hence another factor that to a certain degree will be significant in how we are dealing with selection of teachers and events. In addition to the sampling of respondents comes the sampling of data for analysis and for presentation. This part of sampling process has to be seen in combination with the coding procedures.

Grounded theory does not give specific recommendations for data collection or choice of fieldwork strategies beyond the different methods available for qualitative researchers as interviewing and observation. The lack of priorities may be interpreted as Grounded theory being mainly a methodology and analytical method. At the same time there are some clear pragmatic undertones of the methodology signaling a pragmatic attitude to preferred data collection methods or rather building methods based on suitable co-operative attitudes depending on the field in question. Alongside with this is the undertone of a purposive sampling of respondents. However, it has to be stated, that Grounded theory itself is more concerned with the theoretical sampling going on at any point of the research process. There are theoretical sampling included when choosing locations or respondents for inquiry and when choosing or selecting data for systematic analysis; *“The concern is **with***

representativeness of concepts and how concepts vary dimensionally' (A. Strauss & Corbin, 1998, p.214). Emphasis is on the phenomena and analyzing the events, places and individuals where the phenomenon might be studied. The second part is then to search for individuals, places and circumstances under which we theoretically will expect to find variations of the phenomena in question. The result is hence a combination of purposive sampling and theoretical sampling. The main concern is being aware of sampling procedures or preferences during all stages of data gathering and data analysis.

7.2.6 Grounded theory and the coding procedures

There is a comprehensive view on sampling, analysis and coding procedures in Grounded theory. They are more or less intertwined. Grounded theory can be seen as a methodology depending on the results of the evaluation of statements within the tradition according to the list of the methodological necessities stated at the top of this subsection. Grounded theory is not a theory, but one approach for how to theorize about fieldwork. Even though its origin was within sociology, the methodology has been used within several fields like public health, social work, management, nursing and education. (A. Strauss & Corbin, 1997) In addition to signaling the substantial variety of projects drawing on Grounded theory there are also some indications that fields of research on the border to action research, to applied research and to development programs are projects that focus on phenomena where Grounded theory seems appropriate. The hidden secret lies in the pragmatic attitude to methodology stated by the authors that an eclectic approach lie within the heart of Grounded theory itself. Moreover, maybe a second point is the combination of theory and empirical evidence with the context-close-ness of significance for the illumination of phenomena in practical fields like the ones mentioned. This in sum is also part of the reason for choosing Grounded theory for this research project.

The coding procedures have to be viewed in the light of the constant comparative method (7.1.1.). Coding procedures may be divided, as done by Strauss and Corbin in open, axial and selective coding (A. Strauss & Corbin, 1998). Open coding is the process of discovering new properties and dimensions in the data. Axial coding is the process of linking properties and dimensions to categories and sub categories. Finally, selective coding is applying already defined categories, either defined because of open coding or defined because of previous theory development, to other sections of the data set. These steps of coding could be seen as subsequent, but not necessarily. Theory development and

verifying using this strategy is not a linear process. In practice, I have been working back and forth between these procedures until the stage of theoretical saturation was reached. The computer program ATLAS has been used for the overall analysis after some initial analysis as a part of piloting. I have seen the advantage of structuring the data and retrieving data searching for specific categories.

7.2.7 Different traditions within the same label of “Grounded theory”.

There has been a discussion between the different Grounded theory approaches. This discussion is centered on the significance of theory in the analytical processes, the significance of the backgrounds of the researcher and the researched and single case analysis versus cross case comparisons (Alvesson & Skjoldberg, 1994). I will base the within Grounded theory discussion on the two strands that emerged during the 80's represented by Barney Glaser on one mountain and Anselm Strauss and Juliet Corbin on the other mountain. Between the first text to define Grounded theory (B. Glaser & Strauss, 1967) and the final texts there were discussions about these topics in a number of texts (B. G. Glaser, 1978, 1992; A. Strauss, 1978, 1987; A. Strauss & Corbin, 1997). This discussion was terminated with the final book from Strauss “Basics of Qualitative Research” and the parallel book from Glaser “Doing Grounded theory”. (B. Glaser, 1998; A. Strauss & Corbin, 1998)

Refinement of theories according to researcher or the researched

One of the central ideas behind Grounded theory was not to start from preconceived hypotheses, but to modify and refine theories according to respondents. The grounding of theory in data is itself a problematic issue. In the initial strictest version the grounding of the theory should imply no presuppositions, comparison of incidents and hence the generative development of theory from data mainly or entirely (B. G. Glaser, 1978, 1992).

The other strand of Grounded theory has contrary to this an increased emphasis on the importance of previous theory, verifications, researcher's presuppositions and corresponding necessary statements about the research process seen from the perspective of the researcher. Glaser (B. G. Glaser, 1992) emphasizes the worry of the respondent or the researched. Glaser is continually taking the position of the respondent into consideration, while Strauss/Corbin at the most recent development is considering the

researcher's background and hence making the context of the researcher an issue that requires further description and explaining. Glaser's overarching idea is then the context of the research more than the researcher. My project is leaning towards the Strauss and Corbin tradition or mountain in that I also emphasize the presuppositions I carry with me (including theories), my background as well as different aspects of the research process is presented as important for the interpretation process itself in addition to setting premises for possible applications and implications seen from the reader's perspective.

Single- case versus cross-case analysis.

The status of the single-case versus cross-case analysis is also controversial issue between the two strands of Grounded theory. The Glaser tradition has a slightly more naturalistic approach in that they use comparison for building theory across cases. While the Strauss and Corbin tradition use comparisons for contrasting ideas but the analysis in itself is build on a single case. Within case comparison is important for investigating the same category or code from different angles and in accordance with the different situations in which the same topics or issues were raised. Again I am a representative of the Strauss and Corbin tradition and am building cases entirely on one respondent, using comparison for validating findings and descriptions on that respondent and use cross- case analysis to a very limited degree. I see this as one of the reader's tools in order to find meaning, persuasiveness in and applicability of the analysis.

Neither one of the strands of Grounded theory is including the presuppositions of the respondents. This is a rather problematic point. If the theory should be grounded in respondents practice, the previous experiences, the motivations and the expectations of the researched could be seen as relevant to the validation of the theory development. So far within the tradition this point has not been commented on.

Coding processes

In addition to the status of presupposed theories the degree of 'groundedness' of Grounded theory may be questioned when evaluating the coding process. There is a breaking point in the theory building in which the questions becomes of whose categories we are assigning, the researcher category or the respondent category. The terminology of the researched will

gradually be substituted by the terminology of the researcher. The categories that are emerging and the interrelationship between categories may reflect to a higher degree the implicit understanding of the researcher than the researched. A key here is during the analytical process whether coding is based entirely on a single statement, sentence or part of sentence or whether the single code is validated against the broader text and sequences of text. (Potter, 1998) My stand has here been to start with the single statement, but build gradually analysis based on several statements. However, I have also been co-operation with the individual teacher over longer periods, having meetings during different circumstances and based on this, not validated statements against each other, but analyzed statements from different situations with new sets of glasses. The internal consistence has not been the issue, but the situated practice and contextualized reflections.

Finally I would like to mention a couple of strengths of Grounded theory that may seem obvious, but still worth mentioning. Grounded theory does not give recommendations about data gathering methods and may in principle be applied to all forms of data, interview, observations and researcher logs (just to include the ones I have available in the list). Another feature of the systematic analytical process is the avoidance of, in a rhetorical manner, validating ideas and theories by statements from transcripts. Finally yet importantly, there are available electronic programs for dealing with data that are quite useful. This program, Atlas, has the same strength build into it as the Grounded theory approach itself, the possibility of working in a combination of induction and deduction in a abductive manner.

Grounded theory has had major influences on educational research methodologies. The step further that Grounded theory should bring the field of qualitative inquiry has turned out to be a giant step. There has been studies based on the approach, but maybe more important has been the terminology and its attached meaning. Several handbooks on qualitative research have applied one or more of the aspects of Grounded theory into their own. (B. Glaser, 1998; Silverman, 2000; A. Strauss & Corbin, 1997).

7.2.8 Grounded theory and sociocultural epistemology

Grounded theory is based on a structural sociological tradition in which the phenomena of the world are seen as distinct, separate and each concept give a meaning attached to a situation, but may also be transferred from situation to situation (B. Glaser & Strauss,

1967; A. Strauss & Corbin, 1998). This is contrary to the ontological view behind the concept of socio-cultural epistemology, emphasizing the importance of relational factors, contextual factors and identities as socially constructed (Säljö, 2000) (Section 2.1). An epistemological tension or gap is created because of the duality of philosophical positioning. On the one hand, there is the requirement of precision and clear definition behind the concepts used or as categorized which is a part of the structural view of Grounded theory as an analytical and methodological approach. On the other hand, there is the relational and reflective rational behind a situated learning perspective. The necessary boundaries between positions, definitions, persons and contextual factors that a structural view carries with it are contrary to the interconnectedness of these same factors that a socio-cultural perspective introduces.

This perspective is however of vital importance as a way into dealing with merging the theoretical analytical perspective as a part of the research agenda and the normative prescriptive perspectives as a part of the teacher agenda. Building on the specific, on each test and each learning activity, is crucial in order to communicate with the teacher. The lived experiences works better as bridging the gap between the agendas than general or principal based discussions. Teachers' opinions and reflections are consequences of experiences in social settings and this social practice is important for the development of the practice within assessment. The significant meaning of student assessment as pedagogical tools is for the teacher based on the participation in an educational community.

The institutional setting, the co-operative circumstances and corresponding relational factors makes up the social world in which becoming professional finds it legitimacy. The identity of the teacher has a social dimension and an individual dimension in the dual processes of identification and negotiation (Wenger, 1998). In this project, there is a breaking point here because at the same time it is the comprehension and analysis of the individual teacher's actions and reflections that has been the aim of the study. The interconnectedness is to some extent left behind in the part of the fieldwork based on ethnographic approaches. When dealing with the individual teacher analytically focus has been on the categories that give meaning to the teacher alone. But the concepts the teacher are using and the meaning attached to the concepts are still formed within the actions,

regardless of verbal or physical by nature, taken in the setting defined by specific cultural and social frames.

The meeting point between the concept of legitimate peripheral participation (chapter 2) and Grounded theory is there. Grounded theory is a more classical approach to structural analysis, but works as a theory at the intermediate level in that the categories are developed as a consequence of both inductive and deductive processes. They are based on structures that vary according to the person and developed as consequence of practice rather than as precondition for practice. This corresponds to the structural view embedded in 'legitimate peripheral participation' with the adaptive structures that are not fixed but contextual. In both Grounded theory and situated learning the structuralizing as part of knowing is not a question of implementing prior understanding of concepts, but continually developing structures as part of the actual contextual understanding. Transferability of knowledge is according to this view more related to the ability to use the acquired processes of skills and knowledge and evaluate the applicability in various situations. *"Learning is a way of being in to social world, not a way of coming to know about it."* (Lave & Wenger, 1991, p.24, foreword by Hanks, W.F.)

Within the sociocultural approaches the cultural historical activity theory offers a dialogically and longitudinal approach that can therefore build a bridge between the Grounded theory structural perspective and the ethnographic perspective in the next section. This cultural historical activity theory emphasizes elements like teacher true participation in feedback to researchers' interpretation by a process of practice bound enquiry combined with theory development. Here therefore *"the practitioners themselves are asked to look at, comment on and make sense of the researcher's initial data and provisional analysis (by the use of videotaping). The ensuing dialogue itself becomes a new layer of data that gives voice to the practitioners' interpretations."* (Engeström, 1999b, p.182) This methodological choice makes it possible to generate new concepts and models of significant theoretical import, but simultaneously has a possible significance for practitioners in that *"for the practitioners, those concepts and models are tools that either die out or stabilize and spread"* (Ibid). The developmental longitudinal design is necessary here as stated in the long tradition of ethnography. The tradition of symbolic-interactionism has hence many parallels to the efforts within the activity theory aspects of socio-cultural theory. (Engeström et al., 1999)

7.3 Methods and researcher positioning according to educational ethnography

As mentioned Grounded theory does not have any preferences for the methods used to develop the texts that are analyzed according to the Grounded theory “recipe”. This is the main reason for adding the ethnographic methodology approach to this project. Merging the two approaches does imply merging two methodological traditions whose implicit and explicit methodological considerations are partially but not entirely overlapping.

Ethnographic methodology will therefore be briefly presented before turning to the actual methods used in the fieldwork.

The rationale behind ethnographies in general is defined within the discipline of anthropology. The central ideas of anthropological fieldwork are to immerse oneself in the culture under study for an extended period of time, participating in as many of the activities as possible and learning the language and social codes (Wolcott, 1988). The most used methods of anthropology, participant observation and interviewing has been adapted and implemented into a number of research fields and among them education. One of the first contributions to the development of this overall methodological approach was the merging of “*the anthropological theory aimed at explaining the available ethnography and the production of this ethnography through participant observation*” (Ellen, 1984, p. 16).

Even if we still use the term ‘ethnography’ there is no obligation within educational ethnography to commit to the breadth and depth of original anthropological ethnographic study. This is partly due to the familiarity with the culture we are studying, which in itself raises other methodological issues. The traditional saying of anthropology “making the strange familiar” is turned around in educational ethnography and becomes “making the familiar strange”.

There are also a number of pragmatic reasons for how we build our studies and among the most important are time limits, economic resources and availability of schools, teachers and students that are purposively co-operative minded. The term ethnography will in this entire text mean ethnographies in the fields of educational research.

On the other hand, even if there is no such obligation to the complete applicability of anthropology in educational research, the usefulness of ethnography is evident due to the complexity of education both as a field of study and as its practices. The field of education is in itself a combination of several academic disciplines among them anthropology. An increased awareness of the diversity within cultural aspects, of gender and of language skills are all parts of a sociocultural epistemological agenda that makes the anthropological study of education even more appropriate. Due to this, the quotation including a warning becomes important: *“The educators must accept the necessity for internal relevance of anthropological material – and yet apply their own criteria for selection and modification of what is offered. This means that both anthropologists and educators must exercise a species of “double awareness” that is always necessary in interdisciplinary efforts but which is rarely exercised sufficiently.”* (Spindler & Spindler, 2000, p.71)

Ethnography opens up for the longitudinal study, and the study of human beings, their activities, development of activities and corresponding reasoning in social contexts where the individual meaning is constituted within the educational culture in question. It opens up for the integration of macro- to micro perspectives (section 1.3). And it opens up for the choice of an analytical focus combined with the *“multilayered network of interconnected activity systems”* (Engeström et al., 1999, p.36). *“This dialectic between the systematic and subjective-partisan views brings the researcher into a dialogical relationship with the local activity under investigation. The study of an activity system becomes a collective, multivoiced construction of its past, present and future zones of proximal development... At the same time the analyst must select a member of the local activity, through whose eyes and interpretations the activity is constructed.”* (Engeström et al., 1999, p.10)

7.3.1 Ethnography as methodology

Tracing the use of the term ethnography is a messy business because it has been defined or at least used with quite different content! The extremes are represented by on the one hand a rationale behind the single method of participant observation versus on the other hand a complete methodology. Silverman (2000, p.37) uses ethnography synonymous with observation techniques. In line with this we find Atkinson and Hammersley who discuss the different methodological issues within ethnographic inquiry but also argue for participant observation as being the ethnographic method (P. Atkinson & Hammersley,

1998). The main argument for that is that all social research to some point is participant observation “*because we cannot study the social world without being part of it.*” (Ibid, p.111). The continuation of this is that “*participant observation is not a particular research technique but a mode of being – in- world characteristic of researchers*” (Ibid, p.111). Worded like this, ethnography becomes synonymous to participant observation that equals a comprehensive methodology. Wolcott include four more commonly used data collection methods into the term of ethnography; participant observation, interviewing, collection of written sources and collection of non-written sources like photos, video, maps etc. (Wolcott, 1988, p.192) Another author is on a similar track as the latter in stating that it is “*a general approach which can involve a number of specific research techniques.*” (Potter, 1998, p.128)

Others have argued for dissolution of the whole tradition of ethnography. “What is wrong in ethnography?” addresses this discussion in stating that the paradigm of ethnography defined in opposition to a quantitative research paradigm does not give us the right tools for dealing with the essences of research (Hammersley, 1992)¹⁵. Social research is facing the challenges of building and mixing methodologies across traditions. Necessary concerns are the combination of research topics with the selection of cases to be studied, types of data to inform the topics, preferred analytical strategies and preferred report styles. “*What is involved is not a cross-road where we have to go left or right. A better analogy is a complex maze where we are repeatedly faced with decisions, and where paths wind back on one another. The prevalence of the distinction between qualitative and quantitative method tends to obscure the complexity of the problems that face us and threatens to render our decisions less effective than they might otherwise be.*” (Ibid, p.172)

Ethnography defined as an alternative to a quantitative paradigm for social research is according to this comprehensive view on research problematic. Ethnographic emphasis and ethnographic methods are not. Even in agreement with this serious discussion the term of ethnography will be used but not as an overall methodology, but rather as an approach signaling the combination of methods. This is necessary in addition to the overall methodological perspective stated as Grounded theory.

¹⁵ Among other sources to this discussion are (Ragin, 1987) and (Tashakkori & Teddlie, 1998).

The quality of ethnographic research does not lie in the single method used or in the combination of methods used. Choosing methods is subordinate (Silverman, 2000; Wolcott, 1988) to expectations to the final report stated as research questions, events and findings during the course of the fieldwork, the interests and personal priorities of the researcher and preferred analytical strategies and angles. The hidden, but important message is that the sum of application of qualitative methods does not make it qualitative research. The quality of qualitative research labeled ethnography lies in its ability to state interpretive factors, analytical positions and rationale behind combination of methods and evidence/indications. Yet, varieties of participant observation have become the ethnographic methods. The expression 'participant observation' carries with it the two activities of observing and participating. Even if they can analytically be separated the rationale behind ethnography is always some degree of participation while simultaneously conducting systematic observations (Ellen, 1984). Drawing conclusions based on observations in which we theoretically make a distinction between the observed and the observer has a basis in the objective paradigm. As participants, we interfere and hence cannot make claims about what is really going on in the situation of teaching and learning. Therefore, our presence carries with it necessities of stating analytical positioning as well as the specific claims about how we see the relationship between the observed and the observer.

7.3.2 Educational ethnography

The preferred position and presentation of ethnography that will work in educational inquiry and the project about teacher practices in student assessment is the following:

“forms of social research having a substantial number of the following features:

- * a strong emphasis on exploring the nature of particular social phenomena, rather than setting out to test hypotheses about them*
- * a tendency to work primarily with “unstructured” data, that is, data that have not been coded at the point of data collection in terms of a closed set of analytic categories*
- * investigation of a small number of cases, perhaps just one case, in detail*
- * analysis of data that involves explicit interpretation of the meanings and functions of human actions, the product of which mainly takes the form of verbal descriptions and explanations, with quantification and statistical analysis playing a subordinate role at most.”* (P. Atkinson & Hammersley, 1998, p.110)

This position does not give any preferences of methods used. Nor does it state recommendations for the relationship between the researcher and the researched, values included or significance of theory. Against these four points may be argued that they all somehow are features of qualitative inquiry in general and hence not specific to ethnography. What they do emphasize, however, is inductive generative research processes based on data in the form of texts created in real human world settings with a limited number of respondents.

There are, however some criteria in ethnographic educational research that has been established as specific to the ethnographic approach which are relevant for the design of this study. One such list includes the following criteria of good ethnographic research and consequently for observation in situations:

- Contextualized observations, in immediate settings as well as contexts beyond that context
- Generate hypotheses according to the situation and significant findings continually judged until the orienting phase is over
- Observations should be prolonged and repetitive and chains of events observed more than once in order to establish the reliability.
- The native view of reality is attended through inferences using different forms of ethnographic enquiries.
- The aim is to elicit sociocultural knowledge held by the social participants.
- Instruments, codes, schedules, questionnaires, agenda for interviews and so forth should be generated in situ as a result of observation and ethnographic inquiry.
- Presentation of comparative perspectives even as unstated assumptions.
- Some socio-cultural knowledge affecting behavior is rather implicit and tacit. An aim of making the implicit and tacit knowledge explicit.
- Use of technical devices that enable the researcher to collect more live data.
- Responding categories are not predetermined. This is in order to build categories from the emic informant perspective.
- The use of narratives has to include the personal reporting of the researcher as well as interpretative procedures (Spindler & Spindler, 2000, p.249-250).

This list is getting close to a comprehensive methodology in actually addressing the status of empirical versus theoretical indications, validity concerns and researcher positioning. This list also highlights similar aspects to the Grounded theory. The two approaches of ethnography and Grounded theory has similarities in the importance of real setting contexts, in choosing the participating people and in necessary time spent in order to reach a point of saturation.

The traditional ethnographic unit of study and analysis was the village. This more or less mythical concept of ethnographies can be found in educational inquiries where the school environment has become the focus of the study. Case studies as a concept was introduced in order to emphasize the details and particularities of a study and the unit of the description and analysis could be an individual, any group of human beings, a school or a community. Later cases of phenomenon have been added to the list.

7.3.3 The ‘case’ concept and interpretation

The results of this project will also be mainly presented as cases that are representations of the participating teachers. The problem with the term ‘case’ today is, however, that it includes various meanings from principles of data gathering to the written representation (Hammersley & Atkinson, 1983). A case has become to mean, much in agreement with the quantitative tradition based selection of random samples of cases, the individual selected for inquiry. “*Case study is not a methodological choice, but a choice of object to be studied. We choose to study the case.*” (Stake, 1998, p.86) To do ‘a case study’ had then been synonymous with defining borders for a study of the individual and base the written representation on the same borders but signifying the focus under the slogan ‘what is this a case of’. This case study tradition use “*case study to emphasize ...the question of what specifically can be learned from the single case.*” (Stake, 1998, p.86) The problematic aspect here is, as also stated by the author, that a case study is both the process of studying the case and the product. Even if I will not commit to this tradition, there are some techniques that has become important for building my descriptions and that has to do with the emphasis on uniqueness. There is a bridge between this tradition in stating the details for the study of the particular and information given that I see as crucial to point to particularity, but also to generalizations and applications beyond the teacher in study.

There are many levels of interpretation between the actual actions in the field and the written accounts, and therefore it is necessary to use the term 'case' either for the selected respondent or for the written representations. We cannot use the term to mean both the individual studied in the real world educational setting and our report based on several levels of interpretation. *"To know must therefore be to interpret: to find a way from the visible mark to that which is being said by it and which, without the mark, would lie like unspoken speech, dormant within things."* (Foucault, 1970, p.36)

I have arrived at using the term 'case' for the representation of teachers build into descriptions of Alfa through Omega. A case here is then the construction of a teacher case, a written report or a story of that teacher based on experiences from the field and on conceptual theoretical framing. There are human beings out there that agreed to accept me into their classroom and share with me their experiences and thoughts about assessment. These humans are the teachers while my reconstruction based on my analytical theoretical references are the cases.

The interpretive turn includes these aspects and one of the schools, Grounded theory, has its roots in symbolic interactionism and pragmatism (Alvesson & Skjoldberg, 1994, p.64). We are studying phenomena and social interactions which we very much a part of and hence cannot distinct our self from it or from the analysis or representation of it. We are the main instruments and it is the interaction between the researcher and the researched that can be used as the focus for developing the appropriate research tools. *"They have to be created by some sort of mutual consent, through successful and failed encounters."*(Ellen, 1984, p. 32)

Another major consequence then is that we have to include other strategies of obtaining data or experience materials in addition to participant observation. We have to include data that represent the voices of the researched or observed. I will return to this complexity of methods and researcher positioning when discussing the different methods used and their combination into a methodological approach. I have chosen to use the general embracive term of fieldwork rather than participant observation for my overall gathering of experiences from the field and hence use participant observation as synonymous of one of the methods.

7.4 Ethical considerations and implications

Ethical implications, their considerations and impact on the actual research practice are connected to the previous section about the researcher as the major research instrument. Qualitative research in the meeting between human beings and consequently ethical considerations had to be included at many levels both within Grounded theory and within ethnography. In the Handbook for Qualitative research of 2000 Lincoln and Guba are discussing their initial volumes about basic beliefs included in qualitative inquiry (Y. Lincoln & Guba, 2000). They are here including axiology along with ontology, epistemology and methodology implying that the choices made by the researcher regarding values have importance for knowledge construction and corresponding paradigmatic choices beyond the ethical rules, regulations and laws. Ethical concerns are one of four determining factors for how we relate to the field of inquiry, to the respondents, to the choice of focus for research and the choice of paradigm.

I will outline four dimensions of ethical considerations in educational research. These four dimensions are firstly internal versus external, secondly the individual versus the social dimension, thirdly ethical versus morale dimension and finally the subjective versus the objective dimension. Implicit in these dimensions is the notion of placing the relative importance of different ethical dilemmas. The definitions that I referred to states research ethics as the sum of norms, values and principles on which the researcher bases his or her judgments. This implies that the overall frame for the discussion of ethics is seen from an idealistic viewpoint. I will argue that there are no definite border between facts and values in educational research, but all our judgments and actions as researchers has to be based on methodological, substantial as well as ethical considerations. I take the stance that educational research is a part of the social sciences and deeply value laden. Another overall aspect, but in most projects more implicit than explicit, is the researcher's awareness of own assumptions as crucial for both the scientific process and results. A third point is that educational research to a large degree exists, and has to be evaluated, as a part of a social setting. Hence, knowledge construction is seen as a result of cooperation between several actors. (M. J. Smith, 1998)

Ethical concerns within the ethnography have increased in accordance with the awareness of implications for the researched and with the institutionalization of ethnographic

educational research. Qualitative research does interfere with the life of people and that can imply aspects of enlightenment, but also suppression and possible unequal status. Ethical considerations have become to cover a variety of issues with different legal status. Within qualitative research, this ethical field ranges from laws, over written guidelines to recommendations for conduct and morale considerations of the individual researcher in the single situation. These issues carry with them a multitude of dimensions and I will in this section outline four dimensions that we can use for addressing ethical considerations.

Over the last decade, the three Norwegian national committees for ethics in research have made an effort to encourage the scientific world to elaborate the ethical discussions beyond the point of being chapter in books about methods. (NEM, NENT, & NESH, 1999a, 1999b; NENT, 1992b; NESH, 1999). Just as much as ethical consideration is the meeting point between different fields; it is also an important meeting point between research methods, content and philosophy of science and between research communities and society in general. In various fields these overall considerations have to be thoroughly debated because, as much as they raise multitude ethical dilemmas they are also the main question for how to plan, conduct and communicate results between scientists and the external world. The research agenda very seldom match the agenda of society in general. Negotiation is important in several fields in order to finance and facilitate important research. Negotiated objectives, selection of methods, participation and even terminology is as binding for the researcher as the standards set by their research community. We are talking about an internal as well as an external discussion. (Tranøy, 1986)

7.4.1 Internal versus external

Externally there are a couple of laws that regulate what we can do and how to formalize it within standards set by the society concerning the well being of the researched and regulating research licenses regarding information about individuals. Concerning the legal aspects there are “Forvaltningsloven” about professional secrecy, “Barneloven” about the legal rights of children and “Personopplysningsloven” about the collection and presentation of data. External to our research communities are also expectations for results and the utility of research conclusions. In the field of educational research, we have to relate to groups of professional raising these questions of utilitarianism from administrative point of view, from policymaking point of view and from practicing school leaders and teachers. As researchers we are a part of this strategic triangle formed by groups having

various interests and hence ownership into the research agenda. This requires an awareness of formal implications for research projects as well as ethical considerations concerning importance and application for various interest groups.

Working with teachers almost always raises questions that belong to this category.

Questions that are external to the research community concerns topics like what may the schools and the teachers, and in the next line the student, their parents and the community benefit from the research that will justify the use of their time and effort. In order to meet this need I decided to work with teachers that feel they can benefit professionally from participating. The corresponding internal topic is that we deal with the fact that due to this voluntarism the participating teachers will never be representative beyond themselves. Participators are likely to be more than general interested in evaluation and assessment and more than general able to verbalize this interest.

When we use the two terms “internal” and “external” as aspects of science, we assume that there are two sets of dilemmas and modes of communication. The first set of modes of communication has to do with the implicit set values and norms within our research community. The other set of modes of communication requires another frequency of norms, values and ethical implications that we listen to when operating outside the scientific community. To a certain extent, this distinction is helpful and hence many practitioners of scientific enterprise use the term. On the other hand there are several norms and values with coexisting dilemmas that should work across those boundaries and in both cultures. The main reason here is that if science is defined as “*the search for, acquisition and use of knowledge and insight brought forth by acts and activities involved*” (Tranøy, 1988, p.114), and the arena for both the search, the acquisition and the use is partly the surrounding society, then there should be “*Internal norms of science are norms and values used or needed to guide and justify those scientific activities which can only be carried out by qualified scientists and scholars... External norms of science must, then, be those norms and values which are used or needed to guide and justify scientific activities which are not exclusive responsibility of scientists and scholars.*” (Tranøy, 1988, p. 118) In social science the internal versus external discussion becomes blurred, actors are crossing this artificial borders between research communities, educational agencies or/and institutions in normal social life. We will have to live with that; categories like this can never be mutually exclusive.

7.4.2 Individual versus social

I will now turn to the next dimension, one of individuality versus social considerations. The main dilemma in all research is that as scientists, we have an obligation to contribute to knowledge and we have another obligation: to protect the interests of the informants of our research. In all research, there are costs and there are benefits. Our research may be beneficial for the individuals representing scientific community or society in general, and the same is the case with the costs. (Roll-Hansen, 1995; Ziman, 1996) We are talking about an individual or a social dimension. The social dimension of education as formalized through institutional settings is a matter of controversy in addition to possibilities for educational programming. Teachers have to balance the consideration of the demands set by the institutions versus the individual need. Likewise are individual requirements versus the social consequences a continuous aspect of conducting qualitative research. I have defined my unit of study and analysis to the individual participating teachers and tried to keep my loyalty to the individual teacher in the numerous situations where ethical implications of being present in a classroom, in school offices, in teacher staff room or in laboratories. Nearly all aspects of educational planning and executive activities are to some degree social manifested in elementary education and yet we are quite often focusing on one human being. Conducting fieldwork with the individual teacher imply crossing the roads and agendas of a significant number of other teachers and students in every situation. Considerations will have to take the welfare of and interference with a number of persons, but still focus is on the one individual.

There is a close relationship between these two dimensions, the individual versus the social and the external versus the internal. As researchers in educational research dealing with teachers we continually experience situations, in which there are several possible choices to make in order to progress with the research proceedings. Contributing to knowledge can hardly be superior to considerations based on the well-being of the teacher. In co-operation with the teachers, I have decided that when the teaching agenda conflicts with the research agenda the research agenda will have to retreat. Obviously, this chosen position does carry consequence for the progression and for the representation of the situations included in the fieldwork.

7.4.3 Subjective versus objective and moral versus ethics

This leads us to the third set of dimensions that is the subjective versus the objective. One illustration is the dilemma of how to deal with co-operation with uncertain teachers. A valid subjective and morally accepted argument would be to put emphasis on the concern of the teacher's well being in the situation. A corresponding objective and just as morally accepted argument would result in reasoning like; it is for the teacher's benefit professionally to overcome the initial difficulties and start reflecting upon her reactions in order to overcome the fear and consequently be able to gain from the experience. The objective position would imply considerations based on some objective criteria defined by others than the teacher him/herself. Somebody else will on behalf of the teacher define learning goals and set the agenda for activities in order to reach this. The opposite is the total autonomy of the teacher in defining the challenges, the means and the relations to use for this process.

The term ethics has traditionally been used as the theoretical basis, and morality has traditionally used to describe or prescribe human praxis. It is therefore also a question whether we talk about ethical or moral as two dimensions. (Beauchamp, 1991). A distinction between moral and ethics is made necessary here. In the book *Philosophical Ethics*, morality is used about the sum of conventions in a society about right and wrong conduct. Ethical theory on the other hand is reserved for the philosophical reflection and hence to give precision to argumentation. Dealing with ethics and morals is not entirely rational. Most dilemmas that can be organized and labeled in a system of standards and regulations are rational. This must not lead us to think that the entire field of ethics can be systematized, we will always have remaining dilemmas more or less irrational in which we have to constantly search for good solutions. Therefore, we are finally talking about a subjective (some degree of irrationality) as well as an objective dimension. On one hand we have the Kant heritage of universally accepted or the objectivity of moral standards and the individuals' responsibility to follow the rules. On the other hand, Hume carries the subjective tradition of pointing at reasoning being subordinate and personal psychology of passion and interests being more important. (Beauchamp, 1991)

7.4.4 Application of the four dimensions of ethical considerations

Using this framework for setting the agenda of ethics in educational research is helpful because it will address the issue of ethics according to categories in which we then may

place the various challenges and solutions to these. The few examples that have been given are by no means exhaustive. They serve as an example for how I have used them to interpret my identity within the dimensions and how I have use them for reflection of significant ethical dilemmas as a part of conducting my fieldwork.

As mentioned when starting this section this many faceted topics of ethics implies questions about laws, regulations, explicit and implicit standards set by the society or by the research communities as well as the individual researchers considerations in the actual situations. I have so far more or less excluded issues in which we have national or international laws as I see this of subordinate interest in the framing of dilemmas. However, when it comes to working with teachers we have to keep to a few general principles of informed consent and anonymity. (L. M. Smith, 1990) These principles has been stated in guidelines as well as become the obligatory tool of qualitative researchers. Informed consent includes getting approval for being present in their classroom and at their meetings and hence accepted into their environment. In addition, we will have to make this an ongoing activity. Due to changes of agendas in the school, we may need to ask for permission on several occasions.

The other major principle is that of keeping the anonymity of the persons involved in all kinds of research transmitting. This is an obvious procedure in order to protect participants from focus, from harm due to our representing of their activities within frames set by research and not by them. The dilemma of keeping this principle is often raised due to the size of our society. There is also a growing tradition to include participants in a more action based research or action learning. In these cases, participating teachers are included as authors. As sole researchers and responsible for the reports we are reframing their lives as teachers and narrowing down focus using lenses to dwell on particular aspects of education. They may approve of the written statements and they may not. When leaving the field we are to some extent leaving behind the external world of ethical considerations that have to do with building relations and taking every body's agenda serious. We are entering the internal world of research were there are standards but were we set the agenda of how to address educational issues and how to analyze the researched. A different set of ethical lenses is applied. We stick to rules of anonymity, and I have kept individual teachers, school leaders and schools anonymous throughout the written accounts as well as in presentations based on the fieldwork.

“If there is much already written about ethics in research, and much that all experienced researchers already know, we still find most sensible the conclusion that all researchers must be continually open to the prospect of learning about ethical practice. We believe this because of the considerably diverse ways qualitative researchers may be present in the lives of the researched and because of the changing currents of thought about what is ethical practice.” (Eisner & Peshkin, 1990 p.244) This quotation points back to the dimension of professional ethics versus personal morality. (Ellen, 1984) However, it also points towards ethical reflection as an additional aspect of methodology in educational research.

7.5 External and internal discussions of qualitative methodologies

Based on this generative theoretical naïve position interviews as well as qualitative research in general has been criticized for reflecting common sense, for being subjective, biased, inter subjective, entirely explorative, impossible to generalize, too dependent on the persons involved, hardly valid and reliable (Kvale, 1996, p.284). Some of this criticism can be met by pointing at the systematic approaches within qualitative inquiry. While other aspects of this criticism is based on a totally different view of knowledge construction in which generalizations, context freeness, cultural objectiveness and value freeness is the ultimate goal for research. Most qualitative approaches and in particular here Grounded theory is aiming at the situated, the context near and specificity of particular persons actions and the meaning they attach to these actions. This is then the departing point from which a discussion of greater significance for qualitative methodologies may commence.

Because, there have been raised critics which is more internal to qualitative research and which we need to address. I will continue to structure this criticism from the Kvale’s list of critiques against current use of interviewing (Kvale, 1996, p.292), and at the same time point at different techniques and choices I have arrived at for my fieldwork and corresponding analysis. Different sets of data are not equal analytically; observations and informal discourses are seen as background for conducting interviews.

The first issue is the individualistic, in the sense of focusing primarily on the individual and secondly on the relation to social interactions. For a individual teacher actions in

classroom is to a great extent consequences of interactions with pupils, planning activities are consequences of the school management and administration, of teamwork and numerous other factors. In educational research, because education is in itself only fulfilled within social settings, this is problematic. I have to choose my unit of analysis and treat all the other factors as contextual in relation to that unit of analysis. Here the unit is the teacher and relational factors are brought up to the extent to which it is important for the teacher him/herself.

The next issue is the idealistic and immobile tendency of interviews. The message here is that the interview situation creates the information about a human being. The conclusions are based on this rather artificial circumstances and the corresponding content sometimes as if this represent the real life of the teacher. This moment has partly been met by making the educational setting the focus of the interview. The actions taken by the teacher during planning and instruction has been the starting point of the interviews. However, - simultaneously realizing that it is their verbalizations that undergo analysis those limitations that put on conclusions. I do not have access to the reflections in themselves and it is the teachers' understanding of the actions they will communicate in that situation.

A third critique is the intellectualistic and reasoning aspects, the possible pitfall of neglecting emotional, esthetic and other more irrational aspects of modes of knowledge. Adding to this, we are dealing with the education of maybe the most rational domains of knowledge, the natural sciences this cognitive contra argument to interviews becomes even more important. As qualitative researchers, we just have to realize that our language about the subject natural sciences, about learning and about the teacher identity is set to frame, comprehend and analyze cognitive aspects. Hence, we are to a limited degree able to draw conclusions about the emotional aspects of the teacher's constitution of his/her identity.

The interview and the transcript is a genuine verbalization made by the interviewer and the respondent. There is a neglect of the body language, the facial expressions, the pauses, the interruptions, the sipping of coffees and all other minor human actions that are important for the progress of the conversation. While collecting drawings, illustrations, and written sources referred through the interview, again the choice of analytical positions and physical position in field is defining the contents of texts. Analytically I have decided to stick with the written verbalization as being the main source and corresponding to that is

the inability to discuss topics like apprehensiveness, hesitating and confidence. Different teachers do have different abilities to verbalize their educational actions. For this reason, I will search for incidents, statements and indications in observations as well as interview transcripts.

The interviews may be a-linguistically treated. On the contrary, the development or the verbalization in itself may be the central issue for the enquiry. There is the possibility or dealing with the material, transcribing it for semiotic analysis. My choice has been to regard the language as a tool rather than the core of the analysis. Therefore, the choice of words, the terms and the meaning of the terms have not been analytically important. There are however exceptions to this, the meaning attached to evaluation, to assessment, to learning, to the significance of science are all important for the comprehension of the individual teacher.

Reported cases based on qualitative interviews are often said to be rhetorical reports and that it is easy to write up cases using interview quotations in a rhetorical manner, validating statements about the respondent or the phenomena rather than a thorough cross analysis of all the whole set of data. This is yet another serious debate that constitutes the importance of specifying the analytical process and well as arguments for the designing of the cases. Any research report is a reconstruction of “observations” were our intention is to represent the world by redefining it using a pair of glasses, an analytical angle and research questions to guide or direct both the readers and the analysis. There are several steps of interpretation involved in this transfer from reality to the final reader including creation of field notes or transcripts, analysis and text creation. The initial text, the conversation or the activity being observed, includes some actors, there are researcher (s) involved in the middle steps and finally in the last stage, the reading of the final text there is a reader involved.

Transferability and meaning of a qualitative text depends on the meaning of concepts used by the investigator and the corresponding meaning for the readers. That is how not only the meaning of the text but its significance is evaluated. This distinction between the meaning of the text and the significance of the text (Ricoeur, 1991) is important in order to make a distinction between internal/construct validity and external validity of a text. The internal validity is dependent on the chosen terms and their relation on both theoretical framing and data, but the external validity is in addition dependent on the degree of applicability, significance and implications the text gives for the readers. In retrospect the challenge of

rhetorical devices for constructing texts and for constructing meaning and significance from the text the main emphasis should be put on stating the analytical process and the tools because there is always some rhetoric involved. Quantitative data analysis and presentation is maybe the most rhetorical and powerful devices research have seen, and the problem is often that the position of the researcher, the worldview involved and other premises for interpretation are not stated but taken for granted within the paradigm.

“The creative act is alike in art and science; but it cannot be identical in the two: there must be a difference as well as a likeness. For example, the artist in his creation surely has open to him a dimension of freedom which is closed to the scientist. I have insisted that the scientist does not merely record facts; but he must conform to the facts. The sanction of truth is an exact boundary which encloses him, in a way in which it does not constrain the poet or painter.” (Bronowski, 1956, p.28)

The possible insignificant findings of the interviews are always an issue. To what extent can we claim that the conclusions based on indications are beyond trivialities and commonalities? Significance has to be treated different in quantitative research. The significance in qualitative research not relative to a defined level of probability has been set as a criteria for the rejection of a null hypothesis. The significance of the results is relative to the situation or context in which the study is embedded meaning that for the most that the evaluation of the significance is to a great extent left to the reader. As reader, you have to base your evaluation of significance on my descriptions that serves as the premises for interpretation that I provide. Application and implications of the cases for educational practices within teacher education, in curriculum planning and in elementary education institutions is partly to be evaluated by the reader.

Therefore, finally what contributions can be made using interviews despite all the weaknesses or pitfalls that we see theoretically and experience every day spent in the field. Early in my study, a senior in the discipline of educational research asked me whether it was my knowledge about the issues of evaluation and assessment that was constructed or whether it was the teacher knowledge that was constructed. That question set me off. It took a couple of years to realize that claiming that the combination of the two aspects was a plausible and even methodologically accepted position. I was learning the essences of evaluation and assessment from the point of practicing teachers through the ‘inter- actions’

and the 'inter- views' created with the teachers. Simultaneously the teachers were developing their awareness of importance of evaluation for educational processes because of the emphasis put on the issue. *"The inter view is a situation of knowledge production in which knowledge is created between the views of the two partners in the conversation."* (Kvale, 1996, p.296) The knowledge construction going on with the teachers will come through when reading the cases about Alfa through Omega. But in addition to this the example also points at *"The construction of knowledge is not completed by the interaction of the researchers and their subjects, but continues with the researchers' interpretations and reporting of interviews, to conversations with other researchers about their findings."* (Kvale, 1996, p.296) The knowledge construction of the research project is in addition to this based on the theoretical framing I arrived at during the in field microanalysis (chapter 2). However, important for the knowledge construction have in addition been a number of instances of minor and major discussions about different aspects of the project with more and even less experienced researchers within educational research.

I am including another note from my log with Delta. This quotation is an example of the ongoing analysis of the relationship between me as the researcher and Delta as the respondent integrated with an in field analysis of epistemological and ideological dilemmas involved in choosing formative and summative approaches to student assessment. This is another example of in-field reflections of researcher-respondent positioning.

From my research log with Delta: "Deltas concern in not the teacher as an implementer. He owns the ideological viewpoints. He says "they are internalized through reflections, knowledge and social participation". I am continually pushing him. I say that his view on learning and knowledge is found in his classroom practices and the continuous interpretation he does of the classroom interactions. On the other hand there is difficult to see the relationship between the judgments of the students in the "drama of teaching" and the assessment of students written tests. The tests from the textbooks are based on a different view on teaching. I draw circles of reflection and claim that his reflections about classroom interactions are based on epistemological and ideological framing, but his actions in summative assessment is entirely pragmatic and system related. Delta says he will before the next meeting figure out the relationship between his teaching and his procedures of student assessment. Next time we have to return to ideological reasoning and assessment. How far can I push this? The questions that will guide our next meeting will be: Is Delta willing to use the concept of assessment about

formative purposes? Will Delta see a trend of ideology in combination with both formative and summative approaches?" (2.2.01)

Delta: *“Participating in this project... talking to you has had some kind of therapeutic effect on me and the way I think about learning... and maybe student assessment too.” (21.5.01)*

8 Methodological framing; design of the main study

This quotation, from the final interview with Delta, is pointing towards the relevance and importance participating in a discursive project has had on him. Stating reflections on knowledge, learning and assessment has clearly been both frustrating as well as contributing to increased understanding of his assessment practices as well as their underlying rationale. However, the fact that he was involved in educational scrutiny with a communication partner brought forward reflections that were significant for his professional development. In educational ethnography, we are influencing the respondents in intended as well as unintended directions. The agenda of the teacher and the meaning created and recreated is relational.

Most qualitative handbooks are more concerned with analysis, researcher positioning and reflective tools rather than stating recipes or giving directions for data gathering procedures. Applying methods according to guidelines without accompanying methodological consideration is contrary to the basics of qualitative research in general and ethnography in specific. Therefore, the methods used are subordinate to the contributions from the previous presented Grounded theory and ethnography. The methods will be presented here in the order that they were applied during the fieldwork (8.1). In order to build a comprehensive study the weighing of methods against respondents, against possible theoretical frames and against the development of research questions has to be seen as an ongoing business. This is a circular enterprise. In the case of this study, it became necessary to take several turns of in- field- reflections and out- of- field reflections before the research design found its form. Commenting on the bits and pieces of methods used will have to be done according to the different techniques and their contribution within a methodological framework and according to co-operative considerations. This overall attitude may be illustrated by this quotation. *“I strongly believe that to provide recipes for data gathering are to risk either gross oversimplification or utter triteness. Moreover, in qualitative research, what happens in the field as you attempt to gather your data is itself a source of data rather than just a technical problem in need of a solution”* (Silverman,

2000, p.35). For these reasons, the researcher will be discussed furthered (8.2). Another aspect of the design has been to select the participating teachers (8.3). A section about time aspects in this fieldwork will follow the discussion about teacher representativeness. Then finally, a presentation of the building of the teacher cases will conclude the chapter.

8.1 Methods used and their corresponding dilemmas

Qualitative fieldwork carries with it many choices, choices that have to be made as you go. Many of the dimensions we take into considerations may be stated as challenges and I will take that as a starting point for each of the following sections, but I also intend to end up stating dilemmas for conducting fieldwork in schools.

There is one main dilemma of qualitative fieldwork that I would like to mention. Firstly, there is the overall ethnographic warning of ‘going native’ meaning becoming too familiar with the researched and losing the focus on research agenda. The other extreme is often stated as making the familiar unfamiliar. Both of these controversial issues has to be commented on in the light of doing research in an institutional setting that I have been a part of since the age of seven as a student, as a teacher, as a teacher educator, as a researcher and as a mother. The routines and the actions of everybody involved may seem so obvious that in order to ask questions about the rationale behind the actions we somehow have to ‘un-familiarize’ us with it in order to be able to illuminate the taken for granted. *“Successful ethnographers resolve that tension between involvement and detachment; others go home early”* (Wolcott, 1988, p.189). There is a tension between the deep involvement required for building relations and the analytical distance required for conceptualizing.

In order to meet this challenge of being within this dilemma as a researcher I have mainly used two techniques. The most obvious one has been to read about different educational systems and their intentions, implementation strategies hence different solutions to the control - guidance duality of student assessment. The other technique has been to include teachers working within three educational systems in the study. By including Sweden and England, I also gained the effect of contrasting the Norwegian practices against teachers working under other educational guidelines and under other educational traditions. This

contrasting effect working as a revelation analytically comes in addition to being able to present a fieldwork including teachers from different national contexts.

The dilemmas imply treats to the internal validity and construct validity of my study. An awareness of the pitfalls is necessary. The issue could also be raised as to realize what biases we carry with us because of knowing the system too well from other perspectives than the one chosen for this study.

According to the result of the pilot (6.1) a combination of methods were developed and they will be presented in the order that they were applied during a day in the field. These methods were integrated into a framework (6.4.9)

8.1.1 Participant observation

Observation within the ethnographic /naturalistic field may be classified according to the two dimensions of detached recorder versus involved interpreter and predetermined events versus choosing events based on observations. This system for describing modes of observation makes sense investigating at all the possible purposes that observation may serve in the field of classroom research. Labeled like this, the ethnographic researcher will be an involved interpreter and there will not be any predetermined codes to follow for the observation. (L. W. Anderson & Burns, 1989, p.140)

There is always some degree of detachment and some degree of involvement and some degree of inference and some degree of intervention. We are, when present in a classroom, always to some degree participators. It is impossible to be a human being among other humans being without some mutual influence. For this reason, a finer terminology of participant observation that will capture this degree of visibility, activity and preferred observational strategy is required. Wolcott (Wolcott, 1988) introduces active participant, privileged observer and limited observer and claims that most fieldworkers in schools are privileged observers. In this framework, my position has been alternating between active and privileged participant observations.

Another attempt at describing various contributions of participant observation did result in the following four categories: complete observer, observer as participant, participant as observer and complete participant, (P. Atkinson & Hammersley, 1998). Under section 7.1

arguments against the first category was raised, so for practical purposes we are left with the other three. Complete participant requires an extended period in the field or actually having dual identities in the classroom, for example both teacher and researcher. Again in my case the first and fourth may be ruled out and I have been alternating between observer as participant and participant as observer.

Alternating between positions as active, privileged, mainly observer or mainly participating has had both principal and more practical reasons. Among the principal reasons is a chosen position of being detached and available, but still an outsider. Subordinate to this argument is that I should be known to all the researched and his/her students, that the teacher should know the research focuses in a much detail as he/she wanted and that I would like to be present in all kind of ordinary teaching activities in classroom, in lab or on fieldtrips. Hence my involvement in learning activities has been very limited, mainly to ease the job for the teacher on rare occasions.

Concerning the practical reasons, I made the following points clear to the teacher on all occasions:

- A. You are the skilled teacher in your subject and with the experience as teacher.
- B. I have previous experience with science teaching, but I am mainly a researcher in social sciences.
- C. I am not acting as a teacher in your classroom because my agenda does not allow that.
- D. I will mainly be observing, and therefore only interfere when students or you address me specifically.
- E. I prefer to be in the back of the classroom because most teachers and students find that least visible.
- F. I will only do video recording when I find that interesting for our discussions and when it is not interfering with the learning activities in the classroom.

During a period of fieldwork lasting one and a half year, there have been numerous occasions that I had to diverge from these general rules of thumb. There is no way you can generalize the reasons for those deviations except that my human intuition and overarching

ethical considerations convinced me that my research agenda was less important than other aspects of the relations to the people or the overall school agenda.

The under dilemma here is then being visible and participating in order to ease presence balanced against minimizing the effect on the teaching activities.

8.1.2 Informal discourse

From the point of ethnography, adding this category of methods to observation and interviewing may seem rather redundant. When in field, you relate to the other persons all the time and an inevitable part of the interactions will be continuous discourse going on. The main reasons for including it has been the way the content of this discourse has been included into logs that have been a part of the data for each teacher. In the log, the statements made by the teacher and by me are either in an indirect form or in a direct form. The log has been build up subsequently. Interviews have therefore been based on the observation as well as the informal discourse. Even if the setting was informal, I had on most occasions an agenda for the conversations. Usually during the observation when topics and issues was filtered out I decided which topics that should be raised as a part of a formal interview, which topics that I could talk about immediately and which ones I needed to address at least twice.

The immediate discussion, initiated by me, served mainly the purpose of sorting factual information about the teaching, about the school organization and schedules. Teacher initiated discourse was often more directed to evaluation and assessment as well as teacher identity and general questions about learning and teaching. These happenings were excellent opportunities for eliciting information and eliciting the teacher vocabulary for the issues in question.

The under dilemma is the tension between stating my agenda in order to create a platform for communication and illuminating the teachers ideas, experiences and autonomous reflections.

8.1.3 Interviewing

Parallel to the two dimensions of observing Anderson and Burns also introduces two dimensions of interviewing. The two dimensions are forced- choice responses versus open-

ended responses and standardized prompts and questions versus non-standardized prompts and questions. (L. W. Anderson & Burns, 1989, p 116) These dimensions are reflecting the respective degree of standardization statements made by the researched and the researcher. The interesting point to be made is that there is no automatic connection between degree of standardization of questions asked and prompts given by the researcher and degree of standardization of responses given in this system. The main point of Anderson and Burns is an addition to the definitions of the two broad categories of open-ended interview methods and closed interviews. In one source they are labeled structured formal interview and informal interview, in another source they are labeled standardized open-ended interview and informal conversational interview and in a third source the corresponding labeling is standardized and reflective interviewing (Hammersley & Atkinson, 1983; Patton, 1990; Wolcott, 1988). The latter handbook of ethnography, by Hammersley and Atkinson, also includes the category of interviewing as participant observer and hence pointing at the difficulty of defining the different steps of ethnography because there is more of a continuous line of activities that takes place in a context. We act according to what is possible and appropriate in the situation.

Turning back to Anderson and Burns and their point about interviewing which is not specifically discussed within the frames of ethnography. The point they bring up is however important to reflect upon because experience in field tells us that our intentions and comprehension of interview situation does not necessarily correspond to the comprehension of the researched. Different expectations based on experiences colors the comprehension, more important influences the terminology used, and the content being addressed. Even if we intend to ask open ended questions the respondent may due to the situation or the topics make associations that trigger the forced-choice responses rather than the open-ended responses. Reflective interview settings are emerging when the open-ended questions and prompts are generating open-ended responses that may in the next turn generate new issues and questions. This point is important for understanding and classifying the different interviews. In some cases, I managed to develop the interview in co-operation with the respondent so that it became mutual reflections on student assessment, in other cases the typical questioning and answering contributions were kept but still making openings for continually discussion. Thirdly, the extreme cases were responses that were closed and impossible to build on for further communication. The two extremes are illustrated by the following comments by two of the teachers: "*For me*

participating in this project and talking about teaching and student assessment has had therapeutic effects” (Delta in the final interview 21.5.01) and “*Now, did you get answers to all you needed to know*” (Lambda in the final interview 18.5.01).

In addition there is the dilemma how to structure the interviews or alternating, choosing or combining between structured interviewing and open interviewing. The solution according to the micro analytical approach was to develop semi-structured interviews based on the local circumstances for the individual teacher and in line with the previous conversations with the teacher. For practical reasons this approach involves developing cues and using these as prompts during the interview rather than actual questions.

Interview techniques were multifold according to the following examples. Examples are divided into categories based on the flow of the discourse and the researcher’s different questioning strategies.

1. Open-ended questions. A typical example is found in section 21.2.1. “*Tell me about the correction of notebooks.*” (Interview with Pi conducted 4.10.01)
2. Questions stating my interpretation from an instructional unit. An illustration of this kind of conversation is included in section 11.2.3. Here I am referring to an observation about the use of criteria for assessment during an introductory lesson to a student project. Another example is found in section 14.2.1 where Omega and I are talking about the difference between learning and teaching.
3. Supporting in order to motivate for continuous illuminating of reflections. When I was talking to Sigma about her attitudes to the national curriculum in Norway and her use of this as a planning resource I used this technique as referred in section 13.4.
4. Including statements of potential professional development of the teacher. This may be illustrated by the example under 10.2.3. where I bring in the formative purposes of assessment in my second statement.
5. Building a bridge to a previous conversation or discourse in order to get it taped or in order to sort our possible progress or changes in teacher reflections. There is a short

segment that illustrates this under section 10.2.6 with Alfa. Another example is founding section 11.3.1 when I am asking again for his reasons for using and not using grading on the different learning activities.

6. Scrutiny of a single point in order to reach at a depth in the teachers reasoning. There is one example of this when discussing the competencies involved in grading under section 10.2.4 with Alfa. Another two examples from the cases is referred in section 12.5 when I am actually challenging Pi's stated view of teacher and student participation in assessment.

7. Feeding from my theoretical framing in order to validate my preliminary analysis. I did this on some occasions one of which is referred to in section 11.4.2 when I am dwelling on the lack or presence of emphasis in Gamma's teaching.

8. Questions stating my general impressions or temporary interpretation in order to confirm this understanding of the teacher. Under section 14.4 I am stating my interpretation that Omega is concerned with societal issues and opinion making as emphasis for science education in order to get further information from Omega about this point.

Regardless of the choices concerning the structure and standardization, developing interview techniques and conducting interviews for knowledge construction is based on skills and experience build into craftsmanship. Kvale has developed twelve aspects of the mode of understanding that represents the qualitative interviews (Kvale, 1996 p.29). These aspects are qualifications and ultimate aims for a skilled interviewer. At the same time they correspond to central aspects of the methodology of Grounded theory and hence a methodological positioning I have taken for the fieldwork.

- I. Life world. It is the lived world of the respondents that is the focus of the interview.
- II. Meaning. Understanding the meaning of the interviewees is the heart of the activity.
- III. Qualitative. Use of words requires precision in descriptions and in interpretation.
- IV. Descriptive. There is a focus on nuance descriptions and diversity.
- V. Specificity. Interviews seek to describe specific situations.

- VI. Deliberate Naïveté. Interviewer should try to be without presuppositions.
- VII. Ambiguity, inconsistencies and contradictions should be regarded as reflections.
- VIII. Change of descriptions or opinions should also be regarded as increased consciousness.
- IX. Sensitivity for the respondent and his/her message is always an ultimate aim.
- X. Interpersonal situation. The interaction implies mutual influence and this interpersonal dynamics has to be explored as a part of the analysis.
- XI. Positive experience. Another aim is to make the interview a favorable experience for the respondent.

In this book, with the title of obvious and clever double meaning *InterViews*, the author builds a methodology around interviewing. The interview is not seen mainly as a method but in this text he presents to us the different possible interplays between theory and empirics as well as the interplay between interviewer and interviewee emphasized in the title. Interviewing has become one of the most influential methods of qualitative research and according to the author almost entirely used for theory generative purposes.

In sum, my interviewing has in all cases been open-ended and in some cases could be characterized as reflective interviewing or conversation. I decided to make records of both informal discourse/conversation and the formal interviewing. The interviews were respondent centered in that it was the content of the teaching and the evaluative activities that always was the starting point of the interviews. Records of continuous discourses are included in the main log for each teacher. The interviews were audio recorded and all of them transcribed. Realizing the importance of transcribing for analysis, I did most of the transcription myself. The final interview with five teachers was however, and due to time limits, transcribed by a research assistant. The assistant had experience through a master study in qualitative fieldwork in education and it was therefore possible to discuss the interviews with the assistant. Her reflection about the interview style and the teachers' reflections about student assessment became a valuable contribution to one of the more routinely tasks of transcribing fieldwork. Hence, that contribution more than compensated for losses of interpretation due to not transcribing the interviews myself. It may be regarded as validating interpretations and findings as in researcher triangulation.

8.1.4 Microanalysis

The micro analytical approach of Grounded theory is important to the progress and therefore I will state in more detail how that worked in this project by the use of instrumentation, analytical moments and mental organizers. This analytical approach is an integrated part of the fieldwork because the progress of the fieldwork relies on continuous analysis of the observations and the interviews. As a part of this continuous analysis the line- by- line preliminary analysis of observations and discourses were the sources for further fieldwork.

Undergoing fieldwork is a complicated, frustrating, semi-level mental process. In order to sort out preliminary substantial indications, the multi faceted factors of student assessment and the relational impressions it was necessary to develop mental organizers. Among these mental organizers were:

- a. Two-dimensional charts to organize information and beginning categorizing of relationship between epistemological positioning and ideologies of science, of relation between epistemology and reflection level
- b. Two-dimensional axial system to organize teacher identity according to dilemmas of student assessment, the relationship between national intensions and teacher autonomy, relationship between elements of control and elements of counseling, the relationship between summative and formative aspects of student assessment
- c. Triangles to visualize the dimensions of persuasiveness
- d. Crystals to organize factors of 'didaktik'
- e. Interlocking circles to visualize integration of theoretical perspectives, integration of levels of reflection and integration of educational contexts
- f. Finally borrowed from Uljens, (M. Uljens, 1997a, p.176) the fly of relation between educational planning in all stages, participating actors and relation to the educational activities themselves.
- g. Venn-diagrams to illustrate the relative contributions of mandated implementation of curricula, mandated strategies for assessment and teacher driven strategies concerning both of these dimensions. (Darling- Hammond & Sykes, 1999)

Some of this mental tools or visualizations also serve as communicative tools in contact with the teachers and with researchers. Organizing and analysis of impressions and data

from fieldwork has been somewhat dependent on discussions about student assessment and in order to express preliminary findings visualizations has become handy.

Microanalysis is important for discovering critical events in the fieldwork and build on the issues that were raised in this critical events or golden moments. In these situations clues comes up. Keeping an open mind is crucial for the moments of serendipity. There is a tension between this attitude and the necessary predefined agenda.

8.1.5 Choices based on teacher- researcher co-operation

As already mentioned research on teachers is about setting routines and setting content in which both the researcher and the teacher find a bit of meaning according to the respective agendas. I will in this section comment further on strategies that was developed to bridge this gap of interests that exist despite of the shared emphasis on assessment. The challenge is to find a common denominator for verbal interaction.

An important aspect of conducting this fieldwork was to develop the relationship to the individual teacher. For this reason, I tried to start out spending a week with each teacher. During this first week, I evaluated and analyzed factors like the school context, the teacher co-operation with other teachers, the relationship with the school leadership and management. I tried to take in as many factors as possible to get a picture of how the teacher related to other actors in the school and his/her implementation of this part of the teacher identity. More important was the search for learning activities, classroom settings and communication contexts that I needed to record and select for rigid data collection. In addition, it became important to try out different topics and angles of topics in order to find a communication platform that worked in each single case. The situatedness was important in the researcher- teacher relationship. The overall philosophy was to start where the teacher is, where he/she states the challenges with student assessment and build on these for most of the conversation. The reason for this was not so much the action aspects, investigating teacher learning from participating, but more from the grounded perspective; starting the study of each individual teacher from a point that is familiar to the teacher; from a language of assessment that is familiar to the teacher; and from teaching situations and planning activities that formed our mutual experiences. Conversation with the teacher, both formal interviewing and informal discourse was prepared taking the situation of the day and the student assessment practices going on when we met. This strategy was also

followed throughout the fieldwork. The key here was being specific in order for the teacher to relate to questions raised.

Building my work into the schedules of the school and the work of the individual teacher was also important in order to keep a low conflict level at the schools. I was a guest in their environment and kept a note visible to myself “when in Rome do as the Romans”. This goes for the behavior in general, for how to dress, for whom to address about different issues and to know when not to interfere in actions in the school. It is therefore crucial to state the reasons for being present. The teachers should be able form his/her expectations of participation accordingly under the principle of continually informed consent.

These modes of co-operation and communication were kept throughout the study and became the routine on which the interaction was based. In the meeting with teachers, all of them unknown to me on beforehand, I emphasized predictability. They had to learn how I worked, but it was necessary at some point to establish routines in order to minimize the effect and focus of my presence.

This routine and predictability had to be balanced against the challenges and additional stress I did put on the teacher by being present, by asking questions, by expecting answers and reflections. Quite often, my issues had to be new for the teacher. The teacher had simply not reflected upon that aspect of student assessment. He/she was simply acting without being able to reason about the actions. Digging into the issues quite often made the teacher vulnerable. Qualitative fieldwork implies interventions. This is another dilemma of fieldwork, from the perspective of the teacher, balancing the unpredictability represented by the research agenda against the predictability represented by the familiar teaching context.

Presenting the fieldwork will therefore take on the form of a combination of the actual situations and the development process going on during the whole period of fieldwork.

8.1.6 Synthesis; combination of methods for ethnography

Combining the three methods became my methodology for this project. This methodological approach has roots in ethnography as well as Grounded theory. Ethnography in itself does not have strong traditions or fixed analytical procedures.

Therefore, my choice was to combine the analytical approaches found in Grounded theory with the perspective on the identity of the researcher found in ethnography. I do not see this as a mixed methodology, but rather as the two complementing each other.

Triangulation in qualitative research came up as one way to validate and increase reliability of the single qualitative research method. The questions that are raised about triangulation however have been based on the difficulty of combining different analytical angles that is underlining the different methods. Methodological, theoretical, researcher and analytical triangulation are all connected to a view on knowledge construction that says that there is a necessity to overcome context- boundedness in order to test the reliability of the data and the conclusions drawn. The persuasiveness should according to this view arise from aggregation of data, from analyzing the same set of data from different angles or from analyzing the same person or phenomena from different sets of data. The contra argument is raised from the perspective on knowledge building stating that the knowledge has to be based on the situation and the context and hence according to the circumstances under which the data was produced. On the one hand, triangulation is a methodological perspective closely related to the need for generalizations and for grand theories that we find within the post-positivistic area of qualitative methodology. On the other hand, triangulation is a means to increased and deep insight into one specific phenomenon.

8.2 But still the main instrument is the researcher

“The ethnographer is the research instrument, the villagers are the population. That instrument – the anthropologist in person – has been faulted time and time again for being biased, inattentive, ethnocentric, partial, forgetful, overly subject to infection and disease, incapable of attending to everything at once, easily distracted, simultaneously too involved and too detached – the list goes on and on. Be that as it may, what better instrument could we ever devise for observing and understanding human behavior?” (Wolcott, 1988, p.190)

This quotation sums up some the dilemmas of ethnographic educational research. At the same time it points towards what might be consequences for building a research design matching the field of study and matching the field study. One of these consequences is building systematic inquiry. Another is keeping records of research reflections, actions and

challenges. Because the ethnographer is the main instrument of qualitative educational research, keeping records of the research process becomes important. Developing log or memo writing has been emphasized by a number of authors of qualitative methodology (Silverman, 2000). Logs are important me for two main reasons; the first one is to trace your own considerations and decisions concerning substantial and methodological issues and the other has been to use the log as a possible data resource.

8.2.1 The importance of Logs

Qualitative researchers states five important reasons for keeping a log or what he chooses to call a research diary; To show the reader the development of your thinking, as an aid to reflection, to help improve your time management, to provide ideas for future direction of your work and to use in the methodology chapter of your thesis. (Eisner & Peshkin, 1990; Silverman, 2000, p.193; 2001; A. Strauss & Corbin, 1998) Hammersley and Atkinson in their book *Principles in Practice* from 1996 emphasizes the self-reflection of a fieldworker and the importance of stating problems, challenges and hypotheses in the form of journals in order to keep asking questions to the fieldwork. It is interesting to notice that both of these books of qualitative recommendations introduce the concept of diaries and the rationale behind them about two- thirds into the text. My experience is to start the log or diary when the first ideas come up or the assignment is given and therefore the concept of logs, diaries and the structure of them should be given a higher priority.

I chose to develop logs for both of the purposes mentioned above, to trace and reflect on both substantial matters and methodological matters. During this study, I therefore gradually ended up with two main logs, one electronic log and one traditional handwritten log. The first one serves as a data source to support my observations and interviews because it contains micro analytical findings of importance for the development of the study. Some of these micro analytical findings or conclusions have been crucial to the development of the research questions, the theoretical framing and the teachers chosen for this final report. Some of this is also true for the conventional log, but this is more like a regular (research) diary. A third source for keeping track of the learning part of the research process is the End. Note library, a reading reference bibliography, which was started when embarking on this journey.

To keep track of the different content in the electronic log and in retrospect being able to give the content the right status a system of symbols evolved. This system gave me the possibility to separate descriptive comments from immediate interpretations. The third category was clearly stated analytical and theoretical considerations. Because of the nature of the continuous interaction with the teachers, it was also necessary to include quotations that came about, as a part of the informal discourse, but still due to the spiral of methods had to be kept on records. Here it was important to separate between citations in direct speech and citations based on my memory of the wording. In basic, I therefore used five different symbols that included substantial and methodological comments.

The chronology, hour after hour and day by day, of any log or diary is the obvious format, but less obvious though necessary is to separate between what are the immediate and what are the in retrospect comments, frustrations, challenges and ideas that need to be further considered. For me it became important to set the context, in field or in office under which I did my interpretations. A separate form for the 'in field comments' were used. This then complemented the final log of the day and the in field notes.

To sum up; microanalysis is dependent on log writing in order to both develop research strategies and for the theoretical framing- and for the continuous sampling that takes place during the course of the fieldwork. During this kind of fieldwork the sequencing of visit of schools or teachers will have to progress as a part of the progress of the study. The continuous change of location that I decided to undertake meant that the interaction with the different teachers was influenced by the order of the visit and hence by the different topics raised. Arrangements to visits were sometimes taken in order to get the individual teacher's perspective on an issue that was raised by me in co-operation with another teacher.

8.2.2 Researcher visibility

During the phase of analysis, the memo writing took on a stricter form for a specific purpose. In Grounded theory memo writing of coding, categorizing and theory building is central to explain the gap between the interpretations embedding in the coding process and the representation done in the written records of the research (Strauss & Corbin, 1998). This gap is bridged and colored by assumptions, by theoretical understandings and my own previous experience as teachers. Memos of these factors must therefore be stated

simultaneously as the coding and categorizing itself. Factors here are important beyond the self-reflection as researchers. It is also a part of the premises for interpretations and for the readers' evaluation of possible applications and implications of the results.

Another way of investigating the visibility of the researcher is how we are present in all the interpretation levels from field to the reader. For this reason, I have chosen to let the researcher be explicitly present in the final text in the way I have written my name into the transcripts and in the way, I have kept some of the remarks from the actual situations as explanations and contextualization. Embedded in this choice is the awareness of language as the carrier of the meaning. Even though the language in itself is not the focus of analysis, I have decided to make choices of terminology explicit in the texts in order to explicitly point at my language presence as opposed to or in accordance with the language of the teacher.

The ethnographic researcher is present in cognitive strategies, but also in affective strategies. Emotional aspects of dealing with people are multifold in sensitivity, creativity, feelings, sympathy, antipathy and intuition. Affective aspects is harder to dwell on, harder to verbalize and hence more difficult to put down as criteria for interpretation.

Despite of or in addition to these practical tools developed and used conducting fieldwork is a matter of personal preferences or styles. *“Such styles have four basic sources: the individual and idiosyncratic characteristics of specific fieldworkers; ideological and philosophical presuppositions; The general conception of method; and the nature of the problems to which the research is addressed”* (Ellen, 1984, p.69). Logs or diaries are tools to make explicit for myself aspects of these four sources.

8.3 Teacher representativeness

The ethnographic approach that I have outlined for this study is a part of an interpretive generative research paradigm. Selection of teachers has been done in a combined purposive and theoretical sampling process, an ongoing process throughout the study. I have been investigating the uniqueness in the participating teachers. The theoretical sampling implies that *“The particular is intended to illustrate the general... as a illustration of a more general and complex truth... to illuminate the general through the*

particular.”(Ernest, 1994 p. 25/26) On one hand, the teachers are only representing themselves. On the other hand theoretical framing and therefore pointing to general aspects of the dilemmas and challenges of practicing teachers with emphasis in student assessment inform the representation of the teachers in cases.

8.3.1 Selection of the participating teachers

Selection of schools and teachers for this study was initially done according to availability and teachers interests. The originally design was to search for variety of student assessment practices in the schools around Oslo and hence it was a Norwegian study. After conducting a pilot study it became necessary in addition to evaluate possibilities for including teachers working within educational contexts that resulted in a wider range of practices, attitudes and experiences that could be found in schools in the area of Oslo. The national curriculum of Norway, the implementation of the student assessment guidelines and the overall comprehensiveness all added to a conclusion that it is not likely that the practices will vary enough to be theoretically interesting.

During this period, some schools were applying for alternative student assessment programs, no grading and alternative criteria setting, but the national authorities turned these applications down. In my search for a variety of student assessment practices, I therefore revised my original design to include teachers working under other national curricula and student assessment strategies. Even if availability was still the major criteria, Sweden and England were included based on knowledge about their national policy, my language skills and financial resources from my department and my faculty. The result is the following list of selection of schools and teachers for the fieldwork phase of the school year of 2000-2001, in the order of which they were included in the project.

1. Two schools in the Oslo-area are included in the study. Three teachers at each school participated. There were several attempts at finding schools and teachers that wanted to participate. The first school was willing to undergo the pilot study in the spring of 2000 for three weeks. They were, that is both the teachers and the management, very interested in prolonging the communication when I asked them. The schools in the area of Oslo had several reasons for turning down my request. They had student teachers from my department or other teacher education departments, they were already participating in other research or development

projects, they did not put emphasis on student assessment, they found student assessment too difficult or their experience was that they did not gain anything from participating in educational research. The school in Oslo that finally agreed to participate did so under some pressure due to a contract concerning a teacher education program. Two teachers were reluctantly willing to meet me. We started communication, but a number of postponing appointments and the general attitude remained apprehensive. A third teacher at this school was however interested and so this teacher became my main informant and turned out to be very important for the development of the project. In the case of participating teachers in Norway, the teachers choose or rejected me in addition to me choosing them. In this process that took about one year several different channels were used. My range of methods included the formal channels of educational authorities, friends and relatives of colleagues of the department and direct contact to schools.

2. One school in Sweden, in the area of Gothenburg, has been added to the study and to the original design in order to trace possibly differences due to different national curriculum, different mark setting and different overall as well as subject specific criteria stated. Two teachers from this school were included in the project. These teachers were at that time participating in an in-service program emphasizing implementation of national curricula and local development of student assessment criteria as a part of the general educational planning. The school was selected in cooperation with the teacher educators in charge of the in-service course at the University of Gothenburg. When approached with my request the two teachers were immediately willing to communicate with me, host me in their school and undergo formal taped interviewing. We had occasionally communication over four months before my visit to the school and I had also met the teachers during the in-service training meetings.
3. One school in the area of Newcastle was visited for two weeks in the fall of 2001. Two participating teachers from this school agreed to participate. This school was selected through channels of colleagues at University of North Umbria and school district authorities. The head teacher was contacted by E-mail and letters and promised to arrange for two secondary science teachers via the science department of the school. Therefore, there was no prior contact with the teachers before arriving at the school.

I decided to dedicate one academic year to the fieldwork in order to be able to get the multitude of learning activities that take place. This decision also enabled me to follow the teacher's daily instructional activities, decisions concerning testing, exams and longer projects as well as strategies for returning tests. I had about one visit to every teacher each month and asked the teacher to gather all written materials that they regarded as important for evaluation or assessment purposes in a folder.

8.4 The course of the fieldwork; sequencing and time aspects.

Selection of participating teachers was done subsequently and as a part of microanalysis. That is also true for most of the fieldwork. The fieldworks progress has been a combination of planning for variety and planning for extended visits. Visits were scheduled according to the timetables of the teachers and according to planned activities. Electronic mail was used on most occasions. Mailing involved mainly planning visits, but sometimes discussions about topics rose during a visit.

Qualitative comparisons can involve alternating between teachers during the fieldwork and hence developing focus according to different aspects. The different teachers added different dimensions to the dilemmas of student assessment and I therefore regarded it as an advantage to change location during the total period. The main benefit was to be able to build interviews and focus on the individual teacher but simultaneously frame my understanding of the individual teacher according to a broader perspective based on contributing issues from the other teachers. The main flow of the fieldwork may be read from the following table. The method of constant comparative analysis emphasizes the single case analysis both in fieldwork and during the overall case analysis. The idea here was hence to be contrasting the different respondents and the different contexts under which they were acting professionally. Indications of differences as well as indications of similarities were micro analytical tools.

Table II: Sequencing of fieldwork during the total period of fieldwork from pilot through main study and from spring 2000 until fall 2001:

Teacher	Pilot	Main study	Final interview
Sigma	Week 12, 2000	Fall 2000	4.4.01
Gamma	Week 13, 2000	Fall 2000 and spring 2001	23.5.01
Alfa	Week 11, 2000	Fall 2000 and spring 2001	30.5.01
Lambda		Fall 2000 and spring 2001	18.05.01
Delta		Fall 2000 and spring 2001	21.05.01
Omega	Week 46, 2000	Week 11, 2001	15.3.01
Ypsilon	Week 46, 2000	Week 11, 2001	16.3.01
Pi		Week 40 and 41, 2001	4.10.01
My		Week 40 and 41, 2001	11.10.01

Concerning time factor there are aspects of quality, of length and of frequency. Three modes of ethnographic fieldwork have been described (Jeffrey & Troman, 2002). I will outline these modes and categorize my fieldwork according to the three categories. The modes are more ways of reflecting about aspects of time in ethnography than actual three mutually exclusive categories.

The first mode, the ‘compacted mode’ has a “*panoramic perspective*” and is more led by focusing at the interaction of people with the context and therefore an emphasis on capturing the dynamics of the context rather than in depth interviewing and observation of individuals. The typical compacted ethnographic study will last for a period of one to some weeks. In this mode multi sources of data are important and triangulation or crystallization (Richardson, 1998) analytical tools. The pilot I have described falls into this category of ethnographic fieldwork.

The next mode, the ‘selective intermittent mode’ is contrary to the first in that the depth of the study and the progressive focusing on individuals, on particular educational issues and rather lengthy study. In this mode the saturation concept and the micro analytical approach of Strauss and Corbin (1998) becomes relevant in determining the length, the frequency and the order in which visits are made to the different locations in the field. In this mode there is the opening for reflecting on the fieldwork or doing some preliminary analysis which is important for the progression of the project. Flexibility in order to capture the golden moments or serendipities are as important as the “*flexibility to enter the site at any*

time, the gradual opening up of areas for access, the gaining of respondent's trust and commitment to the research" (Jeffrey & Troman, 2002, p.10). This mode is probably closest to the original anthropological study.

The third mode named the 'recurrent mode' is one where particular phases set the time frames and the sampling of similar events are in focus in order to address issues based on particular instructional activities like lab work or group projects. This mode is suited for incorporating contradictory actions and events in search for tensions in educational settings and to monitor change. The difference to the selective intermittent mode lies in the predefined structure of the latter contrary to the continuous student assessment build into the second mode.

My main project has involved aspects of the latter two modes. On the one hand, there was a flexibility needed in order to fit into the teacher agenda with mine. There was also important to select events that were significant for student assessment procedures. Hence, the flexibility and continuous analysis of saturation was combined with choosing locations and situations of substantial importance. Thirdly, it was necessary to spend some time in order to get to know the teachers and become a natural part of the classrooms. The introduction of these modes goes beyond the challenge of deciding how long time to spend in the field. It also addresses the specific aspects of fieldwork in institutional setting and aspects of scheduling, school years and timetables that in total make educational ethnography different from its mother discipline of anthropology.

Sequencing and time aspects of ethnography concerns the sampling of events to scrutinize. The search for events represents a tension between choosing the typical event to be described and choosing events for diversity of activities. The first challenge corresponds to describing what the events represent in themselves and what they represent for the teacher. The other challenge corresponds to what the event represents in a developmental or cyclic time frame. For the teacher as well as the researcher the meeting takes place at a specific time with specific features of that situation. Repeated meetings are correspondingly constituted by the several specific situations. A developmental perspective is introduced. (Engeström et al., 1999)

8.5 The construction of teacher cases

First, what is implied by the use of the case-concept? Case studies are frequently used about qualitative inquiry. However, case studies are not necessarily qualitative and they are neither implying a particular methodology nor a particular epistemology. (Stake, 1998, 2000)

I will apply the term 'case' because it draws the attention towards two aspects, what can be learned from that case and what is that case a case of. The first aspect points towards the application of the case and its relevance to the reader. The second aspect points towards the specific message of the case and therefore the theoretical framing or the boundary of the case. Case studies are therefore a term used both about the process of inquiry as well as the product as the written report of the inquiry. Due to the lack of a methodological and epistemological basis for case studies, I have chosen to refer to my process of inquiry as ethnographic within a methodology of Grounded theory. In addition, I have reserved the term case for the written accounts of each teacher. However, in the following when referring to the process of writing combined with interpretation and analysis it is convenient to use the terms single-case and cross case analysis referring to the analysis of one teacher versus the analysis across teachers. Principally I have studied particular teachers, but I am writing cases. This difference is important because the boundary of the case was developed far out in the process and the fieldwork was not defined by this theoretical boundary. The cases are approaching typologies, are based on various degrees of time and method triangulation, are basically particular to that teacher but may also be used to gain insight into the phenomena in focus for the case without any purpose of generalization.

First step in building the teacher cases has been to select the teachers to be analyzed and presented in cases. Some factors have contributed to the decision of which teachers to present in written accounts. The selecting process has been determined by:

- The teacher's ability to verbalize his or her student assessment procedures and hence creating richness in citations and statements in different teaching situations. This is the main reason for choosing Pi rather than My, and for choosing Omega rather than Ypsilon.

- The teachers' availability during the period of fieldwork. Some teachers made themselves more available than others hence signaling eagerness to co-operate. This is the main factor of importance for omitting Lambda from my material for overall analysis and hence case-presentation.
- Eagerness to participate, communicate and develop a common platform for discourse. This is the rationale behind developing the discourse with Delta and also one of the factors that made him the sign-poster throughout the dissertation.
- Signaling a personal interest in developing their professional understanding of student assessment.
- By my comparison to the other teachers representing dimensions or specific mix/blend of dilemmas/ideologies and epistemologies.
- Enriching the "types" of described teachers.

The last two points are connected to the single-case and cross-case analysis. The cases are representing one teacher, but the teacher has been chosen to be analyzed and described because the teacher adds to the overall presentation by his or her assessment preferences.

8.5.1 Single case and cross case analysis

The flow of the fieldwork and the analytical process of the fieldwork has been both single case and cross case related. The constant change of locations, the interplay of the preliminary conclusions as well as the mutual illumination of methodological considerations based on different teachers are aspects of the fieldwork in which cross case analysis has been important. During this phase the microanalysis and the constant comparative method involved individual teacher analysis, but also comparing the teachers. The final and overall analysis and the representation in cases are however mainly single case analysis. However the contrasts of teachers and the various ways in which all the other teachers position themselves according to the dimensions within the theoretical frames does have impact on the interpretation of the individual teacher. We are "*constantly making comparisons against incoming cases.*" (A. Strauss & Corbin, 1998, p.89) This fact raises the question whether there is such a thing as single case analysis in theory generating research as there is always some experience that influences the interpretation. Sampling within the material based on the individual teacher is often called sampled within the case. Due to how the use the term 'case' I will based the sampling that goes on within the

material as sampling of specific interview (Hammersley & Atkinson, 1983; Stake, 1998; A. Strauss & Corbin, 1998).

In the comparative constant analytical method, the isolation of signs of representation and the analytical process are intertwined. *“The constitution of sign is thus inseparable from the analysis. Indeed, it is the result of it, since without analysis the sign could not become apparent. But it is also the instrument of analysis, since once defined and isolated it can be applied to further impressions; and in relation to them plays the role of a grid, as it were. Because the mind analyses, the sign appears. Because the mind has signs at its disposal, analysis never ceases.”* (Foucault, 1970, p.67)

Embedded in the research design is accumulation of data from different situations and field experiences. The controversy rising in using the combination of Grounded theory methodology with the situation perspective of ethnographic methods is discussed in section 7.2.8. The initial coding procedures are meant to code for structures identified in each situation, but the same codes are expected to apply in other situations formed by other contextual factors. The structures are therefore given validity in changing circumstances and we are investigating structures valid across situations. There is interplay between coding for structures and coding for process. (A. Strauss & Corbin, 1998) Grounded theory allows for coding the process in cases that the stages and phases of the process are related to the structure evolved from the coding and categorization. This will be used in some of the cases and then much in the line with the following. *“...process can be thought of as the difference between a snapshot and a moving picture.”*(A. Strauss & Corbin, 1998, p.179)

8.5.2 Case-building

Writing up the cases was a continuous interplay between creating the text and Atlas-based analysis of logs, observations and interviews. During the analysis, the categories were developed as open, selective or axial coding.

The construction of the text was hence following mainly this pattern:

- Codes and categories were identified and marked.
- Categories were linked according to theoretical framing by selective and axial coding.

- Relative importance of the different codes was identified according to frequency and repetitions of the same issue.
- The interview statements used were identified going through the data material in search for the categories that were linked.
- Interview segments were integrated in the text with my analysis.
- The text is combining two voices.
- The teacher voice is either directly quoted in cursive with date or origin in parenthesis or indirectly stated following a citation with 'according to Alfa' etc.
- The rest of the text is the researcher voice. This text is interpretation at two levels. Interpretation of the single quotation stated and interpretation of the combination of quotations.

During the axial coding the central category were identified as the category that more or less identified the case. This category was in the next step found in one or more central quotations that were used as headings and as introductory statements. These statements became therefore the beginning as well as the end of the case; the boundary of the case.

8.5.3 Naming the cases

In section 7.6. I pointed at the necessity of constructing cases as a process going through several steps of interpretation. The process is partially guided by theoretical conceptualization, partly by questions raised, partly by initial analysis and partly by experiences from the field. These four elements of the research process are in constant interference with each other (Kalleberg & Holter, 1996 p.33). The cases presentation is consequently seen as a representation of the teachers that I was co-operating with. In order to underline the reconstruction going on in a qualitative research process like this I have chosen to give the cases names that is somehow fictive as human names; Alfa through to Omega. There are also at least two other reasons for this. Gender has not been a main analytical approach. Gender is still visible at several levels. The other main reason is to use the Greek letters to indicate and illustrate how the teachers construct their identity within various possible positions within the theoretical framework. Implicit here are the various patterns that emerged during the fieldwork and analysis which will be presented after the cases as a cross case result.

Interviews are discursive practice formed by both interviewer and interviewee. I was confronting Delta on several occasions in order to bring forward reasoning and hidden ideological rationale for his assessment practices. This quotation from the final meeting, is again signaling his main dilemma; the gap between his focus on externally developed summative testing and in class communicative and relational knowledge construction. Delta is concerned with this dilemma and pointing at it is a means for further reflections. Delta's identity is ideological as well as epistemological dualistic and he is furthermore continually reflecting on dualistic approaches in relationship to the students. Dilemmas are themselves frustrating to some extent, and yet they are a source for reflection. Moreover, he is reflecting on dilemmatic assessment practices in relation to how I am bringing up different classroom and testing situations. Delta is here reflecting on his own process in retrospective. This quotation is included in order to further emphasize the developmental aspect of extended fieldwork as well as the necessity to build on specific educational situations for interviews and substantial analysis. Conducting the fieldwork of this study has attempted at combining these two seemingly contradictory methodological principles.

Delta: "I would like to start with the beginning. At first I taught it was very confronting, that I had such an un-reflected relationship to student assessment... Because, it was very visible that I was focusing on the delivering of teaching and less professional on the measuring of the effects of teaching methods. That was very confronting. And it became clear to me that my degree of individualization was less than anticipated. ... I became very conscious of that. Then over a period I became very frustrated because of the testing format that I feel that I am instructed to use, that there is sort of a mismatch according to my relationship to mathematics. I would like to a larger extent, to emphasize the bildung-aspect, which is apparently more important for me than I realized. My dilemma became very visible. That I am not able to design tests that in a way provoke understanding." (21.5.01)

9 The national educational contexts of England, Norway and Sweden

For my project, I have chosen three different national contexts. The three different countries represent different evaluation and assessment traditions. In order to frame this aspect of the study I will take a starting point from division of three strategies for promoting teacher excellence (Darling- Hammond & Mc Laughlin, 1999). The three strategies are standard-based and curriculum-based strategies, school-based reform strategies and teacher development strategies. The standard based strategies establish goals for the professional performance of the teacher either by stating student intended learning outcome objectives in curricula or assisting teacher performance development through assessment of the teacher. *“The logic of standard-based reform is that once clear goals are specified, the other mechanisms of schooling – will be marshaled to attain them”*. (Ibid, p.386) School based reform strategies focuses on the actual practice within schools and therefore a situated collective perspective on mobilizing the capacity that already exists within the school. Development based strategies has, in contrast to the latter, the perspective of building the capacities of the individual teacher.

The three main strategies are overall developmental strategies. Different educational system will however combine these strategies. *“The power of policies at the intersection lies in their potential to leverage multiple, reinforcing incentives and supports for students’ and teacher’s learning and improved practices. The premise of cumulative effects underlies a spate of policy strategies, many of them stemming from the state level, which have sought to orchestrate the different strands of influence promulgated by government educational agencies, including state curriculum frameworks, assessments, accountability requirements, and professional development resources.”* (Darling- Hammond & Mc Laughlin, 1999, p.392)

The different institutions and the individual teacher will therefore have their own special amalgam or combination of these strategies in any field of inquiry. Of particular interest, is the curriculum and standard based strategy versus the teacher driven reforms. It may also be necessary to make a distinction between the status of the curriculum and the status of the standards due to the different national traditions and the different balances of content,

teaching and learning methods and goals and objectives as stated at the national levels. The teachers' activities and reasoning related to student assessment will in different degrees point at these moments and hence at their relative importance for choosing specific means, tools and learning activities in order to address assessment requirements and necessities.

England is the country that represents the extreme due to the introduction of a national curriculum and hence with one act and one reform developed and implemented for the first time national content based and standard based curricula and regulations. Norway and Sweden on the other hand had prior to the reform of elementary education in the 90ties about 50 years of national curricula traditions. The change in England for the teachers must therefore be characterized as more significant than the case of Norway and Sweden. In addition or as a consequence of this the previous autonomous identity of the teacher has been challenged by externally imposed curriculum guidelines, syllabuses, target statements and assessment criteria. One result is the discussion about the identity of the teacher. This discussion has in particular been addressing the issues about relation between national curricula, national and local adapted syllabuses as well as a comprehensive system of evaluation ranging from individual student assessment to combined school development and school evaluation.

9.1 Reform strategies in England

The National Curriculum¹⁶ (Employment, 1999) consists of 'legal requirements' stated as overall aims and purposes, specific goals for each subject in every key stages and finally attainment targets for each subject in 9 achievement levels. The attainment targets combined with the national grade levels makes up a detailed feedback system. The content of each Key stage¹⁷ is organized into four main topics, repeated at every key stage, in the science curriculum.

In addition, the handbook contains information that should assist teachers in implementing the curriculum like the structure of compulsory education, links between curriculum and

¹⁶ National Curriculum is referred to as NC in most English literature and teacher communication. I will therefore use this acronym.

¹⁷ Key stage 1 from year 1 through 3, key stage 2 from year 2 through five, key stage 3 from year 3 through 7 and key stage four from year 7 through 11.

qualification standards, cross curricular competencies and some general teaching requirements like inclusion, language skills, ICT and health and safety. Based on this curriculum an extended apparatus of syllabuses (Board, 2001, for example), teacher guides, textbooks and assessment tools have been developed. Of particular interest is the combined teacher planning resources with a clear link to the final examination procedures and content (Gannon & Parsons, 2001, for example).

Concerning the summative and formative aspects of student assessment, England has today five parallel systems of assessment testing. They are in the order from degree of possible formative strategies to definitively summative strategies: the teacher/school directed day-to-day assessment, standardized tests for diagnostic and selection/ability grouping purposes managed locally, vocational and occupational selection testing, national assessment at 7, 11 and 14 and finally the General Certificate of Secondary Education or the final GCSE examination in all subjects. (P. Black, 1998b) With a dominance of summative procedures there is a question whether these procedures will both draw attention away from the formative aspects of teaching and that day-to-day assessment will be based on the same testing routines out of convenience, time constraints or prepare the students for testing situations. The techniques of external summative procedures will in sum influence intended formative procedures. On the other hand, Black and William found indications that emphasizing the application of formative assessment are able to raise the standards of student achievement defined by the criteria set by the curriculum (P. Black, J. & William, 1998c). The condition is that they are given equal status within the educational system as a whole. Under such circumstances, the accountability aspects of summative assessment and the teaching improvement aspects of formative assessment could enhance each other, (Preece & Skinner, 1999).

This system of assessment is primarily directed at the students, but some parts are forming a bridge from student assessment into system evaluation based on students' achievements result. In addition to this large testing system, there is system for evaluating most aspects of school educational planning and activities managed through a combined approach of self-evaluation/development and external evaluation. In the OFSTED¹⁸ handbook it is

¹⁸ OFSTED is the abbreviation used for Office for Standards in Education and the subdivision dealing with the inspections are the Inspection Quality Division Office for Standards in Education.

stated that a good inspection is characterized by valid and reliable evidence about the strengths and weaknesses of teaching based on judgments about educational standards, and that this major findings should be reported to the school in order to facilitate school improvement. This dual mandate of the inspectors is further emphasized in statements like inspectors should “*establish an effective working relationship with the school based on professionalism, sensitivity and an understanding of the school’s concerns and circumstances*“. (OFSTED, 1999, p.1)

A number of authors has addressed this changing conditions for the English teachers, most of them by claiming that the teachers has been subjected to a decreased ownership to their own professional life (Woods et al., 1997) (Firestone, Fitz, & Broadfoot, 1999; Jeffrey & Woods, 1998). One interpretation of the underlying mechanisms behind the national agenda, the selection of the subjects and the implementation strategy was summarized like this. “*The conserving of the traditions was more important than the actual training in critical and emancipating reflection as stated within the social sciences.*” (Telhaug, 1997, p.37, my translation)

Another author states the restricted identities of the teachers and the management that may result from this educational reform like the following quotation. “*The fact that the whole of the National Curriculum is framed in terms of its content and explicated in the form of curriculum objectives means that in its entirety it becomes instrumental and must inevitably fail to achieve, except by accident those more subtle developmental goals we saw just now it also sets itself; for these require more subtle developmental approaches to the curriculum of a kind that the Act does not allow or, indeed acknowledge.*” (Kelly, 1999, p.211) This argument comes with a view that the autonomous teacher’s ability to make professional sound judgments rests on a curriculum whose educational ideology is based on processes and developmental views rather than the view of products and objectives. There is however, a question whether the ownership has been decreased or changed, that the new autonomy results in a necessity for qualifications less demanded before, but that the new teacher identity may also result in reflected practice based on different qualifications. (Boxall, Gilbert, & Qualter, 1999; Butterfield, Williams, & Marr, 1999; Day et al., 2000) Among the positive affects that have been reported about the national testing has been the teacher’s comprehension of definitions of curriculum statements due to the link between curricula content and testing items. The same article

reports on negative effects like neglect of the teacher produced assessment tools. Teachers increased understanding of the different dilemmas of assessment is according to this study entirely framed by the ideology of the national curriculum. (Preece & Skinner, 1999)

Research and development projects that include the voices of the teachers are necessary in order to investigate this question. (Leat & Nichols, 2000) *“Especially in a system where summative assessment is so strongly embedded as it is in England and Wales, but in a wider context as well, it is essential that people who are claiming to become teachers recognize that assessment takes on various forms, that it offers positive benefits as well as risks, but that above all it needs to be thought through and carefully considered it is to be truly effective and educationally beneficial”*.(Brant, Lines, & Unwin, 2000, p.278)

In the case of England therefore, in sum, the strategy from the national level has been a standard-based and curriculum based strategy even if there has been some elements of school-based and teacher development strategies. In the light of the references included here the question is therefore whether the minor strategies merely have been tool for the overall curricular and standard driven reform. Curricula can be seen as the *“narration of the nation”* because *“The pedagogic authority represented by the State will seek to produce structures and curricula that are designed to maintain national identity, particularly at moments when national authority might be in question.”*(Ross, 2000) National educational reforms including written manifests like curricula and assessment standards are therefore another political tool to educate newer generations into the ideologically frames of the existing governments. There has been *“a gradually changing emphasis from essentially criterion referenced assessment procedures, which reflected a concern with the attestation of competence and, hence, with content validity, to that more characteristic concern in England with mainly norm-referenced assessment, which evolved as selection and its legitimation become the major task of public examinations.”* (Broadfoot, 1996, p.169)

The debate in England has been influenced by this view on democratic processes behind the establishment of national curricula. This debate has, however been just as significant in the case of Norway and Sweden. (Koritzinsky, 2000; Lindensjö & Lundgren, 2000; Telhaug & Aasen, 1999). I am therefore turning to similar introduction to these countries.

9.2 Reform strategies in Norway

The Norwegian curriculum guideline (KUF, 1996a) has stated objectives at several levels. These objectives levels are in the Core Curriculum general ideological statements about schooling, in the syllabuses for each subject stated aims for the whole subject, including methods and general expectations and thereafter objectives for each age level and each topic. The content for each school year has been mandated through this curriculum, and for science, there are four topics that are annually repeated. The national curriculum states intentions for instructional methods to be used including project based instruction, ICT, practical work and play. The current Norwegian curriculum is hence a combination of detailed content and methods. The implementation strategy is based on locally adaptation and local development of syllabuses has been mandated (KUF, 1996a; Telhaug & Aasen, 1999).

Norway does not have a comprehensive system of evaluation and assessment similar to the English system (Johannesen & R., 1997). Concerning student assessment the emphasis has been put on a combination of summative and formative overall approaches. The major summative assessment tool is the final examination in one, arbitrary selected, subject for each school. (KUF) These results are fed back to the school as well as through the administration of the educational system. In addition, there has been an ongoing development of diagnostic tests at national level. These have intentionally combined summative and formative purposes. The major testing in the schools is therefore the school- and teacher developed tests. The student grading system in Norway has 6 levels of achievements and some corresponding formulations about requirements that should be applied on all subjects. These statements about criteria to be met for the different levels are not accurate in order to be defined as a definite grading system. There is however, an intention about that in the standards or criteria is defined by the objectives stated in the curricula. “ *When issuing grades in the every subject, the emphasis should be put on the extent to which the student has gained a competence in the subject according to the description in the subject curriculum in the curriculum guidelines for elementary education by the use of overall aims for the subject, the objectives for the actual year and the content of the subject.*” (KUF, 1997b, § 9-2 nr 3., my translation) Further concretizing of the criteria to be met for each grade is a part of the teacher mandate and integrated in the implementation strategy. Grades ‘5’ and ‘6’ should correspond to high degree of goal

achievement, '3' and '4' correspond to average degree of goal achievements and '1' and '2' correspond to a below average degree of goal achievement. The former requirements about percentage distribution of grades issued, as required in a relative grading system has been abandoned. (KUF, 1998a)

The debate about assessment, curricula and steering in Norway has been influenced by on the one hand argumentation about the necessity for clearly stated objectives and corresponding result measurements. From this perspective the guidelines have, because of political compromises, embraced several conflicting views on learning and assessment. On the other hand, this discussion has been influenced by arguments that narrowly stated mandates would imply scripted teaching that would result in a degradation of the autonomous teacher. (Bjørnsrud & Raaen, 1996; Fuglestad et al., 1999; Grepperud, 2000; Koritzinsky, 2000)

Curricula organized around objectives are just one aspect of steering by objectives. Steering by objectives requires a comprehensive system build on the combination of objectives with corresponding reporting of results with following characteristics. All laws, curricula and regulations have to be stated as objective/result expectations. Statements about implementation of these objectives should include expected responsibility for all levels of the education system and that the objectives will be locally interpreted and adapted according to instructions. The choice of educational methods is based on professional judgment by management and teachers, and the initial and in-service training of the teachers include steering by objectives. Measuring of results is based on objectives and these results are important for further decision making. This requires information and feedback systems for the entire educational system. Criteria and methods for assessment, including grading and referencing has to be building on the objectives. (Granheim & Lundgren, 1990) Some of these requirements are fulfilled in the Norwegian steering documents, but there is a lack of a feedback system and lack of a comprehensive implementation system in order to claim a steering form like this in Norway. There is also a question whether there is a system of grades that is strictly one-dimensional and hence strait forward interpreted and applied. (Popkewitz, 2000)

In the case of Norway, the overall conclusion is therefore that the first mentioned strategy of curriculum and standard driven reform has been the main strategy by the national level.

Comparing Norway and England with the respect to the strategies the main difference does not lie in the use of one of the three, but in the use of curricula stating content and objectives versus reform through explicit standards formulation and measuring tools as two major constituents of the first strategy. School based evaluation and self-evaluation combined with development strategies have been encouraged nationally. During the past period of reform, there has been an increase in participation in international comparative research on student achievement. A national information system is continually discussed and annual reporting from the county administration offices has been introduced. There has been a combined emphasis on steering by regulations and steering by objectives. (Telhaug & Aasen, 1999)

9.3 Reform strategies in Sweden

The Swedish curricula for elementary education (Skolverket, 2000; Utbildningsdepartementet, 1998) have three main parts, the overall foundation for teaching, a curriculum for each subject and criteria for grading. The objectives, in the first two mentioned, are stated as objectives to strive against and objectives to achieve. The intention of the combination of the overall curricula, the subject curricula and the criteria for assessment using grading is stated as the importance of reflecting the texts of the subject curricula in the outlined values of the overall foundation outlined in the curricula. Furthermore, it is the latter category of objectives, objectives to achieve, which are subject to assessment. Simultaneously the objectives to strive against are found operationalized in several of the subject curricula. (Skolverket, 2000)

The view on knowledge that the existing Swedish curricula addresses is that knowledge is constructed in the intersection between the existing knowledge and anticipated future achievements and experiences. Knowledge foundations are tools. Knowledge is human constructed and has its significance in the application in a practical and social situation. (SOU, 1992) These statements about knowledge has found its place in a corresponding implementation strategy stated that the *“knowledge construction of the students are influenced by how the school is organized”* (Ibid, p.80, my translation). As a consequence of the open form, the curriculum it is the teacher task to locally interpret and adapt the objectives according to the needs of the students and the overall local circumstances.

Concretizing of objectives in the national curriculum is hence a part of the steering by objectives in Sweden.

The grading system within the present reform was established as a three level system¹⁹ defined by criteria stated as objectives for each subject for year 5 and 9 and the grading system is therefore an absolute or definite grading system. (Skoleverket, 2000; SOU, 1992)

When it comes to the combination of the curriculum with the grading system, the result must be seen as a consequence of two parallel committees' emphasis. The curriculum committee was emphasized different aspects or domains of learning, while the grading committee emphasized levels of learning in hierarchies. These different perspectives of learning influenced both the processes and the products. *"The consequence was that the grading system and the curriculum in important respects were not in harmony"*. (Lindensjö & Lundgren, 2000, p.108, my translation)

The national student assessment has been significant. All students should be tested in all major subjects after year 5 and year 9 according to the objectives stated in the national curricula. The combination of formative and summative assessment procedures in Sweden has had similar dual emphasis as in Norway.

9.4 Differences and similarities between England, Norway and Sweden

The differences and similarities that will be pointed at here have been important for the theoretical sampling or selection of the three countries. The teachers participating in the fieldwork has had their practice within these systems. As stated comparison of the national educational contexts or comparison of the teachers is not the intention, however the institutional setting of the individual teacher will in various degrees influence the teachers' assessment agenda.

The combination of reform strategies has had a third twist in Sweden, compared to Norway and England. The more open curricula guidelines in Sweden, compared to both Norway

¹⁹ Godkänt, Väl godkänt and Mycket väl godkänt

and England, have been combined with a more comprehensive national system for evaluation, which makes Sweden similar to England than to Norway in this respect.

Investigating the details of content in national curricula the similarities between Norway and England are the detailed outlining of the content, even if the Norwegian plan has annually mandated content and England content mandated at each key stage. In addition to the national curricula in England, there are nationally and municipally developed syllabuses that have come to fill the same function as the national curricula of Norway when it comes to content of instruction. Sweden is the extreme here in the relative open curriculum and no corresponding semi-mandated syllabuses. This could be interpreted as considering the curriculum the teachers in Sweden are given more autonomy in implementing them.

The grading system however, is similar between England and Sweden in the detailed statements about competencies required to meet each grade level for each subject. In all three countries, there are intentions about an absolute grading system based on definite statements of criteria. Criteria statements are most rigid in England and in Sweden. Both Norway and Sweden has mandated interpretation and concretizing criteria for grading at the different grade levels. Considering then grading system and standards for grading the teachers are given a roomier mandate in Norway than in Sweden and in England. Norway is the country with the most rigid, detailed and definite statements about objectives at the national level within the curriculum. All three countries have their own solution of the relative significance of assessment of achievement and curricula objectives as the two important constituents of the educational teacher mandate.

Overall, all three countries had been under an influence of centralization, in the sense that larger emphasis has been on the national stated content and on national stated student assessment procedures. Parallel there has been in Norway and Sweden a tendency towards decentralization in emphasizing local development strategies, local development of assessment tools, locally adaptation of the content of curricula and local interpretation and concretizing of the grading system as assessment feedback. This combined centralization decentralization processes are for Norway and Sweden again a special amalgam of the three reform strategies. However, the major strategy has in both cases been the combined curriculum and standard strategy. This centralization versus decentralization combined

with steering by objectives for increased professional autonomy has been the major themes in all three countries.(Lindensjö & Lundgren, 2000)

The various curriculum and standard strategies and the corresponding implementation strategies carry with them intended epistemological viewpoints. The curriculum that is stated primarily as detailed objectives of learning draws on an epistemological viewpoint that considers knowledge to be predefined rather than socially constructed. Secondly, these curricula signal that knowledge can be defined in pieces rather than the opposite view that knowledge is comprehensive, continual and relational. Thirdly, universality of knowledge is up against applicability, utilitarian and contextual aspects of knowledge construction. The curricula of England and Norway have an overall more predefined, universal and fragmented closed form. The implementation strategy in Norway should compensate for this universal knowledge view. The curriculum in Sweden opens up for interpretation, contextual and applicability to a larger degree in the plan itself and this is further underlined in the implementation strategy. (Lindensjö & Lundgren, 2000)

A grading system based on hierarchic of knowledge points towards epistemological positioning closely related to behaviorism and individual cognitive theories. This is the case in all three countries, but with different degree of details at national and at local levels. A grading system based on relative grading is based on comparison between students and group referencing. This is more closely related to a summative assessment approach. A grading system based on criteria statements and objectives has an individual approach and can therefore be applied ipsative and formative.

Then finally, this dilemma points towards a combination of the epistemological positioning, which is a part of the guidance versus control dilemma, with the systemic approach to a mandate for assessment. From a systemic approach this represents the various positions a teacher may reflect upon and hence the dimensions of the teacher identity.

9.5 Teachers in different educational contexts

Selection of teachers was done according to a combination of purposive and theoretical sampling. However, at the same time it was a much the teachers that selected me as I

selected them. Initially they were chosen by head masters, teachers educators etc, but the teachers that were actually informants choose themselves based on either their interest for the issue of student assessment or the general interest to discuss educational matters with an outsider. Along with others, I may conclude that the sample of teachers was based of what opportunities they and I had to co-operate. It is hence a combination of opportunistic sampling (Troman, 2002) with a dash of mutual understandings and interests for student assessment that determined their participation.

The theoretical sampling has been done according to an understanding of the national intentions set for teachers and an assumption that the formal mandate set has had implications for how the teachers interpret their teacher identity with emphasis on assessment. The initial intention was to describe teachers within a different context and use the information generated to mirror the Norwegian teachers. Initially then the choice of the different contexts represented in dual understanding different qualitative aspects. The teachers are set within a context whose qualities are of unique importance for the individual teacher.

At the same time as the teachers have been selected to represent themselves they have also been selected within different education system and somehow represent their education system in their own unique way of implementing the student assessment and curricula principles stated by the system. Uniqueness is the key and representativeness is subordinate (Merriam, 1998). The result is teachers who assess and evaluate, act and reflect on their actions based on several factors of which the national intentions are only one. I have chosen to set the frames for the individual teachers by stating the actual national guidelines as a part of the individual teacher's context rather than major theoretical framing for analysis. This is also a result of the micro analytical approach; the importance for the teachers in their arguing was not the national intentions and their interpretation of the national framing rather how do they learn, how do students learn and what are important aspects of the teaching of science.

Adding two different national contexts may on one hand increase the number of student assessment factors that can be illustrated, but at the same time, it represents introducing another dimension to the analytical framework. That they do teach and act within other countries and according to different curriculum frames and student assessment procedures

have to taken into consideration because strategy documents is implemented in order to have impact on educational planning at all levels. Another contributing factor to the complexity is that some practices and reasoning may be traced to statements at an intended level, but other practices, discussions and rationale may be traced to the history of the national educational system without being made explicit from or for the teacher. *“How learning is organized, how it is perceived, how issues about it are debated is always rooted in the particularities of national histories, of national habits, and national aspirations.”* (Reid, 1998, p.11) The teachers are representing themselves and not their system. Some aspects of their thinking can be traced to the system, but this does not make the teacher an advocate of the system nor does (s) he represent the system. The degree to which the rules for student assessment are set by the national, the county, the municipality or the school are subordinate to the presentation here. Nevertheless, it will still come through during the many examples how significant the teacher finds the national rules or the national history of the education system. The teachers represent themselves even if cross-national patterns of similarities and differences may be interpreted. This is not a comparative study meaning comparison between countries even if it does have teachers practicing within three different countries.

9.6 Research questions related to the application of methodological framing for exploration of teacher identities regarding student assessment

This fourth set of research questions is emphasizing the application and development of the methodological framing. This framing was however also a part of the research questions stated at the end of Part II and will therefore have to be considered in combination with research questions A, B and C.

D. Research questions regarding the application of ethnography and Grounded theory methodologies:

What are the methodological considerations concerning the investigation of science teachers actions and reflections concerning student assessment?

What are the relative contribution of the theoretical framing versus the empirical indication in the knowledge construction concerning teachers' actions and reflections regarding student assessment?

How are the participating teachers constructing their identities in relation to the researcher and vice versa?

What are the relative contribution of the two methodological approaches when it comes to the situational and cross-situational analysis of teacher actions and reflections concerning student assessment?

What are the contribution of the various chosen methods for the knowledge construction?

What are the situational versus the developmental knowledge construction according to the two methodological approaches?

How are the cases or typological constructed regarding the different methodological considerations?

PART IV

Teacher Cases;

From Alfa to Omega in Student Assessment

Five teachers are presented in this part. These teachers have found their own combination of epistemological and ideological positions within these dimensions of dilemmas of student assessment. Some of these teachers are ideological non-dualistic and others are ideological dualistic. Some of these teachers are epistemological non-dualistic and others are epistemological dualistic. The teachers that are in action or in statements signaling various ideological and epistemological positions are to varying degree considering this dualist positioning as dilemmatic. Some of these teachers consider dilemmas to be challenging for reflection and hence to some extent desirable, yet other teachers consider dilemmas as genuinely undesirable. There is also one example of a teacher that resists dilemmas of student assessment. Each of these teachers are serious about their teaching, their individual grace is precisely that.

Each of the teachers is unique as human beings, as teachers and as discourse partners. It is my hope that this uniqueness is kept somehow in the following presentation that is my reconstruction of our communication. The cases, as my interpretation of the teachers, are framed and colored by my experiences, values and attitudes. There has been a need to create a complete story about each of the teachers. This need has resulted in cases which are each of them a finished quilt, the pieces of practices and reflections has come together forming different and one of a kind reconstructions. The finished quilt-top is a case with a unique design. However, I constructed the design. The pieces have been chosen because they represent one or more theories important to illustrate using the practices and reflections of the individual teacher.

Alfa: “We have to teach them to observe outdoors and in the lab....specially that about outdoors is important.... out there in the real world. We are becoming an indoor-school. The students must learn from observations in the field as in the laboratory. In biology they can do fieldwork and enquiries and learn to observe the surroundings. They will learn from these observations ... and they will appreciate science.” (30.3.01)

10 Alfa

Grading and assessment for summative purposes

The case of Alfa is a case about a teacher whose motivation is to teach lower secondary school sciences as the natural sciences is understood within the academic disciplines. More specific Alfa is building his teaching entirely on the contemporary contents and concepts of the natural sciences. The initial quotation has been chosen due to the emphasis of observing as a part of scientific enquiry, and according to Alfa as a consequence of this also as important for student learning. Alfa's teacher identity may therefore be understood as a position taken or defined by the scientist. His practices and his statements about student assessment follows mainly a pattern where he argues for testing for summative purposes, for using of objective and collectively set measures for grading and for taking the objectives from externally defined curricula. The teacher mandate stated in the Norwegian national curriculum as well as strategic documents concerning student assessment has a contribution in his argumentation.

10.1 Introducing Alfa

Alfa was teaching year nine when I first met him and when conducting the last interview his students were about to graduate from compulsory education. He has the usual combination of mathematics and natural sciences on his teaching schedule. Alfa possesses a higher degree in sciences and has his teacher certificate from the yearlong teacher education course given at universities in Norway. Alfa teaches at the same school as Gamma and Sigma, but the three participating teachers teach at different age courses and are therefore not co-operating or communicating to any significant extent.

The emphasis of science teaching for the purpose of communicating the structures and the content of academic sciences becomes apparent in the structuring of the lessons as well as

in the introduction of concepts during instruction. The structure is most often that the teacher presents the topic and one or more scientific concepts are explained and illustrated by some examples of how the concept is used within the sciences. In his examples the concepts are defined in relationship to previous mentioned scientific concepts. After this whole class introduction the students work individually or in pairs solving tasks or doing laboratory work. His reason for this structure is that the understanding of the concepts has to be taught first and thereafter practices by solving tasks theoretically or by laboratory work.

Conceptual basic understanding is the core and the major portion of the teaching in Alfa's classes. The concepts are presented as facts and valid under all circumstances. The concepts are also presented as valid according to the relationship with other concepts of science. Concepts are introduced by their definitions; "*acids have pH lower than 7, while bases have pH higher than 7.*" The chemicals at hand, the indicators, bases and acids are used to illustrate these definitions. Thereafter the students would do the same small experiment to see the same results of coloring of the indicators. "*I have found my own combination of theory and exercises that I think is necessary for them to understand. They have to learn to observe because it will become handy later on. They will use that later, that they have learned to observe. The rule is that we have some theory first and then it is correct as one of them said that they do not learn anything new with the exercises afterwards, but the exercises illustrate the theory.*" (30.3.01)

In this example of many from his classes, science is presented as a closed system, built on an enclosed internal logic. The significance of the subject in education is to facilitate learning of this closed system of knowledge. This is the view on natural sciences that Alfa wants to transfer to his students. This is the beauty of science that motivates Alfa, and this is the epistemological view that underlines his teaching strategies and his assessment strategies. Within this understanding of sciences as a closed system, Alfa would also give the students feedback on their achievements.

The quotation above the heading has been chosen due to one of the concerns Alfa has. He thinks that the students should learn from the nature and from spending time in the nature. He is the advocate for observation as a primary source for knowledge. The students should learn from nature and about nature in order to understand the mechanisms of nature. He is

concerned with the joy and pleasure that spending time in nature may contribute to the individual knowledge bases, and this should be the motivation for learning science. The natural science in compulsory education has, according to Alfa, its legitimacy in the extent to which it is able to give the students appropriate knowledge about the nature around them. He is addressing a view on science as secondary school subject that is signaling the emphasis of 'structures of sciences' combined with the emphasis of 'solid foundation'.

There is more to the case of Alfa than this seemingly comprehensive view on assessment and science teaching. The case of Alfa is moreover a case about a science teacher who expresses a need to challenge his competence within student assessment, but who simultaneously is resisting implementing changes into his strategies. Alfas case is a case about a teacher with a specific ideological position who is resisting additional ideological angling like acknowledging the human enterprises involved in education. A consequence of the signaling an awareness of this challenge is to address his scientific view on knowledge building that he transfers to student knowledge construction. Assessment is for Alfa the control of student achievements according to the texts representing scientific knowledge in textbooks and the curricula. Teaching techniques are to assist their learning, but assessment has to be objective and therefore cannot be related to the individual students learning process. His focus is not the individual student as his focus is the academic subject.

During the fieldwork lasting about one year I was continually challenging the different aspects of this view of assessment. Alfa gave several statements that signaled restlessness with his current student assessment practice. My interpretation was that he lacked the didaktik tools, the necessary terminology and alternative strategies for undergoing a change. Therefore the case about Alfa is a case about challenging a fixed and yet unsatisfactory practice of student assessment. As a researcher I found myself in situations continually reflecting on two opposite but equally important concerns in building a relationship to Alfa. The first concern was challenging him and the other concern was supporting him. Therefore the case of Alfa is a case about dual struggles; the struggle of the researcher to define the methodological position and the struggle of Alfa to address assessment issues by partly defending his own position and partly challenging his own position.

The questions that this case will illustrate are consequently of two different kinds. The first set concerns substantial issues. With a fixed view on assessment based on an epistemological positioning in which the objective true knowledge is emphasized as the overall learning objective as well as the means for learning- 'the structure of science'- what are the corresponding reflections about assessment and what are the corresponding assessment strategies? Taken this emphasis as a starting point what are the aspects of assessment that Alfa manages to include in his planning and execution of teaching, and what are the aspects of assessment that he is unable to include?

The second set of questions concerns methodological issues, but still with the core of assessment as the substance. When Alfa is signaling a feeling of insufficiency regarding his ability to address the issues of assessment, in which order and in which situations do I introduce to him the alternative epistemological and ideological aspects of student assessment? Moreover, according to the same diagnosis of Alfa; will he benefit from participating in these discussions if I present the issues of assessment as sets of dilemmas or as alternative techniques to what he is now using? If the discussions with Alfa have to revolve around his increased reflections how can I at the same time and according to the ethnographic design find indications on which I can build a case about assessment positioning? In the meeting with the teacher Alfa the overall methodological question became how we mix his agenda with mine. When all these questions are raised a final question follows inevitably. During the course of the communication with Alfa what are the changes in his statements about assessment, and what do these changes reflect as potential different positioning?

10.2 Grading as the tool for assessing students' achievements.

Alfa used grading frequently. He would issue grades on all written assignments including laboratory journals and task solving, minor and major tests. But even more important he would refer to the achieved grades when discussing the individual student, the achievement levels in his classes and communication with the parents. Grading served two purposes. They were the main tool for communicating results and they were also the main tool for describing his classes. Alfa was concerned with the reliability of grading, and he argued therefore for grading as objective measures in order to ensure fairness. For these reasons grading was the assessment issue that we most frequently returned to, and will

consequently be significant in the presentation here both on the conceptual and on the methodological level.

10.2.1 Grading as description of classes and students' achievements

When Alfa talks about his classes and about the students he is eager to characterize their achievements according to the grading system and the grades he has issued. The first time I asked how he would characterize the students in his classes he says the following. *"In this class there are so many students above the average and some under average. That is what makes this class so special. We do not have the whole range of students. In the other class there are students at all levels and I use the whole grading scale. Here I would like to show you how the best student achieved in the last test. This student always receives 6's."*

(24.9.00) Testing is an important source of information about the knowledge level of his students.

My initial interpretation is that Alfa finds it convenient to describe the classes and the achievements of the individual student in terms of the grades he issues. The convenience of this argumentation is furthermore elaborated by questions asked about the criteria for the grades issued, about what he more specific puts into the different grades and by further reasons for the differences between the two classes. At these points there are no further comments or statements from Alfa. The description using grading scales seems to be adequate for his purposes of explaining the mechanisms in the classes for me and for bringing forward the achievement of some students. Implicitly he is also indicating the challenge he is facing teaching these classes. Many of the students are off task during the classroom hours. Alfa asserts *"I cannot force them to do particular things. It is up to them to decide how they would like to work."* (24.9.00)

The additional message of pointing at outstanding students is made explicit, and this is in addition a message about Alfa's abilities as teacher. He uses the grading at this point as measures signaling the outcome of his teaching. When talking about final oral examination in science Alfa says *"I am hoping for oral exams. I think that I will get many 6's."* (30.5.01)

Following my initial interpretation I find it important to outline a strategy by which Alfa can gain an insight into his reflections about grading as a tool for student assessment

combined with the specific foundation on which he bases his grading. It is however important to contextually ground this strategy by examples of grading and corresponding criteria used in tests, in laboratory journals, in the different forms of oral feedback and in biannual plans to build further discussions on.

In my mail to him after the mentioned visit I write among other comments *“In your classes there are large variations between the students as you state. I am wondering whether this is due to, despite your knowledge of and communication with the individual student, your communication of the natural sciences as something neutral and that the subject is not necessarily is relevant for their life. Science is also about processes, about human beings and their eagerness to reach new insight and knowledge. I think we might agree here. This dimension is however not visible in your teaching as we talked about. The subject is presented as a subject consisting of fixed answers with the human aspects showing up neither in the content nor in learning activities. The subject has relevance for the individual student as well as the learning process is individual. I look forward to your comment about this.”* (E-mail 29.9.00) In addition to the technicalities of student assessment that many of our discourses came to be centered around, this E-mail was initiating communication about the relationship between grading and epistemological and science ideological aspects of student assessment. The concern was possibilities for growing insights into the assessment as indicating viewpoints on learning and on science as a teaching subject.

The next time I was visiting his school and had appointments with Gamma, Alfa says that he wants to talk to me. Following my mail, he outlines his view on knowledge construction in natural sciences and student knowledge construction. (24.10.00.) (Due to the unexpected situation I did not have my recording advice at hand and hence have to refer the main content of his messages without the exact quotations.) Concerning scientific enterprise as a human construction Alfa says that he totally agrees with me. He also thinks about the natural sciences as historically gradually developing knowledge about the nature rather than mirroring the nature. Different periods have different answers and models explaining the phenomenon in the nature. These aspects of science as human enterprise viewed within a relativistic epistemological frame should not be reflected in the teaching of the sciences at lower secondary level. At this age level, the students are not mature enough to understand sciences like this. Therefore Alfa’s principal view is that these students have to

be presented with a subject where most of the knowledge is presented as facts and fixed generalized theories. Basic knowledge should be taught according to the definitions of concepts within these theories. He claims that he is aware of the influence this view on student knowledge construction will have on his student assessment practice. Based on this we agree on working with the construction of tests, strategies for returning tests to the students and different aspects of grading as a part of this. I leave Alfa that day with a feeling that we have to separate the two issues of the technicalities of assessment from the epistemological and ideological aspects of assessment as well as assessment seen in combination with teaching strategies and learning activities in order to continue my discussions with him.

10.2.2 Testing and grading

The following day we discussed a test and Alfa had two important comments about his testing. The first comment concerns the test construction itself and he said *“At this age group we can test the facts and the combination of the facts. Sometimes they can be asked to interpret the facts within the scientific concept, but that is it.”* Alfa's tests are constructed for the purpose of assessing the bits and pieces of knowledge. Alfa argues that other forms of knowledge like evaluating and application are beyond their maturity level. The other comment is about the grading of the test and about the form he uses as a feedback tool to the student. In this form, there are three levels, above average, average and below average. *“Average means that student receives a 3 or 4.”* (25.10.00) There has, at the least at this time, been no attempt at defining the criteria to be met in order to achieve a grade without the use of the grades themselves. Alfa signals again that the grades are themselves defined objectively and therefore no further criteria are needed. A third factor concerning tests is that his tests are designed so that the first tasks require shorter answer, and the following tasks require longer answers. *“This is the pedagogic way to do this. They can use the first items as ‘warming up’.”* (30.5.01) It is basically this test construction in combination with his feedback strategies that has made me put the main label of behaviorist on Alfa.

The testing is done entirely for summative purposes. There are no further comments given to the students that would explain the grade given or possible learning potentials. *“They do not look at the comments. All they are concerned about is the grade.”* (25.10.00) My interpretation is that formative purposes of assessment are at this point not Alfa's agenda. He issues grades for the purpose of communicating achievement levels more than the

concern of contributing to their individual learning. At this point in our conversation I am turning to the counseling aspect of student assessment. I leave Alfa that day under the understanding that he should in the future feedback have attempts at using the forms to comment on their achievements using words in addition to grades. I am aware of the difficulty this would arise since such comments require criteria, some definition of the objective for learning based on either the individual student or group/curriculum criteria, on which the comments should be based. Bringing up this point of formative approaches therefore forces the discussions of reference for assessment. Discussing grading within a summative approach does not necessarily compel these aspects of assessment for Alfa.

The test is based on the textbook and on curricula. A test should not according to Alfa reflect the actual activities going on in the classroom. That would not be fair. Fair testing has to be based on the texts in the textbook because all students can study these texts regardless of their involvement in the classroom activities. There are no attempts at including or referring to learning tasks or activities in the items of the test. Testing is conducted in order to control the students' outcome of the teaching of one or two topics. Grades are always based on points issued for every task. Concerning the reliability of tests Alfa says this later in the fieldwork period. *"I would like to have the opportunity to issue the right grades and it is fair if they are all solving the same tasks and then I can compare when marking."* (27.4.01) The importance of objective measures is his main concern. He thinks fair testing is assessing all students according to the same criteria. Therefore Alfa's assessment procedures are basically group referenced as he is more concerned with the validity according to the all the students and he finds that this is best when the content of tests are defined by the texts in textbooks.

So far, in this presentation, the statements about the grading system itself are lacking. Grading has been presented as the tool to communicate the results to the students, to the parents as well as to colleagues and to me. Moreover, grading has been used in order to characterize the classes. These discussions about the application of grading system are safe in that the more complicated aspects like individual preferences and corresponding positioning are avoided. Two aspects of grading will be followed in our conversations to come. The first one is the epistemological and ideological preferences and for this purpose it has become convenient to use the assessment and grading of laboratory journals as the

learning activity. The second aspect embedded has been the reliability and objectivity of Alfas argumentation of grading as a major assessment tool.

10.2.3 Laboratory journals; grading and epistemological considerations

The next time we talk about grading Alfas says, *“What I do is to write some few comments on each journal and add the grade. I issue grades for every journal (laboratory task) so that I can write them all in this form and then I have a summary in this table over who has delivered, what grade I have issued and then I can issue the final grade based on this. They will receive 3 or 4 if it is OK, 5 if it is very good, and 6 if it is exceptional. They will have 2 or 2+ if illustrations are lacking and the rest is insufficient. I will never give 1.”* (27.1.01)

In this quotation Alfa is pointing at another reason for issuing grades that seems to be important for him. He is systematically gathering the grades in order to document end of term grading and final grading. Grading for him becomes the tool for documentation of the students’ achievements as well as the documentation of results to build end of term and final grades on. He is aware of this responsibility as a teacher, and is concerned with documentation for future use. During this visit I am commenting on changes in his classes. Most of the students seem to be working on tasks and the classroom environment is quieter than previous experiences. Alfa is pointing at grading issued in order to explain this change. *“I think it is because they know that at this point it becomes serious. They were confronted with the seriousness of the grades at Christmas. Some of them did not receive the results they were hoping for. At this time there is full effort in both mathematics and in science.”* (27.1.01)

As mentioned I felt uncertain whether it would be possible to return to epistemological and ideological aspects of assessment. Alfa has on a number of occasions talked about the importance of using laboratory work and fieldwork as learning activities for the student to learn science and to understand the importance of and the status of observation techniques within scientific enterprises.

“They will learn from these observations.” (27.1.01)

“The students will learn to observe in the field as in the laboratory.” (30.3.01)

“The important thing is to learn the basics- to learn about the real life- what you find out there. To read about it is not the real life.” (30.3.01)

According to these statements observing is a main activity on which the students may draw conclusions that may in the next phase result in conceptual learning. He is signaling a view

on student learning. Students are learning the concepts of natural science as they are defined within the academic fields by the use of scientific methods and one major technique is to observe and learn to draw conclusions based on these observations. I therefore find it important to stress the assessment of laboratory journals with specific emphasis of assessing the students' ability to undergo and communicate scientific methods. Again, and in order to build on previous discourses as well as Alfa's terminology the starting point is the grading of the lab journals.

Alfa: *"It is good motivation in receiving grades on all the lab journals."*

Astrid: *"Do the students know on what basis you are grading them?"*

Alfa: *"Yes, I have repeated that so many times: Good hypotheses, the purpose, observations and illustrations. All of that should be included. I have this sheet of paper; how to write a journal that I have issued a number of times."*

Astrid: *"As mentioned before I am concerned with the feedback to the students and the possibility for the students to use this feedback in order to learn how to progress. Is it possible to get at this with the use of these forms?"*

Alfa: *"When using forms there are often important things that are not included. Every report lives its own life. This cannot be put into a form."*(27.1.01)

I am surprised by this last statement of Alfa. He has on earlier occasions defended the use of forms in order to keep track of the students, but in this situation, he is signaling some uncertainty as to the convenience of the forms. Alternatively, is it possible that he is now defending the lack of use by pointing at a gap between what is communicated in these forms of assessment and his view and emphasis on laboratory work. On the one hand, forms are not able to capture what he finds important to communicate to the students, but on the other hand he prefers to use grading to communicate their achievements of both conceptual content and scientific processes.

When asked about the basis for grading, which may be understood as the criteria he is using, he is referring to the predefined steps in scientific enquiry, hypotheses etc. He is therefore referring to the scientific method as reference for how to assess students learning. The students are expected to be in agreement with this criterion because they have been repeated on a number of occasions. Here again we see that the specific enquiry methods of the academic discipline of science are made valid for student learning and are also the

validation criterion for student assessment. The intended reference is the scientific methodology itself. The summative procedure is failing to take this into account.

Maybe we are at the heart of what his dilemma in assessment is. He uses the summative procedures due to his knowledge and familiarity with these procedures, and is nevertheless reluctant to admit or verbalize these procedures inability to capture the essence of scientific enterprise. *“Every report lives its own life”*, he said in the last interview segment. The static view of assessment included in the forms is contrasting the view that doing laboratory work is a learning process. The communication between teacher and student must open up for the possibility of the report to be altered as the student increases his or her understanding of the concept or the observations made. He would on the one hand repeatedly defend the behaviorist position and resist taking other positions into considerations. On the other hand, he would also like to be emphasizing laboratory work as a learning experience with limited amounts of fixed answers. The students should be allowed to draw their own conclusions based on their own observations, and still they are expected to reach the official conceptual content. The learning process is left out as a reference for assessment. Consequently, his intension of emphasizing scientific skills like observation is also left out of the assessment process.

I said to Alfa, in what I felt my final attempt would be to get at the controversy he must feel, but that still remains implicit in all his statements, *“In the previous break you commented that assessment is so difficult, but when we sit down like now to talk about it you have it all set. Your argumentation is there. What is it that you find so difficult?”* Alfa replies *“It is the human aspects.... that about separating the students by grading ... not being able to communicate all other things that are equally important ... who they are... that of labeling...”* (27.1.01)

My in-field interpretation is that we are finally reaching a point were we are addressing the main controversial aspects of building assessment strategies on Alfa’s scientific notion of knowledge construction. This breaking point or is it a golden point is crucial for me and for my relationship with Alfa. I cannot put more pressure on him, because his suddenly stuttering signals that he is uncomfortable with this situation. There is maybe the lack of terminology to further address these human aspects or it is the rocking of his position as teacher defined as a scientist that makes this difficult. He signals that he would like to be

able to take human aspect understood as the individual student into consideration when assessing him/her but he is unable to do that. He probably lacks the tool for how to do it. He is concerned with controlling the student and grading is most convenient. When counseling and formative feedback is raised in our conversations his completely summative practice and his argumentation about maturity levels and factual knowledge is questioned.

The final comments from Alfa about the use of grading in combination with feedback on laboratory journal are stated in the final interview. *“Lab-reports... I have used grades all the time, because I started with that, but the next year I will use accepted or not accepted. We talked about it. Maybe try something new.”* He also says that he in grading of lab journals has used the grades individually. *“Grading the lab reports... they work hard...have I seen in. .and then I issue many good grades.”* (30.5.01) He has here found it convenient to appreciate the effort put into journals by issuing higher grades.

10.2.4 A possible formative agenda in grading journals

I asked the question of what is the significance of doing laboratory work in general. In Alfas reply we are going back to the point in the introduction about observing as important activity for learning. *“It is to train observations. Most of them do the right observations. I am concerned with them reaching what is correct too.”* (30.3.01) With this angle on observation the crucial questions becomes whether the observations makes the students able to draw the right conclusions according to the conceptual knowledge Alfa is aiming for. Therefore, my next question concerns the students’ possibility to draw wrong conclusions. Alfa claims, *“Yes, of course they can. I think it is OK that they do so now and then if they only show that there is a link between the conclusions and observations so that they see that this is the most important. It is most important that they learn to observe. If they write the wrong conclusions in their journals I will comment on it, but it does not count that much if they only work with it. The most important thing is that there is a link in what they say in the report. They have to correct it later when I have commented on it.”* (30.3.01)

In this statement, there are indications that Alfa would use the feedback given on journals for the purpose of student learning, and hence this feedback has a formative purpose. His reference or criterion for this feedback is his statements about observations. He prefers the

students to learn scientific thinking and would give feedback so that they are enabled to draw right conclusions based on their observations firstly, and the right conceptual conclusions according to his scientific knowledge secondly. This is however not made explicit for the students. The explicit statements as the students may interpret as objectives are the scientific method and the conceptual understanding stated in textbooks. These explicit communicated product oriented assessment criteria are in actual practice complemented with some implicit process oriented assessment criteria. Alfa is starting to combine formative and summative purposes in his feedback to students, and he is including both the processes and products of learning. He has at least an intention of an individual approach to feedback. Nevertheless, there are no indications that he is himself aware of this combination or aware of the dilemmas involved. He would like to include the human individual aspects of learning into assessment. There is a gap that he is vaguely aware of, but still unable to verbalize.

There is a gap between his principal view that all human beings are equal valuable and his values emphasizing the assessment based on an objective view on the knowledge construction. Equal human value could include individual feedback in addition to the summative group referenced feedback. Addressing this gap involves addressing a dilemma. The question is therefore whether gaps or dilemmas exist in his comprehension of the teacher identity. Alfa is the teacher who identifies himself as the scientist. Therefore, his view on knowledge construction in the sciences has major impact on his view on science teaching. In his world of science, there are no controversies, dilemmas, or tensions. Alfa asserts that science should be able to give models and explanations of phenomena within some, at the specific time, accepted theoretical framework. Addressing dilemmas of student assessment is therefore maybe not the road to walk with Alfa. He would prefer one position and not have to be confronted with several possible positions of which he would have to make choices.

Alfa's epistemological world is a world of certainties and not of controversies. He prefers the natural sciences to communicate certainties. He prefers to teach a subject in which the controversies have found solutions by the scientists in the scientific communities. He is aware of the controversies going on in the scientific communities. Nevertheless-these controversies are not to be included in the science teaching at lower secondary education. To include the controversies would involve including the evaluation of scientific findings

and the possible applications of scientific results. Alfa argues that the students are not mature enough for this challenge. Therefore, he still mainly ends up with assessing the products of student learning. Assessing the processes would involve individual references, emphasizing the controversies of what knowledge is for the individual and hence a cognitive epistemological position. Still learning processes for him equals piecing the knowledge into manageable and testable bits of knowledge. Major parts of Alfa's tests are constructed in order to maintain this position.

This behaviorist epistemological position is confronted in the assessment of laboratory journals. He says on another occasion "*learning by doing is what I believe in*" (3.3.01). Assessing journals involves assessing according to his overall objective, "*to learn to observe*" (30.3.01). Consequently, he would have to give feedback on their ability to observe and assessing such abilities are not managed by issuing grades without comments and by delivering and returning laboratory journals without the possibility to further feedback for learning this competence.

10.2.5 The objectivity and reliability of grading

These are my thoughts as I decide not to bring up the dilemmas in his statements. After pausing Alfa takes the lead in the discourse and the following presentation of his grading strategy is elaborated on. This conversation is the heart of student assessment interpreted as grading for Alfa. We did a joint attempt at scrutinizing the grading of the two classes. We are now illuminating the objectivity, the reliability and the validity of his grading!

Alfa starts like this: "*I did something very interesting when I was watching the students conducting their test. Here I made some charts based on the grading of the two classes over two years of schooling. Here you can see the distribution of students on the different grades, the development over the years. What is most interesting is that the distribution of grades in the one class, where the class is actually splitting up. The graph has two tops. It is terrible for a teacher when the class is so that the one half is above the average level and the other half is below the average level. How to teach then? This is very difficult.*" (27.1.01) Here we are picking up the point made previously about using grades to characterize the classes and as documentation for the challenges Alfa faces when teaching these classes.

Analyzing the graphs, the two tops are gradually developing over the two years. What in the beginning was unfortunate selection of students or grouping of students into classes has been furthered manifested during two years of instruction. Social mechanisms have probably contributed to this, but there are also the question of the main emphasis of science has had a contribution (see below). These main emphases based on the communication of sciences as solid foundation for future scientists and as an enclosed system of logic within the structures of science itself is undoubtedly creating meeting points between Alfa and the high- achievers in his classes. His ability to communicate science to the low achievers, the bottom half of his classes based on these emphases may however be questioned. Alfa is addressing this group of students differently. The communication between him and the low-achievers are about football, car mechanics and various other activities. He shows his concern with them as human beings, their family and their friends. He relates to the low-achievers quite differently from the high- achievers. The high-achievers are a part of his world of sciences already and he talks science with them.

The main reason for naming this conversation the heart conversation is Alfa's eagerness in the situation. He was drawing graphs and histograms visualizing the grading and the adjacent characterizations of his classes. Based on the test results and the end of term grades he is able to present the classes. He discusses different possible sources of errors in terms of how reliable the grades are. He is concerned with how fair a test is, whether the topics has been equally covered in both classes and hence whether the comparison between classes is reliable. He is also concerned with the fact that two to three teachers have been involved in the marking of tests and therefore that the marking and grading may be based on slightly different judgments. It bothers him that he does not have any measures for the influence these variations as sources of errors may have had on the grading. He is in these remarks indirectly open for his own influence on the test results as one of the markers and graders. This discussion about judgment is a discussion about the different emphases and positions of the different teachers involved in grading the same tests.

Alfa is at home now. The scientist in him can speak. The human aspects put to rest. He can use his language from the sciences to dwell on assessment. The challenging and threatening educational implications are there in the background, but I decide to let them rest for the moment of enthusiasm that Alfa is filled with. This is his half of the field, his home field. He is setting the agenda here and I am enjoying the moment with him. He can

emphasize assessment and grading like any scientific phenomenon that may be presented in a two dimensional chart. He can use his knowledge about statistics to interpret student results. He can scrutinize the objectivity and the reliability of assessment from the angle of testing for testing itself. There is no need then to emphasize assessment as the purpose of individual learning. The technicalities of assessment explained in graphs enable him to feel at home. In these situations, his terminology from the natural sciences and mathematics gives him the ultimate tool for explaining assessment.

However, assessment in education for educational purposes brings us back to the school reality. When I asked how they would use these graphs in order to understand the challenges furthermore and take actions Alfa said, "*The school management said that we had been too strict so I have adjusted the grading a little.*" (27.1.01) The school leadership has given him some support. They appreciate his effort and signal this by arguing for grading in accordance with his presentation of grade levels. It is nevertheless not stated what their frame of reference might be for evaluating his grading like this. Their support in his process of developing assessment awareness is, based on this example, insufficient in order to develop insight into assessment issues beyond grading.

During the instruction, it occurs to me that the numbers of students not paying attention to his lecture and not using their notebooks are few. Many students are leaning back and are mainly listening. It is hard to tell from the classroom interaction how many students are in some or the other way involved in the subject activities. When bringing this up in the discourse Alfa says that he gives the students the responsibility of studying and argues that every student learns differently. So I say "*what about other tools of assessment like logs that would enable you to gain insight as well as themselves getting insight into how they are learning, what they could be aiming for.*" Alfa resists my attempts here at focusing at the possible contributions of different assessment tools. "*Other forms of assessment...I am traditional. We did try. Messy business. They lost the logs. They did not write.*" (27.1.01) Alf's experiences have not been positive. Neither he nor the students have according to his statement gained any insight into learning or teaching by such means. Alfa is pointing at practical difficulties in implementation of logs. Seen in light of his previous rational in assessment it may be interpreted, as he has not found a rationale himself for introducing alternative assessment procedures. Alf's experience is an example of the necessity of ownership to innovation in order for the strategies to be fruitful for teacher and students.

10.2.6 Mixed assessment agendas appear, individual aspects and grading

The picture of objective and reliable grading on tests as the only valid assessment strategy is gradually falling apart and more dilemmas are appearing in Alfa's statements. The topics are bringing dilemmas to the surface in our discussions. They are judgment and individual aspects of assessment. Alfa says when we are talking about judgment: *“Something that I find difficult is to separate the grades 3 and 4. I do have to decide what is required in order to get the one or the other grade. When the students ask me to compare I find it difficult, because I do not want to compromise the other students. Sometimes I would give a plus just as an encouragement. When grading the work of a student it is based on the whole impression. When students ask it is difficult to explain what I in detail emphasize because it is the whole picture that is determining the grade.”* (9.2.01)

Alfa is here emphasizing the definition of competencies required to meet the different grade levels. He is in need of these definitions in order to avoid competition between students or students using each other as reference. He is still looking for objective measures. Simultaneously he says that he would sometimes use grades for individual encouragement and hence as a motivating factor for the student. In this statement, he combines therefore grading used summative and grading used formative.

Alfa is also pointing at another dilemma. The dilemma of assessing based on specific achievements versus grading based on overall impression. On the one hand he signals a need to develop criteria for the specific assessment of tasks, but on the other hand he acknowledges that there are some aspects of assessment that is not definable. His previously stated behaviorist preference is falling apart due to this position's inability to capture an overall impression. Alfa states indirectly that the sum of pieces of the knowledge he can assess using his traditional procedures is not the overall picture. His dilemma includes also his inability to communicate the foundation for assessment to the students. He is therefore pointing at issues of assessment where he feels unsure and where he would like to develop his professional standpoints. Following this argument, he claims *“Judgment is important”*. (9.2.01)

This time we meet I was also following the track of investigating the mentioned gap in his reasoning. The issue was then the relationship between individual and other referencing of assessment.

Astrid: *“We talked about some complicated matters last time. I understood that you now find assessment problematic due to the human considerations.”*

Alfa: *“It has to be like that in assessment. We have to draw a line between the subject related and the personal and I do think that that is problematic, yes. I am afraid of becoming unfair and that the so-called face validity should pay an impact. We are responsible towards the parents, society and students themselves. That is why I think that we have to play safe and keep to the objective. The human aspects are important. Assessment and activities in science have to be based on understanding of the subject. That makes it most fair and objective.”* (9.2.01)

There are some uncertainties involved in interpreting the term ‘objective’. The word contrasting the term objective is here ‘personal’. His use of the term ‘objective’ could be understood as setting objectives without reference to individual student learning. In which case ‘personal’ would be with reference to the human being he is teaching. Setting objectives with reference to the individual student and the individual students learning abilities is not an option for him. There are no signals that Alfa is attempting at defining learning objective based on his knowledge of the individual student. The mixing of the terms personal and individual is bothering me when we are talking. He is avoiding taking the individual learning into consideration by using at the word ‘personal’ that have a negative value in educational settings.

The use of the word ‘personal’ therefore makes addressing the learning of the individual student invalid due to its attachment to the human itself rather than the learning of or knowledge of the human. I have to find a way around this problem and introduce individual aspects of assessment that are not attached to the human being itself but the achievements of the individual. My agenda is now to communicate that assessment based on the individual abilities is not the same as assessment of personal values and hence the human him/herself. I decide to bring up the objectives set by the educational system that do not address the learning of the concepts of a subject. I claim therefore, *“I think that it is more complex. We are working within a system whose foundation is written and stated in objectives about co-operation, development of values and attitudes and this too has to be*

taken into consideration when assessing the students.” The answer Alfa gives is in accordance with the previous interpretation. It is representing his position as the scientist. *“I am more concerned with the subject. I am concerned with recruiting to sciences and am hoping that some of the students have an urge to work within the sciences. We have to influence them in a positive direction to want to work with these subjects at upper secondary too.”* (9.2.01)

This statement is clear. He has positioned himself as the teacher whose overarching aim is to build scientists. The values to be taught and the criteria for assessment have therefore to be taken from the sciences. Other societal or individual values are not to be reflected in the references for assessment. Assessment procedures based on the sciences secure his preferred objective position. He has been touching on the dilemmas raised in the aftermath of a summative behaviorist position based on sciences as objective knowledge constructions. The dilemmas of capturing the individual student’s learning processes understood as the scientific inquiry, the dilemma of addressing or specifying the judgment involved in the overall grading and his dilemma of addressing the individual without becoming personal has become issues in our conversations. However when confronted with the consequences of these dilemmas, dressed in the terminology and message of the national curriculum, Alfa is again emphasizing his scientific position. This last statement therefore creates a bridge to the next subsection and presentation of his position to be analyzed, his science ideological positioning. However, before turning to this some comments about grading and assessment on projects have to be included. These activities add even more complexity to Alf’s assessment positioning.

10.2.7 Assessing projects and in-classroom assessment?

There are few examples of assessment as a classroom practice in my material about Alfa, both in the observations and the interviews. However, on one occasion the students were asked to present their solution to homework tasks at the blackboard. The combination of summative grading and assessment for controlling students is visible in this statement concerning the grading of students performance. The student performance is based on homework assignments. *“They have done their homework. I will rehearse the students. One student is to present the task at the blackboard and I will give a grade on the performance. I will say that it is good if it is a good performance. If there is a mistake I*

will say so. The goal is that they should do their homework, and I have told them that one will present the task at the board.” (9.2.01)

Our next conversation about assessment procedures, following laboratory work, is about assessing projects. I assumed that this would be complicated for Alfa due to his summative approach and due to his emphasis of objective grading procedures. I started by referring to the sheet of paper that the students had received for their guidance and asked about statements concerning assessment included there. Alfa said, *“Yes, I had intended to issue grades. That became difficult because they had taken their material from the internet. And there are few references included. It is hard to know where it originates. I started to emphasize co-operation, layout, structure and scientific facts. Then I concluded that it would have to be accepted, accepted with doubt and accepted plus. I had to change my plans. I do not know which parts are theirs. That bothers me. Then it becomes difficult to issue grades... This means for me that it will count less for the final grading. Maybe if the student is in between grades. It will definitely count less.” (30.3.01)* Alfa is reluctant to use grades on projects. His concern is first of all that for grading to be used he is in need of proof for their individual contribution to the process. Grading, for him, is too accurate to be used in such circumstances. When this objectivity and reliability is not met his solution is to apply assessment that requires less reliable measures. The three levels created here is less accurate and therefore applicable. His reference is the individual student and co-operation creates one uncertainty. Another is the use of internet. Internet as a source of information is less able to control that written sources like textbooks and library books.

Alfa previous remarks about the use of written comments and the students' eagerness to use these for further learning are also commented on in this situation. At this point he says *“I can write 14 pages of comments and they do not look at it. A grade on the other hand is the stamp, is the quality... They do very rarely dwell on the comments. If it is accepted, OK then they do not look any further at it... In the moment they get not accepted then they would look very careful at the criteria.” (30.5.01)* He is here referring to the criteria that the team of teachers at his grade level has developed in a joint effort. Alfa is never referring to these or other criteria when talking about planning his own instruction. He signals that his contribution in this planning process has been minor. However when assessing projects he does see the relevance of criteria, at the least for some of the students. Alfa continues his arguments about assessment in project work with stating *“Out of the two*

groups that got 'not accepted' one group returned their report with a lot of corrections. The other group has not bothered. So we have 50% success. We could have developed it furthered (the criteria), but that is a lot of work, to set it, the whole list. They have to get it in advance and we have to discuss, you have to look at this and that...." (30.5.01)

The amount of work included in stating criteria is on the one hand bothering Alfa. But on the other hand Alfa is at least indicating that he finds it important to state objectives. The learning activity project is the only student activity in which he brings up this point. Maybe he is, in this activity, meeting learning under circumstances were his formerly emphasis of basing criteria in the academic disciplines conceptually and procedurally is not sufficient. The implicit criteria Alfa brings with him from the formal science education is challenged in these teaching situations because projects like the one he is referring to here involve more subjects and they are often group work. His mainly summative approach based on individual assessment and predefined implicit criteria is being challenged. The reliability criteria he has been arguing within for grading is not possible to apply in projects. Therefore he talks in favor of using accepted and not accepted as feedback. To Alfa that is less accurate.

Alfa is overall questioning the projects as appropriate learning activity in gaining knowledge. *"I see that learning using projects is much lower than classroom teaching using two-way communication... Well it is more an activity that will not give the knowledge I want them to have according to the national curriculum."* (30.5.01) This statement brings up a theme of what status the national curriculum has in the planning and in legitimating his preferences of emphasis, topics and activities. On most occasions, Alfa is concerned with the objectivity of the knowledge and on some occasions, he is concerned with the students' possession of the knowledge. When it comes to grading, he finds it difficult to grade if he does not have the documentation for what they have actually been producing on an individual basis.

10.2.8 The status of the national curriculum

Alfa is concerned with rooting his teaching in the national curriculum. In some interview situations, he is referring to and is showing me the objectives from the curricula that he is basing the activities on. Sometimes he is writing these objectives on information sheets to the students. *"What I have done here is to take the things that are written in the curricula.*

Then I have written it down, but shortened versions. This is the way I can make sure that they have been working on what is said in the plan. If so... we can be sure that they have learned what is stated there.” (27.4.01) Alfa is validating the activities according to the curricula. He is also using the same objectivities as a security for the students learning.

In the final interview, he argues for projects when they are rooted in specific objectives stated in the national curriculum. *“Like when we are outdoors in science, fieldwork in a pond or river or something like that, and they are involved in an activity. Then it is easier to have projects, because then I have control with the knowledge they are supposed to gain. Then I have clearly stated objectives... and that and that are they supposed to learn from the curricula. While in other projects I cannot put together ...and see it in relation to the national curriculum and it is the curriculum that steers.”* (30.5.01) Another aspect of the complexity of the project has been addressed by this statement. How to ground the project according to the teacher mandate? His concern with knowledge gain is also connected to the students’ tendency to use internet uncritically. *“The most important is for the student to possess knowledge so that they are able to solve the problems we are not able to solve. Then they must have an insight. They cannot just get on the computer and download what they do not know to download...”* (30.5.01) Learning critical use of Internet is not Alfas learning agenda. He is stating the problem but his solution or preference is to turn to more traditional learning methods.

Alfas final comment about his relationship to the curricula is a strong message. *“The national curriculum, I really like it. I think it is very good. If everybody does their job according to the plan from first through tenth year... There are something important from our daily life and important knowledge for every human being. The previous plan, the interest of the individual teacher would count too much. Maybe I like it because of my background from the university.”* (30.5.01) The Norwegian national curriculum is in line with Alfas academic structuring and he is aware of this concurrence. Alfa finds support in the objectives stated in the national curriculum as they are more or less referring the academic structure he is familiar with from the natural sciences. My overall impression is however, that the specifics of the curriculum concerning the prescribed teaching methods like project are less in concurrence with Alfas methodical preferences.

The teacher mandate from the Norwegian national education system concerning final examination, concerning grading, and concerning the implementation of the curriculum guidelines are all significantly present in Alfa's arguments about teaching seen from the assessment angle. Final examination and grading policies are implemented as had has challenged these assessment tools and found them suitable within his teaching emphases. Concerning the pedagogic platform outlined in the general introduction (the ideology part of the national curriculum) and the principles of teaching activities he has neither made the strategies his own or he has found didaktik reflection and reasoning for not implementing it. His autonomy concerning the content of the subject is however partly based on this teacher mandate and partly based on his identity as a scientist.

10.3 Alfa and science ideological positions

So far, in this presentation Alfa has been presented as a teacher most concerned with teaching emphases drawn from a substantial academic discipline focus. Alfa has been labeled the behaviorist teacher. His assessment purposes have been characterized as mainly summative with some attempts including or developing formative assessment strategies. Before turning to a further analysis of Alfa's emphases as science teacher, I will leave it to Alfa to comment on how he positions himself as a teacher. Alfa is, in the following quotation, asserting a view on his teacher identity as well as a view on knowledge. *"I am of the opinion that it is the teacher that owns the truth and that it is me that the students have to turn to get the answer on something. They reach the point later that they want to know what is right and then they ask. To observe is a step on that road."* (30.3.01) This 'definition' of a teacher identity may be interpreted as the teacher being the person that is defining the learning goal for the student. The student has no place in this process. This again is connected to the teacher being the person that already possesses and understands the natural sciences. When the teacher is the carrier of the knowledge, the learning process has a point of reference outside the learner. This teacher identity is based on a predefined fixed knowledge base and embraces both epistemological and science ideological preferences.

In one of our meetings, we had a rather long sequence about what Alfa finds most important with teaching the subject science in lower secondary education. I have included some of his statements in the following. Firstly when I asked what is most important in the

teaching Alfa is answering by pointing at one academic discipline. He says, according to the quotation used as a heading to the chapter, that biology is the most important.

Answering the wide question addressing biology indicates a preference for legitimating education in the subject science in the academies. This indicates an emphasis of teaching science in order to transmit the 'structures of science' themselves.

Secondly, he says, *"The important thing is to learn the basics – that is to learn about life itself- what you find out there. To read about it is not the real life."* (30.3.01) Real life to Alfa is the nature. Science education is the mean to learn about the nature. Basic knowledge in the sciences is his primary concern when it comes to the content. Alfa argues that the teaching should be based on the basic concepts as they are defined in the academic discipline. Basics may be learned from spending time in the nature, observe and draw conclusions based on observations. The natural sciences are based on studies of the nature and therefore the nature has to be studied by the students in order to learn sciences. Implicit in his statements are therefore that the structures of sciences are valid as emphasis in lower secondary education.

Thirdly, I have an urge to further explore alternative emphases. With a framework in the back of my mind, I am bringing up two more alternatives. These are the application of sciences for societal issues and the application of sciences for the benefit of insight into daily life challenges. Concerning the first of these two, Alfa asserts: *"It is important that they understand so that they are not fooled by the newspapers. The student should learn to appreciate the nature. Learn to know what it is like to be out there. They have to gain an ownership of what it is- environment and so on. Today they have an ownership to computers, but not to what surrounds them. . We have discussed environment – greenhouse effect and these things- it is clearly a possibility that they will be fooled if they do not know anything about what is being discussed."* Alfa is here just touching upon the natural sciences as important for societal involvement before turning back to his core message, to learn about the nature. Environmental issues are subordinate compared to the acquirement of basic conceptual understanding based on the studies of nature itself.

Concerning the second point that I brought up, the challenges of daily life that sciences can contribute to he says, *"Have not been thinking about that. Maybe that about nutrition is important... I do have my dreams as science teachers"*. (30.3.01) The way he talks here has

to be understood that these aspect of science is the application of knowledge rather than the actual emphasis or angling of the teaching. Learning the basics is the primary concern and applying this basic conceptual understanding is subordinate in his teaching agenda.

Fourthly and based on Alfa's statement that he has a dream, I ask about those dreams.

“That would have been a different science education. We should have omitted some more difficult topics. We should have had fewer topics...some depth of chemistry, of biology and of physics. I think that ecology is important and paleontology. For the students to understand that there has been an evolution. We should get rid of the abstract. It is too difficult. Just the basics of chemistry and simple laboratory exercises. In the upper secondary they should not just repeat what we are doing, but build on it.” (30.3.01) He is bringing us back to his first point of taking the academic discipline as the organizing principle behind the teaching and the topics. He is getting back to the practical aspects of science teaching, emphasizing laboratory work. His previous point of maturity of the students is also present in this quotation. He finds that the students at upper secondary are prepared to take the more theoretically advanced topics and that at that educational level there are possibilities of emphasizing abstract theoretical aspects of sciences involving evaluation and application of scientific concepts. The teaching at lower secondary education should give a ‘solid foundation’ for both teaching at next educational level as well as for future carriers in sciences. The practical aspects of sciences are again repeated in his next statement.

Fifthly, my final attempt is to ask about the historic aspects of scientific enterprise. *“We do not need that. It is too boring. Learning by doing is what I believe in.”* (30.3.01) The Norwegian teacher Alfa is actually using the English expression “learning by doing” signaling a practical and behaviorist position. Sciences have the ability to explain our surroundings. The study of real life lies in an understanding of the structures of the scientific explanations. If we study the nature, using the scientific methods the structures of sciences will follow subsequently. He is concerned with the history of sciences that can give us important information about the results through some scientific disciplines like paleontology, but he is not to the same extent eager to view the sciences as a human enterprise. For him that is boring. The principles for selection of the topics for teaching should be the scientific disciplines, and it is the disciplines as they exist today that should be transferred.

When the challenges that living in a society is raised in our discussions, Alfa claims that the importance of the subjects lies in developing a relationship to the nature. He thinks it is important to understand the discussions in the society, but not so much to interfere with the society. He does not relate to the technology aspect of sciences, applied sciences as important matters for education in compulsory schooling. Even when emphasizing the societal issues and application of sciences in societal issues it is the sciences themselves that he evaluates as being important.

For Alfa science in lower secondary education should contribute to the formation of scientists. The sciences should give a 'solid foundation' for students to progress within the subjects of sciences at the coming educational levels and in a forthcoming carrier within sciences or applied sciences. The potential scientists become his audience and the students that he would be involved in subject related discussions. His relationships with the other students are mainly of social character. In order to single out the potential scientists he uses the grading. Grading above average signals that they have a thorough understanding of the subjects and therefore they are in his view potential scientists.

When addressing the means for encouraging students to participate in classroom interactions in order to motivate for learning in general, Alfa answers by pointing at the contributions of sciences. In this setting, his view is that the contribution of sciences for motivation to learning is to make the processes of scientific enterprise to the learning activities in themselves. His reason for student activities like laboratory work is for them to learn to observe, to test hypotheses and hence learn the basics of the scientific method. In this context, he emphasizes the students' ability to continuously discover the contribution of the scientific method. He is therefore also emphasizing 'scientific skill development'. A scientist for him is a person that approaches knowledge building from angle of scientific methods.

Alfa is also an advocate of the emphasis 'correct explanations'. He thinks that sciences can contribute to the understanding of how things are. If proper taught the sciences can give the students the best explanations about the world surrounding them. The natural objects and the events taking place in the nature are therefore best explained by the natural sciences, as they exist as academic structures today. Following this view on the sciences is also the

identity of the teacher as someone that in his assessment has to correct the students according to the official view of sciences. The reference for assessment, the conceptual validity is set by the academic discipline and the science teacher is the carrier of this scientific truth. The overall aim for the teaching is that the student should acknowledge the scientific models and corresponding conceptual understanding. This is the understanding that the student needs in order to understand the nature and sciences reflects nature. The correct explanations of the sciences should therefore be a valid point of reference for student assessment. Correct explanations are bringing the understanding of nature to the student.

10.4 Alfa and student assessment within a behaviorist position

The conclusions about Alfa's positioning will be presented from two angles. This chapter has been focusing on Alfas processes in gradually acknowledging the complexity of assessment and more specifically grading. It has also been focusing on the dynamics of communication between Alfa and me. He has on some occasions commented on his own learning process as a consequence of taking part in this project. The first part of this concluding subchapter will revisit the fieldwork investigating specific statements concerning reflections about own learning process. While the second part of this subchapter will draw some concluding comments concerning the substantial Alfa.

10.4.1 Fieldwork revisited

Alfas participation in this research project has brought some reflection concerning changes in teaching practices and assessment practices. Towards the end of the fieldwork period there were three interview situations that made it possible to focus on participation benefits.

Alfa says on one occasion that he is prepared to change his focus and his practice. "Next year. I have decided to spend more time outdoors. I will do many things different. Our conversations has entailed that I have more and more been thinking about the significance of assessment and what we can do. I do know that something will be different... I am not so sure about grading... not grading on laboratory journals. I think it is better to give evaluations and comments. There is too much focus on grading, but then again that is what the students wants. I am thinking a lot about this. Did almost not think about it before. I

will emphasize comments more." (30.3.01) In this situation I contributed some comments about developing criteria for the benefit of his own awareness as well as the benefit of the students awareness of what is important in the subject and as guidance for his assessment and their interpretation of the assessment for their future learning. This is still, I as see it, an unexplored territory for Alfa.

Assessment has become more important in his planning of teaching. The following discourse took place the second last time we met. There are some indications here that his major emphasis has been manifested during this school year. Firstly, I asked about the school support in developing assessment practice.

Alfa: *"We do not discuss assessment at this school. Why do we issue a '4' in some subject, has never been discussed. I think that is a pity because I am getting more and more aware of how important it is. Participating in this project has made me constantly thinking about how I can progress. So I think more or less about assessment all the time when planning teaching and when teaching."*

Astrid: *"Can you say something about what you are thinking different about now?"*

Alfa: *"That is a lot. I have started to use the curriculum, working through the points there and use that as some kind of memo. I will use it to see that we have actually been doing that. Then I have furthered developed the grading charts that I showed you."*

Astrid: *"Have you been considering the objectives from the curriculum and making them more concrete according to your students and where they are at?"*

Alfa: *"I think that is too much work."* (27.4.01)

During our conversations, Alfa has taken on some challenges in elaborating on more aspects of student assessment. He is more concerned with the status of the national curricula and would use it to confirm his activities and as validation of learned topics. I leave him with a feeling that we did not get to the point of investigating the difference of having covered in the instruction and having learned. He is more concerned with the definitions of the grades and he is concerned with using grades to describe his classes and as background for teaching challenges. Alfa has therefore used this fieldwork period in order to confirm his summative approach to assessment. He is even more concerned with the reliability of grading, the fairness of testing and the objective and group referenced criteria.

My last question here was about the work with objectives. Previously we have seen that projects as learning activities has been bringing up objectives in our conversations. In the situations of planning projects Alfa has found it necessary to state objectives even if he is reluctant to do so due to the workload included. He does not emphasize objectives as reflection tools for himself. He has a fixed view on the importance of teaching science in compulsory education and hence he does not need objectives in order to develop his emphases. The reason to state objectives in projects is for him only to communicate the meaning of the activity and expectations to the students. He needs the objectives in order to use 'accepted' and "not accepted' as these categories are not externally defined for him. The way that he brings up this point makes me wonder that he is actually accepting the definition of the grades in the teacher manual issued from the national level. This is another unexplored point in the development and uncovering of Alfas assessment reasoning.

10.4.2 Grading

Concerning grading in project work and laboratory journals, Alfa is arguing for the use of 'accepted' and 'not accepted' rather than using the grading scale. His viewpoint has been that the grading scale has to be applied reliable and just. The fairness is connected to treating individual students equally. The reliability is connected to grading defined in the national manual for student assessment. His message has been switching between defining these grading as sufficient and searching for further definitions. Most often, he just applies the grades without questioning them. In one interview, he is asking for discussions at his school about the particular competencies to be met a certain grade level. There is however, no support among his colleagues. At the same time, he finds grading to be quite accurate measures for student achievement. Therefore, he would avoid using them in situations were the individual contribution as in group projects is uncertain. He would not apply grades in situations were the learning process is gradually becoming important aspect of assessment like in feedback on laboratory journals.

Alfa is in the sum of his statements about grading both searching for ways to develop his own application of grades and as a part of this he is revising his former attitude about grading all student work. He has reached a point were he is stating activities were grades are applicable according to his view about grades, but this principal view has not changed. Grades remain summative feedback tools for Alfa. A part of his argument is also that

activities that are not graded will remain less important for the overall and final grading. The consequence here is that the laboratory exercises and projects are counting less than individual assignments and tests. This point is left unexplored as controversial in our discourses.

In the final interview, we were also getting closer at defining the competencies in his grading scale.

Alfa: *"The best of my students do have an understanding."*

Astrid: *"So then you would issue like 6's"*

Alfa: *"Yes, because they have used what they have learned and that has to be the goal."*

Astrid: *"So possessing basic knowledge is not sufficient to get a good grade?"*

Alfa: *"No, not with me. No. No they would have to be able to use it."*

Astrid: *"What do you think about the other grades?"*

Alfa: *"Yes, the same for 4, 5 and 6, they have to show that they can use the knowledge. The others...my experiences are that there is nothing special; they are about average to see the combinations. There are some facts and they have explained something, but it is very imperfect."*

Astrid: *"It is so that repeating facts will be rewarded with a '3'."*

Alfa: *"Yes, but when brilliant including reasons and courses and embedded in a deep discussion. That is very good, and we do have these students. And they will receive '6', and I think according to the curriculum and how to grade, that that was the intention as have I understood it." (30.5.01)*

This last conversation about definition of grades indicates that Alfa has been spending time investigating the curriculum and the assessment guideline defining the grades in the Norwegian compulsory education. At the same time, he is more concerned with the definition of the higher grades than the lower grades. Taking his analysis of the grades issued at the profiles of the classes based on these profiles into consideration this conversation is puzzling me. The tests on the other hand have been designed to regurgitate facts. There are few tasks emphasizing the combination of facts, the understanding across concepts and application and evaluation of scientific knowledge. Alfa is starting to emphasize the specifics of higher order knowledge skills, but these skills are not yet reflected in his test design. This is another challenge for him in his future teaching along with further definition of competence levels.

Grading has been the entrance to Alfas reflections about learning and emphasis of science teaching. This choice was based on his main agenda. This last conversation is also signaling that he is starting to analyze by the means of grading what learning is about. What are the specific aspects of knowledge that he needs to emphasize is for him the necessary result of the definition of grades that are forced by our common scrutiny of his assessment procedures. For Alfa therefore the existence of grading in our education system combined with his preference for using grading has been adding to his reflections about learning.

10.4.3 Additional challenges

Another point that is still to be focused upon is the development of individual criteria and other issues that is concerned with the learning of the individual. He has still not developed a student focus for his assessment. His focus is still the subject and the mandate. Alfa has been touching upon some formative assessment approaches but these purposes have not been unfolded for him as alternatives. Individual referencing and ipsative criteria are still unexplored fields for Alfa. Alfas last comment about criteria and his identity in developing criteria for assessment is the following. *“It had been all right to have discussions about it (criteria) since we have not been good at that. It does not work with the other teachers I think. We should have spent time on assessment, during the Thursday meetings, rather than a lot of the less important...”* (30.5.01) Alfa is in addition here questioning a lack of assessment focus in teaching discussions at the school level.

About participating in the project, Alfa asserts, *“I think that we can discuss things that I have not discussed in depth before and I do question my practice. That is important. I do have more things in the back of my head now than before you came, and that is positive... I do have to take a choice and that choice is well founded now.”* (30.5.01) Hence, there are a number of assessment issues that is left uncommented or undiscovered during our fieldwork, and there are a number of issues that we managed to discuss on several occasions. Among the issues that were the subject for joint scrutiny were grading, summative procedures and the combination of these with their epistemological and ideological foundation. Formative corresponding foundation and procedure were touched upon but we never managed to piece formative purposes together entirely. Development of formative criteria, individual referencing and assessment of projects are among Alfas

future challenges. The same is the dilemma of grading laboratory journal based on his emphasis of scientific skill development versus his demand of assessment references external to the learner. According to this analysis, the application of competencies at the different grade levels versus the competencies included in the tests is yet another challenge to be faced for Alfa.

The starting points for discussions with Alfa have often been based on his practice and often on issues he was bringing to the discourses. In other situations, the discussions have been based on my agenda. My overall agenda may therefore be evaluated in this perspective. The process of investigating assessment in the light of epistemological and ideological emphases may have been slowed down due to taking Alfas focuses of grading, testing and summative approaches as starting points. On the one hand, did these focuses bring us closer to his present epistemological and ideological positioning? On the other hand, was this starting point inhibiting to some extent the possibilities of scrutinizing alternative assessment purposes for Alfa?

10.4.4 The substantial Alfa

Alfa is a case about a teacher whose main position can be interpreted as a behaviorist position. He argues that the best way to assess students is to view knowledge as pieces of information that can be tested in a fair way. The tested knowledge may be pieced together and become the total measured knowledge of the student. The reliability of testing lies in its ability to capture objective measures. The valid tests are drawn from the texts in a textbook and to some extent the national curriculum. The textbook and the national curriculum as well as the teacher are the bearers of the knowledge truth and therefore the valid reference for learning and assessment. The criteria for student assessment has to be based on criteria from an external source like the curriculum or the subject itself and not based on the learning potential of the individual student.

His behaviorist position is cracking when analyzing his reflection about judgment, about overall assessment and during activities of laboratory work and projects. In these situations, he is signaling that he is facing a challenge. The challenge is for him partly to see the individual, ipsative and formative elements of assessment as possible alternative assessment procedures, and partly to argue for further development of summative purposes in order to find solution for grading and objectives that would complete his summative

preferences. He is facing a dilemma between his preferred summative purposes based on this behaviorist position and his growing awareness that this position is failing to address the human perspectives of teaching and assessment.

Predictability in education and in the life of the school became an issue at a point where Alfa was unhappy about changes introduced. When confronting him with the possibility of more changes Alfa says that *“I like structures and I think that the students like that too... that is probably why I am a scientist.”* The school institution encourages changes by dissolving schedules, introducing new co-operative models between teachers, new learning activities and consequently new assessment techniques makes him uncertain about his place as a teacher. He asserts therefore *“If this continues I will quit working in lower secondary and start working in upper secondary.”* (27.1.01)

Alfa is a case about a teacher whose main science ideological emphasis signals an essentialist position. He wants to bring the subject to the students. The subject science is the subject and the student is the object for the teaching. The reference of his planning is the academic discipline. For him natural sciences are the reference for learning and the meaning of science in secondary education is for the student to learn to appreciate the structures of the natural sciences. This passion for science that he owns is also the passion that he wants to pass on to the students. This passion is based on the structures of science as an academic discipline. In order to assess students accordingly the reference for assessment has to be the structures of science. He does not have any foundational problems with this. There is no controversy for Alfa involved in choosing this positioning. He is aware of other teachers choosing other positions, but does not see this as possible positions for himself. Alfa does therefore to a very limited extent address the dilemmas of summative versus formative student assessment. Nor does he relate to the collective versus the individual dilemma of criteria setting in student assessment. He is quite confident within his essentialist position combining a mainly positivistic epistemological position with an ideological position in which he bases his arguments on his formal background in the sciences.

The students should learn about the nature and from this knowledge draw conclusions about scientific knowledge in itself. Science in lower secondary has its place when it contributes to insight into the concepts and products of the scientific communities. He does

not say that the students should discover the laws and the language that has developed within the sciences. He does not equal the nature with the scientific understanding of the nature and does not expect the student to be able to deduce laws from their observations. He does stress observations as important for scientific knowledge, but he thinks that students may achieve conceptual understanding by the means of studying nature. Observations outdoors and in laboratory are instructional activities undergone for the benefit of learning the science itself.

The emphasis of ‘correct explanations’ has a major impact on his assessment procedures. The emphases ‘solid foundation’ is the main emphasis in his statements about what is the significance of science in lower secondary education. The emphasis of ‘scientific skill development’ has been important intentionally for Alfa, but he has not yet found the tools for bringing this emphasis into the assessment of students laboratory work.

The single most important reason for teaching science is for the students to learn to appreciate the nature in which they are living. The natural sciences as school subjects have according to him to mirror the academic subjects of sciences. These subjects should accordingly be taught separate as biology, chemistry and physics. These subjects have the ability if transferred to the students by enthusiasm to explain the students’ surroundings so that they are made able to understand the importance of the sciences and the importance of taking care of the nature. He takes the stand of the realist. The realist stand claims that science as academic discipline is able to capture the reality as existing in the nature. The reality outside has found its representations in the subjects of sciences. Therefore, science as a school subject should be taught and assessed according to the structures of sciences.

Alfa has still some road to walk in order to see the relationship between learning and assessment and the relationship between assessment and subject emphasis. Immediately following our last referred conversation, he argues like the last citation to be included from Alfa. According to this quotation, valid knowledge in science is the knowledge about the nature. This is a theme running in all Alfas statements about science as a school subject. The particular contribution here is the way he argues for grading and assessment of knowledge acquired outdoors as being more valid and more assessable. Knowledge acquired using computers is less valid and less assessable due to Alfas inability to trace the learning process. Learning in the nature makes the process and the content assessable for

Alfa. He can apply the grading system according to his viewpoints about knowledge construction.

Alfa: “And how do we grade then, if they are downloading from the Internet and we interpret without having the basic knowledge from the nature. Then I think that we are doing a mistake. So they get grades and it seems as if they are very good based on what they are doing indoors. If they then go outdoors they do not know anything. They may not even have seen a living insect.” (30.5.01)

10.5 Alfa in a nutshell

The exploration of the identity of this teacher and reconstructing this into the case Alfa has brought forward pieces of student assessment are the following:

- Scientific knowledge as presented to the students in lower secondary education should be based on knowledge as universal, given, value free and decontextual.
- Knowledge should furthermore be acquired by transmission and by individual involvement in the scientific methods of inquiry emphasizing in-field activities.
- Student assessment should be group referenced, objective and collective criteria and grading applied on most learning activities.
- The student is a client of assessment.
- Learning activities that mirror the activities of scientific enterprises are preferred as the assessment criteria of these activities follows from implicit references of applied scientific reasoning.
- Assessment and application of learning activities like projects are less emphasized due to uncertainty of standards and references.
- The subject matter is the basis for instruction and emphases are ‘solid foundation’, ‘structures of science’ ‘correct explanations’ and ‘scientific skill development’. The academic structure of the subject is the organizing principle as well as the objectives for learning.

According to this synthesis of Alfa, I have given this case the labels of:

- assessment strategies are based on a behaviorist view of knowledge construction,
- assessment strategies are also based on subject emphasis representing a essentialist ideological position,
- summative student assessment approaches are preferred,
- non-dualist epistemological and ideological positioning,
- dilemmas not existing in his world of student assessment or he is resisting the existence of various assessment purposes based on epistemological and ideological varieties,

- and comprehensiveness of assessment strategies based on fixed ideologies and epistemologies brings him to a non-dualist and non-dilemmatic position.

Gamma: *“There are so many things mentioned, so that you just pick a little from what you feel like picking... And then the textbooks become more important for the planning. There are probably many teachers that just are following the textbooks... I think that is the way it is for many teachers. I do not know... because the textbooks are covering the content in the national curriculum. But I do think that if the textbooks that was before only covered some of the curriculum... There are so many that are following the textbook instead of the curriculum. I think that is the majority. So then they will decide more than the actual plan.” (23.5.01)*

11 Gamma

Managing the assessment mandate

The case of Gamma is a case about a teacher who is starting his teaching career with an openness to try out many positions, many emphases and many assessment techniques. The case of Gamma is therefore a case about a teacher who does not have clearly stated preferences concerning neither assessment nor teaching in general. The case of Gamma is a case about a teacher concerned with both formative and summative assessment. He is sometimes putting the learner in the focus of the planning and the execution of assessment, and he is sometimes focusing on the teaching of the basic conceptual understanding of the academic disciplines of science.

The fieldwork with Gamma took place over two school years, starting one spring when he was teaching 10th and final year of compulsory education and following him nearly one more year when he was teaching eighth graders. The changes in groups of students resulted in changed focus for the discourse because Gamma was concerned with the social implications of teaching. However, as we shall see his assessment emphasis did not change significantly over the year and a half long period. The structure of this case-presentation will follow the chronological order of the fieldwork. Learning to know Gamma and his assessment procedures took place during one week in the spring of 2000, (Section 11.1) while following him developing his reflections took place the following school year (Sections 11.2 and 11.3).

11.1 Introducing Gamma; getting to know his assessment techniques

Gamma has a mixed formal educational background with a combination of engineering and teacher education. His four years of teacher education has a major emphasis on mathematics and sciences. He was in his second year of teaching when we first met. Gamma is a young teacher who is open for changes and challenges as well as viewpoints and inputs from other teachers and the school management. My first meetings with Gamma leaves me with two significant impressions on which I based my fieldwork interactions with him. The first impression is that he expresses an interest in discussions with me due to possibilities of dwelling on educational matters in general and he states “*Student assessment ... I want to learn more about that.*” (23.2.00) He is searching for a professional identity, he is eager to challenge existing practices and he is willing to include his colleagues in this process. His teacher team is important in several aspects of teaching and planning, and he is often addressing the different topics and discussions going on in the team. The national curriculum and textbooks are important planning resources and Gamma refers to these sources when talking about the importance of teaching science in lower secondary education.

The second impression concerns Gamma’s systematic approach to most educational activities including planning, execution and student assessment. Gamma is eager to show me his planning devices and his student and subject folders. Gammas educational planning consists of an annual, a biannual, and a weekly and per lesson planning. Annual, biannual and weekly planning is a result of joint team discussions and the plans are distributed as written documents for all the classes at the age level. His lesson-by-lesson planning is in writing and he refers to these plans when talking about the flow of his lessons and when evaluating the instruction. His says for instance on one occasion during the first week we were together, “*the lessons went as planned...* (Gamma is pointing at his planning folder) *in the one math lesson I had to stop and lecture for the whole class because there were so many asking about a particular thing.*” (28.3.00) The plans Gamma shows me consist of content to cover, tasks and items to be conducted and teaching methods to apply.

The first year Gamma teaches two classes with different social environments. Gamma has this description of his two classes. “*The class with the poorest social milieu has best results. They are bookworms. Before the tests, they are learning by heart everything.*”

Concerning the effort during instruction the two classes are more alike.” (31.3.00) Gamma states that his strength as teacher is his formal subject background and that his present challenge is communicating with the parents and the local municipal co-operating agencies.

We will see that there is a lack of preferred stated or observed assessment emphases and purposes. There is also a lack of specific epistemological and science ideological positioning in the case of Gamma. The case about Gamma is largely a case about a teacher who is anchoring his teaching practices in the mandated national curriculum and the chosen textbooks. The case about Gamma is therefore also a case about a teacher whose identity is grounded in his administrative routines and whose reflections are revolving around continuous development of assessment tools and techniques. The questions that this case is illustrating are therefore: When implementing the mandated national curriculum interpreted through textbooks becomes the emphasis of the teacher, what are the corresponding assessment techniques and tools that the teacher finds convenient to apply? What about the formative and what about the summative approaches to student assessment within this curriculum led assessment practice? During the course of the fieldwork, are there any indications of changes concerning these administrative routines and what are the corresponding reflections? What are the individual and what are the team contributions in the planning and execution of assessment from this angle?

11.1.1 Assessment practices

For Gamma educational practices and assessment practices start with his planning based on the national curriculum and on textbooks. I will therefore start by his initial statements about his task of implementing the national curriculum. Thereafter the different assessment procedures will be presented according to the teaching or learning activity that the procedure is tied to. This part of the presentation is based on fieldwork conducted when Gamma was teaching tenth graders.

Educational planning

The first quotation from Gamma is an answer to a general question about planning the lessons I am about to observe. Gamma is immediately pointing at the status of the national curriculum. *“National curriculum is important for planning. The importance is to omit things from the textbooks. The textbooks are probably even more important.”* (28.3.00) The

next day Gamma confirms this statement by stating that *“I do not think is so important to use other text resources because it is a matter of teaching the curriculum.”* (29.3.00) To Gamma the textbook is a significant source in the teaching process as well as the planning processes. He defines the content to be learned by partly pointing at the curriculum and partly pointing at the textbook. According to Gamma, the textbooks are covering the curriculum, but sometimes it is necessary to compare the content of the textbook and the curriculum in order to choose what topics to emphasize. I asked Gamma for his opinion of the student assessment procedures as they are outlined in the guide to teachers. His reply *“I guess that is OK”* (29.3.00) can be interpreted as he is rather indifferent to its content, but it can be understood as the guide could be insignificant for his assessment practice or that he takes it for granted. In either of his planning procedures, this guide does not seem to be important as a planning tool. For Gamma, the planning process and the emphasis of the subject are rooted in the national curriculum and its interpretation represented in the textbook. The teacher mandate manifested in the educational system is setting the frames of his educational planning and therefore of his teaching emphasis. Gammas initial loyalty to this mandate forms his teacher identity.

Testing and assessment practices

Gamma says that he conducts both oral and written tests. The written tests are more common and they mainly take the form of achievement tests testing conceptual understanding. These tests are also most important for the overall grading. Most of the written tests are designed for repeating factual knowledge.

Gamma is in the following quotation describing his assessment strategies concerning tests. *“This test was easy to mark. It has clear answers. The short answers are very easy to mark. About the longer items... Here I think that that and that are to be included. First I read through once and then the second time I am correcting. At that point I have decided that if a particular fact is omitted that counts for one point less or if two facts are missing then I subtract two points. The last item is much more difficult than the others. It is not taken directly from the book, but they have to draw conclusions from other things they have learned. That is what is separating the best students from the second best students. The students had no comments when the tests were returned. They were only looking at the grade and not the written comments.”* (31.3)

The grading is entirely based on assigned points that are again based on defined pieces and bits of knowledge. The sum of the students' achievement is the sum of factual knowledge. Conceptual understanding is therefore based on measured knowledge pieces. The students' individual grades are based on repeating factual knowledge taken from the textbooks. These grades based on single tests are however just one of many sources for the overall grading and assessment of the students. There are no particular strategies for returning tests in Gammas classes. That is, he would return the test with comments and grades and thereafter he would revise some of the items or tasks that a certain number of students failed to complete or answer satisfactorily. The combination of factual knowledge with lack of formative approaches built into the return of the tests makes these tests entirely summative from the angle of the students. There are no attempts at making the testing a learning experience, and there are little emphasis on comments that is assisting the students' future work and comprehension of the subject. From the teacher perspective, these tests may be used diagnostically in the sense of indicating the knowledge levels of the students. There are however, no direct statements that lead us in this direction at this point in the fieldwork.

Laboratory work and assessment practices

Gamma has two significant statements about the status of laboratory work after a day of instruction consisting of four lessons used for laboratory assignments. This teaching takes place in groups of students at the size of about half classes. The task was to find the building blocks of sugar. These two quotations indicate a view on laboratory work as learning experiences or activities and as a basis for conceptual learning. Gamma says first, *"We have to drill the scientific method. They have to know that a hypotheses and a conclusion are linked. We have to assist them in the direction of which observations to use. Then they have to do a lot of experiments, write hypotheses and conclusions."* (28.3.00) Then Gamma adds, *"Usually I find it convenient to have control with the experiment so that they are steered onto the right track. They do not know what to find out. They cannot be expected to find it out themselves and therefore we have to steer the activity. It I did not speak so much and steer them there would be chaos. In order to avoid the chaos I am steering them."* (28.3.00)

As a learning activity, laboratory work can be very messy and therefore he prefers to have a structure. This structure has implications for conceptual learning. In order to learn from laboratory work Gamma finds that he has to manage the students in a way so that he gives them the detailed instructions of what to do and what to write down. His argumentation is that he will avoid conceptual misunderstandings and he will consequently have control with the activity of the students. Controlling the students is important in order for them to learn the scientific method and write the journals according to the predefined structure. He is therefore the advocate of the structure of the scientific method as a learning activity. By securing the scientific structure as a part of the lab work, he is securing the conceptual learning of the students. He is administrating and managing the laboratory work. The doing of the task in a particular order managed by him is allowing the students to write good reports. It also enables them to learn the structure of the scientific method and see little by little the relationship between the specific elements of these reports. They are therefore learning the scientific method and the scientific rationale of knowledge construction. Gamma thinks that the students cannot be expected to draw the right conclusions and he has to assist them in doing so. He finds that it is important that the right conclusions be written down in the reports.

The structure and steering that takes place during laboratory exercises are in contrast to the informal and loose structuring going on during the solving of other tasks. *“When they are working with theory they can work on their own. They have no problem with that.”* (29.3.00)

About the assessment of laboratory reports Gamma asserts, *“The lab reports should have a specific structure. I assess the reports giving written statements but no grades. Structure, comprehension, results, description and comments... if they for instance have forgotten the hypotheses I will write that in the section for comments on the form.”* (28.3.00) The assessment form Gamma applies has four dimensions to be assessed; *“description of the experiment, observation of experiment (result), understanding of the experiment (as shown in conclusion) and structure and accuracy”*. There are five competence levels. Very good, good, average, less good and unaccepted should be applied for each of the four dimensions. There is also a space for other comments. These competence levels equal grade levels, but Gamma is able to give feedback on each particular dimension of scientific skills as defined. He is concerned with the students’ possibilities to learn the scientific

method, and he is concerned with the students' possibilities to learn the concepts that the laboratory experiments are designed to illustrate. This feedback form enables him to give feedback on both. He is emphasizing the 'development of scientific skills' in the way he is managing the activity and the assessment of the written accounts of the activity. He is not assessing the activity itself beyond taking notes of individual students (see below).

Projects and assessment practices

In the first conversation we had, Gamma is both describing the project assessment procedures at this school and the student perception of mixed grading and open comments. *"They are supposed to get a form without grades and one form with grades. The form with assessment and without grades should accompany the leaving certificate. The grade is valid in social sciences only. The students prefer grades. In the beginning we said that they should not get grades and they found that odd. Then we agreed to issue grades, but on separate assessment forms. All they want is the grade. I think that also is the case with the parents. It does not count what is said in writing. When we state on the back of the test in three to four lines why we have issued that grade they do not read it. If the grade is not what they hoped for then they ask. Then I say that they have to read what it says there, and then they read it and understand the grade. What they see is the figure."* (28.3.00)

The relationship between grading and open comments has been an issue for Gamma in testing, in laboratory work as well as in projects. In this citation, it comes through explicitly, and Gamma manages to express his frustration concerning this relationship. His would prefer to communicate feedback using open comments. The implicit message may be possibilities to give advice for future learning to the students by the use of open comments. However, when viewing the forms used, there are four categories to be assessed and these categories are all assessed using five levels of achievement. The categories are the process, the product of presentation and mediation, the content of the report and the total impression including theme with questions, content and results. The levels are from very good to less good. As with laboratory work, this system enables the teacher to give feedback on important dimensions of this learning activity. This form is therefore a more detailed feedback tool than the actual grade.

“The time perspective for this job is relatively good. They are supposed to have performances and I count on that the presentations from the other groups are sufficient to have all the topics covered.” (29.3.00) According to this quotation, Gamma is addressing the social aspects of learning in projects. He is viewing projects and presentation of projects as a learning activity in which the students are expected to learn from each other’s presentations. This collective dimension of the learning activity is not reflected in the assessment. The feedback of the assessment is entirely individual.

Assessing as a classroom activity

“I am often checking the homework. I am mainly checking that they have done it. Checking whether they have made an attempt. If they show me clean sheets of paper.... That is not good enough. They should at least have one attempt. It is fair enough that they do not solve it.” (28.3.00) Homework assignments are learning activities and the check Gamma is conducting has two purposes. Checking the students is both checking their conscientiousness and their subject abilities. Gamma says that he accepts the homework if they have done one attempt, and he is signaling that he can base his diagnose of acquired competencies demonstrated by the student on this attempt.

So far, in our conversations about the assessment of factual knowledge and the administration of specific activities had been commented on. The technical demands of the teacher and Gamma’s interpretation of his identity as evaluator has been presented from this angle mainly. However, our conversations about learning and teaching in general have been revolving around the social environment in the classes, the communication with different groups of students and their participation in different learning activities. I am therefore raising the questions of whether these aspects of learning are important for Gamma to document and to assess.

Gamma says firstly, *“I am not very systematic when it comes to the communication in the classroom. I should be more concerned with that. Often I ask... like in general whether they have been getting the points... and then it is up to them. I do not feel like asking the individual students because that may work contrary to the intentions. They may feel denounced. I can tell from looking at them whether they have been keeping track with the presentation. Small signs like eye contacts, pushing away the book... I do know them. I am*

particularly concerned with including the girls. In the one class where there are so few girls and the boys are so dominating.” (29.3.00) Gamma dislikes using communication as a feedback tool for his own teaching or as indications of learning. At the same time, he does view this part of his teaching as a field in which he could be improving.

Therefore, I said *“We have been talking a lot about the social milieu in your classes. How are you assessing the social interactions or skills?”* The reply from Gamma asserts that he is aware of these aspects as important for learning, but he is less eager to assess them. *“The social aspects...more like general effort in the classroom...assessment...”* (31.3.00) The hesitating sound of his voice is underlining his reluctant attitude to make the social environment an object for assessment. Immediately I steer the discourse in the direction of documenting the classroom interaction. Gamma has the following to say about that. *“I have this folder in science with all the lab report turn-ins and corresponding comments about their work. Sometimes I can take a particular lesson and then I emphasize the students’ effort during that lesson. Then I pick three to five students and when the lesson has finished I write that down. Taking turns like that I get at least some documentation. I take notes if there are certain things that are repeated. It is hard to document the general impressions. If one of the parents starts to quarrel for instance... “When did not my son pick up that book.” And then I have got it. It was that lesson... that date. But if I can only say that he usually does not do it. Then it becomes too vague so it does pay off to have some rather concrete examples I think.”* (31.3.00) Documenting his grading, both subject grades and conduct grades, seems again to be the outspoken reason for keeping track of the individual student in class achievements.

Self-assessment is also a continuous issue for Gamma. In the first situation this was commented on, he says the following about the relationship between self-assessment, student responsibility and differentiation according to ability in individual seatwork. *“I am emphasizing responsibility for their own learning so they get to choose the items themselves. They have to evaluate the responses and the solving strategies. I do not use answer books (keys) because then they get too concerned with the right answer and less concerned with evaluating the methods used. I am now considering taking it with me.”* (29.3.00) This quotation is connected to the teaching of mathematics, but the interesting point is that for Gamma the students’ growing awareness of solving strategies is even more important than correct calculations. The main emphasis of learning is to learn the concepts

themselves. His evaluation of the use of keys is therefore that they could prevent the students from learning about their own methods.

11.1.2 Gamma; a preliminary conclusion

So far, in this presentation Gamma has been presented as a teacher concerned with his feedback routines. These routines are based on a common effort in his team of teachers. In all learning activities, he argues for assessing using feedback including several competencies and defined levels of achievement. He is however in most situations more concerned with the communication of the assessment results than the actual ability of the student to use this feedback for future learning. There are some formative intentions built into his feedback approaches, but they come out as mainly summative. In some activities, the figures of the grades are replaced by defined competence levels. These definitions of competence levels serve the function of defining criteria for the teachers, but there are no indications that they have the same function communicating criteria to the students. The exception is testing which for Gamma is not a learning activity, but entirely summative.

When we were talking about the grading scale Gamma was also commenting the issue of objectives. *“The students that received ‘G’ last year could be everything from weak to strong students. No they will get ‘3’ or ‘4’.* I use 6 very seldom on tests or rehearsals or small lectures. I do not state what I am assessing because I think they do know that.”

(31.3.00) There is no attempt at defining explicitly the expectations to the students using the grades. There are no given references of which aspects of the activities or conceptual content that are assessed in combination with the grading. However, when Gamma argues for using his forms there are a number of specific competencies explicitly stated in these forms. These competencies are important as directing the teachers thinking of dimensions to include in the assessment. They could also be viewed as criteria for assessment to communicate expectations to the students. There have been no attempts at defining criteria for assessment and criteria for learning activities beyond the content of this form and the content of scientific methods. The criteria are therefore rather implicit and the student is expected to see this as a reference they are assessed against.

Gamma dislikes having to issue grades and the implicit message is that the grade is not able to communicate the finer competencies that the form is addressing. The application of both forms and open comments makes Gamma able to evaluate specific competencies and

issue detailed feedback to the students accordingly. The explicit stated reason for including comments is on the other hand the possibility for arguing for the grade given. His main reason is therefore documentation of application of grade levels. Gamma is less concerned with the definition of the grade levels themselves, but in sum, he is concerned with the definition of different competencies as they are expressed in the forms.

Based on these statements about assessment procedures in different activities and in different circumstances the overall question arises: Given the administrative routines built into these assessment techniques, do they open up for further formative approaches or do they hinder formative approaches to be developed for Gamma? Gamma's use of grading combined with specific defined competences gives us the possibilities for investigating the dilemma of summative versus formative assessment from an angle of managing two different feedback systems. Is the national grading system too vaguely defined for Gamma so that the competencies he chooses are replacing the grades? We take these questions with us when entering the second year of instruction. This school year is exciting for Gamma as this is his first experience with starting new classes at lower secondary level. He looks forward to this. He says about the present challenge *"These classes I had to take as they were. They were formed by other teachers and I just had to carry it through for the remaining of the school period."* (28.3.00)

11.2 Assessment strategies during the second year of fieldwork

This section continues the presentation of Gamma. He is now teaching eight graders, and this is his first opportunity to plan for three years of instruction and assessment. The relative importance of the assessment of different learning activities is one of the recurring themes in our discussions. This section will therefore be divided into subsections according to learning activities.

At one of our first meetings this fall, we were discussing the different terms we use in assessment and education. *"I think that informal assessment is assessing without the use of grades and formal assessment is with or without grades. Formal assessment is when I say beforehand what will be assessed and informal is what is happening all the time and without viewing anything in particular. For example when working with the theme 'work' in mathematics I have said that both the process and the product will be assessed. I use*

formal assessment on tests and on journals, but on the journals they do not get grades. That is why I have to use my judgment... how much the journals should count in relationship to the tests. I am the professional here and the parents have to accept that.”

(27.10.00) This teacher has a vocabulary for describing assessment techniques and procedures. He has an awareness of the breaking points between formal criteria based assessment and informal judgmental aspects of assessment. He is also aware that the choices he makes for different assessment techniques has consequences for the communication of learning results as well as the responsibilities he is taking on as a professional teacher. He is defining formal assessment according to a stated reference and regardless of form of statements given to the students. He is therefore opening up for assessing without grades based on stated criteria. Informal assessment is the continuous assessment that does not result in grading and that is judgmental according to Gamma. We will see that he defends this viewpoint of personal judgments during the next section.

11.2.1 Assessing tests

In October the classes has a test about species of rocks. Gamma is commenting on the different tasks, the relationship between the test and the textbook versus the activities in the classroom. He says, *“The test is so that items 1 through 5 are facts. Item six and onwards they have to use their own words and the items are slightly more complex because they have to formulate their own answers. That requires that they have learned it in a different way. There is more information. The whole test has been taken from the textbook. That is because all the classes are doing the same test and we are doing different things in the classes so that it becomes difficult to use the activities in the classes for the tests.”*

(27.10.00)

There are two important messages in this quotation besides the point that the textbook is still important for designing tests. The first is that the co-operation in the team is actually setting its limits to see the tests as a learning activity in continuation of the other classroom activities. There is a breaking point here between the collective and individual planning, execution and assessment of learning. These teaching activities are based more on the individual teacher. The assessment becomes a collective teacher issue, while teaching in general is more individually based. About the importance of grading of tests in order to issue final grades, Gamma asserts, *“I want to conduct two to three tests every term. That is why they will have the next test around winter break that will cover the next topic. I think*

that I will have enough documentation for final grading and I do not think that they should have more tests.”(24.1.01) The collective team planning of tests is setting the premises for the testing and the testing is relatively more important for grading than the other aspects of teaching.

The other message is that Gamma and his teacher-team are involved in jointly designing the tests. Two competence levels are demonstrated in these tests, the reciting of facts and the combination of factual knowledge into more complex knowledge. Applications, implications and evaluation of scientific knowledge are not included as competencies.

This conversation continued with a discussion about strategies for returning tests. Gamma replies, *“First we talked about grading, then I returned the tests with the grades and we went through the test item by item and the number of points for each item. I do not want to write down the number of points because they get too focused on that and the relationship between half points and grades... does not necessarily have anything to say...”* (27.10.00) Gamma argues here that the students would be focused on the relationship between the number of points given and the grade. Hence, he is not in favor of such a technical viewpoint on assessing tests. He argues that there should be room for the teacher to grade the overall achievement of the students in addition to the item-by-item marking. His argumentation is therefore slightly different from the last school year. On this occasion, he was arguing for a close relationship between points issued and grades issued. The learning element for the students in this return strategy is to correct the items that were incorrectly answered in the first place. This strategy of marking, grading and returning were applied on all the observed testing situations.

Gamma is also concerned with the format of the final examination. When talking about the end of term testing he is referring to this format. *“This has to do with the format of the final examination, and then it is Ok that they get some practice. Doing it 6 times in fact.”* (23.5.01) At least for the sake of practice in mathematics the final examination is having an impact on his test format, and the reason is for the student to be familiar with the format.

11.2.2 Assessing laboratory work

In the previous section about assessing laboratory experiments Gamma’s structuring of the lessons were seen in connection with his feedback procedure. This part of his teaching is,

during this school year, following the same pattern. Gamma is with the eighth graders even more concerned with their learning of the scientific methods and he is leading the students through the experiment also citing what to write down from the experiment.

Laboratory experiments are important activities for student learning according to Gamma. He is, on some occasions, considering the students' possibilities for drawing conclusions based on observations like in the following quotation. *"In science we have been talking about solids, gasses and liquids before. We could have talked about molecules and elements at that point. This is repeating... But like it is now... important things are mentioned two times in somewhat different combinations. Then we are doing two experiments. Of course it was problematic to see the transfer from water to vapor without being able to see the gasses oxygen and hydrogen. Looking at one without looking at the other is difficult."* (26.4.01) Drawing attention to what is important during the exercise in order to illustrate the intended concept does not happen by itself according to this quotation. Gamma is concerned with the students' ability to see the right things that the exercise is meant to illustrate. In order to facilitate this link between observation and learning the concepts of science Gamma finds it convenient to conduct the laboratory experiments for the students.

In March, the classes are doing an exercise about making oxygen. The teacher is demonstrating the task in order to avoid accidents due to the heat developed in the tubes. He is still concerned with the written laboratory journals and he states in the class what grading is signaling here. *"As I said in the class, the grades do not reflect the success of the experiment, but if they are able to explain what they are doing and why the result may be different from expected. But it seems like our recipe with equipment, hypotheses and so on seem to be something they know."* (28.3.01) The student abilities to state their conceptual and scientific methodical learning in the written accounts is still the main emphasis of the assessment of laboratory journals.

When we talked about assessing lab journals for the last time, he confirms the impressions from last school year. *"I use very good, good, average, less than average and not accepted and these corresponds to the grades 5,4,3,2 and 1. I do not issue grades on journals. The comments are little used, because I do not find the time. Using the comments is really to explain why I have given this and that assessment."* (29.9.00) Following the statement I

brought up the counseling aspect of assessment and linked this to the opportunities for the students to learn more about their own conceptual and methodical understanding. Gamma had no further comments to that. His main emphasis stated orally for the students is only partially communicated using this format of assessment due to lack of individual comments. He is managing the workload with the forms using predefined categories for assessing the students, but the students will easily compare the levels to grades. The application of the forms does address the individual achievement, but the question becomes whether and to what extent the students see this link between their own words and the teacher's assessment when there are few written statements that are individually formulated.

During the remaining period of fieldwork, I did not observe any changes either in the classroom laboratory activity or in feedback given and hence this issue was not brought up again. The defined levels of 'very good' to 'not accepted' have replaced the national grading system. The application does not however add any competence dimensions. The advisory aspects have little emphasis, and for this reason, the summative purpose of assessment is the most visible emphasis.

11.2.3 Assessing projects

During the first week with Gamma his practices of project assessment was centered on the use of the school forms with specific categories to assess. This form was used in combination with individual grading and the overall assessment strategy was individual. The complexity of individual contribution and effort versus collective results became an issue in the forthcoming period of fieldwork. The following examples will illustrate this complexity in the order that it came into our discourse.

What about the students' effort when working in groups with projects? On one occasion, Gamma says that *"they are working quite well for the last two hours before delivering and they are wasting their time in the 8-10 hours before."* (24.1.01) During another project, a technology project, Gamma claims on the contrary that the students are eager and enthusiastic. *"The students are so enthusiastic. No breaks. Yesterday they were exhausted. Today I will say that they have to take three breaks."* (7.3.01) Student effort and teacher identity as counselor in projects are related according to Gamma. *"I am watching them and when they are hitting the wall they need some advice and encouragement in order not to*

loose their courage. There are numerous solutions. If you observe you will see what groups that work. Most groups work well, but they do have very different ways to solve the tasks and find new solutions." (7.3.01) Gamma's concern in the project period for the students is to facilitate the counseling part of his teacher identity. His support as teacher requires his physical presence. According to the following, there is sparse written documentation of the process to base student support on.

Documenting the students' progress and learning processes in projects, as a part of the student assessment techniques is an aspect of project assessment I am raising following this discussions about individual and group effort. Gamma claims that he does not find logs necessary or convenient. *"We do get a picture of how they have been working using logs. We are evaluating all the time."* (9.3.01) Continuous assessment is informal and does not require criteria according to Gamma. He finds that documenting the students' processes does not add to his understanding of the students and hence to the overall assessment of their achievement. The lack of written accounts of the processes brings forward the next point of what criteria are made explicit for the students and what criteria are implicitly influencing the assessment.

The presence or absence of criteria was the next issue that came up. *"Criteria for assessing were stated in the sheet of paper they were given beforehand with the task and the competitive criteria."* (9.3.01) Gamma is here referring to the product criteria, as they were the only aspect of this project that was made explicit. Numerous other criteria were added that set process premises for the project. These premises were partly mentioned as planned and partly added through the progress of the project. They were such as gender grouping, creativity and scientific reasoning. Gamma concludes this discussion with *"the most interesting aspect of this project is the student co-operation. In some of the groups one student was quite dominant, but in general everybody added solutions. This project became so complex that I do not think we would have been able to develop more about student assessment here."* (9.3.01) This remark signals the teachers learning as a part of administrating projects. As the teacher slowly becomes aware of aspects of student activities that are contributing to their learning, he has a growing awareness of the significance of stating these aspects as premises for the activity and corresponding criteria for assessment. His statements in the final interview below are other examples of this.

In the next project, the students were working in groups of four. The theme is mathematics in daily life, and the students are asked to plan their economy based on a number of financial factors like income, house mortgages, holidays, grocery expenses etc.

“Assessment criteria are: effort (logs, who did what), all elements included, correct calculations- handed in, presentation and individual grading”. (Sheet of paper to the students, 28.3.01)

The third issue that was discussed was individual grading on group projects. When starting the project in March Gamma is arguing for individual grading.

Gamma: *“I have tried group assessment before, and the students did not favor that. That is the reason why I would like to try individual grading. They are supposed to perform the results and make posters.”*

Astrid: *“It is the first time I have seen you actually stating criteria like this”.*

Gamma: *“I think it is OK. They know what is expected and what to do during the project. We have been three teachers developing this. But I do think we can develop this even more.”* (28.3.01) I give him support on this and emphasize in the discussion my interpretation of the differences of assessment foundation as criteria, students' documentation of learning and feedback using grading.

In April, I am back visiting his classes and we are talking about assessing the same project for a second time. *“I have not finished the assessment, but it will be according to the criteria stated. Individual grading as mentioned. That is most convenient. But I do have to evaluate the posters and then I have to consider the effort. I do have my own opinion about that. Good effort will give a better grade. They were given grades on the performance there and then. Logs are no good. They will only write where they found their material, where they went and so on. So they do not learn anything from that and I do not learn anything from that.”* (26.4.01) In this example of the process of assessing Gamma is holding on to the intentions stated in his team of teachers concerning individual grading, effort and logs as unnecessary for documentation. The extra grading of the performance came as an addition during the process.

In the final interview, we are for the third time addressing the assessment of projects. In this situation the project as well as the assessment is history and the complexity of Gamma's experiences are coming forward. Group versus individual grading in combination

with measuring products versus processes was commented on. Likewise was documentation of these dimensions either by the students or by the teacher.

Gamma: *“We had chosen individual assessment. But a lot of what they are doing is the same for the whole group. Then the assessment is done for the group. And then from person to person... that is in a way... That is for the effort. It is the same from group to group if all the elements are included. Is not that so? It is the same within the group. Having correct calculations is the same for each group since they do have one poster. The presentation is the same for every group member because they are dividing the tasks among themselves. So then it is the effort that is different from person to person.”*

Astrid: *“How can you document that?”*

Gamma: *“I do not have any log. What they are supposed to do is to write their name on a sheet of paper and what they have been doing but very few of them have done that. I do observe the students that are working very... during the month. The same effort is repeated.”*
“(23.5.01)

These examples of discussions about documenting learning processes, about the relationship between effort and products and about individual versus group assessment result in one overall strategy for the teacher. The combination of group work with common presentation and results leaves the teacher with one learning documentation outcome per group. The final assessment of the products will therefore be based on group results. On the other hand, the teachers claim that they are able to make individual judgment of effort resulting in individual assessment of the effort aspect stated as individual grades. The overall assessment is therefore individual grades based on group results and individual effort. Gamma does not sound convinced that this is the best assessment strategy. He is actually questioning this by stating questions and by hesitating to draw conclusions. His previous intentional assessment rationale is breaking apart as this complexity is gradually being illuminated. It seems as if he does not find any good explanation for this assessment strategy. The complexity of group results and individual effort as foundation for assessment is maybe at this point insufficient as strategy for Gamma.

Throughout the fieldwork period with Gamma, there have been a number of occasions when projects has been the issue. Gamma seems to like this way of teaching. He seems to be comfortable with the teacher tasks, but he is also questioning the scheduling, the administration and the assessment of projects. In the final interview when we are taking

about planning for changes he shares some of his ideas for the future administration of projects seen in combination with other teaching activities.

“How to do the projects? Is our present way any good? I do not like it. There are many things I would have done different. Yes, I would prefer more comprehensive periods, about 3 to 4 weeks of 10 lessons per week of projects. And then another period of about 4 to 5 weeks with no projects and just ordinary teaching in the subjects. Because now, with 3 lessons per week... there is too much time between the project lessons, and there is no continuity, I think.” (23.5.01) In this final sequence he is more concerned with the administrative part and with the possibilities for the students to concentrate on one activity and one learning process than the actual assessment as a consequence of this.

Concerning grading and other assessment strategies Gamma has however started to raise fundamental questions. His statements in the final interview are indicating an awareness of the complexity involved in project assessment concerning the product and the process dimensions as well as the use of grading to communicate both of these dimensions taking the collective dimension of these learning activities into consideration. He is however not yet ready to draw any conclusions that would result in changed practices. His reflections are mainly illuminating the administrative aspects of teaching, but he is to some extent signaling the importance of the relationship between planning, execution and assessment of projects as well as the dilemmas involved.

11.3 Communicating assessment

Communicating assessment concerns the forms used in combination with grading or written statements, oral comments, criteria and references. Communicating assessment is however also a matter of status and participation of the addressee as well as explicitness of criteria. Gamma was concerned with the aspects of co-operation with and participation of parents and students.

11.3.1 Grading

Throughout this presentation, grading in combination with other defined competence levels has been a recurring theme. In the final interview, we had the following conversation about grading.

Astrid: *“What do you think about using grading now?”*

Gamma: *"I think it is OK."*

Astrid: *"But you still do not use them on all assignments."*

Gamma: *"No, on major work, tests but not on lab journals..."*

Astrid: *"You may have told me why before but I do not remember."*

Gamma: *"They do get that feedback on little things. Therefore, they do not need the grade for feedback. However, I have to issue grades at the end of each term, and then I need the grades as a start. It becomes too vague to use good, average and very good on the tests. I need something more specific... On the major things, because they take that more serious, studying and so on...."* (23.5.01)

Grading is still the main documentation tool for the end of term and final grading. Testing becomes relatively more important for this documentation since they are graded. In the following quotation, he explains how he applies the grading scale when assessing tests.

"When correcting the tests I always view the first five students again to adjust the grades to what I have given the last students. Then it is fair because I have a tendency to be stricter in the beginning and then little by little adjust the grading when evaluating what the other students have answered." (26.4.01) Gamma is referring to group norm for grading here. He would compare the achievements of the students in order to issue grades for the individual student that is fair compared to the grading and achievements of the other students. The reference for grading is therefore an overall impression of all students rather than reference in statements about competencies to be achieved. There are no indications in the interviews or in the observations that he would use the grading statements from the teacher manual in his grading procedures.

"A lot of times it seems as if people believe that you can divide the total number of students into groups and so that this and this many students should receive that grade....And then you divide like that... and then at the end of the school year you sum up to 5's and a 4 to 14 and divided by three you end up with 4,80, and according to them that is supposedly the final grade. It seems to me as if that is the way people are thinking about grading... So what I have found is that people do not understand what they are complaining about." (23.5.01)

Communicating the criteria of grading stated at the national level has according to Gamma at least two dimensions. The first is the dimension of the reference and criteria of the single

grade issued and the reference and criteria for the overall assessment done for final grading. The mathematical principle is not sufficient in order to find the right grade. Gamma is arguing for the overall assessment of competencies of the students. The other aspect is the number of students receiving the different grades. The former principle of distribution of grades “*according to Gauss*” (23.5.01) has been replaced by a reference in objectives stated in the curriculum. The switch from norm referencing to objective referencing is according to Gamma causing a lot of confusion. This switch requires that the educational system is educating the parents as stakeholders and as addressee for the results of their children.

In the continuation of these statements, we were discussing the possibilities individual teachers have to communicate the premises of assessment to the parents. Gamma says “*We have been talking about it at the parents meeting once, but then in connection with the conduct grade. There were so many poor conduct grades at the end of fall term, so I thought we had to talk about it in the parent meeting.*” (23.5.01)

Grading is mainly a communication tool for Gamma, a tool for communicating the students’ results to their parents. I will therefore continue this presentation of Gamma as I did on several occasions during the fieldwork, by asking about the communication with the parents.

11.3.2 Co-operation with the parents.

“*I am the one that is in the classroom every day. I am the one that has seen all the work they have done and corrected all the tests.*” (23.5.01) The teacher has according to this statement an autonomy and professionalism that enables him to have the authority concerning student assessment. Gamma claims that the parents have to trust his assessment based on the single assessed activity and the additional overall judgment. This was one of the issues of assessment that we returned to on several occasions. The first time I met Gamma he said that he found the communication with parents and municipal instances challenging as a teacher. He claims that the judgmental aspects of assessment are not possible to always communicate.

Communication with parents became a major strategy for Gamma in the second year of fieldwork. The reason is the development of the classroom environment. His class had

started out as a quiet and focused class involved in the activities with enthusiasm. In September, he says, *“This far I have used the activities in the lessons to get an impression of the subject knowledge of the students. This far I find them (the two classes) quite alike. The students are mainly positive and they work well in my lessons.”* (27.9.00) During my visit in January it is clear to me that something has happened in his class. In between the lessons, we are talking back and forth about a teacher challenge that is a combination of poor concentration, effort and conduct. Class environment has become a major issue in the team of teachers. They have been discussing various means like rearranging the seating and use of extra teacher resources.

During our next meeting in February Gamma has two comments concerning the team effort in addressing and progressing with this challenge. *“We have developed this form to send to the parents every month and the first is Friday this week. We had a discussion at the parent meeting some time ago and will do that again in the next meeting just before Easter.”* (14.2.01) Gamma was also commenting on the in class solutions they have found working satisfactory for the time being. *“We decided that they should be seated one and one, and only grouped when working with tasks so that we have the control. We will give this feedback to the parents. We have decided to keep tight reins.”* (14.2.01) Concerning the support and communication in the parents group Gamma continues, *“This is a very good parent group. We have their full support. They have an understanding for the situation. I am happy with including the parents so that they understand the means.”* (14.2.01) For Gamma it is important to develop the format of feedback concerning effort and conduct in cooperation with other teachers as well as parents. The form has been developed by the use of the school regulations and according to Gamma, *“we have been adding some more things that we have found important to separate like being late in the morning and being late for lessons throughout the school day.”* (14.2.01)

At this point during our communication I became eager to find the breaking point of expected involvement of the parents and asked the question *“have you considered the possibility of having an open-ended question at the end for the parents to give their comments?”* Gamma replied, *“I was sure that they would feel free to write such comments on the back of the form.”* (14.2.01) The parents were not expected or invited to communication beyond signing the form.

In the final interview, we are also investigating in detail this challenge of how to include parents in student assessment. Gamma is asserting his professional identity by stating “*I am with four years of education in order to be able to grade.*” (23.5.01) The challenge when it comes to assessment is in communicating the specific requirements set by the national system. “*I did receive complaints the first year. When I was answering that was the end of it. Because I do use that orange book about student assessment. I cited from it and... If you have never been teaching you have not heard about it. Common people who are complaining do not know what they are complaining about. They are adding the grades and dividing by the number of tests and think that the mean is the grade. That is what people believe. They have probably not heard about the book, which exists.*” (23.5.01) Communicating assessment results to the parents has therefore a dual challenge for Gamma. In addition to the actual grading or comments, the mandate foundation needs to be addressed.

11.3.3 Student participation in assessment

So far, in the presentation of Gamma’s strategies the students have been viewed as a group or individuals that receive assessment based on implicit or explicit criteria from the teacher. The student has not been given an active contribution in self-assessment in any of the observations or interview segments. Therefore, I found it necessary to raise this question in the final interview.

Gamma: “*I have tried, but I do not think it works. Because they do not have sufficient self-insight, or what... If assessing each other the aspect of being friends is very apparent... The effort I think they can assess. Then they are actually stricter than us.*” (23.5.01) His next statement is interesting. “*We have those students that think that they should get 5’s and 6’s on every test, but they never get any better than 3’s. So then they do not have very good self-insight. I tried that, but it did not work.*” Gammas argumentation is also connected to thinking about maturity level. “*They are not grown ups. They do not have a required maturity level... I do not think they are able to think meta...*”

On the one hand, he has for the time being given up self-assessment. His self-assessment concept is based on the formalized criteria embedded in the grading system. Consequently, he does not find the students to be able to assess. They do not have the needed understanding of the grading system nor the learning objectives. On the other hand, he

recognizes that the students are assessing all the time, but *“That is not formal assessment. For that they need more practice.”* (23.5.01)

As a part of knowing what they can do and not do, he finds self-assessment to be important. This conversation is also an example of an ongoing attitude that assessment is defined as the formalized summative processes. His statement of student formative self-assessment is not considered assessment by Gamma. Gamma bases his attitude mainly on student participation on formal criteria angling in which assessment is grading based on the mandated curriculum. In the continuation of this, I am raising the issue of whether assessing as this is important for learning and ask more generally, *“What is important for learning?”* (23.5.01) Gamma switches then to curiosity related to the subject itself (see below).

11.4 Educational planning and subject emphasis

The introductory quotation is pointing towards the importance of curricula and textbook in the planning of instruction for Gamma. It is moreover signaling that Gamma is referring to these planning resources when stating the content of his instruction. There are no specific stated emphases based on scientific view, epistemological view or science ideological view. Implementing the national curriculum becomes his purpose as a teacher.

11.4.1 Planning resources

We are continuing the conversation about planning using textbooks and planning using curricula. About the textbook, he says, *“The way I use the textbook is that I am just switching the order of the chapters.”* (23.5.01) The textbook is more or less defining the content to be covered during the year of instruction.

Secondly, about the national curriculum he says the following. *“I think the first part of the curriculum is very different from the syllabuses. Because it can be interpreted in a number of different ways. The syllabus in science can only be interpreted in one way. The general part, there you can pick whatever view on the human being you want. And find one that fits you. Most teachers think that it is a text put together by Hernes in the beginning of the 90s that he himself likes. But I do not think that many teachers use it for their own view on human beings.”* (23.5.01) There is, for Gamma, no attempt at discussing the content of

neither the national science curriculum nor the textbooks concerning the angle of science teaching. He seems therefore to be acting in accordance with the stated national intentions and has no personal preferences that are conflicting or enforcing the national curriculum and the interpretation represented in the textbooks. The curriculum as an ideological document does not have any significant contribution in planning of instruction or in discussing the basis for the educational system. Our discussions based on the national curriculum and the textbooks did not bring us any closer to science emphasis or preferences.

We were briefly touching on his view of the curriculum in religion and Gamma argues in this subject for necessary interpretation of the plan. *“But then of course there is me... that I am doing the evaluations of what to teach, without you know what it said in there...”*

(23.5.01) The similar interpretation of the science curriculum is not necessary as it can only be understood one way according to Gamma. He is despite of this sometimes talking about the national curriculum as a menu to choose from. *“I do not know, but you see that the plan entails incredible much that has to be covered in such a short time. And what you have to consider what is important and what is not important, but as long as you have mentioned it you can say that you have covered that part of the curriculum.”* (23.5.01)

So far, I am drawing the temporary conclusion that Gamma thinks that natural sciences consist of sets of facts to be taught and learned. The syllabuses of science and the textbooks are defining the factual knowledge to be taught. His fraction of his statement above, *“The syllabuses in science can only be interpreted one way”* (23.5.01), is a strong message as there are no alternative interpretations based on other views of what teaching science is about or what science is about.

I tried to get at his motivation or the heart of his teaching by asking the question of *“what do you think is important in order to learn science?”* Gamma’s reply to these questions was the following. *“It is ...to learn...they have to be curious, wonder and such things. They have to possess an interest for finding out things. If they do not have that, then it is very difficult to learn. Somebody will just want to recite it, and then it can just fall out later. That is the challenge. To become curious. That is not easy... learn to become wiser. That does not exist. And some topics, they are wondering about a lot of things. There is also a difference from groups of students to the other group. Some are wondering about a lot, and*

some are not curious about anything. Sometimes the only thing they are wondering about is when they can go home... And then of course it does depend on the topic.” (23.5.01)

Curiosity is important for learning according to Gamma. I am continuing to challenge him on this point in the forthcoming discussion.

11.4.2 Lack of emphasis?

It is difficult to find specific emphasis in Gammas argumentation.

Gamma: *“There are so many things that are important.”*

Astrid: *“Such as”*.

Gamma: *“Everything. There has to be a little of everything”*.

I am bringing up aspects of learning for mastering daily life or learning the concepts for the conceptual knowledge itself.

Gamma: *“Well I do think that that it is not the one or the other. If there is the subjects applied in some situation or like that then that does not become right either. For the students that like sciences they think science is fun in itself. And not because it can be applied in some situation. But for the students that do not think it is fun, then it becomes more important to use the subject in some situation. And be able to do that rather than the subject itself. And then it becomes, then it has to be a little of both when there are 28 students.” (23.5.01)*

The subject itself is the subject understood as the academic disciplines without application, or any other relevance in nature or in society. Gamma argues for alternative approaches to teaching mainly as motivation for the students that do not catch the interest for the subject itself. Gamma argues for the combination of different emphasis due to the variations among his students concerning the interests for the subject. He is dividing students in two groups and arguing for different emphasis for different students. The scientists among the students find the factual conceptual teaching intriguing enough. The other group of students may need some aspects of application in order to find interest in the subject, in order to understand the subject, or to see the relevance of the subject.

Astrid. *“What about the environmental issues?”*

Gamma: *“That will come up.”*

Astrid: *“What about ethical aspects.”*

Gamma: *“That too.”*

Astrid: *“Is teaching science mainly about teaching facts.”*

Gamma: *“Yes, in a way it is.”*

11.4.3 Criteria, teacher identity and assessing based on judgments

There was, on several occasions, a need to look into Gammas attitude to stating objectives. My overall impression was that except on the one incident of stating objectives in a project little is said in the written instruction that could be considered as expectations or formulated statements of emphasis of activities.

In the forthcoming two quotations about communicating expectations, Gamma is defending his viewpoint of unimportance of explicit statements. He says first *“In the project about math it was important ... so that they know what to relate to. But now, in science, we will have ordinary instruction and therefore we do not need any criteria. That would be like working well during lessons and so on. The students know this. I do not have any particular expectations. They know the general after having been taught by me in almost one year.”* (23.5.01) Then he adds, *“I cannot continuously bring forward what is always emphasized in the instruction. I do not expect anything in particular. Then it is the usual that the students know.”* (23.5.01) Gamma is arguing that stating expectations and criteria for the learning activities are redundant due to the students’ knowledge about him as a teacher and that the expectations do not change from activity to activity. After a couple of repetitions of the same message from Gamma, I referred to my observations: *“But at the beginning of the lessons you would almost always say that today we will work so and so or that or that topic. That is also a kind of stating goals for the learning activities in the lesson.”* Gamma replied *“I think that is important because that is a way to get them tuned in on what is happening here and now and make them mentally prepared for the lesson and the work.”* (23.5.01)

Gamma is communicating that stating expectations has to do with motivation and with being mentally prepared. These oral statements of criteria for classroom interaction, of content or premises for the activities are not statements used in the next line for assessing these activities and the students’ achievements based on these activities.

These discussions about criteria for classroom interaction and criteria for assessing classroom activities developed into discussions about judgmental aspects of teacher

assessment combined with teacher identity. On the first occasion, Gamma is pointing at predictability and consistency. *“It is about stating the same thing over and over again so that it becomes plain and that you are a plain teacher.”* (28.3.01) Being clear and being distinct is his way of communicating expectations to the students. Two months later Gamma claims, *“They have to be mentally prepared in order to catch the new content. I am quite calm now. We are in eight grade and have no hurry. The two other teachers are far ahead of us.... If they are allowed to raise many questions there is so much that is brought forward. Something is important and something is less important. However, regardless of that, it is important for them to ask the questions. Some of it I am able to build on, but not everything.”* (23.5.01) Mental preparedness is more important than rapid progression or progression at the same speed as the other teachers at the same age level. He would adjust his teaching more to his students than being coordinated with the team of teachers and their joint planning. Gamma is signaling that he finds oral communication to be important for learning. He indicates also that he continually evaluates the oral contributions of the students as to whether they are adding to his agenda for the lesson. His progression is therefore a consequence of the indications he gets from classroom interaction on learning in addition to his instructional planning.

Gamma states explicitly that he has an awareness of personal judgment as important for the continuous overall assessment. *“We often say that the students are good or less good and are categorized as soon as they begin at a school. Thereafter they remain in that category. I often say that to the students so that they should know that this is what is happening... We are always evaluating and we cannot expect that we stop the judgmental assessment. The students are given less opportunities to change the view we have if we do not think more about how we are categorizing them.”* (23.5.01)

Lack of criteria statements combined with lack of emphasis leads to an interpretation of Gamma as defining his activities, their content and the reference for assessment in the mandated strategic documents as well as the textbooks. He states expectations for activities and subject content orally, but he is not concerned with the implications this might have for assessment according to his statements. He is also considering assessment in the classroom as important as a driving force for the instruction. Classroom assessment is however based on more implicit criteria than explicit criteria. Gammas' room for judgmental assessment becomes important in order to understand this lack of criteria or emphasis statements. It

also comes important to understand the previously analyzed overall grading procedures. Gamma is continuously clear about references for assessing when applying grades than when not applying grades. He is however not very specific when it comes to stating criteria and that can be seen in combination with a lack of preferred emphasis and purposes for assessment.

11.4.4 Co-operating in the team.

There is a meeting point in Gammas instructional planning of the importance of the team versus his independency as instructor. *“Concerning the instruction, the team does not have any significant importance in the single subject. The major planning for all the classes at the age level....that is different. There is a lot of talk. The real job, I am doing my self. The end- of school year test we are planning together. Probably repeating a lot from last years test.”* (23.5.01)

The major message about instructional independence is repeated at another point in this interview. *“What we are doing in the classroom is up to each one of us. And we cannot be alike in that aspect. And then there is the classroom, there is ...I am different from the other teachers in year 8th, when acting in the classroom. But what way we are doing it (interacting assessment) can be different for each one of us. ”* (23.5.01) There is a limit to what can be discussed in the team of teachers. The actual interactive teaching with situational assessment is not a topic because there are no possibilities for standardizing procedures. In situ assessment is an issue with limited validity for Gamma. The overall assessment with a mainly summative purpose however is a team responsibility. The testing is therefore a joint effort that separates the testing from the interactional situational and relational aspects of learning. Final testing is the control of achieved results and joint planning of these tests is valid due to the decontextualization that takes place in the making of these tests. To Gamma, this does not seem to be a matter of controversy. *“The curriculum and textbook is setting the content here anyway.”* (23.5.01) The reference for this testing are the planning tools and this reference is more important than the actual learning activities in the single class or the actual angling of the individual teacher.

Team discussions about assessment concern tests, lab work and projects. Concerning challenges in assessing students' projects Gamma is addressing the duality of defining common assessment procedures across subjects and the possibilities the different teachers

have to understand the assessment thinking in the other subject traditions. *“How they are assessing in Norwegian and English. I have no idea.”* (23.5.01)

Developing forms has been a strategy for Gamma in order to master the workload. Some of these forms are results of joint planning in the team. The use of forms may on the other hand reduce the comments to each student and therefore make the formative purpose of commenting reduced to predefined categories applied on all students. *“Feedback and that, written feedback. I understood soon that I needed to do something... Because you are not supposed to only correct 55 end of term tests and grade them... and in addition to that write half a page of comments. That takes too much time. And then I have to come up with something. And therefore I have the forms. I would only repeat the same comments anyway.”* (23.5.01) Gamma is thereafter repeating previously referred statements about students neglecting comments given. His effort in stating individual comments has therefore been reduced to a minimum. His comments has become standardized due to workload and based on impression of students’ attention to the comments. The individual formative perspective of assessment is reduced consequently. Gamma continues, *“The forms are based on different things they might need or not need to practice. Then about half of the students would take out the form and review it before the next test.”* (23.5.01) His argument here is that due to individual developed comments the students might use the feedback given to direct their learning activities in the next phase of learning.

11.5 Gamma

Gamma is the administrator. He is developing techniques and procedures that enable him to manage the many tasks of a teacher. He is eager to discuss these tools and revise techniques is his way of dealing with the many faceted aspects of his teacher tasks in general and assessment in particular. There are few stated explicit priorities as a teacher and there are few personal preferences. Gammas identity as teacher is found in his identity of administrating a curriculum and assessment mandate and managing the implementation of this mandate applying various forms as tools.

Gamma is the implementer of national mandated curriculum. He is taking his mandate from the educational authorities and implementing them. He is not questioning this mandate. He is more concerned with understanding this mandate and claims that the

curriculum for science can only be interpreted one way. His identity is to implement this curriculum as a factual statement of science knowledge. Gamma is a case about a professional teacher interpreted as a teacher that has an identity attached to the premises set by the educational system. Gamma has a pride in his professional understanding of the teacher identity, and he allows himself authority as a professional teacher on these terms.

His identity is as the implementer of national policy also regarding student assessment. He has a task in communicating the premises of the system to the students and to the parents. He has an awareness of assessment the way it has been defined in the handbook of teachers and uses the terminology of assessment in agreement with this standard. He argues for both 'formal' and 'informal' assessment as important for the overall student assessment. Hence, he gives stated objectives as well as judgments equal status in his statements about assessment. He seldom refers to the objectives in the curriculum and he seldom states criteria for learning activities or assessment. He somehow takes criteria of the subject as granted, as they are implicit in his argumentation. He points towards redundancy of explicitness due to the students' knowledge about him as a teacher. He does not open up for various interpretation of subject emphasis and therefore stating objectives becomes unnecessary.

His assessment purposes turn out to be mainly summative. He is also concerned with application of grading system, and would compare grading system to the different developed competence levels he uses for projects and laboratory journals. He is less concerned with specifying the competencies required for grade level.

The team of teachers is important for developing the assessment techniques and the team of teachers is developing the tests that are more important for the overall grading than the classroom interaction that is mainly Gammas responsibility. The premises for the summative assessment are therefore to a large extent set in a team of teachers drawing the focus away from the actual learning situation. The formative elements of assessment are difficult to analyze. He does not state any criteria that are signaling actual emphases. He is concerned with the procedural feedback mechanisms, and these techniques become the entrance to his assessment purposes.

About participation in my project Gamma claims that his attention has been more tuned onto assessment than before. His awareness has increased. Early in the final interview he says that *“If working as a teacher and nobody ever mentions assessment like it was for the first year I was working... I do not know whether I would have done things differently, but I had not been thinking about why I did this and that.”* (23.5.01) Later in the same interview he adds to this issue by confirming that he still does not know whether his practices have changed as a consequence of communication with me and participating in the project, but that he seems to be more aware of assessment and more aware of the necessity to reflect and reason around assessment in order to justify his practices.

Gamma: *“I have become more aware of it in that you have been here, things that I probably not would have been concerned with... I would have done it automatic without thinking about what I was doing. Like it is now, I am thinking about it more.... I have changed over the past 2-3 years. Even if you had not been here, but I do think that I have not been thinking about it on my own... or become more aware of it in the same way. Then the question becomes what I have really learned. But awareness, yes that is important.”* (23.5.01)

11.6 Gamma in a nutshell

Gammas' uniqueness as teacher regarding student assessment could be summarized as follows:

- Emphasis on development, application and revision of assessment tools like feedback forms.
- Testing for summative purposes, but some formative elements in learning activities like projects and laboratory work.
- A combination of grading with written and oral feedback based on objectives and references from curricula or criteria are implicit.
- Knowledge is given and universal and measured by defined knowledge pieces.
- Science is a set of factual knowledge communicated through national curricula and textbooks and this knowledge is not a subject for interpretation.
- Learning is mainly individual as students are expected to acquire knowledge defined by curricula.
- Students and parents are mainly clients as their participation is in general limited to receive information.
- Emphases that are somewhat visible are ‘structures of science’ and ‘correct explanations’. The academic structure of natural sciences is important due to the organizing principle in curricula.

Gammas' case is illustrating a teacher whose identity is:

- manifested in the administrative routines he develops in order to implement a national curriculum, assessment documents and textbooks,
- managing the teacher mandate,
- signaling an essentialist position,
- and signaling a behaviorist view on knowledge construction by his assessment preferences.

PI: *“It is the way I think. It is very logical. If you have an inquiring mind, and as a scientist with your imagination... You are always asking questions and seek to try that out. Science is always seeking out hypotheses, there are no facts really.”*
(4.10.01)

12 Pi

Creating cognitive conflicts versus testing for summative purposes

Pi is a case about the tensions between the preferred constructivist epistemological positions versus testing procedures that are more summative than formative in their overall approach. On the one hand, the teacher states priorities of creating cognitive conflicts for promoting conceptual learning. On the other hand, he subscribes to a combination of summative assessment procedures with the organization of students in ability groups. The quotation above signals the rather strong epistemological overall attitude that his identity as science educator is not to present the students with fixed answers and facts. Science, as a school subject and as an academic discipline, should be centered round building inquiring minds.

12.1 Introducing Pi

Entering Pi’s school in Yorkshire in England is for a Norwegian like entering a world of different codes and expected behavior. Two students are called upon to direct Ms Eggen to Mr. Pi’s science room. The science department is located in a new building on the school campus. The science labs and preparation room are very tidy and organized, and the students are placed in rows of about 12-16 students. The desks are used during all learning activities. I find my place in the back at a computer, but move around during phases of the instruction when I find that convenient and in accordance with signals of accept from the teacher. Standing at the blackboard, Pi is properly dressed with a tie, blue shirt and dark trousers and he has a pencil behind his right ear.²⁰

²⁰ In accordance with the code of this environment, the preferred term of address when students are present would be Mr. Pi. I have chosen to keep the informal form of first name for convenience and in accordance with the other cases.

The first and most striking impression from the teaching is that the communication pattern and the practical tasks and quite often the notes on the blackboard are all following the same logic. This is the logic of The Scientific Method written in grand letters on one of the walls; Question- Variables- Prediction –Hypotheses- Plan (diagrams, method, safety and fair test)- Results (table and graph)- Conclusions- Evaluation. Other interesting details observed regularly are use of examples from real life situations. Often these examples are taken from technical appliances in the household. The children use their own notebooks and on rare occasions textbooks that are stored on shelves in a corner. Most of the instruction is teacher-led. In almost all of Pi's classes, the students are alert, paying attention and they are exercising very good conduct. There is a mix of theoretical and practical activities going on in most lessons. There are humorous comments build in, and a quite relaxed atmosphere. Simultaneously detentions are issued for low attentiveness, poor conduct, physical and oral misbehavior and time off task.

The lessons start without exception, by the teacher repeating the topic, the activity or the focus of the previous lesson in science. Likewise, the lessons end by assigning homework. The homework is working on a question, looking up one word, finishing a report, thinking about new questions to address or possible hypotheses to investigate.

About the use of the scientific thinking as a teaching method and a major emphasis, Pi says, *“Creating a cognitive conflict is the main idea. When we have managed to create that conflict we can start teaching the concept... Often I find that I can take it from the misconceptions of the pupils. I can start by retrieving their misconceptions like that the earth is flat and show the obvious silliness of what they claim in order to establish a new understanding for them.”* (2.10.01)

Pi's companion teacher, My, teaches in the science classroom next door. I spend most of the time with Pi. Some lessons I spend with My and besides he is present in some of the conversations I have with Pi. They are in the third year of co-operating as science teachers. Their co-operation involves annual and bi annual formal planning processes and continuous discussions about student progression, different possible ways to illustrate scientific phenomena and classroom management. Their schedules are coordinated. They teach the same age level in every period, but different ability groups. These ability groups are defined according to the students' achievements on several tests in combination with

teacher recommendation based on expected grades and general impression of the students' achievement levels academically. Organizing the students at each age level in ability groups is the institution's preferred way to manage student differentiation in natural sciences.

Pi and My have similar backgrounds, in that they both possess a teacher certificate on the top of degrees in engineering. A few years older, Pi is the more experienced teacher of the two. Pi says when talking about managing the national curriculum: *"For the first period I was working all the time, but I had to stop that for my family and now I see what is worth doing and what I find is not worth to do."* (1.10.01) Pi's eagerness in teaching is noted by me. He states that his primary motivation has to do with *"...always liked the subject, I would like the students to understand the world around them also within the terminology of science."*

Pi's main emphasis is hereby introduced as the emphasis of science for scientific reasoning. The building of inquiring minds is based on an emphasis of scientific reasoning. This is the core of science teaching for Pi. Inquiring minds and scientific reasoning is again connected to his intentions of creating cognitive conflicts by addressing misconceptions. The introductory statement points towards the individual knowledge construction as being more important in secondary education than the stated facts of the disciplines of the natural sciences.

Based on these impressions of Pi's teaching and the institutional setting he is working within, my main question became how does the intentional viewpoints of cognitive conflicts and misconceptions compare to the combination of formative and summative evaluative approaches? Alternatively, stated from the viewpoint of science ideologies - if scientific reasoning is the overall objective for PI in his teaching what are the corresponding epistemological reflections that are manifested in student assessment? Practicing within a comprehensive system of ability testing as administrative tools for managing student differentiation, what is the relative importance of these formative and summative approaches for PI in his reflection about student assessment? In order to further interpret Pi it is necessary to investigate further the assessment approaches chosen as well as the reasoning behind them.

12.2 In class assessment according to summative and formative purposes

The second striking factor being present in Pi's classes is that student assessment is visible in all the groups he is teaching. Both teacher and students are involved in a number of different activities that I interpret as mainly assessment activities, but that according to Pi mainly are learning activities. Some activities are however referred to by him as mainly diagnostic. Assessment of students' written work happens frequently, that is almost as a part of every lesson. Formal testing is important. There are different tests with varying status, but generally the students will have a test every fourth night on average. Oral feedback is built into almost all activities. Marking and grading takes up a lot of the PI's working time, effort and focus, and therefore Pi is eager to talk about their procedures for grading. There is a connection between on the one hand the relative importance of summative versus formative approaches and on the other hand the principle behind as well as the practices of ability grouping. This connection is however more implicit than explicit in Pi's statements of his reflections.

12.2.1 Assessment seen as a major learning activity

During classroom instruction, there are several activities that at least from the observer's point of view serve an assessment purpose. One of the learning activities with an assessment focus frequently used is students' correcting each other work. They use a marking system set up by the teacher as they go. They issue points for each single right word, concept, denomination or calculation. The total amount of attainable marks is counted and the students are asked to give their own number of marks orally in the class. As students are giving their total number of marks, the teacher will give very few comments, often just followed by a "good".

Pi is correcting the students' written work using the same technique for marking. Often he would also write longer comments to their work. He keeps records of the individual students' achievements in different activities on their individual spreadsheet.

During instruction Pi would use comments that are built into the flow of the oral discussion like 'very good', or 'you should work on that', 'think about whether or not you think that is correct' and the most common used 'well done'. Quite often, the teacher does not emphasize these comments. They come out as reflexes on students' oral activities. In

addition, Pi would after most of the lessons be commenting on how they have been doing over the past lesson or what the expectations are for the coming lesson. These remarks are important according to Pi in order for them to prepare mentally for the next activity.

When I raised questions about these activities, Pi was surprised as this following section shows.

Astrid: *“Tell me about the correction of notebooks.”*

Pi: *“Would you like to see how I correct notebooks!”*

Astrid: *“Certainly.”*

Pi: *“If viewing at these two here, we have notebooks that are just examples. This child here has a quite good understanding of the content and I will give marks and grade the work once in a while. I will with this child give more remarks like here what is this, why is there no drawings, how could you work further on this. What I like to get at is asking the child questions that direct their attention to what they can do in order to get a better understanding of it. Sometimes there are too many things to say or write down so instead I ask the child to come and see me at a break and then we will have a discussion about it. I tend to spend so many breaks talking to the children about their work.”*

The element of surprise for Pi has to do with his emphasis on summative assessment as the assessment, and that he consequently considers these activities as mainly learning activities with subordinate assessment purposes. The heart of student assessment is found in the quotation in which Pi in addition tells us about evaluation in comparison to assessment.

*“In terms of the children. **If I am assessing the children, I am assessing what they know and my evaluation will be whether or not my objectives have been met.** It is scary. You have a beginning and an end and you do not know what the end will be so you assess to find out what that end point is and you evaluate will be to find out what goes on in the middle. Whether what you intended has happened and if not then how can you make that better and if something better has happened then what is it that has made it better. You keep it stored here on paper so you can use it further time on.”* (4.10.01, my emphasis) His concept ‘assessment’ here embraces the summative strategies or approaches based on predefined objectives. Assessing the students is for him techniques of comparing their achievements to initial stated objectives. These objectives are based on groups or syllabuses. In addition, the predefined objectives work as his reference when evaluating the success of the educational program including the learning and teaching activities.

Processes of evaluation are for Pi the constant reasoning concerning the gaps between intended learning outcomes stated as objectives and achieved/measured learning outcomes.

Nevertheless, as we have seen, there are clear indications of formative assessment approaches in his statements and in the classroom practices. His mind is centered round oral and written teaching strategies for promoting the conceptual understanding of the student and this influences his meetings with the individual student and to a minor extent the flow of the lessons. These teaching strategies serve the function of feedback strategies and are formative to the extent that it is the learning of the students that is the main purpose.

Pi applies the term diagnostic on some occasions and therefore it becomes important what his content of this term embraces. During my final interview, he had the following statements connecting diagnostic strategies to student identity, teacher identity and ability to document and reflects on the events during a lesson. *"For the example the class that I had this morning, if I had asked to concentrate their effort on the... jelly experiment... in terms of the hypotheses. Then everything else is sort of the stage for in order for them to think of the particle theory. So that is what I will be looking for when I see in their books whether they at least had an attempt to do that. If they had not had an attempt to do that then they have not done what I asked them to do... It tells me lots of things about their work in terms of diagnostic ... that could be as simple as them answering ten questions and looking up the answers in the book and marking the themselves so I could look up in their exercise book whether they have done that or not. If they have not done it they have wasted their time perhaps or they have not understood. So that tells me a lot of things of what has been going on. If you see some doodles in the margin or seen them sitting doing nothing it has been too easy. ... You cannot write down everything. There is too much that goes on in your mind. And far too much that goes on in your classroom that you can actually put down in words.... and there is certainly not enough time to sit down and reflect on that lesson."* (4.10.01)

In these situations, the students' time on task is signaling their understanding. The teacher is administering tasks and checking for work done. If the work were completed, Pi would draw the conclusion that the student has understood the task and the science concept. The students are seldom involved in the process of planning or defining the activity. Record

keeping is mainly marking and grading of students work. Written records of in class activity individual or collective is time consuming. Likewise is systematic reflection. His content of the term 'diagnostic' is therefore rather managerial – he talks mainly about administering the classroom and the students during the number of activities that he has planned.

However, there is more to it than the actual statements concerning diagnostic assessment. Pi has, in addition a clear view on his task in helping the students achieve scientific understanding. Embedded in his scientific counseling discourses there are numerous indications of the students thinking that works on a formative level. He stores these impressions and brings them forward in his conversation with the individual student. He explains how this works. *“You can sit down with a child and there is very... very often when somebody comes to me and says that I do not understand. I would not necessarily call them a liar, but I say I bet you do understand. And then we will have this little abando were they will say I don't understand sir and I would say I bet.... And then we sort of discuss if from basic principles you see and I ask them well what is this and I will continue to ask them questions and lead them through step by step and they do understand. It is just that they have not been able to form those links in their minds as clearly.”* (4.10.01)

Pi explains here in detail his idea behind discourses with his students. His task is to help them make the connection between their previous understanding and the concepts they have been introduced to. Addressing the individual student, he takes their background, their testing results and his expectation into consideration. This individual counseling is however not of particular importance when planning lessons, activities and progression of teaching. His knowledge of the students is important when addressing them individually, but planning for the whole class, he is more concerned with the stated objectives for a lesson.

It is within this dilemma of the individual versus the collective agenda of his teaching that the following statement has to be understood. *“Yes, because if they have not, the last majority of the children have not done what I asked them to do then it becomes obvious to me that for some reason I have not communicated my instructions clearly.”* (2.10.01) His instruction for classroom activities are based on objectives that are set with reference to the group of students or taken from syllabus. Hence, it becomes important for him to

communicate the instructions based on this objective. He would consequently interpret the students' failure to meet the expected task achievement as failure to communicate instructions.

This remark is in a way the sum of Pi's teacher identity. His instruction is based on and connected to his predefined goal for the instructional activity. He is concerned with individual learning, but would interpret time off task as poor managerial work from his side. His formative approaches do not have significant impact on the progress of teaching beyond his individual meetings. The ability grouping is a tool to manage student variation. Therefore, this organization of classes eliminates the necessity for focusing on formative assessment in order to define the learning potential of the groups of students. This learning potential has been predefined by the ability testing (see below). Managing the classes is therefore also partly predefined. Formative approaches works consequently, mainly at an individual level. That is in the meeting between the individual student and the teacher. This is where the teacher would have an ipsative reference giving further advice to the student. As classroom practice, the reference for the evaluation of progression will be the stated objectives. These objectives are mainly not based on the learning progression of the individual, but rather from the syllabus or derived from a general impression of the whole group of students.

Pi has found his formative approach that complements the national testing procedures. He has found his solution to the dilemma of collectivity and individuality. The solution is to minimize an unwanted disfavor to the individual that the use of a collective approach stated as objective and/or group referencing and the effect this may cause for the individual learning by grouping the students according to their measured ability (See section 12.1.3). Pi is arguing for diverse educational planning for the different groups. During the instruction, the conceptual level is set by predefined collective objectives. These collective objectives are expected to meet the majority of the students with their individual learning cognitive ability, their previous conceptual understanding and their interest of the subject. Individual learning objectives is hence not a relevant topic. According to Pi that would be redundant.

The meeting point between the individual and the collective agendas of assessment has another important aspect, the choice of grading. In order to give appropriate individual

feedback understood as optimal learning opportunities of the individual students the school needed other tools. Pi, the head of science department and the principal found that the national grading system does not communicate the necessary competencies on an individual level within the collective set of objectives. The formalization of formative approaches exists therefore through an extra grading system. This additional grading system for individual feedback is applied parallel to the national, but for different activities.

12.2.2 The two grading systems and their application

Pi is explaining the grading system they have developed. This grading system has, according to both teachers and the principal, mainly formative purposes.

Pi: *“Well, our own grading system in the school which has four levels, and then we have the one through four for effort. It is the combination of the conceptual and the effort grading that gives the child and the parents the complete picture of how they are doing in their school work on a daily base...It is like this: the top one equals A, the next one B/C, then C/D and finally E. We use it for in class work, but not for major tests. I think they (students and parents) get used to it quite quickly.”* (2.10.01) The school system does compare to the national system that is used for final grading based on final examination, GCSEs. Pi interprets his identity in line with this. He would say that *“our job is to prepare for that, but the final grades not.”* There is no formalized meeting point between the formative grading and the summative grading. For Pi, this lack of involvement in the final grading of the students is not an issue. Hence, the formative grading does not have to be converted to the national grading. The teacher would use both systems, but he does not have to issue any final grades and therefore document any relationship between the two systems. The validities of the formative system and the national system are based on an ipsative and an objective reference respectively. Relative reliability of the two is not an issue for Pi.

The school grading system combines two dimensions of competencies in order to give the feedback they think the students need. The conceptual understanding is according to the philosophy not necessarily connected to the effort shown by the student. For the school it has become important to signal expectations of achievements also at a level of effort put into the learning activities.

Working on an individual formative level the grading according to this local system should not compare between students. Nevertheless, “*we cannot prevent students from looking at the results of the others.*” (2.10.01) The school has found a strategy to bypass the national summative system, but the competitive element of grading remains even within the grading for formative purposes.

The national system is linked to the attainment targets stated in the NC. These attainment targets have outlined nine levels of competencies. I had to explore a possible relationship between the competencies defined at the different levels and the competencies of the school grading system. The issue is then whether and how the two systems compare and if there exist a common denominator. Pi’s reply is “*We tend not to use them a lot.*” (2.10.01) I interpret this reply that he never applies them as statements guiding their daily feedback to the students. Pi’s answer is slightly more moderate. According to my observation of individual oral and written feedback, he never uses the levels of attainment targets. Nevertheless, he is by the cautious expression also signaling a loyalty towards the official mandate of his teacher profession. A part of this official mandate is the national and school testing systems. PI has a number of reflections concerning the testing and their importance in the school system as well as for the individual student. These reflections are presented in the next subsection.

Even if the school’s grading system compares to the national system it is different and therefore enables the teachers to firstly grade on a daily basis according to individual abilities and thereafter to consider progress. By not using the national system, they do not have to build the reliability of the national system into their judgments of individual work. The second system works as individual feedback and the teacher can hence reserve the national system according to the national objectives and criteria for assessment. The extra system is ipsative referenced and the national system is criteria referenced.

12.2.3 “Testing, testing and testing... we are testing all the time”

There are a number of tests issued during a school year. The tests serve different purposes. Some of the tests are, according to the teacher for diagnostic purposes, some are for placement at ability level and some are national tests.

The head of science department in co-operation with Pi has developed the systems of ability testing. Pi says, *“The grouping is done according to the testing the previous year, the expected grade and the cognitive ability test, the CAT, done in year 7. The year 7 students are doing that this week. It is a two hour test, well... And then we have the tests that we do every four weeks. Once they have covered a topic, a test is issued. We keep track of the results in one of these forms and after all that, we also ask the teacher for their recommendation. There could be various reasons for the child to achieve lower than expected and we need the placement to be serving the single child’s best.”* (2.10.01)

The testing is extended and considers several competencies. The teacher will defend this extended testing of the individual student because the total amount of tests will secure the best picture of level of ability for the individual. According to this view, the ability testing is used equivalent to individualized programming. It becomes important to define general transferable scientific competencies to build the tests on. It is the cognitive ability of the individual child in combination with actual subject achievement that is stated as important to test. These two dimensions are therefore the major concern of the teacher on which he would base his planning and evaluation of the educational activities. *“Social factors of learning are a challenge of the classroom interactions.”* (2.10.01) Explicit here is that they are important, but not able to measure. Therefore, they are not the actual goal of the education nor are social competencies necessary to state as objectives.

It is possible for the students to transfer between ability groups during the 5 years of schooling, but *“it does not happen very often”* (2.10.01). Pi sees three major advantages with this differentiations system. He says, *“We are getting better results, which shows that it works. The grades for the GCSEs have been going up the past few years and we see that as a signal that teaching in these groups is a good way to reach the students. Of course, we use to have all different reasons for placing the students into different groups, but with the testing and the spreadsheet, that I showed you the placement is done more objectively. There is no more of that pretty handwriting syndrome. There is another major advantage and that is the fact that we do get a better spread of girls and boys due to the better reliability of placement build on achievement results as well as teacher recommendation. Placements are less likely to be based on face value factors. The result is a mix of girls and boys in each group and hence they can work at their level. Gives the different student a better opportunity to learn because of the combination of results they are taking into*

consideration. They are then based on the true results instead of factors like neatness and more visible but less important for real subject achievement.” (2.10.01)

According to Pi, the testing and corresponding teaching in different ability levels works because they ‘reach the students’. It is worth noting that ‘reaching the students’ here is defined as GCSE grades going up. Therefore, the formative assessment grading combined with the ability grouping serves the purpose of raising the standards according to the summative examination and corresponding grading system. The individual element of actual learning suddenly becomes subordinate to the collective system of certification. Certification and intake measures to working life and further education by the GCSE stands out as the ultimate goal for all assessment and evaluation activities.

In addition, the testing for ability grouping serves a second purpose, preparing the students for the kind of items they will meet in the national testing of SATs and GCSEs. *“The tests are based on a computer program with all SAT tests and we pick items from there. The rationale behind is that the students are then tested in items they will have to do for the GCSE and SAT testing. They get used to the items, the level of expectation and idea about how the serious testing will be like.” (2.10.01)* This means that the national standards for testing are influencing the testing for ability grouping and hence has a major influence on the actual learning situation themselves. Pi is working within a system, and he addresses the systemic solution in which the actual classroom interaction has been defined, within the frames or under influence of the national testing. The formative is again subordinate to the influence from the summative national system.

The acronym GCSEs pops up in different classroom contexts. It is used for different purposes. Firstly, it is used frequently as motivation during instruction. In one lesson with year 10, he says for instance: *“I have a mixed impression of some people in this class. Remember that all they will look at are the GCSEs. You need to be able to answer questions like this and therefore it is important that you tend to tasks, read in the books ...”* (Observation of 5.10.01) In addition, the phrase ‘To study for GCSE’ has become synonymous with learning activities. Thirdly, the materials provided have been labeled GCSE-material in order to give it status according to national examination. The GCSEs items are used for revision. During some lessons in year 11, the revision material based on the last 5 years of GCSEs is used. Pi started one of these lessons stating to the students:

“They are not hard. This is just revision material. Some are easier and then they get harder. Copy out the questions and write the answer in your book so you can later refer to it.” (Observation of 4.10.01) Finally, Pi is frequently referring to this national testing as the quality standard forming the frame of reference for how the students are doing.

Pi is aware of the GCSEs influence on the teaching. *“Our GCSEs are better because they are open-ended questions in which the children have to explain the answers and to prove why they think that... For the open ended there is a mark scheme... there would be a range of answers that would include particular phrases, particular ideas or concepts or what vocabulary would be awarded particular marks... The old system was more like regurgitating facts, but these are different. They have to understand the concept, to work through, to apply the facts.”* (4.10.01) Pi’s attitude is that the GCSEs address competencies that he find important to measure. He is also aware of the influence this testing has had on his way of thinking and therefore he adds the following during this conversation *“I like that because it is my way of thinking. Perhaps it is my way of thinking because of the GCSEs, I do not know.”*

Dwelling some more on the actual influence of the examination on the individual teacher this statement becomes relevant. *“They are national exams that the teachers resisted for years. We boycotted it for years, because it was too much testing so we do it because we have to do it. It has a benefit in that it focuses our thinking, the teachers thinking towards a goal. We try to push as much knowledge into the children’s heads for this exam and then make the next step for the GCSE a little easier. But it also means that... because it is reported... is a way of which the school reflects on its KS 3 grades.”* Pi is pointing at a duality here. On the one hand, there is a lot of testing that does take up time from teaching. On the other hand, he emphasizes further the advantage of focusing the didaktik reflection and his judgment according to the GCSE. He finds that it creates valid frames for reflection about student’s learning and for his assessment of student learning and corresponding grading. The GCSE is hence standard setting both for the content of the instruction and the reflection of the results of the instruction. Seen in relation to the NC the examination system becomes even more important for both educational planning and for forming the epistemological viewpoints of the teacher.

After having discussed the grading systems and the assessment procedures on several occasions without the national curriculum being mentioned I could not resist asking, “*What is a mystery for me then is how this compares to the competences that have been given as a part of the attainment target package in the national curriculum.*” Pi says, “*We do not tend to use that a lot.*”(2.10.01) It turns out that he actually never relates to the national curriculum as a written document.

12.3 Pi about the status of the National Curriculum

The examination has this far been given a superior function in Pi’s planning and reflective thinking about student assessment in relationship to the NC. Due to this fact, it is interesting to analyze a couple of statements that further emphasize the actual lack of status of the NC in planning. “*The exam board transfers it to me with a syllabus like this one which has things that I need to know and that is good enough for me. This KS3, we look at the program of study rather than the descriptions, that tells us the conceptions and ideas and then we use that further on and we never get out the national curriculum. Well there are just hundreds of statements in that and how would we use it!*” (4.10.01, my emphasis)

As a planning document, Pi finds NC difficult to relate to. His solution is therefore to rely on the examination board and their interpretation of the national curriculum. The implementation strategy, from Pi’s perspective, therefore gives the NC a subordinate contribution. Examination boards run the GCSEs and provide him with a corresponding syllabus that would be his planning tool number one. He does not even relate to the content of NC. He is managing his teacher identity within the board of examination and the standards they are setting.

Pi explains further his planning procedures. “*Planning does not start off from the national curriculum. I very seldom look at that. We tend to use “Science: A scheme of work”, the teacher material in order to divide the year and stages into manageable units. However, I need to say that we do consider this manual a resource and optional rather than mandatory to use. The teachers guide has an introduction of setting the scheme of work and what the scheme covers. Thereafter are the aims and purposes of science at key stage 3. Scheme of work is the breaking up of the content of the NC for yearly planning. All the units comes in little booklets that the teacher can use one by one to plan and execute his*

instruction... I would have been wise if we had the materials for the teacher out at the same time as the NC was out, but that was not the case. We had to develop our own plans and then we got the material. That does not make sense. The NC should have been better prepared.” (4.10.01) For Pi it is clear that he prefers the examination board to do the interpretation of the NC. He actually sees the initial job he had to do with the NC as wasted. This work did not give him any important aspects of teaching or learning to reflect within.

Educational planning for Pi is connected to his viewpoints about learning. He states here two important aspects of his planning with particular importance for evaluation. Firstly, he states that the starting point for him is to define an objective. Secondly, he continues by connecting this planning procedure to his idea about building on misconceptions. He says *“When I plan a lesson... the first thing I want to know is what do I want them to know by the end of the lesson or what kind of skills do I want them to practice by the end of that lesson. Then that tells me what they need to do. That would be the learning objective for the lesson... Sometimes, if you can work in some misconceptions and make me look as if I am a fool that also captures the kids attention. And it makes them capture me or challenge me, and it makes them think at the same time.”* (4.10.01) Hereby the focus of this case narrative has changed from evaluation in co-ordination with planning till evaluation in co-ordination with reflections about learning.

12.4 “To iron out those misconceptions”.

Epistemology and ideology.

Development of scientific skills and scientific reasoning are important during planning of instruction, during execution of instruction and are also to some extent influencing his informal evaluation of instruction. His strategy has been to concentrate this main emphasis into the scientific method as outlined in the introduction to this chapter. As a main emphasis, this influences both his epistemological and science ideological reasoning.

12.4.1 The dilemma of ‘scientific reasoning’ versus ‘correct explanations’

I will therefore continue the presentation of Pi by this quotation: *“In science, I have to make sure that they understand that they have to use their brains. They cannot afford to sit back and write something that they will never be able to use again. I like them to be able to*

use it and to realize that they are their own little scientists in their own little right. They have their own authority. They have just as much authority as me to challenge everybody else's' ideas. As long as they have some sort of hypotheses... some sort of valuable hypotheses that they think is correct. Then we can discuss it and challenge it. Because they have to form their own path in their own minds. If they are challenged they can understand why they were right and why they were wrong. That will be a valuable lessons for them.” (4.10.01)

The use of scientific reasoning as the main strategy for building thinking skills in science education is interesting due to the linkage that is formed in the educators' mind between the idealization of processes of scientific reasoning in scientific communities with the application of these scientific reasoning in science teaching. He wants the students to view themselves as scientists by emphasizing their individual right to build on their own ideas, formulating their own hypotheses or asking their own questions.

Pi says:” *I think that that is the basic point to my philosophy really. There is nothing special about Isaac Newton until he had some ideas of what gravity is all about or what light is all about. He was an ordinary person like everybody is an ordinary person so he builds up his own knowledge. So there is no reason why everybody else can do that as long as they have the same sort of scientific discipline perhaps or the way you can think or keep your mind open to possible ideas and solutions. If you tell the children things and do not allow them to think for themselves well that is the way they will grow up. They will grow up without an open mind to new ideas or exploring new things.”* (4.1.0.01) Scientific discipline based on the methods of scientific enquiry and open minded imaginary ability are two necessary processes in order to achieve as scientist according to Pi. Therefore, in the next phase it is the students' right to plan experiments and make use of their imagination. He says, “*I do think that a creative mind helps because you can image things in your head. Everyone can image things, but the next step is to put it in words so that ...as long as you have access to the vocabulary.”* (5.10.01) Thereafter he wants to challenge the students to form their own conclusions and evaluate the results. When they do evaluate the results, they need a reference. The reference for Pi is then what ‘is correct’ within the accepted structure of scientific conceptual understanding. Human imagination is appreciated as important for reaching correct results, but is not appreciated in the overall assessment of students.

He combines the two positions of ‘structure of science’ with ‘correct explanations’ as being important, but the overall intentional emphasis is development of scientific thinking skills. Pi interprets his responsibility as a science teacher to identify the students’ ideas and to guide them towards the correct scientific explanation of the phenomenon by correcting the errors in their thinking. He is himself very confident in the scientific view of the world and he finds this conceptual system to be very relevant for the students’ understanding of the world as well. His confidence in the scientific structure makes him view this conceptual system as important to teach and transfer to the students. Lab work and theoretical tasks have the same main objective of increasing the ability to scrutinize their own ideas in comparison with the accepted scientific conceptual understanding.

12.4.2 The dilemma of predefined objectives versus ‘scientific reasoning’

There is a tension between forming their own path and drawing their own conclusions on the one hand and on the other hand evaluate against an official standard for the concept or topic. In addition, scientific evaluation presupposes conceptual understanding, and conceptual understanding is simultaneously the learning objective of the activity and scientific reasoning. This everlasting paradox of education is mirrored in Pi’s reflection about scientific reasoning as the mean and as the goal. Furthermore, it is mirrored in his viewpoint that the students are able and they are being made able with assistance from him to think scientific in a similar manner to the educated scientist. This point towards the ideological emphasis labeled ‘scientific skill development’. However, it also points towards the emphasis labeled ‘correct explanations’. Even if the students are left to discover their own ideas and evaluate those, Pi has most often predefined the learning objective. Therefore, that learning objective is his point of reference when assessing the effort and the conceptual level of the student’s understanding.

What is even more intriguing within the frames of science education is that his predefined objectives are connected to his emphasis of using misconceptions as a starting point for educational planning and the conversations in the classroom. Pi” *Yeah, The things that you said...if I can see misconceptions in what they have written down in their books, then I know what I need to reflect upon with the children in the next lesson. **To try to iron out those misconceptions.** Sometimes, as we talked about yesterday I like them to be aware of the common misconceptions so that they know what is the wrong thing to think about. And*

if they know what is the wrong thing to think about then they might take another route and think of the right thing of their own.” (4.10.01, My emphasis) Included here is the message from Pi that it is not necessarily the actual conceptions that his students have when starting on a learning journey, but common misconceptions that he is aware of that he is considering when planning the lesson. These misconceptions will also influence the objectives he states and the assessment based on these objectives.

Pi is concerned with diagnostic assessment and with cognitive conflicts and common misconceptions, but does not define starting point of the students' misconceptions or cognitive understanding. Diagnostic assessment is not assessing according to the individual ability. Variety in individual abilities for scientific reasoning has been taken care of in the system of ability testing and corresponding organizational differentiation. Hence, the daily instruction does not have to be concerned with individual abilities. He is addressing a group of students and that group can, in his mind, take the same instructions as they have the same starting point for learning. If they fail accomplishing a task or otherwise fail learning a concept, the reason is interpreted as failure to follow instructions and hence he as a teacher has not been able to communicate his decisions clearly to the students.

The predefined objective and the predefined misconceptions collide with the idea of building on their individual formation of ideas in their heads. When, as he says, the end point has been defined, the dilemmas of assessment tell us that reference of assessment has been set that does not take into consideration the starting point or the learning processes of the individual child. Even the formative assessment would then refer to objectively stated criteria. Assessment is not ipsative referenced and formative assessment procedures approach summative assessment in practice even if not intentionally for Pi.

There is a consequence of the combination of the emphasis of correct explanations, with structure of science and scientific skill development for student assessment. In his formative approaches, he will to some extent talk about the scientific skills as being important. However when he actually assesses the students this intended main emphasis is sacrificed to the benefit of the more product oriented structure of science and correct explanations. In his summative procedures, the reference is the accepted universal view of science. The individual aspect embedded in the scientific skill development and even more thinking skill development disappears as emphasis in the assessment of the students'

achievements for summative purposes. The process related scientific reasoning emphasis is undermined in the overall summative assessment of students and the product oriented emphasis remains.

12.4.3 ‘Everyday coping’; teaching strategy or learning objective?

Pi is also concerned with the building of a scientific vocabulary. He finds it impossible to build knowledge and skills without possession and application of the proper scientific terminology. *“Some of our children have a problem with the language. If they do not have the access to the vocabulary it is much more difficult for them to try to communicate those theories and those ideas from their own head. As you hopefully have seen when watched me I stress the scientific vocabulary.”* (4.10.01) Again we have the meeting point between the students’ conceptions and the scientific accepted conceptions. Pi is concerned with the general ability to express their thinking in order to challenge their thoughts against the correct scientific vocabulary. He does stress the scientific vocabulary in the classroom interaction and in the written work as the way to communicate the ideas they might have about a particular phenomena.

In the next quotation, Pi is pointing at history of science in combination with the application of the concept for humans today. Pi’s orientation is that once the pieces of information and different concepts have come together by inductive teaching it is possible to apply them on everyday situations and the practical life of people in this society. He will build in the history of science by examples of the scientists that developed the actual concept and the experiments they used. He is bordering on having ‘everyday coping’ as an emphasis. However, he does not do that. He would use practical daily life as examples, but his emphasis is the correct explanations. Daily life implications and applications are merely appetizers or illustrations during the instructions. PI: *“We are looking at details and if they understand the basic looking at the small then we can sort of come away from that and look at how that fits into everything else. We look at resistance and how resistance was arrived at by those scientists... Joule Jones... and how he did it. I will say that you are now doing the same experiments that he did all that time ago in Germany and then we will look at that and come to energy losses and power and currents and using Ohms law and work out how big fuses is suppose to be in a plug for a particular instrument. We will move on to power and see that every instrument has a power reading on it, to again find out what kind of fuse to put in it. I think in that way it is easier to move from the micro-*

knowledge until you have the basic knowledge to move until the bigger knowledge. Bringing it in using the smaller pieces and then bringing it together.” (4.10.01)

Along with the arguments about using daily life examples and historic examples, he argues for the teaching of the concepts separate, then secondly combine them into more comprehensive conceptual system and thirdly illustrate the daily life application. He continues *“As we start small and get big on the way we talk about things that they will see, we do costing electricity, electricity bills, and appliances, what they cost to run. Anyone will complain about the costs so I like to build that into the lessons as well. This is how much money you are costing your parents.” (4.10.01)* The inductive approach to knowledge construction builds on his emphasis of the structure of science and correct explanations. In assessment, understood as testing, the daily life is not visible any more.

12.5 Pi about students and parents participation in assessment?

The reference point for assessment is the scientific structure, the scientific method and the correct conceptual understanding as defined by scientific communities. Where does that leave the students? Would they be able to participate in setting their own objectives for the learning activities and for the content apprehension? Or is Pi left with the predefined objectives? When bringing up the issue the following discourse takes place:

Astrid: “Students and the way they are involved in evaluation. They are sort of involved in setting targets for themselves and in evaluating their work. What do you think about students getting involved in this?”

Pi: “I think it is really useful, because that means that I do not have to do it. ... If you give the bottom class to do that it is too hard for them. That can not simply do that. The middle classes... like when I asked them to swap books and read their partners work... what they had done and suggest them three ways of what they have to do to improve. That means they do not need a lot of time, they can pick up ideas from the other students and that they can be the teacher. That is important. Ask them to ask questions to write their mark and evaluated their own work.... How would they know what they should be able to do. They do not have the experience for that. I can give them the syllabus and they would all have different ideas about that. In about two weeks time I need to finish that. How can they manage that? What about the ones who have lower expectations? “

Astrid: *“It is difficult to manage. It is the question of would that be important for the students so that they could learn something about their own learning and their own strategies of learning?”*

Pi: *“What do the children have to gain by doing that? We do know what they can gain from, but they have other things on their minds. The last thing I wanted to think about was how I can learn differently. That I think is up to us professional to help them along with. We do have target settings processes that they are involved in. Last year with my form class we read through their reports and there was a discussion and we came to an agreement. I asked them how they think that they could be better in this subject. Why is it that they are not doing as well as there and we came to a solution of what would be an achieve...able target for them. They would say that if I handed in my homework that would maybe improve my results. So I said is that a good thing to focus at next term. We will go through a similar process again with our form classes looking at different ways of improving. That is something that we will have to help them to manage. They can not manage that themselves.”* (4.10.01)

As previously mentioned, students are involved in marking their own work as well as the work of the other students. They are also expected to sometimes take responsibility for a group of students in completing tasks. Therefore, they are set to manage the assessment system that has been defined by the teacher. Setting objectives for the benefit of insight into learning strategies or setting objectives for the benefit of insight into learning abilities is not an issue in his mind. Pi would question what they can possible gain form that. Learning gains are assessed according to syllabuses. They do not possess the necessary knowledge about the subject or about the syllabus to be able to set objectives according to expectations of the system. In Pi’s mind, the student s have to possess an insight in order to be partners in setting objectives. They do not have realistic view on their own expectations that are based on their objective ability. Their abilities are defined by the ability testing and by the teachers and not by the students themselves. Actually, my agenda about student participation makes Pi sound ironic. His first sentence starting *“I think it is really useful”* is put in a tone of irony. My point, about student participation, is far from his agenda as science teacher being responsible for student achievement according to content and objectives set by syllabuses.

After this rather controversial discussion, I was pushing further by bringing up the contribution of the parents. In the back of my head was my knowledge that the parents are frequent visitors in this school both to choose school to send their children and to have short meetings with the parents. According to the principal, they are always welcome to visit the classrooms and some parents take opportunities to do so. However, as the following section of interview signals the parents have no participation in evaluation and assessment processes. These processes are by Pi defined by the professional teacher. The parents are expected to be supportive of primary learning processes, but when it comes to assessment procedures the school carries, the whole responsibility based on professional experience. There is no dilemma or conflict to be traced, but a firm belief in this view communicated by Pi.

Pi: *“Most parents, I can not speak for all of them. In the beginning years they help them out reading and that. There are many things the parents can do. Not many parents would be able to that.”*

Astrid: *“The parents would know their child in order to say how much they can achieve or not?”*

Pi: *“Would they? What kind of experience would they have of the child in the learning situation? Perhaps some would. In this school... You go to the doctor for advice on your health, the electrician for problems of that kind, or sort it out with an adapter...teachers would just do it or not normally think to much about it. Parents might come up with something, but it is not based on experience of learning processes.” (4.10.01)*

Moreover, the answer was a definite no- in Pi's mind the teacher carries the professional responsibility of setting objectives due to his teacher and science training. His task is to transform the accepted scientific conceptual system into knowledge bits that are manageable for the students according to common theories of misconceptions. This requires a skilled teacher and neither the students nor the parents have the knowledge and therefore ability to take part in this.

12.6 Pi as a part of the institutional agenda and teacher mandate

The school has according to Pi a choice of examination system and hence course system. The head of the science department is a major person forming the system of ability testing

and choosing the examination board. The strategy of student assessment is therefore a responsibility of the department in co-operation with the management of the school rather than the individual teacher in this case. The menu of summative approaches is set nationally, but interpreted and given priorities at school and department level. Pi is largely, and more than his companion concerned with this teacher mandate. Pi is involved in these discussions at school level. He expresses a loyalty towards his head of department and towards the principal. This seems more important for him than a loyalty towards the national mandate and its written strategic documents. He expresses therefore a trust in the ability testing system that forms the basis for grouping of students and therefore sets the premises for all other factors of planning and execution of teaching sequences. It is these summative approaches therefore that sets the classroom agenda, the communication between students and teachers are framed within the ability group that is predefined. Formative approaches of assessment are applied within these frames. The school procedures are hedging the individual teacher's assessment strategies. Pi is not merely an instrumental tool implementing these strategies, because he is actually developing them in co-operation with the head of the department. This strategy is therefore his, and he defends the system by pointing at the reliability, objectivity and hence the possibility of avoiding human factors of personal based judgments. His autonomy in student assessment is kept intact due to his ability to influence the school management and therefore diminishing ideological gaps.

He is, because of this, made able to reflect in accordance with the practices he is involved in. Neutralizing the importance of the NC, developing a grading system that works for formative purposes and personal involvement in school development are his means to remain an integrated teacher who performs in accordance with himself and with his superiors. He does not any more discuss the national mandate. His first comment to me about this was, *"Discussing? This is a top-down approach instead of a bottom-up approach. Some small amount of teachers have been included in the previous rounds, but at this point we take or leave it."* (1.10.01) He therefore argues for dual systems of student assessment, by which the national requirement of accountability is kept and so is the school and the teachers need for feedback to the individual student for learning purposes.

Reputation of the school is a separate issue that comes up in our conversations. Pi would for instance say, *"This system works. You can tell from what we see from the results. Our*

students are performing better and that helps on the school reputation.” (2.10.01) There are two strong messages embedded in this quotation. He is defending the combination of ability grouping, testing and extra grading system by the fact that the students’ grades have been better at the national exams. When talking about the results in this setting it is the national exams he is referring to. The second strong message is that beside the advantage for the individual student there is the advantage an improved school reputation. School reputation is important for the number of applications and for the relationship to the local community. The school statement is excellence for all, prepared to learn, pleasant, co-operation and respectful, able to work calmly and effectively. This statement is found on walls and in homework book as well as frequently used orally in the assembly hall and in Pi’s classroom.

12.7 Pi, the constructivist essentialist preferring summative assessment

Pi has a technical and systematic approach to planning and execution of instruction as well as evaluating the teaching. He can manage the constructivist epistemological approach to learning to the point of understanding the learning of the students. His interpretation of constructivism is somewhat technical. He tends to define programs of learning, common misconceptions and cognitive reasoning as something objective rather than subjective. His ability of applying cognitive conflicts as principle behind student assessment fails due to the lack of individual references for student assessment. During the minor incidents of person-to-person interaction with the students, assessing their individual understanding and cognitive reasoning is made possible to some extent by the use of the extra grading system. On a general level, this epistemological main position disappears in the comprehensive summative testing and grading systems. He does not become instrumental as a teacher.

The system he operates within gives him frames for professional practices that fit with his own ideas for teaching. And where it does not fit he would work on two tracks, one track in order to please the system and one track for the benefit of the students’ possibilities of developing true scientific thinking skills. He remains autonomous as a teacher. His technical approach enables him to both be dependent on the system and work within the system without the loss of professional identity. He takes part in the planning and development of testing, choice of teaching resources, ability grouping and grading at

school level. Involvement becomes his strategy for influencing the science educational planning at school level and hence keeping his autonomy.

Pi is a case based on a teacher whose main ideological position may be interpreted as the essentialist. He has his identity within the subjects of sciences and his emphasis as science educator is to teach the structure of science as it has developed in the academic disciplines. Consequently, he finds the structure of the academic disciplines suitable for teaching as well. He actually prefers to teach chemistry and physics as two separated subjects. He does not find it necessary to think about the students as future scientists, but he finds that they can all gain from the scientific reasoning. They would gain thinking skills from considering themselves as *“little scientists in their own right”* regardless of their future formal use of science qualifications. Unfortunately he is not able to (or made able to within the educational setting he is practicing) to practice these important aspects of science teaching as a part of the assessment procedures. When emphasizing individual thinking skill is bordering to progressivism in his reasoning, but this student-centered preference loses to the benefit of the structures of the natural sciences.

Pi's main dilemma is his implementation of ideas of cognitive conflicts for evaluative purposes. His intended epistemological position remains a teaching preference but is not visible in his student assessment procedures. They are not a part of the competencies built into the outcome measurement. Cognitive thinking skills lose in the battle against correct explanations. The preferences are lost on the way due to his turn towards predefined objectives and hence group referenced assessment. Even on the daily basis, the stated and preferred epistemological positioning loses against the summative collective rationale.

Pi is thirdly the interpreter and implementer of a national education documents. Pi is interpreting the standards, the curriculum, the syllabuses and the different teacher directions. Pi commented that when he was on the board for selecting the new head teacher he voted for the present head teacher because of her answer to how she felt about the national curriculum. Her reply was that no matter how the official policy is stated, the basic challenges of teaching remain the same. Pi is therefore working within a school where there are relations of shared ideology. This means that the way this school has established their own system for assessment, which more or less runs parallel to the

national system of assessment, is in this system a combination of a joint effort by the staff of the school and shows their autonomy within this system.

The national curriculum is set up to establish equal opportunities for all students regardless of cognitive and physical abilities, to ease transfer between schools and to provide all students and teachers with targets to strive towards. Interpretations are found in teachers' handbooks and lots of material. From outside this may seem like a very rigid system, but at this school, they have found their way to work with the challenges of education of teaching in the different subjects. The national curriculum is difficult to relate to so the teachers find it easier to use material that is based on it because that puts into language they can relate to and syllabuses they can actually implement. The exam board does this interpretation and this step of implementing that gives the exam board extra power in influencing the teachers with their way of thinking. The epistemological thinking put into this material becomes even more important than the NC itself. Exam boards have both a direct impact on the exams and testing procedure and at least two indirect impacts through the testing influence on learning activities and on the teachers' resources materials that they choose to use.

According to Pi, the students and the teachers are not equal participants in the process and discussions with parents are not about these issues. The teachers are professionals that have to build this system to the best for all the students. The teaching profession is a proud profession and education is important. School reputation is important for keeping the school running, but it is obviously important for the self-esteem of the institution. His heart is not necessarily in this final quotation, but his acts and most of his argumentation certainly is:

Pi: *“The only thing that you need to concentrate about. I do not think it is, but it is a product. If you look at the school as a business we have an input and an output and our output is based on the GCSEs and this has an impact on the students. They are assessed by... and employed by their qualifications and it has an impact on the school and its teachers by the reputation. We have a good reputation. Getting good results.” (4.10.01)*

12.8 Pi in a nutshell

Exploring the identity of Pi and reconstructing this teacher in this case has brought forward pieces of reflections and actions concerning student assessment as follows:

- Scientific knowledge as presented to the students in lower secondary education should be based on knowledge as given and universal, but also considering the individual cognitive construction of knowledge as part of instruction.
- Emphasis on cognitive reasoning, misconceptions and cognitive conflicts are present during instructional interactions, but not guiding assessment strategies.
- Scientific knowledge is primarily an individual enterprise acquired through the processes of scientific enterprises applied in education, but also to a minor extent a result of participation in scientific reasoning as collective activity.
- Student assessment should be based on predefined objectives, be group referenced, its objectivity rests therefore on testing, and grading/marking procedures based primarily on behaviorist assessment strategies.
- The student is a client of assessment.
- The subject ideology is based on ‘solid foundation’, ‘correct explanations’, ‘structures of science’ and ‘scientific skill development’. The latter is primarily a teaching technique, while the other three are more visible in assessment. The same is the case with ‘everyday coping’.
- Pi is hence epistemological and ideological dualistic in actions as well as reflections.
- Pi does not state corresponding assessment dilemmas himself, but seems to be striving towards comprehensive solutions.
- Among such solutions are two parallel grading systems, extensive testing as basis for ability grouping and objective statements to guide his classroom interactions.
- Formative approaches are embedded in the communication with students, but are not considered assessment by Pi due to lack of ipsative referencing or objectives stated individually and corresponding status of such standards.

Pi’s case is illustrating a teacher whose identity regarding student assessment practices are:

- ideological and epistemological dualistic,
- signaling both individual cognitive and behaviorist epistemological viewpoints of instruction and assessment,
- signaling mainly essentialistic ideological viewpoints but to a minor extent also including progressivist viewpoints,
- not stating dilemmas as part of reflective practice himself,
- and primarily based on behaviorist and summative assessment purposes and strategies.

Sigma: *"My weak side is that I too quickly put an answer in their mouth. I have to remind my self of not leading them. Because I am who I am, fast and eager to do as much as possible. It is supposed to be effective and then I have done a lot. If I present the result we can move on. I am constantly working on this. I feel that it is not the answer that is the most important. It is just as much the process in reaching that answer... If they only write the answer and that answer is wrong I have no possibilities to evaluate that answer by knowing how they have been thinking and so give them appropriate feedback."* (22.3.00)

13 Sigma

Cognitive reasoning and formative approaches versus classroom-control

The case of Sigma will to large extent be a case built on her perception of the implications of classroom management on students learning and student assessment. The main controversy for Sigma is that when she practices her tasks as classroom manager her eagerness for progression puts her in a controlling position. There is a tension between her intentional formative approach to student assessment built on cognitive reasoning and her identity as classroom conductor.²¹

13.1 Introducing Sigma

My first meeting with this energetic teacher happens on a snowy day of February. The first that strikes me is that Sigma must be the ultimate science teacher in Norwegian lower secondary education with a master in biology on the top of teacher college education. At least intentionally this formal background should give her the combination of pedagogic reasoning, subject related depth in natural sciences as well as practical didaktik. In addition Sigma has five years of teaching experience from two schools. I am also struck by an open personality, by an eagerness to communicate educational ideas and an exceptional giving person with a balanced self-confidence. Sigma seems organized both in educational planning and in all the minor and major tasks of a working day. In addition to the mandatory teacher diary she keeps written records about the classes as well as the students, she issues weekly working programs for the students and has annually and biannually educational written plans. Her presence in the classrooms, the science labs as well as in the

²¹ This chapter has been published as (Eggen, 2003)

teacher lounge is notable due to verbalization of the events of the day and apparently significant contributions to the fellow teachers of both social and substantial character. Her energy is visible in almost every situation I was present and she has analytical as well as creative aspects built into her teaching. Her mind works constantly on at least two to three tracks and her speed sweeps me off my feet on several occasions.

The classroom activity is characterized by a high degree of verbal activity, the instruction is loaded with examples and illustrations from daily life experiences and Sigma is challenging students' cognitive ideas by exploring their answers. About the verbal activity in general she says: *"I am concerned with communication and student activity as signals on learning and cognition, but I have to encourage the less eager students to activity... of course some learn without raising their hands"*. (20.3.00) When talking about the use of different illustrations she says: *"Yes, I do use a lot of examples, stones... and volume, egg that floats... and saltwater, photo taken in Red sea. I think this makes the teaching more relevant for the students."*(20.3.00) And finally she comments on my description of the communication pattern by stating that *"I recognize your description. The reason behind it... is that I try to pursue the thinking and dwell on reasoning. The students often answer by a number or a word. They want to give an answer. I want the other students to understand what the responding student is thinking."* (22.3.00)

Sigma has, on most occasions, a reason behind the choice of the learning activities as well as the organization of the activities and the administrative routines of the classroom. This is illustrated by two citations about the grouping of students according to gender in one classroom and according to ability level in another classroom. *"In my classroom... I have girls and boys in separate groups... because I can talk to the girls in their language and the boys in their language. Both gender like this grouping."* (22.3.00) *"In the other class the ability levels are very diverse... that is why I decided to group them according to ability level. When they are co-operating at the same level the possibility for learning from each other in order to reach a higher knowledge level ... that is what I have been concerned with this time. Differentiating is my biggest challenge."* (22.3.00)

The statements in these two paragraphs underlines my initial impression of the teacher Sigma as well as tickles the curiosity of what are the aspects of her educational reflections about assessment that rocks this picture. Has this teacher found her place and is her

confidence signaling epistemological and ideological stability as well? Is confidence and apparent stability signaling fewer dilemmas in her daily life as evaluator- or maybe more dilemmas? Throughout the year I met with her, the answers to these questions came to me gradually and as much as a consequence of the way she was talking as the content of the conversations.

13.2 Identity; intentions and realization of approaches

From the first conversation, a duality is communicated. Sigma's confidence is blended with an urge for educational reorientation. There is a change going on in the mind of this teacher and she is herself eager to express these changes. Sigma talks about her personality. She is at a turning point, and she is actually fighting some aspects of her personality. *"Typically me... would have been to run back and forth like a small rubber ball. I like to be in control... but I have decided... it is only myself that gets exhausted."* (22.3.00)

Sigma likes to be in control of the classroom environment. The control is firstly connected to her identity as administrator. She is aware of the disservice she is doing for the students. *"We are pampering them by constantly feeding them information."* (22.3.00) The challenge for Sigma is that the visibility of her person makes the students dependent on her. Her administrative identity smears off on her identity as science educator. She likes the social attention and she often stands in the middle of the classroom having everybody's attention and hence controlling the complete full circle. In these situations, she reminds me of a conductor signaling to the students by voice and body language, in the form of minute head movements and conscious eye contacts.

Secondly, the control aspect of her classroom management identity has implications for her thinking about learning and student assessment in science. Sigma is aware of this and her inner fights are expressed like this: *"When should we interrupt the students' activities? If we think they are on the wrong track... When should we interrupt and say that we think they should rather do like this? What is a wrong track? Or should we decide these are the bits of knowledge and the skills that they should acquire? What went wrong or why did you not learn anything? The content of the subject... Maybe we should endure their failures. They have to learn something from this. How they can work, how to spend their time. But*

what is that? - Self-assessment and responsibility for their own learning. Presently, we are clever at telling them that these tasks are the homework for tomorrow." (4.4.01) Students cognitive reasoning is challenging for her. She raises questions concerning the identity as cognitive advisor. She thinks that when building on the students learning feedback have to be given according to the individual process rather than predefined bits of knowledge. A management identity that defines the activities and the objectives as well as the assignments of homework is connected to the predefinition of knowledge and this predefinition of knowledge is not individually based. Making a shift towards true formative approaches involves giving up some of the controlling aspects of classroom management and planning of activities. She is searching for a combination of giving more responsibility to the students and tools for increased insight into students' cognitive reasoning.

Sigma realizes as she talks here that her personality, being quick and result-oriented sometimes hinders the implementation of her own view on learning. Communication of cognitive reasoning is the heart of conceptual learning for her. During the assessment of student performance of a project about rain forests, the following discourse goes on. "*That is correct, but Heidi, what were you thinking when you said that? Why did you use that expression 'threaten animal species'? What do we mean by that?*" (Sigma in observation 24.10.00) Heidi is responding by pointing at two reasons that threatens the animals like insufficient food supply and consequently inability to breed. These reasons are connected to the phenomena of animal extinction. The reason for asking the question is according to Sigma that the facts that the group had presented animals that are not in danger of becoming extinct. The bridge between the reasons for extinction, the animals to illustrate this phenomenon and the mistake the group of students had done are left in a vacuum. It remains unanswered and unlinked as subject information for the group as well as the rest of the class. Because Sigma would continue, "*How was the co-operation in the group?*" So even more important here, her personality can at least to some extent hinder her ability to assess the students accordingly.

Sigma encourages verbalization and written statements about reasoning in order to trace students thinking. In her view, appropriate feedback is to build on these strategies and correct them in order to reach a correct answer. If her own behavior works contrary to these intentions, the students may be discouraged to show her every step in their thinking

and she would be left without evidence of their thinking strategies. This fight with herself is therefore a signal of a breaking point between her intentional preference for formative student assessment and the danger of ending up with mainly summative approaches. Her key idea intentionally is assessment for individual learning. Student assessment for outer control is subordinate. Sigma is aware of the necessity for evidence of student reasoning in order to assess for further learning. Moreover- she is aware of her own dangerous pitfalls. That she, in the eagerness for progression issues answers, and therefore loses the opportunities for further illumination of student thinking strategies.

Sigma's intentional preference is assessment for learning, formative assessment and the counseling position. Before returning tests to students, she says, "*Do not think about the grade. Think about the mistakes you have done first. ... try to solve the task first, then ask your mate, then ask me.*" (observation 26.9.00) Her classroom practice however signals that she personally also likes to be in control and to have the overview over the classroom situation as well as the individual student learning. Her self- understanding brings her to express that she has to realize that in order to give the responsibility to the students she has to step back and let them make their own mistakes. Her self-insight tells her that she is too eager to give the answer. As in the last interview quotation: "*If I present the result we can move on*". She has a lot of energy and her eagerness has a dual effect on her students that she is aware of. Her enthusiasm is motivating the students. Nevertheless, her eagerness also brings her in the position of thinking that her control is important for students' learning.

The dilemma of control versus counseling is her personal dilemma as it relates to her identity as a teacher. In order to fill her identity as supervisor and facilitator she has to struggle with her personality that normally puts her in the position of being in charge of others. A change in teaching methods brings with it a comprehensive change in her identity and her reflections about learning. She was in the middle of this struggle when I met her for the last time.

13.3 Sigma's formative and summative approaches

Sigma is by her own statements, signaling a relationship between the dilemma of controlling versus counseling and the dilemma of formative versus summative approaches.

I will now analyze details of how the combination of these dilemmas becomes elucidated during her reasoning about student assessment as a part of the different teaching activities of testing, laboratory work and projects.

13.3.1 Testing and laboratory work- two opposites

The breaking point between summative and formative approaches is especially apparent in the strategy for correcting/marking tests. Sigma writes the following: *“Assigning points is just as difficult every time, because the points sum up in a grade. If I did not have to issue grades, I think that I would rather not weigh the different items. I would just have corrected their answers and commented on how they have solved the tasks, given some advice about different possible solutions. I feel that I spend a lot of time giving points due to the grading instead of comments about the different tasks they have done. I feel that we spend too much time issuing grades and therefore too little time giving feedback on how they are doing and what they are mastering and what they are not mastering.”* (E-mail of 23.10.00)

There are two arguments running parallel in this quotation. One argumentation concerns the purposes of student assessment and the other the use of grading as communication tool for the assessment. Concerning the first point the primary priority for Sigma with testing is to make the testing a learning experience. Time constraints force Sigma to compromise this priority. According to the quotation in the previous paragraph, she would prefer to give individualized feedback concerning their strengths and weaknesses rather than spending time on grading based on calculation of points. The time limits also make it impossible to validate student responses according to the specific reliable measures of a just system of points- and at the same time write and explain correct or incorrect reasoning and results. The formative approach is sacrificed to the benefit of the summative approach, and the reason in Sigma’s mind is the presence and implementation of a national grading system. Embedded in her arguments here is the uncertainty of the grading system, she thinks it seems more reliable than it actually is. The grading system requires valid documentation, and this is understood as issuing grades on written student work like tests. These grades will in the next phase be used to document the end of term grades as also formal qualifying grades from the compulsory education. This significant importance of her grading outlined

in the national guidelines to assessment in compulsory education is present as a part of her argumentation even if not stated explicitly.²²

Testing as a learning experience is, on the other hand, underlined in the strategy for returning the tests to the students. There are two stages to the return of a test. First, the students are able to review their responses and the comments from the teacher. These comments are mainly concerning what rules are applicable, alternative solutions and questions about their thinking. Some items are reviewed in whole class and the rest are left for individual corrections. After this first stage, the tests are returned to Sigma who checks for further progression and grades according to the initial achievement before the second return to the students. (Observation 26.9.00)

However, switching to laboratory journals, the approach is entirely formative. Sigma states: *“I have developed this form myself, but I see that it needs to be improved. I have told them on several occasions what I am searching for and what I am assessing. Then I make notes on what they should work harder on next time. They need to practice how to formulate a goal, the actual experiment, hypotheses... What are the reasons for the different results? What is the meaning of the lab exercise and why do we do it? Are there any sound reasons for different errors? We work orally with the formulation of hypotheses. During the first exercises we did actually write reports together.”* (22.3.00) There are no signals of summative approaches built into her reflections about laboratory work and lab journals; no principal difference between the assessment of lab journals and the focuses of the verbal communication during the introduction to the exercise and following student activity. As underlined by the statement Sigma emphasizes the same aspects of scientific methods during lab interaction as she emphasizes after the journals are handed in to her. She has a dual concern with lab work. Equally important are the processes and the products of science. Performance assessment is for Sigma a combination of the teaching of scientific

²² There is one grading system in use, the national grading system that is intentionally objective referenced with some, but vague statements about competencies to be met at 6 levels. At lower secondary level all students receive grades in all subjects unless they are on an individual leaning program. In which case they can chose to be graded. The teacher will issue end of term and end of school grades. In addition they will receive grades in the subject(s) they are testes for the final exam. Normally one subject is tested at each school in this national examination.

methods of confirming and evaluating hypotheses and results and these processes' contribution to the students' understanding of the scientific concepts.

Sigma does not grade lab journals and her preferred formative approach is therefore not compromised by external demands of reliable measures. About the use of grades, in general she expresses herself like this: *"I want to avoid the use of grades as much as possible. I am quite often trying to find better methods for feedback that points the students in the direction of learning more, get more motivated for science and becoming fonder of the subject."* (25.10.00) Motivating the students for the subject is the primary concern and assessment techniques merely means of achieving this.

13.3.2 Assessment of projects and student participation

Assessment of a third type of activity, projects, was commented on when playing a video-recording of a lesson in which the students performed dramatization of environmental issues concerning the rain forest: *"The students were so passive even if they did give some feedback. The passive role... they did not participate in the content of the performance. The feedback was only related to the performance and not to the content. When we have projects with each group working on different topics... that requires the student to catch some of the content during the performance. I am really concerned with increased learning from the projects. Maybe it involves organizing the work so that the students take notes during the performance. That entails working on those techniques... I have to consider different possible ways to get the students more engaged in each others topics"* (25.10.00)

Here another point about assessment was raised, the tasks of the student in assessing the performance of fellow students in classroom situations where performances are used as documentation of group work. In Sigma's statement, this is a situation where the relationship between the facilitating teacher identity, formative assessment and social participating student identity becomes very important and has to be addressed as a part of classroom assessment procedures. Hence, as a part of this formative approach the collective versus the individual learning and participation in assessment was raised. Sigma has therefore two major concerns. Her first concern is that students should gain substantial knowledge from projects. This concern is primarily individual and is raised due to distribution of topics to the different groups. There is however a requirement for all students to learn all topics according to textbooks and curricula. Sigma's concern is

therefore to develop studying skills in order to improve the students' opportunities to gain this knowledge by learning from the 'instruction' going on as a part of the performances.

Implicit in this concern is the second concern about individuality versus collectivity in classroom settings. The students were regularly invited to give their comments about the performance and some students participated quite eagerly in suggestions about the use of overheads, the use of memos, the prepared costumes etc. This requires a social awareness of the students. They are given responsibility for own learning and are in addition expected to contribute to the learning of the fellow students. Moreover, they are expected to learn from the assessment of their own performance as well as from assessment of the performance of the others. Again, the learning situation and student assessment procedures are totally integrated. The organization of projects requires an active participation in order to benefit from the topic being presented, and it requires that the students can alternate between tasks of receiving and offering feedback. (Observation of 24.10.00)

In the situation of this interview I was eager to continue discussing the problematic issue of collective responsibility that we signal to the students as a part of assessing in the classroom situation, but also the development of projects as methods for learning in science. Hence, I continued by raising the general question of "*How do you want to develop projects in this class?*" (25.10.00) Sigma responds addressing both different ways of collecting documenting materials and putting a greater emphasis on creative ideas, problems and issues for scrutiny. Concerning assessment procedures Sigma is, however, quite determined to continue her classroom practices even if the content of the teaching is changing.

In the middle of conversations about projects she suddenly changes focus by stating that "*I will try to take the content of the curricula as a starting point in order to emphasize... with the students that there is a content that is set nationally. I want a discussion with the students about working methods that are appropriate for the different topics.*" (25.10.00) This is only one of several quotations in which Sigma on her own initiative brings forth the status she attaches to the national curricula.

13.3.3 Sigma and formative purposes of assessment

In the case of Sigma, there are few examples of explicit stated criteria used for the purposes of assessment neither in her written planning documents nor in her statements about student assessment. There are, however several examples of statements about her emphasis and priorities of science learning experiences. She is focusing on experimental methods and the “*drawing and labeling of graphs*” (22.3.00). She makes items for tests that are direct representations of preferred ‘classroom’ activities like the use of statistics and hence both illustrate the daily life aspect of the subject as well as building content bridges from instructions and testing situations. There are no requirements from other persons or from the school system that either forces or encourages her to explicitly state this embedded priority as specific assessment criteria. However, in her practices they guide her teaching and are embedded in her teaching assessment of her students. Criteria exist therefore as implicit content and process priorities. They become visible when Sigma talks about educational activities. During instruction, she would state the premises for student activities, and would argue that these are also the premises on which she will evaluate her own teaching.

In all learning activities, the student assessment is embedded in the actual learning situation. The returning of students’ tests, the criteria for assessing lab work and the actual involvement of students during projects are three strategies that bear evidence of a preferred formative approach. It is the learning that is in focus and hence feedback mechanisms are built into the daily routines in the classrooms. There are no definite borders between principal evaluative activities and learning activities. There is the intention of making evaluative activities learning experiences and preparing learning activities so that documentation may be used for evaluative purposes.

This integrated perspective on student assessment and learning makes it difficult for Sigma to relate to my questions in some situations. Questions about the specifics of criteria, goal statements and definition of grade levels are often not answered. Instead of a direct answer a whole sequence of different reflections concerning learning, didaktik and administrative solutions are offered me. The next interview segment is, among other perspectives, also an example of this.

13.4 Sigma and her “Læreplanverk”²³ (and assessment)

Astrid: “When you are determined to use the national curricula, what are your attitudes towards the content, the goal statements and the view on learning?”

Sigma: “I think that an active use of the curriculum is very positive. To make it more part of our work.... it is really it that governs.... it is not very visible. What is included in the core curriculum and what is stated in the goals for each subject. Using it will make us more aware. What are we doing? That we have a goal for the work in the school. This awareness is so important all the time. What is it that I want to achieve with the teaching and where do I want to go?”

Astrid: “You may also look at the curriculum as one source of a growing content related and methodical awareness.”

Sigma: “Well, but it is the most important source for awareness of what we are doing.”

(4.4.01)

Sigma used the curriculum more in its introductory phase and she became more familiar with it during the work of selecting textbooks at the municipal level. She expresses that she intentionally gives it a higher status in planning processes than she actually uses it for validating content and learning activities. The subtitle here is chosen because it indicates the frequency of which she was turning to the topic of national curriculum during the period of fieldwork.

For Sigma, there is also a relationship between the teacher as a facilitator, the educational planning processes and the national curricula. There seems to be a need to justify and plan according to this national curriculum in order to avoid the textbooks as planning instruments:

“That is something we are really working with. Get away from the use of the textbook as planning instrument. It is the curriculum that should guide the teaching. These days the teaching is to an incredible amount steered by the textbook.” (4.4.01) The essence of this message is important for Sigma as it is repeated on several occasions. Her main message

²³ The ‘Læreplanverk’ is the Norwegian term for The National Curriculum that consists of a general ideological part with statements about overall objectives for education at elementary and secondary levels, outline of organization of timetables and teaching methods and curricula/syllabuses for every subject with general aims and goal statements for every topic at every age level.

seems to be that teachers' use of curricula encourages didaktik reflection more than teachers' use of textbooks. Exploring reasoning behind educational programming has become significant as a part of her professional development. She easily transfers this insight as potentially important for other teachers as well. *"When making work plans (for the students) we need a common understanding of the core of the topics and therefore teacher co-operation is so important. In doing so it is the curriculum that guides the planning. This way we are avoiding the weekly plans telling the students to do this and that on Tuesday."* (4.4.01)

In these conversations, I am waiting for the controversy of differences between her philosophy of education and the national ideology to come up. However, it does not. Her identity as teacher and manager is strongly associated with the mandate at this point. The tensions she expresses are, according to her own interpretation of her classroom practice, caused by personality versus epistemological and science ideological implicit intension.

Implicit criteria for education are not interfering with the criteria stated in the curricula. In giving status to the national curriculum as a planning instrument, the criteria there should consequently form the evaluative practice as well. There seems therefore at this point in Sigma's professional life to be two parallel running validating systems. Sometimes she is justifying her planning by internal motivated epistemological and ideological (see below) reasoning and in other settings she brings forward the "Læreplanverk".

Sigma is confident in her own ability to find solutions, but she is also a team player. She probably plays the game with other teachers to her full potential when she has a formal or informal leader identity. She grows into a management position always using her subject related reflections as a reference frame. She evaluates the validity of an activity or an educational program in relation to its applicability within her own subjects. *"I feel all the time that I think during these new teaching methods we are introducing. How would that work in the sciences and in mathematics?"* In order to do that she has to signal what she does find important in her subject. What is her major emphasis in teaching sciences?

13.5 “We need to find new aspects of science, what is it that we want with this education.”

Science ideological positions

Sigma continues, “*There are so much negative... (written about) this... mathematics and science teaching. But again there is a lot of traditional teaching going on.*” (4.4.01) The message is that traditional teaching is not necessarily good teaching today. What, in her mind, should we emphasize today in the teaching of science? We have seen that on the one hand motivation for learning the processes and the products of science is the major reason for emphasizing feedback and the development of her formative assessment strategies. But simultaneously science is a means for personal development.

Signals about emphasis in science are found embedded in other messages throughout my logs about Sigma. Immediately after her principle viewpoint about grading quoted under 13.2, she says for instance, “*The most important is to learn about co-operation with other human beings through the work with science... am very concerned with aspects of co-operation and that is why I emphasize projects.*” (25.10.00) In this quotation the academic discipline of science is the means or content used for aiming at the higher objective of development of human co-operative skills. Hence, in some situations, science is the tool and in some situations scientific skills and knowledge are the learning goals themselves. She is therefore switching between a formal and material bildung as rationale behind science activities in elementary education. To Sigma, these extremes are mutually dependent in order to build a comprehensive education for this age group of students. Her science ideological basis can hence be characterized as a mixture of the child centered and the subject centered emphasis. The ‘development of scientific skills’ is important for the understanding of the concepts of science, and for the development of logic reasoning. But a main portion of her arguments draws her in the direction of the child centered thinking embedded in the ‘self as explainer’. Sigma arguments will consequently put her in the position of an educational progressivist.²⁴

²⁴ The two ideological positions here mentioned as ‘scientific skill development’ and ‘self as explainer’ are parts of a framework of science ideological positions. The others are ‘everyday coping’, ‘structure of science’, ‘science, technology and decisions’, ‘correct explanations’ and ‘solid foundation’. Firstly published

In another situation, Sigma easily builds bridges of reflection from assessment of projects to communication as a major means for learning. She continues addressing students' relationships to scientific concepts. She ends up with an argument that making the subject relevant for the students is also about relating to their daily life experiences. As within the introductory quotations about classroom activities Sigma is here stating a preference for practical tasks in order to underline applicability of sciences in real life situations.

“Education is filled with theory. They might think the classroom of science is an enclosed world. ... What is a good and what is a bad task? I work with ... does it sound reasonable... that is important. It has to be based in real life. In order for them to relate to it.” (22.3.00)

This is underlined by her items picking up daily life experiences in testing, by the use of illustrations and examples in instruction and by referring to the students' common experiences as a part of the classroom verbal interaction. It is actually the emphasis labeled “everyday coping”, that comes forward here. There is again a dual message embedded. Firstly the education has to be based on the students knowledge and experiences in order for them to relate to it and hence a common cognitive epistemological viewpoint. For Sigma, it goes beyond that. The content and the activities have to be transferable to their life outside the classroom. Science education cannot be perceived as an enclosed world without external application. The facilitating teacher identity entails relevance and this relevance is built into formative assessment procedures.

When the topic is motivation, Sigma squeezes in a comment about the importance of learning to enjoy nature before turning to one of her favorite subjects, the use and implementation of national curricula. *“It is very sad that this aspect of knowing the species... that it is not a part of the curriculum any more. When walking in the woods, knowing something about the surroundings. Being able to name the trees. It is too bad, because the fun and the more enjoyable aspects of science disappear. We end up with theory and fewer practical activities.”* (22.3.00) She admits in parenthesis that she teaches it anyway!

in Roberts (1988): “What counts as science education?” in Fensham: Development and Dilemmas in Science Education.

The method of storylines was the latest addition to Sigma's repertoire of teaching techniques. By applying this method "*once during fall and once during spring term*" (4.4.01), she argues for the possibility of emphasizing science in the making as well as the narratives of the great men and women of scientific enterprises. She is still in the beginning of defining assessment as a part of her teaching methods. Viewing her previous achievements, she is likely to succeed in building formative procedures for these activities too. In this process, during which she is really emphasizing the use of "Læreplanverket", she will undoubtedly again question her priorities of science education.

Continuous scrutiny of what aspects of the subject to emphasize and how to teach those aspects are parts of Sigma's professional reflective practices. The subtitle has been taken from one situation when she applies changes into her planning and instructional routines. After communicating with Sigma over one year and in several different classroom contexts, it seems like her stability and self-confidence is based on her ability to continually question her practice. There are neither fewer dilemmas nor more dilemmas involved in her reflections, but dilemmas are possibilities for educational planning and do not hinder her professional development. She is in need of the scrutiny in order to find herself as a teacher. Her identity as science educator when the system implements changes or she herself introduces changes is based on continuous verbalization of challenges. A motivating factor for questioning assessment procedures is to build new formative assessment procedures based on both cognitive and sociocultural epistemological viewpoints.

13.6 Sigma, bridges of reflection and subsequent formative challenges

The reorientation towards formative assessment building on a cognitive and sociocultural approach is for Sigma a reorientation in her thinking about learning and about routines for student assessment. However, it is also a reorientation for how she personally relates to the students. Her personal challenge reaches beyond rational epistemological and ideological reasoning and is deeply embedded in her understanding about the self and her teacher identity. Her teacher identity has impact on the relations she builds with the students. This relational constitution of identities, when the controlling aspect becomes too visible, interferes with her intentional principles about learning and student assessment. The change that is going on in her mind works therefore at several levels and personal identity

is a major part of it. Sigma is the conductor of her classroom environment, but her challenge is to use her energy to bring forth the cognitive reasoning of the students and the social relations in her class. She is herself aware of the disadvantages and the benefits concerning assessment of both the summative controlling position and the formative counseling position.

Sigma's pattern of reflection is characterized by switching between the methodical and the theoretical levels of reflections. She incorporates the epistemological and ideological character of the activities in each statement. The majority of her statements are either pragmatic classroom administrative preferences or subject related child centered argumentation. There is the flow in her reflections that is interesting in the way they form bridges from one topic to the next. Another aspect is the questioning mode of communication.

She is determined to give the formative assessment most time and effort in her own teaching and is therefore concerned about the teacher identity that she sees because of this. This teacher identity is a facilitator and a supervisor. The introductory quotation, Sigma concisely, points towards the main difficulty in filling that identity. Her main question here is who should define the learning goals within such a system. Is it still the teacher that should define the expected learning outcome or is it the student that has to be involved in defining the learning outcome according to their learning path? If the students are to take responsibility for their learning and learn the subject and the studying techniques the teacher cannot on their behalf define what they should achieve and how they should achieve it. This view requires the students to be directly involved in the planning process as well as the assessment processes. We have seen that during the execution of instruction the teacher includes the students in her formative assessment procedures.

Sigma is constantly questioning her practices, her administrative, classroom management and content related solutions. In our discourses, she does most of the talking and there are long sequences in which different educational issues are brought forward without any clues from me. Sigma signals by her questioning attitude, an awareness of the tensions or dilemmas involved in teaching in general and in student assessment in specific. She does not have definite answers, but she likes to raise the questions and point at the different possibilities of interpretations of her identity. In the introducing quotation, she is therefore

actually setting up two contrary views on student identities, but also on learning. She does not, however, ask these questions in order to get an answer from me. She is entirely on her own mind track, and I often remain listening to her explorations of the different possible positions. My task is not to give answers. She does not necessarily search for answers in these conversations. She searches for opportunities to verbalize her reflections about student assessment and teaching in order to theoretically sort out the consequences of different possible positions. She is also sorting out practical solutions while talking. She thinks aloud.

The way in which one issue brings up another signals the way in which her reflections are linked. In one of these sequences during our final discourse, she walks from the necessity to evaluate applicability in science before introducing new teaching methods. Thereafter the following topics are given one to three sentences each: the applicability of storyline methods in math and science, the possibility for the teacher to create an ownership to this teaching method, the necessity for an ideological rationale embedded in this teacher empowerment, the products of the method at different levels of elementary education, the challenges for different categories of teachers in implementing it, different possible focuses for professional development among her colleagues. Finally, she is ending up with the tool they have decided to develop, the working program. (4.4.01) During the interview she is building the bridges between different aspects of educational planning, she is piecing together her rationale as science educator.

There is an incredible internal motivation to push herself to newer achievements as a science educator and as a significant adult for the students. *“During the school day I have to speak to, address or signal the existence to each of the students. They are all important.”* (22.3.00) Her priority is also to have the managerial overview. Therefore, in my search for the center of rotation in Sigma’s reflections about student assessment there is the one aspect pointed at on several occasions by herself as personal control that seems to be the main challenge. It is for Sigma a double-edged sword. On the one hand, it gives her the strength to continue an autonomous development by means of ongoing questioning of her practices to a large extent based on internal motivation. On the other hand, there is a danger that it might slow down the development of the formative approach she views as a necessary integrated asset of the new orientation towards becoming a facilitating teacher and a supervisor. In her argumentation, there is a relationship between this teacher identity,

the changes in teaching methods (introducing story telling and extended projects), changed organization of the school year and –day, and epistemological and ideological positioning.

During the period of fieldwork, Sigma’s formal identity changed from being employed as a teacher to being appointed to deputy with a specific responsibility for the project concerning the reorientation of teaching methods. In this new identity, the curriculum is reintroduced as significant for her educational planning. The curriculum states goals on a general and a subject level. It seems as if Sigma is more concerned with the general ideology of the curriculum than applying the stated objectives as criteria for student assessment. They guide her activity, to a major extent the choice of topics and to a minor extent the assessment of student outcome.

The autonomy reflected in her confidence may seem contrary to the external factors communicated through her loyalty to the curriculum as a main tool and guideline for educational planning. When I left Sigma, I was aware of the fact that my attempt at initiating a joint exploration of the possible differences and similarities in her educational preferences and the official ideology fails. The first quotation about the status of the curriculum as “*the most important source for awareness of what we are doing*” (4.4.01) signals again her loyalty towards the teacher mandate given through the school system in Norway. This loyalty exists parallel with an eagerness for progress and her position is that the curricula are a source for reflection about teaching and formative assessment. When it comes to stating criteria for the formative assessment, she is vague. She does not express criteria explicitly and hence are often left with vague basis for evaluation of her own practices.

Sigma is consequently reflecting within her frame of reference, which is the best for the individual student and the classroom situation. She states few criteria and would emphasize her right to base a major part of her assessment on her personal judgments that are not verbalized or written down. Sigma is probably typical in two respects; she does not express any criteria and she emphasizes formative approaches. This combination makes student assessment procedures difficult to relate to for external actors like parents and school administration. The student assessment becomes a closed and secret process that is both difficult to externally communicate and evaluate. On the other hand, she does have an ability to express the dilemmas of student assessment and to explicitly state the different

aspects of didaktik that are considered. This ability to communicate her educational priorities is important for her self-identity as a teacher and it is important in the institutional setting. She is defining her identity in relation to the other teachers by her ability to verbalize reflections about science education. In line with this understanding of Sigma it seems right to conclude the presentation of her by this quotation summing it all up:

Sigma: *“I am most concerned with what goes on in the classroom. Criteria for assessment of tests is not that important for me... Assessment of what goes on in the classroom has become very important.”(4.4.01)*

13.7 Sigma in a nutshell

Sigma’s uniqueness is connected to her identity as signaled by her assessment practice in the following way:

- Sigma is ideologically and epistemologically dualistic.
- She is addressing dilemmas of various assessment strategies and corresponding purposes as well as epistemological positions, ideological positions assets of these dilemmas.
- According to her scientific knowledge is collectively negotiated as well as individually constructed.
- Knowledge is contextual and cultural embedded and therefore individually constructed, but also given according to an academic universal standard as scientific accepted truth.
- Learning is both individual and relational.
- Students are mainly seen as participants in assessment practice.
- Important ideological emphases are ‘everyday coping’, ‘scientific skill development’ and ‘self as explainer’. Therefore, Sigma is signaling progressivist ideologies in classroom assessment practices, and individual formative assessment strategies.
- She applies various summative and formative assessment strategies and uses different means to communicate assessment.
- Sigma does only to a limited degree express references for assessment or objectives for assessment for the students.
- The national curricula are important as planning resources, but also as basis for reflections concerning learning and ideologies of science.
- To Sigma, the awareness of dilemmatic reasoning is triggering her reflections concerning student assessment, and dilemmas are hence a source for further development of assessment practices.

The pieces of Sigma's case are therefore illustrating a teacher whose identity is characterized as:

- a combination of summative and formative purposes of which formative are preferred,
- dualistic ideological and epistemological positions,
- assessment strategies based on cognitive and sociocultural perspectives of knowledge building,
- and dilemmas are sources for teacher identity formation.

Omega: *“When we have been working with that objective the goal is that we should know those things. Sometimes we have ordinary instruction, but often we instruct them to take out the sheet with objectives and then they work individually... look at the first objective and have to think about how they are doing with that objective... then they work, write something in their notebooks, have to consider whether they have learned it and we give them that responsibility. The most important I can do is to assist them in ...we have to teach them how to learn... that they find out how do I learn. Science too is important for this.” (15.03.01)*

14 Omega

Individual objectives, assessment and teaching for the main emphasis of insight into own learning strategies

Omegas case has less focus on dilemmas involved in student assessment. Omegas strategies in student assessment seems more comprehensive in that her epistemological position combined with science ideological position is in line with a preferred formative approach. Summative procedures are present in her own practice, in her school and in the Swedish national educational system. Omegas implicit argumentation is that national curricula as well as national testing procedures play an insignificant impact on assessment as a part of classroom interaction as well as a part of the grading procedures. The main impact of the national curriculum on her teaching and educational planning is however the intended implementation strategy of local adaptation of the national stated objectives.

14.1 Introducing Omega

Omega works in small city municipality in the middle part of Sweden. She prefers to live in the municipality bordering up to where she works. She has three years of teaching experience and four years of teacher training with emphasis on science and mathematics education. Omegas teacher companion is Ypsilon. Omega is teaching sciences in ninth grade and mathematics in seventh, eighth and ninth grade.²⁵ Ypsilon teaches mathematics at all levels, but sciences in year course eight. Ypsilon has two more years of experience and about the same formal teacher qualifications. Omega and Ypsilon are participating in a

²⁵ Swedish school has nine years of compulsive education, six years at elementary level and three years at lower secondary level.

national program of in-service training focusing on student assessment as a part of implementing the national curriculum. Omega and Ypsilon consider themselves as being in a stage of becoming professional teachers. They are aware of the national teacher mandate. In some aspects of the system, they have found teaching and assessment strategies that correspond to strategies that are necessary in order to meet the challenges they face in their local teaching situation. Their reflections go beyond the agenda set by the strategic documents of the national system. In fact, they seldom refer to the national, the municipal and the school documents. Statements and reflections signal personal confidence and strategies chosen that are in accordance with their own educational values. Despite of different teaching styles and classroom interaction preferences Omega and Ypsilon have joint planning and student assessment procedures.²⁶

In Omegas classroom, the major portion of teaching time is spent for individual and group activities. Omega says about the classroom activities: *“That is how it usually is in our classroom. The students are working according to their own pace and to their own plan. Less teaching from the blackboard. Since we are two teachers, we are able to individually guide the students. We prefer to do it individually. (Explain solving strategies and concepts.) We are very concerned with levels of differentiation.”* (15.3.01, explanation added.) Walking around her classrooms two educational dimensions concerning the individual organization of teaching becomes interesting. The first dimension is the many different activities going on simultaneously. Examples of parallel activities are group discussions, individual task solving and minor practical laboratory work. Secondly, the activities seem to be adapted to different levels of knowledge and skills. The individual student or group of students seems to be following individualized programs. Planning, execution and evaluation of this organization of classrooms becomes a major issue in my discourses with Omega. Among the main tools she uses for planning and student assessment are individualized objectives based on the national curriculum. The local adaptation of national stated objectives as organizing principles for individual learning and as guides for the order of learning activities, as means for didaktik reflection and as tool for student discernment is hence a major focus in this case.

²⁶ My selection of Omega for this presentation is a consequence of availability during fieldwork for discourses due to unexpected events for Ypsilon. Their eagerness to involve in discussion of assessment as well as their ability to express their reflections were however equal.

Before or during instruction the students are given sheets of paper with statements about learning. The statements are written in two sets; one set for achieving the grade accepted and one additional set for achieving a higher grade. The objectives are partly formulated as conceptual learning goals and partly as activities to undergo. There are references to the chapters in textbooks, in laboratory workbooks and comments about assessment like “*you will be asked to assess you own working progress*” and “*at the end of this topic there will be issued a test*”. (Written objective statements following instruction 13.3.01)

The reasoning behind the objective statements is explored with Omega. She says, “*The students should know what is expected. The students should receive help in choosing what is important in the subject. They may use it for revision before a test. It is not only the goal, but the road leading to the goal that is important. It is more important that they work than me talking. This is a help for them to structure what is important to work with. For me it is also a help to grade. That is why I formulate these objectives before working with a topic. I could have formulated it afterwards, but in that case the students would not have had this support during the process. It also becomes important for me because it helps me to make clear what it is important to teach in the single topic. I do not find it tedious. You know- all teachers do this I suppose, but not everybody writes it down and not in the kind of system that we have. I think it is a help to state objectives, formulate them and think about my teaching. I always issue them in science, but not always in mathematics. It also works to some extent with substitute teachers. They are not necessarily used to it and do not know the intention behind it and then it may be somewhat halfway...*” (14.3.01) This long and rich quotation contains a lot of reasons for stating objectives. These reasons will be addressed in the next section with reference to single sentences in this quotation.

Goal statements are equally important for learning processes and teaching processes. The first quotation by Omega above the heading is referring to the advantage in individual learning. According to this statement objectives are a means for the individual reflection about learning and are structuring the conceptual learning activities. This signals an emphasis on sciences as contributing to understanding of oneself within the subject. Furthermore it involves the individuals ability to evaluate the scientific knowledge building according to own understanding of the world. A main emphasis of ‘self as explainer’ has therefore been acknowledged by this teacher. Stating objectives are

furthermore a tool for clarification of teachers' subject emphasis set in combination with assessment of the students. Omega is concerned with the students' ability to use science knowledge in their identity as citizens in general and for their daily life. This points towards the emphasis labeled 'science, technology and decisions'.

Developing individual learning objectives based on national curriculum is therefore an attempt at joint differentiation and formative assessment approaches to teaching based on both a preferred epistemological and ideological positioning.

The reflective teacher Omega has found her central tool for organizing her evaluation of teaching and learning. The reflective tool has become the work with stating objectives, at collective and at individual level. The scrutiny of the other major didaktik factors of student ability, subject emphasis, administrative routines, own preferences and background, teaching resources like textbooks is done accordingly. Stating objectives gives her the systematic approach to increased awareness of appropriate epistemological and science ideological emphasis. Two such main emphases have been introduced; 'self as explainer' and 'science and technology and decisions'. What does the teacher view as appropriate assessment tools for maintaining these focuses of science education at lower secondary level? Does the major emphasis come through in objective statements? Moreover, as a major part of this, what are the relationships between the local adaptation of collective and individual objectives and the assessment of students for Omega? The question becomes therefore; are the objectives merely a tool for organizing the teaching and learning or are they a tool for bringing the formative approaches of assessment closer to the testing? Is the implicit purpose to close a gap between summative and formative purposes of student assessment? Alternatively, is this duality of assessment not an issue for Omega?

14.2 Stating objectives for the two benefits

In the long and significant quotation the teaching and learning runs parallel as two integrated aspects and main reasons for stating objectives. Omega starts by referring to learning and so will I.

14.2.1 Stating objectives to the benefit for reflections about learning

Objectives are firstly used for the benefit of learning. According to Omega, in the previous quotation, the most important factor is for *“the student to know what is expected”* and what is emphasized in the subjects of sciences. The objectives serve as a tool for study techniques and for revision of the subject matter before tests. Hence they have the dual purpose according to Omega of both directing the students’ minds towards a particular content and emphasis of the content and towards how they should be working, what are the preferred learning activities. They are both process and product related intentionally as signaled by the statement.

About the use of objectives for the student knowledge about demands or expectations Omega says: *“We are discussing all the time how they are doing... and then we are issuing the objectives so that they can themselves check and see what are our demands. Some of them will fail to meet the lowest criteria and some actually have to take on that responsibility themselves.”* (15.3.01) Here the point about using objectives to communicate expectations is combined with the communication of the competencies required to meet the level of grading called accepted (godkjánt). The key word is responsibility.

Communication of expectations by both means, objectives and grading, is seen as assisting the students in taking responsibility for their own learning processes by doing the activities that are stated in the objectives. If they fail to take this responsibility by not doing the activities, they might have to face the consequence of receiving the grade unaccepted.

The next part of the quotation states: *“This is a help for them to structure what is important to work with. I could have formulated it afterwards, but in that case the students would not have had this support during the process.”* The objectives should both prescribe practice and steer assessment. They are signals to the student of what is emphasized in the subject. It is also a signal of in which order to work with the different aspects of the topic or concept. As process learning objectives, they are hence prescribing activities. As product learning objectives, they guide the student towards the achievement level intended for this year group.

Implicit in these statements is another issue; the everlasting controversy between having done an activity and having learned the concept that the activity is meant to illustrate. This issue is seen in combination with the reason *“They may use it for revision before a test.”*

Omega states that *“Sometimes we can see, like today when working with objective number one... we are discussing having a test next week... the students would argue that we have not done it. And we are arguing that we have actually done it... and when looking into it they agree that we have actually done it.”*(15.3.01) Stating detailed objectives cannot prevent the students or the teachers from evaluating the accomplishment of the activity as being as important as the comprehension of the concept. Objectives do not prevent an instrumental and behaviorist attitude to learning even if the intention of the strategy is for insight into own learning strategies. On the contrary, stating objectives has been used in order to break down knowledge pieces into manageable and testable pieces. That is the reason way I am eager to further explore the intentions of objective statement for the benefit for learning with Omega so I ask the inevitable question of what she thinks is the difference between having done something and having learned something.

Omega: *“I usually ask the question, do you know this. Yes, we do know it they say, or if they say that they do not know it we have to do it over again. I agree, it is a huge difference between having done it in the classroom and having talked about it and actually knowing it.”*

Astrid: *“We know that difference, but the students are not necessarily aware of it. It became very obvious during the revision. Some students said they had done it and some students said they did not know it. They mixed it.”*

Omega: *“That is a signal that they are at different stages in their understanding about how they learn.” (15.3.01)*

At first, this last quotation from Omega took me by surprise. In her mind doing and learning as terms stated by the students are actually the important signal of their comprehension of own learning and what learning is. She can hence use these statements of students during revision of subject matter to evaluate their acknowledgement of their own learning strategies. For Omega the verbal interaction in the classroom carries with it important information about their individual discernment in addition to the subject discernment. Verbal interaction becomes a tool to assess the students concerning their conceptual understanding, but also assessing their ability to use the objectives as organizing tools for learning and as reflective tools about learning.

In the initial quotation one other reason for objectives statements is given. *“It is not only the goal, but the road leading to the goal that is important. It is more important that they work than me talking.”* There are two messages embedded in this part of the quotation putting the focus on the processes of learning. The first is a message about student activity as the core for student learning, and the other is the underlying epistemological positioning that this emphasis reflects. Concerning the first, the actual student centered instruction Omega states: *“There are so many things I could have said, but the fact that it is being said by somebody else make them listen more carefully, and for this person to be able to say it that is the most important... for the students that they actually masters something... I think it is more important that they formulate it than I do it... they will better understand later when they have formulated the text themselves... when revising the texts they can think that I have been writing this.”* (15.3.1) During the instruction the verbalization of scientific concepts that takes place among the students with or without the teacher is continuously stressed. For Omega the student verbalization is the signal that the student has achieved some level of conceptual understanding. Stating objectives is help in this process. Therefore, she states that the objective has to address the road leading to the goal in addition to the goal itself. Objectives should in her mind give the students directions of how they can achieve their learning potential. The stating of objectives need to address processes as well as expected products and the statements have to be accompanied by specific teaching strategies in order to work as learning tools.

The second message concerning the epistemological reasoning behind objectives also continued to be explored during our discussions. *“We try to have an individual plan for every student... that everybody should do activities at their own ability level... yes, we do have a plan for every student. Sometimes we are presenting the same content for the whole class, but it works so much better if they are allowed to work at their own pace and according to what they feel that they need. I try all the time to get them to understand, what do I understand and what do I not understand. And thereafter what do I need to work with. During the time I have been working I have given much more responsibility to the student... how do I learn.”* (16.3.01) The individual cognitive approach to learning embraces both the processes of learning and the products of learning. It is the students that should be in focus and therefore the teacher is the advocate for student activity. In order for the students’ activities to serve the individual learning the actual level has to be adapted to the abilities of the individual and the tool is individual planning stated as objectives.

The development of terminology based on the students' background is significant for Omega. The use of students' language is set up against the use of the scientific vocabulary. She claims that: *"I want them to be as active as possible. When working with year nine students, there are so many that have a poor language and if I then give an explanation... it is better that they explain for me first what they are thinking and the words they are writing than me forcing my scientific concepts on them... sometimes I feel that the scientific can disappear due to the rather simple language we use..."* (15.3.01) There is a tension here for Omega. She is emphasizing the terminology the students are able to use in order for them to comprehend some phenomenon. The common terminology is too imprecise, but it has the advantage of being their possession. Nevertheless, she also sees the problem in not using the official scientific language. The teaching becomes less scientific due to the terminology being based on their daily language. She is here to some extent sacrificing the academic interpretation of important scientific comprehension to the benefit for the students' ability to gain some understanding of the phenomenon based on their background and their common language ability. The sociocultural approach to learning emphasizing terminology building in relationship with other students becomes her positioning. In this paradox the academic scientific official language loses against the center for instruction that for Omega is the students.

This emphasis on student learning as a part of stating objectives rises the question of student participation in this process. The students' participation has been seen at two levels, they are to some extent involved in setting the objectives, even if the teacher views this primarily as her task. The students take active responsibility for their own learning in organizing their activities and in deciding their ability level. The students are in addition asked to evaluate themselves. *"It was Ypsilon that started with it... not every lesson, but the students are asked how they have been working and how it has been... that comes in addition to what we are writing. The perspective is broadened. We would like to have the parents' signature on that too. We send it home with them for the parents to see how we are working. We gather them and use it for grading."* (15.3.01) Following student participation is the issue of parent involvement in assessment processes. For Omega communicating the processes of learning is here seen as equally important as communicating the results of learning to the parents.

Omega finds co-operating with the parents frustrating, due to many parents not showing for the biannual conferences, and at the same time rewarding. About the more positive aspects of parent communication she claims that it is important for the parents to get to know the teachers as the persons they are, but even more important is the communication of the learning potentials of the students along with their difficulties. *“About every student there is something positive to say. Every Friday I talk to some parents that it is necessary to keep frequent contact with. I have to reinforce the positive aspects, which are more worth than strengthen the other aspects.”* (15.3.01) According to these statements, both students and parents play active contributors in Omegas reflections about student assessment. Parents are mainly the addressees of student results and learning processes, but students are certainly active parts in influencing the learning agenda and the processes of learning.

Omega views this point of student assessment as a field in which she needs to develop. She would like the students to become equal partners in the planning process. *“In secondary schooling the students are actually given less responsibility than at elementary level. I have given them some responsibility. Their own learning can they only be responsible for themselves.”* (15.3.01) But again she finds that this has to become increasingly important as the student learn about their own learning strategies. Student involvement is in itself a matter of differentiation as some student have the ability to participate in objective formulation, ability level decisions and test level decisions while other student need detailed instruction in order to use these tools of instruction to the benefit for their own conceptual and strategic learning.

14.2.2 Stating objectives to the benefit for reflections about teaching

In the quotation in the introduction to this chapter the teacher firstly addresses the benefits for learning and secondly the benefits seen from the angle of teaching, or these two aspects of objectives are more or less intertwined in her reasoning. The second sentence in the main quotation addressed the teacher identity in stating the following: *“The students should receive help in choosing what is important in the subject.”* It is the teachers’ task to guide the students is finding the angle or the core of the subject. There is a strong message here about Omegas view on teacher identity. She finds that it is her task to interpret the academic subject sciences, and it is her task to facilitate learning for the student within this interpretation. This message is repeated further down in the statement: *“It also becomes*

important for me because it helps me to make clear what is important to teach in the single topic.” As much as it guides the students, it is a tool for the teacher to state main emphasis of the subject. Secondly, therefore the formulation of the objectives is a means for the teacher to increase her awareness of emphasis in the subject, emphasis of aspects of teaching as well as the anchoring of these dimensions into the planning and evaluation of the teaching.

Other aspects of objectives as guiding teaching are grading procedures, the nature of the objectives as well as their relation to the national curriculum, their importance for reflection and the integration of Omega's teacher identity.

“For me it is a help to grade. That is why I formulate these objectives before working with a topic.” Concerning the use of grading Omega says on most occasions that she will not issue grades. They grade in the ninth year of schooling and at the end of term in the eighth year. On these occasions, grading is done according to an overall impression. They seldom document what goes on during the instruction. The main reason for not grading is according to the following statement that grading would contribute to a static picture of the individual student. *“If we were grading the system would become to rigid. If a student receives a grade this grade would easily be the label of the student. This would work contrary to that everything a student does should influence the grading.”* (15.3.01)

A further exploration of the reasoning behind this practice results in the following statement. *“We have specific statements about the use of the different grades, but too many students will receive an ‘accepted’. It is hard to separate the students and even harder to use the grades to communicate gains. The next grade level requires that they can apply the knowledge in other situations, but also that they are able to combine the concepts, ability to decide solving strategies and have a wider understanding. A lot of the students that work very well on the basics will probably not reach this deeper understanding. They will not be rewarded for their good work and basic understanding.”* (15.3.01) For Omega the national grading system is insufficient in order to give appropriate feedback for the individual student due to the definition of the competencies levels, but also due to the number of grading levels. The combination of competencies with the limited number of levels does not allow for statements about gains according to Omega. The strategy has been to avoid using the grading for formative purposes and instead use written statements to the students

as well as their parents. The written statements allow for more detailed feedback than the repeatedly use of the grade 'accepted' would communicate.

This individual approach is furthermore underlined in her intention to use the stated objectives as a reference when grading. Therefore, they have to be stated prior to the teaching. Stating the objectives afterwards would unable her to set individual learning goals that are communicated to the students. Communicating the learning objectives to the students is a prerequisite for ipsative referencing in her argumentation about the relationship between objectives and assessment.

The objectives link the assessment to the content and the methods of teaching. It guides the teacher in the actual teaching situation in addition to guiding the test development and the grading of the tests. It is important to have the insight into the principle behind the strategy for it to become a tool for reflection. If this insight does not exist, Omega thinks it would just be another strategy that may turn the teacher into an implementation instrument within the break down of the objectives stated in the national curriculum of Sweden.

The objectives are either group referenced or individually referenced. The individually referenced objective is the intention for Omega. The rational behind the objectives are for Omega the abilities of the student. The individual planning is the aim of the educational programming she in doing in co-operation with Ypsilon. Therefore, they are continually striving towards formulating objectives assisting the individual according to their background, conceptual levels and learning progression ability. However, they find that to some extent they may also use a group of students as reference when stating objectives.

The objectives are formulated within the national curriculum in which the objectives are formulated as learning objectives to be achieved in grade five and grade nine. These objectives are used for the national testing. Omega has her own opinion about the implementation of the national strategy based on objectives. *"They are quite detailed formulated in the national syllabuses so we decided that we did not what to break them further down at the school level. But this is the task of the teacher... that for every objective break them down into new objectives... and it goes on like this. This should be done by the teacher because we have different interests, are good at different aspects of teaching and I find that this is so important."* (15.3.01) The teacher are given a major

contribution in this and Omega points at differences in capabilities, competencies and educational preferences as arguments for giving the individual teacher his/her autonomy in dealing with this national strategy. She continues. *“I have been doing this for three years and save them all. Sometimes I take out the old ones, but I change and then there are new agendas in the society that influences what I am doing.”* (15.3.01) The influence from society in her planning of learning activities comes through as a part of objectives statements (see below).

The objectives are stated in the national curriculum. The school plan contains the same objectives. The teachers decided that the actual objectives for the planning for instruction are the responsibility of the individual teacher according to the student, the background of the teacher and his or her personal preference. This is a statement about the autonomy of the individual teacher. This is also a statement that the individual teacher has priorities that they should be able to address. The individual emphasis is the main driving force for the teacher and therefore important to be able to state as a part of the teaching agenda even if the objectives are learning objectives for the student.

“The students should receive help in choosing what is important in the subject.” This part of the quotation points at her preference of teacher identity. The teacher should know her subject in addition to knowing her students. This combination gives the teacher the ability to choose which aspects of the academic discipline to teach and from what angle to present it. This interpretation of the teacher identity points towards a relativistic and dynamic view on science in the classroom. It also signals the importance of continuous scrutiny of teaching processes and teaching content.

The objectives are important for Omega in order to reflect about teaching. *“I think it is a help to state objectives, formulate them and think about my teaching.”* Objective statement is a thinking advice. She has to consider all aspects of teaching when actually writing them down. Instead of the silent knowledge and skills of many teachers, Omega prefers to push herself in making clear statements about educational and subject related priorities. In order for the objectives to be a reflection advice for the individual teacher, it has to be the individual teacher task to interpret the national objectives. Interpretation on school level is subordinate in this process of increased epistemological and ideological awareness of the teacher.

During these discussions concerning the multiple advantages of using locally developed objectives to guide teaching and learning the dilemma of using objectives in combination with grading and testing as a controlling means or a guidance means has been more implicit than explicit. Omega says to illustrate her teacher identity: *“Either you become the person that controls and checks or you becomes the person that guides. I would rather be such a guide. I want to show the students trust. I do not want to mistrust them, one have to decide for oneself what kind of teacher one wants to be. Somebody says that we should be more strict, but I feel that I have to be the person I am- in order to flourish with the work and at work... We eat with them and are in the role all the time. This is, at times, very straining. But you cannot do that... become the controller. I do not want to be such a person.”* (16.3.01) Her teacher identity is to be the counselor. This definition of her teacher identity is in co-ordinance with her own view of her personality. She claims that she cannot be the controller as she identifies more easily with a person that guides other human beings into their own understanding.

Within the dilemma of controlling and counseling, she is on the extreme part of the scale in her emphasis of her identity as the teacher guiding the students. She is aware of the possible positions, but she has chosen hers. The objectives are in this perspective her main tool as a teacher guiding the students into their comprehension of learning strategies.

14.3 Testing for diagnostic purposes and testing as in the national system

Testing occurs in the classroom along with other activities in Omega’s classes. There is less focus on the testing, as testing is primarily another learning activity. Diagnostic testing is a part of the differentiation techniques Omega uses. However, there is also national testing in Sweden, but this testing has according to Omega less significance for the teachers’ knowledge about student ability.

Testing is important for Omega. Contradictory to my assumptions she finds testing as being an important tool for student learning and for student differentiation. Diagnostic tests are used individually corrected individually and under the supervision of the teacher deciding the level of comprehension and activities to involve in. The testing has definite

formative purposes and is diagnostic. The testing is therefore a part of defining the ipsative objectives. Omega tests to define the individual progression for the student and some of the testing is actually the student's own responsibility to complete and to mark. They are hence given the responsibility of finding the right level of tasks according to their own results on the diagnostic tests.

There are basically two different tests used for diagnostic purposes; the tests that the teachers develop and the tests that are included in the student textbooks or the teacher guides to the textbooks. Omega prefers to use tests that consist of three different ability levels labeled A, B and C-level. These levels compare sometimes to the three grading levels. However, as Omega puts less emphasis on grading there is usually no intention to compare competence level of testing with grade competence levels. They avoid using grades for single tests. *‘There are three levels and the students are themselves choosing levels. We intend the levels to be suited for most of them. We prefer not to use grades for single tests. We issue grades very rarely. If we issue grades we and they are trapped.’* (13.3.01)

Concerning the national testing in year nine Omega says, *“We are doing the test in order for the student to see what it is like. We have to sort out whether we have taught the items included. It is important that there is not too much text. How difficult they are, are important. The national testing receives a lot of attention. If we accomplish one the fear would decrease.”* (16.3.01) For Omega it is the practicing of doing a test that is the main reason for issuing tests. Practicing for national testing is important for the students to be able to recognize the situation and their feelings connected to the testing situation. In another conversation, she has an even stronger message about the national testing. *“There is so much hysteria around the national testing, in Sweden and at our school, there are so many, English, Swedish and mathematics and we talk a lot about them. Sometimes it feels like we work for the national testing. It is a part of the grading as I say to the students. Everything they do is a part of that. The national tests also.”* (15.3.01) The national testing as a summative testing procedure has impact on the final grading the students are given. The teachers are given an active participation in the national testing program.

National testing as a means for the teacher to learn about testing, to learn about standards for grading or to adjust grading and testing procedures according to the national procedures

are moments in the back of my mind when I ask the teacher about her benefits from administering the tests. She replies, *“NO, it is for the students. They would know what to expect. I think that testing is more for the students and the parents than for me. The test shows only what is asked in the test. There are so many other and larger perspectives that are more important parts of education than the test can measure.”* (15.3.01) On the one hand she claims that the grading is partly based on national testing, but on the other hand she claims that she as a teacher facilitating the students learning, gain no insight into these processes from national testing. However, she adds this when grading in particular is brought up. *“Well in a way may get some indications of how we are doing in the grading. Our grading is about correct. Simultaneously I think that it has been too difficult the past few years. So then we can reflect around whether we grade accurately. The past few years the tests have been good for grading at the two higher levels, but not on the level ‘accepted’. That makes the test inappropriate for many of my poor students.... Such tests ought to be possible to use at all grading levels.”*(15.3.01) National testing is given some meaning as a tool for standardizing grade levels nationally. She finds the testing format to be interesting in that it is challenging the students to show their solving strategies. *“It becomes obvious here that they have to write what they have been thinking. Most students do not want to do that, they prefer to give the answer they have calculated.”* (15.3.01) From this statement may be drawn that she evaluates the testing format as formats that may give her at least some ideas of testing for cognitive reasoning. However, national testing is not her main source for reflection about student learning.

This testing format is to the benefit of the learner, but not necessarily for this teacher. Omega does not find that she may learn something about the learning of her students’, her teaching or evaluation of either two during this format of testing. She considers testing to be appropriate for developing some national standards and these standards are to some extent important for the accuracy of the grading system. National testing does not give her any indications of the actual learning that goes on in her classrooms, only the knowledge that is tested at that particular point of time. The tests show only what is asked in the test, she says. Testing to get indications of learning, the individual gain in conceptual comprehension is in her mind the purpose of the diagnostic testing that is included in learning activities. The national testing cannot give her this information as these tests are not developed and adapted to her students and their levels of competencies. There are two reasons pointed to; firstly, the test is too difficult for most of her students and secondly the

tests do not address what she finds important for her students to learn. She is therefore pointing at the gap between the implementation strategy of the national curriculum in which locally adapted objective statements are the main technique and the national testing that is fixed at three different ability levels. She indicates the possibility of undermining the principle behind the local implementation by testing nationally. National testing can therefore not be a major tool in her evaluation of learning and teaching. The main reason for doing tests is to give the system what the system demands, and therefore give the students some opportunities to practice this testing procedure. Within her dominantly formative diagnostic approach to testing, the summative national testing has minor contributions. The indirect influence of the testing format on her teaching and her reflections of learning remains unfortunately undiscovered in these conversations.

14.4 ‘Self as explainer’ and ‘society, technology and decisions’; ideologies

One reason for developing objectives was increased awareness of what is important in sciences, what is the main angle of the subject and what does the student and the teacher need to emphasize. When reflecting about the work with the objectives Omega shows me the folder containing objectives for three years. She says, *“I do have this folder with all the objectives developed during three years. I probably have some papers then too... with my present students I can use the same objectives. .or rather rewrite them... and I change too... and there are new topics in the society that influences what I am doing.”* (15.3.01) Omega considers the possibility of using the same objectives, but simultaneously rejects that idea. Her continuous scrutiny of the importance of scientific literacy in our society demands the continuous development of new objectives for teaching. As much as the objectives are a means to push herself in her reflections about learning and teaching they are also a means to repeatedly reflect on the inclusion of the contemporary societal issues into the teaching of sciences. *“I change all the time, and I become better at knowing what works and suits my students.”* (15.3.01)

The main emphasis in her teaching of natural sciences is stated as the contribution of the subject to social awareness and ability to reflect on societal issues. Such an emphasis requires constant reformulation of objectives. We talk about this.

Astrid: *“You are thinking that the students should understand the societal issues and that they should have the background to make up their own opinion...”*

Omega: *“Yes, I do think that that is the most important. If there is something that I think we still are poor at ...it is to teach the students to discuss and take a standpoint on questions . That is what we are working with, but we should do more of that....it is so important...it is what is most important...to apply the knowledge.”(15.3.1)*

Teaching science is to enable the students to take standpoints. Science knowledge is important as it provides the background information the students need in order to discuss societal issues. Omega states this as the most important aspect of teaching science, but there are also other aspects of science that are emphasized in our discourses.

14.4.1 Two intertwined emphases

The two main emphases of ‘self as explainer’ and ‘society, technology and decisions’ are intertwined in the last statements as well as in the introduction. The students need to understand the importance of scientific knowledge for their own empowerment and an important aspect of this empowerment is fulfilled when they are enabled to participate and relate to societal issues from scientific reasoning about the issues. One aspect of empowerment is reflecting and evaluating conceptual understanding according to own identity. In Omegas mind ‘self as explainer’ is a prerequisite for ‘science, technology and society’. Having a focus of decision-making in the society as a main emphasis in science education presupposes an epistemological view that puts the students’ cultural and societal environment at the center of the teaching. Objectives will accordingly be stated as collectively or individually with a reference to some analysis of or at least knowledge and interpretation of the students’ sociocultural background.

Omega is pointing at an example of her societal main emphasis in the following quotation. *“When working with energy questions... we have this discussion about energy resources... shut down Bärsebeck is important to mention and discuss. Even more now than five years ago.” (15.3.01)*

In accordance with this view of making discussions based on scientific knowledge a major concern for student learning, Omega is addressing discussions as a main teaching activity in the classroom. Discussion is problematic due to the management of the classroom

activities and due to the students' ability to absorb the scientific vocabulary and make it their own. Omega says, *"It is crucial that the students are participating in the discussions. Consequently, I have to work extra on the discipline. There are so many things that I could very well have said, but if somebody else says it they are listening more careful. And for this person that is making a statement it is so important... because the student is actually mastering that."* (15.3.01) The classroom discourse activity is meant to develop terminology and to develop confidence in the subject.

Another challenge for her as a teacher is to see the children's general language ability as important for scientific language understanding. *"If they have difficulties with the Swedish language they would not understand the new words that are so difficult. Then every word becomes a difficulty... all common words becomes difficult within the framing of the subject."* (15.3.01) Dwelling some more on the ability to use with insight the scientific terminology brings forward this factor she has to consider in teaching science. Omega: *"That is also something that I think... when working with ninth grade, there are so many that have poor language skills and if I explain something I do not know whether they have understood... it is better if they explain to me what they think and when they write the words... better than me imposing the scientific language."* (15.3.01)

Her general attitude seems to be that the general language ability is a major factor that would prevent the students from expressing themselves in science. The scientific language is therefore for Omega not the universal academic language existing regardless of local application of the knowledge. The language she is applying to assist the student in their development is the language they need in using scientific understanding within the society in which they live, act and could play an active influence. It is therefore the students' challenges again that are deciding her angle rather than the academic structure of the sciences.

This is building up to a third emphasis found in teaching and in statements; the 'everyday coping'. When I ask her about what are the most important topics of science she would reply: *"Biology, they all need that in order to live as human being in our society and they need that in order to take care of themselves."* (14.3.01) Again her answer is addressing the students' challenges, and in addition she points at necessary knowledge for their daily life.

Within the framing of her overall arguments this emphasis is however subordinate to the other two.

‘Scientific skill development’ is a final emphasis that is drawn to my attention in Omega’s lessons. During her lessons there are, without exception, several activities going on simultaneously. The students are responsible for choosing the order in which they prefer to do the assigned tasks and work with the assigned objectives. *“Task solving and laboratory work constitutes about 75%”* (13.3.01) of the learning activities. The reasoning behind this is first that the students should themselves consider the level of challenges they would take on at different times and hence the progression they can handle. Insight into ones own learning is the heart again. In addition, there is the argument that acquiring scientific skills is a benefit for the general ability to reason. Scientific skills acquired in the laboratory are to the benefit for conceptual understanding, but mainly for understanding the processes of the scientific communities. This insight will give the students an insight into the thinking of the scientific communities that in the next turn might give them an insight into their own reasoning. The process dimension of science as scientific enterprises may hence be transferred to the teaching situation. Discussion and co-operation in laboratory work is for the benefit of understanding oneself and one learning within the social interaction taking place in the classroom. *“They work in pairs, but with the tasks of their own choice. The best for them is to write the kind of journal that forces them to express their own observations in their own language.”* (15.301)

Omega explains her thinking behind the laboratory work like this: *“Either we go through the task together or I plan for different stations... sometimes I talk about it first and sometimes not. It depends on the topics... when it is about topics that I should be talking about. They almost always write a report, with a heading, hypotheses... they prefer to write themselves. Sometimes I collect them and give comments so that they should know how to write a report. Only for future use really. It is important that they learn how to write a report.”*(15.3.01) The reasons for the students to write reports are that they should be able to learn from it themselves. Omega thinks that they should gain some insight into the scientific reasoning. This is underlined by the structure of the reports as well as focusing the feedback on the report writing. Report writing is important for scientific skill development and her feedback is given accordingly.

Concerning feedback to the students about the laboratory reports she says:” *It is a part of the grading that they master it. It does not have to be very advanced. They should know what they did and how it turned out. .but I do not issue grades. Sometimes I write about how they have been working. If they have worked or not they should be told. I do not keep track of how many they have delivered. I do have demands that they should have done these and these tasks, written reports, delivered them to me and have them accepted. The last time they did not deliver them. That is because last time they had a lab test in order to show that they are able to apply what we have practiced. Then they see that it is important. I would like to do more of that .*” (15.3.01) In these feedback situations she would never apply the grading scale as in her mind the grading of student work does not give them acknowledgement for the effort, the conceptual understanding nor the gains of either of the two.

Integration of the sciences becomes important for Omega in order to be able to address the progressivist position but also to address the sciences relevance for the bildung of general competencies- the general education perspective. The society is the reference for what the student should learn in science and within an emphasis of science technologic and decisions. Within such an emphasis, Omega finds that an integrated science is important. The challenges of the society do not in most cases address one concept, one academic discipline or one subject topic. Organization of knowledge is therefore seen as best integrated. She says “*I usually mix the three (biology, chemistry and physics). Sometimes, as present the physics is more visible, but my ambition is to mix it more and more. Reality is not divided into disciplines, but reality is... my ambition is to develop a focus of societal issues* ”. (15.3.01) In order for the sciences to address societal issues the school subjects should take on a form that makes it easy to structure the teaching around societal issues rather than academic concepts. Omega uses the word reality. She is not referring to reality as the nature that sciences should reflect. She uses the word reality about society. Her position is not that the sciences as a subject should reflect the nature, but sciences are tools for societal involvement.

This integrated perspective is also an issue when investigating the grading. Omega has other intentions concerning grading than the present choice of the school. “*We can choose whether we want to give one grade for biology, one for physics and one for chemistry or one common for sciences. We issue three grades, but we should rather issue one. This is up*

to every school.” (15.3.01) Her preferences is contrary to the decisions made at school level both when it comes to grading and textbooks.

14.5 Omega; formative assessment, sociocultural positioning and progressivist.

According to this analysis, the case of Omega is presenting a teacher who is the progressivist. She is concerned with bringing the student to the subject of science. It is the student that is the subject and the sciences that are the object for Omega. The teaching has to start where the students are conceptually and socially, and the overall aim is for the subject to be able to empower the students further within their sociocultural circumstances. The challenges of the students become the challenges of the teaching and hence the didaktik main question becomes how sciences can contribute to bildung in general rather than the specific science bildung. Local adaptation of the content as well as the teaching methods becomes the main didaktik tool, and stating objectives the assessment as well as the main tool for organizing, evaluating and reflecting over the teaching activities.

Omega is concerned with the well-being of the students. *“The most important is for the students to feel good. If they do not feel good they are not able to learn.”* *“The physical environment is important, we need a quiet classroom. Some students cannot work in a noisy classroom, they have to work in other rooms.”* (15.3.01) These two quotations are examples of statements concerning general aspects of learning, not particularly addressing science, but still embedded in the conversations about criteria for learning science.

The case of Omega is also a case about a teacher positioned as the liberal educationist. The question becomes whether Omega could be teaching any subject because her reflections and her emphasis seems to concern education in general rather than specific academic disciplines of biology, chemistry and physics. Omega’s own response is a definite NO! She has herself found the joy and the application of the sciences to be their significance for understanding the society around her, and it is this angle that influences most of her communication with the students, with Ypsilon and with me. In addition, she is determined to further develop teaching programs that are suited for her students and in the environment they live.

The objectives that have been the major focus of this chapter are formulated partly as conceptual learning goals and partly as activities to undergo. One additional point is to analyze the objective statements to see whether they or to what extent they are signaling ideological and epistemological preferred positioning. Viewing some examples of objective statements it appears that a major part of the conceptual objectives are referring to basic conceptual understanding like *“understand how the thermometer works, understand the principle behind the Celsius temperature scale and have a good understanding of the concepts of boiling point and melting points”*. The odd objective is stated as this example: *“understand how different materials are influenced by temperature differences and emphasize what challenges this creates in real life”*. (Excerpts of student objective paper of observation 14.3.01)

Hence, the preferred ideological positioning and sociocultural positioning of the teacher that are stated in the interview do not appear to the same extent in the objectives. The objectives are to a major portion presenting conceptual factual knowledge. This knowledge may however have been broken down into pieces of information that make the goals manageable for the actual student. The objectives are the major communication between the teacher and student in addition to the oral communication. Due to their significance as organizing principle and as tool for student assessment it is therefore possible to draw a conclusion that the intended ideology of the teacher does not come through presently in the student assessment to the extent that she is aiming at. On the other hand the teacher is aware of her learning potential in the teacher profession and her claim of the status of the objectives as reflecting tools for both student learning and emphasis of teaching remains. Omega’s challenge in the present as in the future is to build her sociocultural approach into the objectives. She is also in need of doing this in order to emphasize preferred ideological positioning in the formative approaches of student assessment to the extent that she intends to.

Omega asserts that there is so much she is considering when grading the students and that the particular conceptual knowledge as well as the single activity and the objectives stated are only a part of it. There are underlying or overall aims of education that are equally important. Some of these aims are stated by her in the interview and reflected on by her as well as interpreted here in this chapter. The sociocultural and ideological positioning she is stating as important does not manifest itself in the actual objective statements, but they are

regarded as equally important for the overall assessment of the student. Adaptation of learning objectives as stated to the student covers only some aspects of the learning and teaching process. The other aspects that are referred to here may therefore represent some of the overall perspectives of learning that she herself finds difficult to break down into statements about learning. They remain the part of student assessment that in sum is her teacher positioning that influences the student assessment even if not explicitly stated as a part of the intended implementation strategy. The sum of this positioning is what we often labels the teacher professional judgments. Professional judgments, teacher experience and teacher intuition influences the assessment of Omega's students as well as any other student.

For Omega formative purposes of assessment are the focus. She is concerned with summative assessment only in order to feed the educational system with testing results, but her preference is assessment for individual learning. The ipsative objectives are stated within this understanding of assessment. They are however not used to the same extent when assessing as when guiding learning activities. Duality of formative and summative purposes is an issue for her. They live parallel lives in her reflections about assessment. She is aware of the duality of the implementing principle versus the national testing, but to a minor extent, that is her agenda as a practicing teacher. Implementing the national curriculum by local adaptation of learning objectives is her major concern because she evaluates this as contributing to learning for the student as well as a reflection tool for herself. The purpose for her is hence not to close a gap between summative and formative purposes.

I could not resist one more time digging into what had become our favorite topic. Therefore, as a confirmation of previous statements and interpretation, my final question to Omega was *“Would you consider responsibility as the major educational concern you have?”*

Omega: *“Absolutely, because that is what they need out there in the society. The rule is that if you are able to take responsibility you can acquire the necessary knowledge. Some are not able to take on the responsibility. We have to assist them. They are different. I cannot learn for them. The main thing is to discuss things like how you do it and how you learn. We need to further emphasis those discussions with the students. This is so interesting. How they are learning. Some*

students I would like to have more of the kind, but it is enough having five of the other kind...” (15.3.01)

14.6 Omega in a nutshell

Finally, the main pieces of the identity construction of this teachers regarding student assessment are:

- Scientific knowledge as presented to the students should primarily be considered as socially constructed, individually and as a part of a learning environment.
- Ideologically science education in lower secondary education should focus on ‘self as explainer’, ‘everyday coping’, ‘scientific skill development’ and ‘science, technology and decisions’.
- The progressivist position in student assessment practice is connected to the value of sciences in becoming a part of a learning environment, understand oneself as human beings and understand the society that the students are a part of.
- There is a preference for formative assessment based on local adapted and defined objectives and ipsative referencing.
- The students are participants of objective statements and most aspects of assessment practices.
- Stating objectives are means for reflections about locally adaptation, about teaching and about learning for both students and Omega.

The case of Omega is therefore reconstructed in order to illustrate identity construction pointing at:

- non-dualistic socio-cultural epistemological and essentialist ideological positions,
- preferences for formative assessment,
- application of curricula for objective statements used for multiple purposes of reflective practices,
- and comprehensiveness of assessment strategies based on progressivist and sociocultural perspectives.

Part V

Conclusions, Implications and Discussion

Delta: *“What has been very important to me is the growing awareness about what I am measuring. I have been thinking about that a lot and am frequently reconsidering it. I can not say that I have changed the practices much, but I do understand myself, what I do as a teacher and why I do it... in a different way.”*
(4.4.01)

This final part consists of three chapters. The first chapter revisits the cases from an empirically close methodological point of view. The intention is here to illuminate analytical turning points and serendipities in fieldwork within the methodology of Grounded theory, but in addition consider a number of factors not analyzed within this methodology. Chapter 15 is therefore a discussion of the validity and reliability of the project within the chosen methodology, simultaneously addressing some issues not presented in the cases. This chapter is empirically close due to the extended use of data sources such as logs generated in the field, interviews and school documents. As such, this retrospective reflection of the fieldwork is also a subset of Grounded theory strategies. However, the content of the cases and the respondents have been presented from the situated ethnographic approach, the relational nature of fieldwork and the external societal educational environments.

The second chapter revisits the cases from a substantial point of view looking across the cases in order to draw some conclusions about what the epistemological and ideological positioning presented in each case represents across the cases. From this follows the development of a discussion related to a merging of ideological with epistemological positions for teacher dilemmas of reflections concerning student assessment. Hence, Chapter 16 is a presentation of Alfa through Omega indicating the possible implications for a comprehensive view on assessment as integrated in all educational activities. Some implications within a normative didaktik and ontological implications for science education are presented in the wake of the empirical indications.

The third chapter discusses the knowledge construction of this research project within a wider outlook at educational research represented by the integration of the dimensions of

ontology, epistemology and methodology. Chapter 17 is therefore a discussion of the validity and reliability of this project from the wider perspective of social sciences. Some critical comments will also be offered on various positions within Grounded theory as contributors to knowledge construction. The methodological gaps between Grounded theory and ethnography can be bridged by the introduction of a constructivist Grounded theory.

15 Revisiting the cases of Alfa to Omega within Grounded theory as a methodological approach

The main assets presented, as important within Grounded theory in Chapters Seven and Eight were the relationship between theoretical pre-understanding and the empirical indications in theory development; the different techniques for increased validity and reliability as aspects of establishing the specifics of the persuasiveness and quality of research within this paradigm; sampling strategies; and finally analytical tools, memo writing and coding procedures.

The project was designed with one foot on each side of fence between two fields labeled context specific ethnographical fieldwork and non-context specific Grounded theory analysis. The uniqueness of the cases exists at least at two levels, namely the preferred flow and order of discourse adjusted to each teacher and the particular aspects of student assessment and issues of education emphasized as a consequence of this context close ethnographic approach. The development of the cases reflects the different processes undergone with each teacher when it comes to the content of what we were discussing. That is due to different practices as well as my intention to develop the project in close proximity to their practices in order to facilitate a discourse as familiar as possible for the teacher. On the one hand, this situational nature of the fieldwork, based on a sociocultural view of relationships in the field, has resulted in case-specific genre. On the other hand, the structural view of Grounded theory's constant comparative method including transferable categories has resulted inductively in the theoretical framing that has been deductively applied during the analysis. To some extent and in some of the cases this cross-situational analysis has been applied in order to create cases that are not specific to the situation in which the data was generated. These two conflicting methodologies with correspondingly different underlying epistemologies have been running in parallel throughout this project as outlined in section 7.2.8.

Before turning to the substantial discussion I will revisit the cases in order to describe and explain in retrospect the differences and similarities in the genre used in the written accounts and comment on these in the light of the time aspects of the fieldwork and development of focal points. The combination of time and methods applied (15.2.) in the

various cases signals the combination of situatedness and transferability manifested in techniques such as triangulation and respondent validation. All cases have been constructed in order to find a focal point. (15.3.). The point of focus is a result of tedious scrutiny of single pieces of information as well as an overall analysis of the material of the individual teacher, but having the main impressions of the other teachers at the back of my mind. Thus, the serendipities and analysis leading to the focus of each case carry the special amalgam of theoretical and empirical indications involved in the different case constructions (15.4.). The combination of theoretical and purposive sampling is another aspect of Grounded theory bearing the persuasiveness and I will include some comments about the relative application of the two in this project (15.5.).

My project has been influenced by the ethnographic research tradition from which I have derived issues like building in- field relationship with the teachers or the combination of different data collection methods. The visibility of the researcher in the relationship with the researched and in the interpretation of the data represents two assets of respondent researcher or the object-subject dimension of social research. Some reflections will be included here in addition to what is underlined about the relationship between the researcher and the researched in the sections based on log writing (15.6.).

I have intentionally omitted the questions about gender, power and the cultural societal context of the fieldwork and the analysis, even not without some hesitation and struggles as I believe these issues to be important for a socio-cultural epistemological paradigm. These are, however, not factors at the core of Grounded theory. Nor are factors like different verbal genres, nor irony and rhetoric. Some comments will be included about these aspects of verbal interactions due to their presence in the fieldwork and in the data material analyzed (15.7.). The case construction and analysis have taken the teacher's opinions as a starting point. Therefore, the wider societal context of the educational institution has become invisible in the analysis unless specifically referred to by the teacher. My interpretation may still have been influenced by information provided and impressions formed. I will therefore take a step away from the case construction as framed by Grounded theory Methodology and briefly present some of this external contextual information (15.8). The data sources for this chapter are, first of all, the research logs written almost daily throughout the entire project period. (Silverman, 2000, 2001; A. Strauss & Corbin, 1998) Secondly, groups of sources are represented by documents issued

by the schools, while an interviews conducted with other personnel at the school are third group of sources.

15.1 The construction of the different cases; some introductory comments

Grounded theory transferability and sociocultural situatedness have both influenced the fieldwork and the cases based on the fieldwork. The first revisit to the cases is therefore a discussion of the analysis in combination with the methodological positioning I have taken in order to combine the situational nature of ethnographic fieldwork with the structural view in the combination of theoretical framing and empirical indications in Grounded theory. Situatedness has to do with time perspectives and closeness to the teacher activities. As mentioned in section 8.4, time perspectives incorporate aspects of frequency, time in field, time out of field, sequencing of observations and interviews as well as time between these research activities. The degree of the situatedness, the relationship between the text and its educational context has implications for applicability and transferability. This discussion therefore addresses both the internal and external validity of this project.

Grounded theory introduced the constant comparative method which implies comparing different respondents according to the same concepts, different sets of data from the same respondent including different educational incidents created under different educational contexts as well as comparing different categories and concepts within cases and across cases. This method therefore implies triangulation of times, methods and respondents.

There are a number of considerations involved in choosing the written genre of these cases. One overall consideration was an ethical concern of presenting each teacher with a positive flavor; each position exists in its own right and makes important contributions to the many faceted landscape of student assessment. When portraying human beings, even under pseudonyms, the respondents may recognize the case and identify themselves with the written accounts, or they may be recognized by colleagues. As much as this is not intended it still represented a concern when writing the cases. On several occasions, the limitations of the research project were highlighted in discourses with the teacher.

Furthermore, I have decided to use metaphors to explain the positions of the teachers in pictorial language by creating a picture in the reader's mind, maybe adding to the richness of both the story and the contextual information. Questions also direct the reader along the track to the extremities/outer limits of the single case, thus creating chronological linearity in order to organize the focal point of a story that consists of both situational messiness and processes throughout the fieldwork at several levels. These stories switch between present and past so as to make distinctions between in -fieldwork and post-fieldwork activities - just to mention a few of the techniques that I am aware of myself.

Van Maanen has identified seven styles of case presentation: realistic, impressionistic, confessional, critical, formal, literary and joint. (Van Maanen, 1988) This is based on a retrospective analysis of a number of case presentations. The cases in this dissertation are mixed in style. Sigma, for example, employs an impressionistic use of terminology. The other cases are predominantly realistic, but with impressionistic elements. This author together with other scholars wishes to signify that case construction as an ongoing process involves aspects of content, genre, styles and structure, and that the case "*evolves even in the last phase of writing*". (Stake, 2000, p.441) I think this is important to underline as the structure and the content of the text develops as a consequence of the abductive analysis and for this reason the written genre.

Two voices are present in all the cases. The voice of the teacher is present in all the statements. Even here my voice is indirectly present when selecting the quotations. All the remaining text is my voice, and these parts are interpretations at various levels. The first level of interpretation used repeats the content of the quotations applying my words. Thereafter there is the piecing together of information from different quotations, the initial interpretation of classroom interactions corresponding to the interview quotations and the interpretation according to the theoretical framing. Another, and the last main point, is that I have allowed myself to be present in the cases to a greater extent than in the previous chapters. This reflects the relational character of the fieldwork and my superior contribution in the overall knowledge construction.

The use of different voices and the blending of voices for text construction are however more than a choice of written genre or what parts of the texts represent the researcher

versus the researched. These choices are ontological and epistemological by nature, and as a consequence of their blending the voices of the researcher and the teacher they entail choices of whose knowledge construction this is, whose meaning is communicated through the text, whose reality is described, and what rationale lies behind the specific aspects of reality interpreted. I will return to this discussion in chapter 16.

15.2 Combining time and methods in the creation of cases

The three Norwegian teachers, Alfa, Gamma and Sigma were all included in both the pilot and main projects. As a consequence, the material, observations, teacher documents and interviews based on these three teachers are more voluminous than for the remaining teachers. Due to Sigma's change in teacher position the discussions with her were terminated at Christmas in year two and the number of observations is more limited than for Alfa and Gamma. The two Swedish teachers, Omega and Ypsilon, were visited on two occasions, each time for about a week. However, all the relevant written material is from the last visit. The fieldwork conducted in England with Pi and My lasted for two weeks. The combination of observation and interview based on microanalysis throughout the fieldwork has been applied in all cases. The cycles of analysis driven observations and interviews was repeated more frequently with the Norwegian teachers.

The first two cases involving Alfa and Gamma are constructed chronologically according to the events of the fieldwork. The different interviews and observation have been used in the order in which they happened. There were two intentions behind this construction. Firstly, one intention was to illustrate the process involved in the fieldwork with special emphasis on the relationship between the teacher and me. Secondly, the intention was to illustrate those aspects on which the teachers had developed their practices or reflections around their practice throughout the period of the fieldwork. For both of these teachers the relationship and field work lasted for almost one year and three months. In the case of Gamma it entailed a change in the student groups. In the case of Alfa that entailed going from grade nine to grade ten with the ensuing focus on the final examination in the last year of fieldwork.

In the cases of Alfa and Gamma the situated ethnography perspective is therefore applied in the analysis and the written accounts to a larger extent than in the three remaining cases.

As a consequence of the chronological presentation, the educational context framing the quotations has been more significant and visible in the presentation. The context under which the text was created is presented as a major aspect of interpretation. The description has brought forward some aspects of processes of professional development of Alfa and Gamma as a result of the lengthy period of fieldwork.

In the remaining cases, Pi, Sigma and Omega, the data sources have been interpreted and pieced into the presentation basically regardless of chronology. The main intention has been, in all these cases, to validate the focal points developed. The different data information sources have, therefore, been triangulated with regard to both the time perspective and methods. Hence, the relationship between the educational context that forms some of the background for the quotation and the quotation itself is less significant. There is a wider gap between the text as analyzed and the context presented than in the cases of Alfa and Gamma.

Pi through Omega are cases constructed without having a teacher process particularly in mind. Pi and Omega are both based on one week of intensive fieldwork and they are thus snapshots of the practices and reflections of two teachers at some point in their professional development. The shorter period of these cases makes a development in the teacher reflection process less relevant. The time aspect here also enables combining the information to a greater extent without compromising the internal validity of the cases.

As I was writing Pi, the epistemological complexity and duality of the case building became more and more importunate. I wrote in my log at this point the following. *“The ‘truth’ about Pi is definitely not in the single statement but in the syntheses of the different statements. How can I deal with this challenge of contextual interpretation combined with my theoretical framing? The persuasiveness concerning Pi in this framing lies in combinations of quotations, the- in -between –the- lines- of- the- quotations, the intuition of the fieldwork, the serendipities of fieldwork often not included in the transcripts, the ...”*

The fourth case, Sigma, has also been constructed without illustrating the process of the teacher despite the time perspective in this field relationship, lasting from March through December. All educational situations and interviews have been combined in order to

illustrate one phenomenon, her reflection about a dualism of classroom control versus student centered formative assessment approaches.

So far, I have discussed the aspects of combining different times in the construction of cases. The time perspective involved in this research also embraces time for gaining access, leaving the field and time from living the fieldwork to writing the fieldwork in cases. This last time perspective is important when considering the concerning of the cases in that I have tried to keep the lived experiences of the teachers and their encounters with me from the past alive in the present.

The methodical triangulation commented on here has an aspect of disregarding, not eliminating but still downgrading, the different educational and situational contexts of which an interview and an observation are parts. The information has been combined pragmatically in order to illustrate the background but also to bring together pieces of information that would shed light on the phenomena in question. The time triangulation undertaken in some of the cases is a part of the time factor related to with the point of time of retrieving of the information. The presence or absences of processes in the cases are consequences of focal points, but this is supported by a total shorter period of fieldwork in at least two of the cases, Pi and Omega.

15.3 The development of the focal points of Alfa through Omega.

The cases are reconstruction from research experiences. Developing focal points has been important in this reconstruction. The focal points of the cases fall within Grounded theory as the 'central category' with a requirement that the major portion of the open and selected codes are related to the central category. The central category is therefore the one that provides the story; the case or description represents character and is simultaneously the category that defines the theoretical focus of the presentation. I will accordingly retain the term point of focus.

Memo writing is the term most frequently used in Grounded theory for the reflections, ideas and possible concepts stated in written accounts. Hence, memo writing serves as an important tool to develop analysis, administer data collection and data analysis and also as mental organizer in these many faceted processes. My preferred term is, however, log-

writing. This served the important functions of defining and keeping to my defined substantial and methodological dimensions. They are tools for setting an analytic course based on theoretical framing as well as the methodical course based on ethnographic reflection. However, log writing has also turned out to be an important source of retrospective reflections about the whole research process. This section is based on logs as a data source. In the forthcoming description, I will follow the order in which the cases have been presented previously.

Therefore starting with Alfa the focal point for assessing for summative purposes within a positivist viewpoint of knowledge construction in science combined with an essentialist ideological emphasis occurred to me as central to his reasoning about science education during the fall of the second year of fieldwork. The following after- a- day- in- the- field- micro- analytical- notes are moments of serendipity in the development of Alfa's case as well as in the overall project. In my log, I have stated: "*Alfa is, in comparison to Sigma, concerned with teaching academic science, of control and summative elements. He has at the same time an informal relationship to many of his students. I am wondering whether he does not see science as a scientific enterprise isolated from the nature of education. Is this a limitation that hinders professional teacher practices based on wider menus of assessment purposes? I have to look into this.*" (25.10.00)

Then three months later, I wrote this note. "*Alfa is concerned with the individual student and possible formative elements in assessment. He seems to lack a vocabulary for addressing and developing these techniques. The realist traditional objective demands controlling variables in his language that is also applied to student assessment. At the same time, he is signaling a nuanced view of knowledge construction in the academic sciences and to some extent the students' active role in knowledge building. There are no statements about assessment that follows in the same line of thinking. Is this teacher another example of a science teacher that knows his subject and some of the theory of pedagogy but is simultaneously not able to see the relationship between theory of motivation, didaktik and perspective on humans and use this to develop assessment strategies?" (27.1.01) In retrospect these and other preliminary analytical comments in my log have formed my overall analysis of Alfa and Alfa seen in relation to the other teachers. The case of Alfa started to find its focal point during the micro -analysis in the fieldwork.*

The case of Gamma at the other extreme considered at what point in the research process the golden moment of realizing the focal point of the case occurred. *“I am one week into scrutiny and writing about Gamma and I still do not know what this case is about. What does he really add to my overall presentation? There is something here that still is hidden to me.”* (11.11.02) But finally, *“ Gamma covers almost 10 pages and I do know that Gamma is about the teacher who is clever at administrating his business, but that there is a little more specific personal emphasis that drives his teaching and assessment. He must be the implementer here.”* (12.11.01) Again in retrospect, I probably suspected this long before without being able to verbalize it because I was in need of confirmations from the more ethnographic cycles and more analytical scrutiny of the interviews. Alfa, Pi and Omega had made me look for dimensions that were not significant to the same extent in the case of Gamma. This case became saturated considering the content of our discourses, but the theoretical glasses I had chosen as a consequence of working with the other teachers prevented me from realizing the point of saturation here.

The next case, Pi, became saturated at an earlier stage in the process. The decision of including one or two British teachers came as a consequence of saturation among the Norwegian teachers. The educational traditions and the present educational evaluation system have framed a different teacher mandate than the corresponding Norwegian and Swedish systems. My awareness of the controversial discussions about the National Curriculum, its implementation and the student assessment system was a hindering factor to be necessarily overcome in order to firstly discuss matters with Pi and My with an open mind and secondly look at the material from different angles. Simultaneously I was determined to find out what their stories were rather than what they were in relationship to the national mandate. I was struck by the overall professional attitudes in everything from planning to evaluation of activities. One of Pi's first remarks made me realize that these teachers are not entirely the dedicated servants of the system. *“Discussing? This is a top-down approach instead of a bottom-up approach...at this point we take or leave it.”* (1.10.01) With this remark on the first day the last reminiscence about the system approach agenda was gone. This has to be about something else than ‘where standards reside teacher autonomy is killed’ or ‘assessment as assassinating in England’.

From my log at the end of first week in England: *“What I have been experiencing this week is that it is difficult to separate the official mandate from the traditions and codes of this*

society. To some extent maybe the way that they interpret the standards, the curriculum and the different teacher directions reflect that more than it actually reflects the written mandate. Pi commented that when he was on the board for selecting the new head teacher he voted for the present one because of her answer to how she feels about the national curriculum. She said that no matter how the official policy is stated, the basic challenges of teaching remain the same. I think this answer is interesting beyond the fact of how implementing the guidelines and regulations are done. It is interesting because Pi's representation shows that they share important ideas about the important aspects of education that have not been stated and hence are more implicit in this society as well as all other societies. This means that the way this school has established its own system of student assessment more or less running parallel to the national system of student assessment is in this system a combination of a joint effort by the staff of the school and shows their autonomy within this system. School reputation is important for keeping the school running, but it is obviously important for the self-esteem of the institution.”

(5.10.01)

Pi came to be about the dilemma of, on the one hand establishing learning activities related to cognitive epistemological theory and, on the other hand, assessing the same activities mainly by the use of summative assessment techniques. This is simultaneously a meeting point between the demands set by the national assessment system and his epistemological and ideological positioning. The case therefore illustrates the autonomy from the perspective of implementing with insight and reflection the demands from the national agencies, but, in addition, autonomy in developing assessment strategies that works for the purposes of the school and the students based on a different view of learning.

Let us now turn to the case of Sigma, which was the first I wrote. This case marked my almost having finished the analysis based on Atlas before starting the writing of the case. One week was spent going through the logs, interviews and observations before arriving at the focal point of this case. The categories I developed on the road to the dilemma of controlling the classroom versus intentionally formatively assessing purposes were again, according to my log the identity of a new teacher and her expectations of herself; looking at assessment from new angles; changes in the intentions of her instruction; changes in teaching methods including more didaktik categories in her reflections; status of curriculum and planning resources; changes in classroom interaction. Her statements about

her eagerness to consolidate the classroom environment and be in control of the interactions as well as the consequences of being in control of the students learning became the principal means by which these other categories provided a comprehensible meaning.

One of my first micro analytical comments embracing one part of this dilemma of Sigma is the following. “ *What characterizes Sigma is that she always talks about the importance of human enterprises, of the social dimensions of learning, importance of co-operation and that the processes are equally important for results in order to get an impression of the students knowledge construction in the sciences and the relevance of science for daily life. She is concerned with the formative aspects and states that assessment is difficult. She has established a practice that I made positive remarks about. Her replies are that she needs to develop an integrated view on assessment with respect to learning, humans and teaching. She is strongly signaling an eagerness to move on. What is hindering her from doing that?*” (24.10.01)

The case of Omega has yet another story behind it. The first time we met, during an in-service course, I wrote in my log; “*Omega is concerned with the combination of local developed objectives and the national objectives.*” (13.3.01) After one day in the field I summed up my impressions based on interviews and observations in 36 issues for further observation and discourse. The most important issues were: “*working with local criteria and her relationship to student adapted education; criteria as an organizational tool for instruction; criteria as learning devices for the students; classroom interaction and scientific language skills; emphasis of students empowerment ability levels in testing and textbooks; student involvement and parental participation; the status of science as a subject in her teaching and in the choice of textbooks; the relationship between grading and objectives/criteria developed; individual objectives and national grading; individual objectives and statements about expectations; national testing as a source of teacher reflection; summative strategies for formative purposes; and inclusion in science.*” (14.3.01) Hence the focal point of the case as well as a major portion of the categories that presented this central category is to be found in the first circle of analysis based on four observation lessons, informal discourses without recording and one discussion during the in-service course. In this case, the questions asked during the interviews equal the open and selected categories largely.

15.4 Relationship between theory and empirical indications

Going through the cases in Greek alphabetical order gives an impression of the development of the single case, but in addition also an impression of the development of cases concerning the relationship between theoretical framing and empirical indications. The teachers were included in the project at different times and therefore the fieldwork involving the teachers was defined under different theoretical framing.

One particular point should be made here in the cases of Omega and Pi. At these points of time in my fieldwork, about one year and one and a half years after starting the fieldwork with the Norwegian teachers, my theoretical perspectives were developed to a point where these perspectives framed interviewing and in-field analysis to a greater extent than in the case of the Norwegian teachers. I was continually developing alternative positioning and hence refining theory grounded in practice, but the main frames had been defined, verbalized and committed to during the work with Alfa and Sigma.

The overall inductive process most apparent in the first period of the fieldwork was slowly taking a deductive turn, and thereafter embraced both inductive and deductive thinking strategies. Applying the defined frames became the main strategy instead of developing the frames. Alfa and Sigma defined the theoretical premises, while Gamma, Pi and Omega represented different analyses according to these frames, yet continually looking for new emphasis, assessment practices and corresponding reflections. Elements of induction were retained in order to allow for diversity within and outside framing. Hence, in this phase the relationship between the theory of knowledge construction and empirical indications followed a pattern of abduction. A combination of induction and deduction in an abductive manner forms a fixed element in Grounded theory approach and its analytical tools. (Alvesson & Skjöldberg, 1994)

The challenge of including teachers from other countries follows on from this in chronological order. The main reason for including the Swedish and English teachers was that my categories had become saturated. Other Norwegian teachers added less to my overall research questions. By including Swedish and English teachers I also introduced two different national educational contexts that framed the practices of these teachers. The consequences of this extension of respondents were anticipated at two levels. The level of

comparison to national mandate was excluded as a main analytical emphasis for the benefit of the possible different positions according to the different epistemologies and ideologies of these teachers, whether as a consequence of the national context or as a consequence of individual preferences.

Theoretical triangulation has been a major principle behind the analysis and the presentation of cases. Investigating assessment from a number of angles has been important for addressing some of the complexity, but the number of angles has been limited according to the initial overall inductive process. The introductory quotations for each case are pointers to the central category of the case. They are the best illustration based on a single quotation, or one of the quotations that illustrates the focal point of the case. They incorporate the most central message, chosen by me, of the teacher by which the theoretical saturation will be validated.

15.4.1 The presence of various school subjects in the cases

This project was intended to research student assessment in the natural sciences. This intention came into conflict with another intention, namely that of including the actual agenda of the teacher and her/his various activities during a day in the field. All the teachers, except Pi, teach both mathematics and science. Discourses have primarily centered round science and their beliefs and reflections concerning science education. However, the teachers have, to a varying degree, been eager to comment on their teaching and assessment of mathematics. I was present for both subjects in order to familiarize myself with the groups of students, and got to know the circumstances the teachers were working under in a wider sense.

For the Norwegian teachers, Alfa, Gamma and Sigma, the national final examinations system of oral examinations in science and written examination in mathematics have made an impact on their awareness of formative versus summative purposes of assessment. For Omega from Sweden the national testing in mathematics was the mandated requirement that brought assessment in mathematics to our agenda. Such factors have resulted in including some of the teachers viewpoints based more on mathematics than on science without going in detail about their corresponding epistemological and ideological aspects with regard to mathematics education. The testing procedures and strategies for the return of tests have been commented on in the context of both science education and mathematics

education. One reason is that testing turned out to be more frequent in mathematics than in science, and consequently our discourses were based on the actual learning activities going on during my visits to both the mathematics science classes.

Looking at the cases in retrospect the presence of one, two or more subjects gives us some additional information about the teachers' perception of their professional identity. Alfa views himself as the scientist. He is less concerned with teaching mathematics and therefore more eager to discuss science matters. Gamma does not identify himself as a scientist nor as a mathematician. He argues for the one or the other without the subjects depending on the activities we were discussing. He does not state a preferred emphasis either. In both these cases mathematics is apparent, but more in the case of Gamma. In the cases of Sigma and Omega they both talk as eagerly and passionately about the one or the other subject. I have given science more space in the analysis and presentation due to the research question and therefore omitted many activities and citations concerning mathematics. The presentations here do not therefore represent the number of quotations concerning mathematics. They are concerned with the learner, and their overall ideology is based on the students' abilities and challenges. Subjects are therefore subordinate to their overall teaching agenda. In the case of Omega I am tempted to draw the conclusion that she could actually be teaching any subject due to the fact that her reflections centered round the learner more than the subject. Pi is entirely concerned with science. He does not teach mathematics, and he also emphasizes the academic and essentialist aspects of science education. In sum, my overall evaluation of relevance has been situational and based on the agenda developed for the single case.

15.5 Theoretical and purposive sampling

A progressive inquiry model has been used in order to develop the central categories and the theoretical framing of the project. This model entails developing research questions as a part of the process itself; it involves developing the specific research strategies as well as the conceptual framing. Creating the research questions has been done progressively as a part of a research cycle including such steps as constructing working theory, the critical evaluation of the application, seeking deeper knowledge, generating sub-questions, developing new theory and creating the context for enquiry. There is also a distribution of expertise here. The teacher is an expert in his field, facilitating the teaching according to an

infinite number of factors while the researcher is an expert in analyzing this practice according to a more narrowly defined framework. Sampling human beings as respondents representing teacher expertise and sampling texts are two intertwined processes involving both purposive and theoretical aspects.

The combination of purposive sampling and theoretical sampling are different tools in the process of narrowing down the theoretical focus and looking for variations among teachers that may contribute to the descriptions of the central categories within the theoretical frames. This process started out with an enquiry about teachers in the area around Oslo. During the pilot stage, methods were refined according to a merged agenda. In this first part of the process, the teachers were selected according to their availability and in order to minimize the cost of the fieldwork. Teachers worked at the same school, but with three different age groups. This initial sampling strategy continued when the second school in Oslo was selected. The purposive aspect was reflected in the choice of location. The theoretical aspect was reflected in the assumption that a variation in the educational institutional setting would imply different practices among teachers and that assessment challenges varied according to the age level taught.

In the third stage when the Swedish and English teachers were included, the theoretical aspect of sampling was changed to assumptions that variation in national educational contexts would cause different positions within the dilemmas of student assessment. The purposive aspect in this stage was present in the selection of teachers with relationships to the international research network. The intention was not to look at the implications of national student assessment strategies and at the teachers as implementers of these strategies. The teachers themselves identified their challenges according to different factors, of which the presence of national mandates was merely one. The inclusion of teachers from two other countries had the dual effect on the research project. Methodologically it encouraged reflection on the Norwegian teachers when writing up their cases. Substantially new positions were identified.

The categories that were developed and the theoretical framing that arose from the initial analysis viewed teacher identity along dimensions that were less tied to the institutional setting of the teacher. In all the cases, the teacher's background including formal teacher training was reflected as an important factor in the identity concept. Nevertheless, their

epistemological and ideological positioning as an aspect of identity has been analyzed only on the basis of information about the teacher. A theoretical assumption that the national educational context would become visible is only partly true. In the case of Pi the science teacher, training emphasizing individual cognitive epistemological views stated as constructivism in science education appears as a clear, visible factor when he talks about learning and instruction. In the case of Omega those teacher training courses emphasizing objectives as reflective tools for teacher and students are visible in her statements about assessment. Accordingly, Pi and Omega as well as their colleagues added important dimensions to the forthcoming theoretical framework.

The implicit assumption was that my developing categories were saturated and that the contributions of Pi and Omega would add other positions. However, my assumption that the Norwegian teachers were similar fell partly to the ground. Alfa, Gamma and Sigma spread along the continuum. As I did not carry out an analysis based on the national educational context but on epistemological and ideological positioning, the national educational context has not been reflected in the positions of the cases along a continuum. Hence, my sampling criteria were not theoretically informed towards national student assessment strategies.

The next stages of the process - selecting the teachers to be reconstructed in cases, the selection of material to be analyzed, the selection of quotations to be included in the text, the selection of central categories and of the structure for each case - became an interpretative process during which theoretical sampling was at a peak. The teachers that would add to the presentation by their statements and corresponding positions were selected. The quotations that validated this theoretical position were included.

Theoretical sampling has after all been an important tool in both developing the theoretical foci and presenting the theoretical foci. Methodologically theoretical sampling is a device for defining the conceptual boundaries combined with applying these concepts. As a sampling technique with implications for knowledge construction its importance reaches beyond the strategies of purposive sampling in Grounded theory as well as in this project. Theoretical sampling in addition to constant comparative analytical strategies therefore represents the core of the applied methodological approach as well as the most crucial

strategies and their implications for external validity, e.g. transferability and applicability, and internal validity, for instance credibility and confirmability.

15.6 Relationship between respondent and researcher

In ethnographic research the relationship between the researched and the researcher has been scrutinized from the perspective of going native or becoming too familiar, i.e. getting too involved with the respondents/informants and hence not being able to present either their point of view or that of the researcher. The opposite happens when we as researchers remain strangers, detached and therefore unable to represent our opinions due to the distance.

We continually find ourselves in the dilemma of how to view the relationship between the teacher as an object of the study and myself as a subject interpreting the object. In choosing the position of looking at the teacher as an object and ourselves as subjects we lose any sensitivity we may possess by having experienced the social environment of institutional education as students, parents, teachers and teacher educators. In choosing to regard ourselves as teachers the subject of inquiry equals the status of the object of inquiry. The possible result is a lack of analytical distance and rigid systematic attitudes to social inquiry. It is my experience that as a researcher in the field of education I have to do both. We have to possess sensitivity towards the researched and their working agendas, their working day, the expectations of both parents and students in order to relate to them, gain access again and again and find new dimensions in the data. We have also to step back in order to ask the teacher questions about his agenda, his relationship to the students and his view on the subject taught.

In educational research it is my experience that the main challenge is rather to **get the very know unknown** as we are natives of the system in question, even if not of the local culture and context we are participant observers in. Therefore the dilemma of going native remains. Familiarity challenges our abilities to see and recognize the researched points of view in addition to our own. Visiting England and Sweden and communicating with teachers there was therefore an eye opener both in respect to assessment discourses and building relationships in the field. *“Writing for and about the community in which one has grown up and lived, or at least achieved some degree of insider status, should produce*

engaged writing centering on the ongoing dialectical political-personal relationship between self and other.” (Tedlock, 2000, p.467) This perspective is in particular relevant in the applied field of education.

We are as researchers and researched not separate categories as we share experiences from the same system as students, parents and teachers. As an amalgam of involvement and detachment the challenge of participant observation requires us to work along two mental tracks simultaneously while in the field. On the one hand, we have to be present as individuals with the experience we have in education and on the other hand maintain a critical analytical distance to the researched. These critical, ethical, reflective and political implications and applications of ethnographic research became a part of ethnography during the 60's. The introduction of ethnography into various fields of social sciences including education was one main factor. The initial dilemma has therefore been extended to include the societal frames and institutional circumstances under which the relationship between the researcher and the teacher exists (see Section 15.8).

15.7 What about gender in this context?

Another issue turning up in various discussions about these cases has been the gender issue. My initial reason for using the Greek alphabet was, in addition to the creation of cases along some dimensions, to create a descriptions and analysis in which gender issue was not a focus point. However, both orally and in writing it turned out to be impossible not to use him or her in describing the particular teacher that was the starting point for the case.

There turned out to be both a substantial and methodological aspects of this choice. The substantial aspects are related to the fact that Alfa, Gamma and Pi are men and Sigma and Omega women. Gender as a part of identity formation in their relationship to students and to the subject emphasis is therefore a visible consequence of this research rather than an intentional one.

Methodologically I am not able to quote from specific situations in which the gender issue is visible or a main factor in interpreting the fieldwork. However, that is not to eliminate the fact that gender may have had an impact on the relationship I developed with the

teachers including the content of the on-tape and off-tape conversations. All information has been relevant in forming a basis for open discourses, but gender issues has intentionally in most instances been neglected in this analysis and presentation taking the generated theoretical framing into account. Whether the meetings with Omega and Sigma raised female issues and whether these female issues influenced the child-centered position they were placed in therefore remains an open question.

Likewise, influences of religious political or leisure time preferences may have interfered with the issues of the conversations. Even these topics are beyond the methodological scope of this dissertation. These elements of interpersonal relationships of who we are and who we are becoming as persons are as much a part of the life we live outside work as our professional life is a part of our identities. As this has not been a life history project the different personal preferences have been analytically eliminated even if they are present in the relational aspect of the fieldwork. However, as much as they are implicitly present so also is the societal cultural context under which we have been formed and which we are continually forming as human beings. These societal frames, here labeled as the external educational context, have been eliminated from the presentation of the cases. I will include some information here that agrees with my data material on the schools visited.

15.8 What about the outer societal and educational context of the cases?

Following from the structural Grounded theory approach the cultural societal outer context of the teachers has been omitted when this is not present in their interpretation of their teacher identities. The case presentation focuses, for example, on national curricula and strategic national evaluation documents when these mandated teacher - planning sources are important for the teacher her/himself. However, the outer societal context of teaching in addition includes the social environment of the institution, what the residential area is like, SES factors, municipal educational policy and the surroundings of the school, just to mention some. From the teacher point of view the school environment is also an outer context taking his classroom as the primary educational context. Therefore the way the school presents itself, its educational agenda, the message from the management and the co-operative atmosphere in the school in general are also a part of the outer context.

A corresponding presentation and discussion of the local cultural environment of Alfa, Gamma, Pi, Sigma and Omega resulted from this, as I have chosen not to include the outer societal context in the case presentation beyond the information and referencing the teacher applied to this contextual layer. These short presentations will be based on observations, written documents issued by the school management and some interview quotations. Different aspects will be included as the material here is not comparative and by no means comprehensive in illustrating outer societal contexts. However the information can be seen as relevant for evaluating the transferability of the knowledge construction of the cases.

It can also be argued that contextual factors are all and everything in educational research and that the fact that “*context cannot be controlled*” makes “*educational research the hardest science of them all.*” (Berlinger, 2002, p.19) Still we cannot disregard the context, neither the classroom context nor the outer social context in which the education takes place. (Erickson & Gutierrez, 2002) In one larger scale survey referred to in the *Educational Researcher* several different teaching models were evaluated against their effects on student learning. “*Doing science and implementing scientific findings are so different in education because humans in schools are embedded in complex and changing networks of social interactions.*” (Berlinger, 2002, p.19)

15.8.1 A school at the outskirts of Oslo

Alfa, Gamma and Sigma worked in the same school at the time of the fieldwork. The school is physically situated in a semi-rural area on the outskirts of Oslo. The school campus consists of two larger and three smaller buildings surrounding the central building that contains a library and ICT rooms. The smaller buildings are classrooms and the larger buildings sports facilities, offices, a teacher’s lounge and offices and special classrooms for science, food technology, woodwork and arts, music etc.

The atmosphere in the teacher lounge strikes me as being like a family environment as it is very relaxed. Contrary to many teacher’s lounges I have visited there do not seem to be any fixed seating preferences as everybody moves around talking to different colleagues in the various breaks. Many of the teachers have office desks in rooms adjacent to the lounge. The principal, vice-principal and other colleagues with special tasks are present in the teacher’s lounge during several breaks throughout the day.

The students attending this school live in the local community. Most of them can walk to school, but quite a few take buses. They live in detached houses or villas. The immediate environment comprises a river, the main road in the valley, a church and small wooded areas. The nearest residences are half a kilometer away. The school is situated one kilometer from the nearest service center with stores, post office and a gas station.

This school presents itself in a folder distributed at the start of every fall term to all students and their parents. There are two to five newsletters every school year. Together the folder and information newsletters contain information about the personnel, contact hours, holidays, timetables, plans for parent conferences and meetings, rules of conduct, rules about the use of ICT equipment, the cafeteria prices, upcoming events, parent and student contacts, information about a program for gifted students, information about student assessment and in particular grading, and various other administrative information and routines. The information about assessment and grading contains the exact wording from the national information folder about student assessment.

During my one and a half year long period of fieldwork I was frequently in informal contact with the vice-principal. She was interested in the discourses about evaluation, assessment and school development. On a more limited number of occasions I had short meetings with the principal. According to the principals' presentation of the school at my first visit, evaluation and student assessment were not issues particularly in the spotlight at this school. The principal was eager to talk about the extra instruction for gifted students as this program had received some media attention.

The development plan, a three-page document revised annually, contains a vision, some long-term objectives, several short-term objectives showing the name of the corresponding responsible person, time perspective and tasks, and finally a plan for the use of the teachers' time in planning processes. The vision states, "*The school shall be a developing school, where everybody has a responsibility for each other and for the surroundings, locally, nationally and internationally.*" (Development plan for 2000-2001, my translation) The four long-term objectives cover a safe and confident environment, responsibility, instruction based on the abilities of the individual student, and international relations. These issues are also highlighted by the stated annual objectives. In addition, issues

concerning the identity of the teacher, the national curriculum and project as learning activities have been included.

During my frequent encounters with the vice-principal, she has talked about a lack of educational discussions in the school as well as a lack of direction in the developmental process. She has strongly signaled her uneasiness with the present situation as the school has employed a number of highly qualified younger teachers. It was my impression from the beginning to the end that there was less drive in the developmental process, less attention paid to the evaluation of existing objectives and activities and less discussion about future objectives than the personnel probably was able to become involved in. The relaxed homey atmosphere made everybody feel comfortable, but this did not challenge the teachers in terms of school development. The vice-principal chose to leave the school for a principal position at another lower secondary school.

Alfa is concerned with teaching science outdoors, and the school is situated in a perfect area for smaller out of classroom activities. The school has an excellent library with a librarian. This school has both the material and personnel resources to develop a good level of science education. The finances of the municipality are good. The intake area is, according to Alfa and Gamma, characterized by supportive and demanding parents. In general the school has good relations with the local community and has established formal partnerships with the nearest companies as co-operative partners for introducing the students to working life.

As stated in the case of Sigma she is concerned with the educational and interpersonal atmosphere of the school. She is also concerned with the possibilities for her professional development within the frames set by this school. She left at Christmas during my year of fieldwork. Gamma also signals an ambition to participate in educational planning at school level. He finds that he has the possibility for this at the school. All three teachers have found that the school is not particularly concerned with the development of student assessment practice as an institution. Their involvement in my project has put this on their agenda, but not on the agenda of the school.

15.8.2 Science education and assessment in a Yorkshire school

Pi's school is situated in a small village in the Yorkshire countryside although the students choosing this school come from suburban areas as well as neighboring villages. The school campus consists of buildings representing the entire history of the school. It has basically been built in three stages. The original brick building is low, and has narrow corridors, old fashioned science teaching rooms, poor ventilation and small classrooms. Even at the time I was visiting, in October, the trees and rose beds in front were beautifully kept. The gym building is newer and is used for weekly assemblies as well as testing. The newest building has the look of a hangar, but with a practical floor plan and all the most up to date facilities within ICT and science. Pi is generally happy with it. All the buildings contain rooms for different subjects, and students of different ages use all the buildings.

The key informants at the school were of course Pi and My. I conducted an hour long interview or conversation with the principal that was important for my overall impression of this school and therefore quite a number of quotations will be found here from this interview. I had beforehand given her some key words for the interview. This statement about half way through the allocated time is still ringing in the back of my head. It seems to sum up both her attitude towards pedagogical management and her innovative attitude within the English school system. *"I think the children in the school should be called students. From the Latin a pupil is lead, a student leads and that is really important."* (Interview conducted 9.10.01 in the principal's office.)

The atmosphere is a lot less familiar to me than Norwegian schools. The formal verbal tone and the formal clothing are two aspects I was expecting but still needed time to adjust to. I was addressed by my last name and was expected to address the teachers likewise when students were present. Of course, I failed this British test many times, but I used these opportunities to inform the students about schooling and culture in Norway. I was visible with my Nordic appearance, American oriented terminology and Norwegian accent, with a backpack along the beeches to and from the school and my guesthouse and despite of wearing similar clothes to the female teachers. I was more present in the science classroom than any other school I visited despite of, or may be because of, my general location at the back of the room. I was more of a detached observer than participating observer. At the same time I was able to ask the fundamental questions so difficult to ask a Norwegian or

even any Scandinavian teacher. Pi and I had less in common and I used the opportunities this gave me to elaborate on the most basic questions of teaching.

In the meeting with the principal, the situation was different. Here I felt privileged to be given time, so I had to prepare properly and tried my best to be at her level verbally. I saw the principal three times, on arrival, during this interview and when leaving the school on the last day. I never met her when moving around the campus. I was formally introduced to the head of science department and exchanged just a few words with him. The other management of the school I did not meet or talk to. I signed in and out every day at the main office of the school, and at all times I wore a visitor's badge.

School ethos is visible everywhere on the campus. There are stickers around the school stating "*Albert Einstein's mother used to say*" *What good questions did you ask today Albert.*" The school's improvement plan is decorated with the slogan "*Excellence for all*". The school's principles are stated here as well as on posters in the different buildings. There are ten major principles and in total, they state the following; Everyone is a learner and has rights and responsibilities; Planning, targets, resource allocation and quality standards are appropriate tools to state expectations and support continuous school improvement; Monitoring, evaluation and assessment are developmental activities. Following on from these principles the school issues annual reviews based on their own developed review strategy or cycle and specific content. The vision of educational quality central to this process was threefold, "*accessing learning, assessing learning and acknowledgement of learning*" (Principal in interview).

The school's principal introduced me to her main philosophy of student assessment as follows: "*To take the assessment issue first of all. One of the things I try to do is to get the staff to have a very clear understanding of the formal national assessment requirements of the formal national assessment GCSEs. Because if you do not understand very well what is required you can't prepare students adequately for what is facing them. But that terminal activity, that assessment process.... even the course work of the topics is largely terminal at the end of five years. Clearly, no one will be motivated for what is going to happen to him or her in five years time. Certainly the young people are not, and therefore it is necessary to pick apart the requirements of the ultimate assessment and put it into our terms for this school. To be sure that we are developing in the children the knowledge,*

*skills and understanding that are necessary for them to achieve that assessment and with as high grade as possible. That is a terrible narrow thing for which to prepare children, a formal assessment. No parents will be pleased if I said we were disregarding that. I could not disregard it before the children, that is the first thing, because they have to have that currency... it has market value and it is their future. We cannot, for the parents or the children disregard it. We would never consider disregarding it, but what **is import is a view on the young person rather than the qualification.***”

I have emphasized two aspects of assessment underlined by the principal. She is mainly talking about the summative national assessment and the qualifying examination. It is important for her to talk about how the school implements the national mandated examinations, but in these two parts of the statements she raises two additional moderating aspects. Firstly, she presents the idea that teachers need to be educated in the national qualifications process and “*pick it apart*” in order to locally adapt it. Secondly, she presents the formative approach as the important approach in educating the individual student. Her main message seems to be her school’s ability to meet the requirements of the individual child. The national examination is also a means of benefiting each child due to its status as a form of admittance to higher education and therefore of deciding the future of the student.

Pi has pointed out to me that this principal in many issues works contrary to the majority of principals in the area. He favors her independency shown by her opposition to acting purely as a manager of the system. In this conversation the principal elaborates her bottom up approach to evaluating the school’s activities and results, and she underlines the importance of standards and criteria in this process: “*There was no qualified standard against which we could be met at. There was no articulated vision of what quality in the classroom might look like... What I would do was make my own judgment and talk to the staff, children, parents and governors. We would find a (name of school) way to do things and we would not have an externally imposed way from anybody or any agency outside. It does not improve the planning, if it does not improve the lessons or if it does not improve assessment, why are we doing it. If the focus is not about teaching and learning then we are missing a point. Then we are managing a system instead of managing how to learn.*” The principal is concerned with using the specific challenges this school is facing and the qualifications the teachers possess in order to develop a plan for development for the

school. Her identity as a leader is therefore to make a strategy that takes the necessities of this school into consideration.

This school had failed one OFSTEAD inspection, the principal was employed after that and two and a half years after the first inspection they had another one. Her general attitude to the inspectorate is stated like this: *“When OFSTEAD came about I welcomed it because it was the first time that anyone had tried to qualify what a good lesson would look like.”* Our discourse took a turn in the direction of the tools needed to build confidence among the teachers, the students towards the parents of the school. The main argument about confidence building is based on reputation in the intake area of the school, and the principal illustrates the results of the school. *“We attract children from right across the barrier. Those are parents that are discerning parents making a selection of schools rather than the nearest school. They are looking around. That is scaring our intake to more able children. We improved the headlined figures, which is the number of children or percentage gaining five or higher grades in any subject, five A’s down to C. In 1998 there was 48 %, in 1999 there was 50%. In 2000 the results went up to 60%.”* Building confidence in the area is important for the intake measures, while the information provided to the parents comes from the official statistics of student results and oral and visual information provided during visits.

The case of Pi draws attention to the existence and application of two parallel grading systems, one for national purposes and one for formative purposes. The principal is very clear on her preferences in developing and maintaining her school’s system for daily learning activities, and its success is measured against the national examination results. *“It is our own system. It cannot be contrary to the national system, because against the national benchmark we are progressing much faster than the national progression so the proof in the pudding is not easy.”* Hence the school grading system to her is a better technique for feedback on minor learning activities as this grading system has an ability to give the students direction for their daily work. Its success is measured against the summative results of the students according to the national GSCE levels.

Concerning the other technique emphasized by PI, ability grouping, the principal has opinions contrary to Pi’s positive attitude and commitment to the technique’s contribution in student centered teaching.

Principal: *“I am very much in favor of mixed ability teaching. We simply cannot do that here yet. The science department has this system and it is a good one, but I have seen other places students benefiting from being with other students of all abilities.”*

Astrid: *“Benefiting socially then or...”*

Principal: *“And academic... with increasing their results, both the weaker and the more able students have been benefiting.”*

The principal is presenting herself to me as a former science teacher still teaching some science at the last age level. As mentioned in Pi's points of view there are many similar attitudes to be found in his statements contrary to those of the principal. Pi was on the board electing this principal. They share their views on the dilemma of formative versus summative assessment within the student assessment strategy of their educational system. Pi is mainly committed to the same basic ideas about student centered teaching even if he would prefer other organizational methods to master this. Pi's outer context in terms of the school and its management is in co-ordinance with his inner ideological positioning. This is a contributing factor to Pi's confidence as teacher.

This case is different with regard to the societal context surrounding the school. The reason is that the school's environment is not determined by local societal environment. The school is physically located in a village, but the majority of students attending come from other residential areas. According to the teacher, this fact has actually been raising some controversy in the neighborhood. The students flooding the village during lunch break and occasionally during instruction are not the children of this village. Local residents are referred to as the “villagers”. This causes a ‘we’ and ‘them’ discussion in the school, and during weekly assemblies general conduct in the village is an issue frequently brought up.

This comprehensive school is one of openness. They are used to visitors and parents coming to obtain an impression before deciding on where to send their children. People are open-minded, but at the same time committed to their own business, and may therefore seem reserved. It is therefore difficult to get them to talk outside the agenda and the school agenda is serious here. Teaching has its rules set by traditions and by school regulations, laws, curricula, and the different manuals (of which there seem to be many). What I experienced during my two weeks was that it is difficult to separate the official mandate from the traditions and codes of this society. In this case the school codes for conduct or

behavior, their dress codes, their whole way of thinking about education reflects the attitudes of British society in addition to or as a part of their messages to me. I would not know and that bothers me, but therefore I have to remind myself of my purpose for being there.

15.8.3 The caring atmosphere in the Swedish school

My first meeting with Omega's school happened a Wednesday morning. I was intentionally early for our appointment, and that gave me an opportunity to look around before being introduced to the school by the teachers. Thus before meeting Ypsilon and Omega I had met the caretaker, a number of students, counted the number of flags on display in the central cafeteria court and read some of the posters and information letters on the walls. Ypsilon and Omega took their time showing me the octopus architecture of the school.

The principal was not available during my one-week visit for an interview, and I never met any of the administrative or management personnel. However, other teachers were quite eager to talk about the reasons for my visit. Most of the time was spent with students or in Omega's and Ypsilon's office (shared with four other teachers). They seldom sat down in the teacher's lounge, and hence there were few occasions for me to informally involve myself in conversations with other school personnel.

Omega and Ypsilon spent almost all their time with students, in instruction, in communication and during meals. They said that that is what this school is about. They both claimed that teachers at this school have to be comfortable with working surrounded by students all the time. They claimed that the school was based on a caring environment and only teachers able to adapt to that could find a place here.

Omega and Ypsilon talked about the school as one characterized by low SES. They claimed that a number of students came from low-income families, and there were a high number of socially and emotionally challenged students. A high proportion of students have Swedish as a second or third language and consequently there are a lot of intercultural challenges facing both the local community as well as the school. The flags decorating the central area, 39 in total, represent the students' different nations of origin whether in the first, second or third generation. Omega and Ypsilon on several occasions emphasize the

importance and effort put into having weekly contact with a number of parents as well as the challenges they face in getting in contact with other parents.

Statistics Sweden has information about student results at this school. Seven percent of the students do not receive final grades at all, while 41 % do not receive grades in **any one or more subjects**. These are the lowest results in this municipality. The corresponding national figures are respectively one and 15%. Only 59% of the students are admitted to academic upper secondary education compared to 89% nationally. These statistics represent an additional challenge for Omega and Ypsilon when adapting science education to the ability level of their students.

There was definitely a special atmosphere in this school. The two teachers introduced me to a school environment centered round safety, hospitality and caring. Their rule of thumb was in addition to greet and see every student every day, also to physically touch them, to smile and talk personally with each and every one of them when meeting in the hallways or during lunch.

I did not however come upon any written material stating an ethos, slogan, profile or vision for the school. The school development plan was the same as the municipal development plan. At the municipal level I was told that this school had been urged to develop their plan, but this had not happened. The municipal plan has five areas of objectives embracing statements about learning, caring, co-operation, social and physical environment and development and evaluation. The personnel responsible for the various partial objectives are stated.

These teachers have therefore the national curriculum and the municipal development plan as mandated planning documents. There was no planning process at school level taking care of the joint development of the school. There was only this invisible and implicit understanding of what the school was all about. So far as objectives and consideration of the students is concerned, their plans for subject objectives in science within these frames are particularly interesting. It challenged their professionalism as they stated it. The lack of joint planning at school level seemed to be compensated for by close relations with some selected colleagues to the benefit of interpretation of national curricula, discussions about

choice of textbooks and many other educational topics. Assessment was not a topic of any great relevance in the school agenda according to Ypsilon and Omega.

16 Revisiting the cases of Alfa through Omega; Towards a framework for reflection within the dilemmas of student assessment

The construction of the cases has mainly been based on single case analysis. However the cases have been constructed in the Alfa to Omega spectrum in order to develop a pattern that emerged as my fieldwork progressed through the use of the constant comparative method for both single case and cross case analyses. The teachers represent themselves as individuals within the boundary of the case. The case does not represent a construction of the world of the teacher, but that particular aspect of the world of the teacher set by the frames. The case is a unit defined for the presentation of the interpretation of the teachers and, therefore, the term ‘case’ does not imply the use of case study. (Stake, 2000) I am closer to the application of the term *case* as the theoretical construction unit than as an empirical unit. (Ragin & Becker, 1992)

These differences and similarities have resulted in the following presentation which then outlines the comparison in a cross case analyses and furthermore establishes a framework for teacher positioning in student assessment. There is the epistemological positioning, represented by the relative importance of behaviorist, versus cognitive and sociocultural viewpoints of learning. Secondly, there is the positioning stating what teaching emphasizes within the subject of the sciences, going from an essentialist to a progressivist position. Subordinate to these main dimensions are the dilemmas of student assessment outlined as formative versus summative purposes, group versus individual referencing and national mandate versus teacher autonomy. In the pattern that emerged throughout the fieldwork and analysis the first two dilemmas may be seen as subsets of ideological and epistemological positioning. The relationship between these dimensions and the third dilemma seems to be more complicated, and the relationship has been less focused on in the analysis.

The cases vary in their substantial content and in the genre used in the written accounts. The substantial variation is mainly due to different positioning, but also due to differences in the time and frequency aspects of the fieldwork.

16.1 Reflection within dilemmas

In this section, the concepts of dilemmas and reflection will be reintroduced as a consequence of the presence of dilemmas and levels and content of reflections presented in the cases. The dilemma concept that introduced in section 4.1 was a concept that theoretically provides information about the different controversies and tensions that exist in the fields of education. As such, these dilemmas are defined externally in relationship to the actors within the field. Simultaneously I have applied a concept of dilemma in those cases where the dilemmas are identified according to the tensions and controversies that the teachers explicitly or implicitly address in our discussions. Dilemmas are not externally defined waiting to be solved by the teacher, but are experienced as tensions for which the situation decides the actual solution. Hence, I apply both a theory driven dilemma concept and a grounded dilemma concept. The corresponding dilemmas that the teachers address in the conversations are therefore diverse. Some of the teachers address dilemmas explicitly. They identify some dilemmas, and I identify some through analysis. Some of the teachers avoid tensions in their reflections.

The reflection concept was also introduced as a structural concept, and gradually the sociocultural view on reflection brought forward an ontological concept in which reflection is seen as a means to interpret, evaluate, comprehend, judge, reason and understand the circumstances we as practitioners exist under. The content and levels of teacher reflection were the starting point. Gradually qualitative research as a reflexive enterprise involving the relational activities of fieldwork became more and more important as a focus for the research itself. Thus, there have been the teacher reflections and my reflections, and consequently the challenge of separating the two from each other. In the relational enterprise of fieldwork, structural analysis is important in order to separate the two.

16.1.1 The dilemmas presented in the cases

Alfa has almost no dilemmas, or he avoids controversial questions. He attempts to define one comprehensive answer to the assessment dilemmas that I raised. He does not argue for different positions in different situations. Neither does he argue for different assessment purposes in different learning situations. He finds himself most comfortable when addressing assessment as one comprehensive field. Alfa's criteria for evaluating different educational possibilities fit into his existing educational paradigm. Additional student

assessment purposes need to match his preferred patterns. Within such a closed system of educational practices; neither controversies nor tensions have any place for him. Tensions disrupt a preferred comprehensiveness. Following from his worldview, his comprehensive assessment strategy finds its legitimacy within a positivist view of knowledge and behaviorist view of learning. His language of assessment is the language of objective knowledge construction. In Alfa's worldview, dilemmas are threats to objectivity and realism. Dilemmas signal uncertainties and an interpretation of the situation which is subjectively situational. Dilemmas presuppose a relative worldview. Alfa has arguments for his practice within a view of learning and of science as well as of several didaktik categories. Therefore, Alfa is comfortable when reflecting at all levels, practical, didaktik and theory of science. However, he would reject a reflective evaluative practice outside his preferred position. Alfa reflects at all levels to the utmost degree possible within his worldview.

Gamma does not address dilemmas either. Gamma's reference is his teaching mandate as described in national documents. He is the pragmatic administrator of educational intentions stated there. He is therefore concerned with finding practical solutions to assessment strategies, and this practical attitude results in systematic and rigorous assessment techniques. He also claims that national curricula can only be interpreted one way, and is less concerned with identifying contradictory statements in the curricula and other mandated documents. He is concerned with consolidating a mandate. He has, therefore, in contrast to Alfa diverse methods for assessing students, but his argumentation for a diverse application of methods is administrative and practical rather than principal. Hardly any dilemmas caused by his view of knowledge, learning and ideological emphases are to be found in the material. Gamma's reflections lie mainly at a technical and practical level, but addressing dilemmas requires reflection at a critical level or at a level of theoretically informed didaktik or theory of science (3.1.5.). Gamma's motivation for participation in the project may have been to develop his techniques, and as researcher, I am afraid that his expectations were only fulfilled to a certain degree. His focus was too far from mine.

Pi, Sigma and Omega communicate dilemmas directly or indirectly. Pi does not verbalize his dilemmas. I identified the dilemmas found in his assessment practices. Pi prefers to present solutions to assessment squeezes. I have identified his dilemmas as epistemological

by nature. His individual cognitive epistemological reasoning applied to scientific reasoning contrasts with his assessment techniques, assessment purposes and competencies that are assessed. He builds most of his instruction on student cognition, except the assessment that is built on behavioral theories. The dilemma is that his emphasis on individual reasoning falls short in assessing the results of their reasoning. I have identified this dilemma and the time limited possibilities for confronting Pi with my interpretations. Pi's theoretical insight gives him a tool for reflecting at all levels and within all domains of teaching practice. He fails, within the period given, to address dilemmas at all levels, and it can, therefore, be interpreted as his reflective practice at diverse levels are concerned with all aspects of education but not assessment. Furthermore, this is due to the assessment frames set by national authorities. However, Pi never argues against these frames. He tailors his assessment strategies and tools to these frames. I therefore think that the more valid conclusion is that for Pi assessment is not necessarily a part of instructional evaluative reflective practice, but rather a set of tasks to be managed in addition to instruction.

Sigma directly highlights her dilemmas by verbalizing her professional challenges. In her worldview teaching and assessment dilemmas challenge her to professional development; by verbalizing and discussing the dilemmas already made explicit, Sigma is signaling that such explicitness is forcing change in assessment practices. Contrary to Alfa she is comfortable with living and practicing within tensions. She is open to tensions as a driving force for professional understanding and development. She is similar to Delta in her ability to verbalize dilemmas and in including dilemmas in her worldview. She is comfortable with relativism, that educational meaning is dependent on the situation and that finding solutions to assessment purposes and techniques is similarly dependent on the situation.

Omega is similar to Sigma when addressing dilemmas, although she simultaneously presents a more comprehensive assessment reflective practice. She is confident in her sociocultural progressive corner of practice, and her reflections on assessment mainly correspond to this position. She finds herself in an educational system that permits the tools and assessment techniques she prefers. Her reflections concerning these practices are found mainly at the practical and didaktik levels. She recognizes dilemmas, but does not live them as a part of her daily professional life.

This cross-case analysis of the application of the two concepts of dilemma and reflection has to a certain extent resulted in a discussion about relativism versus realism as two worldviews signaled by the teachers. Alfa through Pi are most comfortable with a fixed worldview, a closed system that can internally evaluate their assessment practice. Omega and Sigma are most comfortable with an open system to reflect within and are therefore open towards the dilemmas of assessment as legitimate framing for their reflections.

16.1.2 The dilemma of student assessment and equal opportunities for educational achievements.

The dilemmas of educational assessment have societal implications that go beyond the individual teacher to act on, but not necessarily to reflect upon. However, the societal control mechanisms did not become a part of the discourses and the analysis. The dilemma of teacher autonomy versus assessment as societal control mechanisms was therefore less emphasized. The forthcoming reflections will therefore be done according to a combined sociocultural and empowerment view on dilemmas.

The exclusion and selection mechanisms refer to external control standards as well as internal control standards, but address mainly the product dimension that was the second dimension of this dilemma. It is the product control of students' access to and their possibilities within an educational system according to results based on the efficiency of a system. Selection mechanisms may be viewed technically from a utilitarian point of view. From this point of view the evaluation selection mechanisms are of two kinds. The first is admittance selection for gaining entry to educational institutions and the other is selection thorough testing, final examination and regulated grading. Both of these relate to the product of education and serve as types of selection within an institution and for transferring between institutions or different educations. Selection mechanisms may, however, also be considered from an ideological point of view emphasizing equal opportunities of obtaining insight into assessment strategies.

According to Bourdieu in the following quotation, equality in educational systems is more than mere social equality. *“Thus some writers reduce educational inequalities to social inequalities, ignoring the specific form they take in the logic of the education system, while others tend to treat the School as an empire within an empire..., or they reduce the problem of equality before the examination to that of normalizing the distribution of marks or*

equalizing their variance, or they identify the 'democratization' of education with the 'democratization' of the teacher-pupil relation, or they reduce the conservative function to the conservation of academics." (Bourdieu & Passeron, 1990, p.155) As pointed out here selection may also be viewed in light of the power relationships between students and the teacher in asking questions such as who defines the criteria. The newest wave of student assessment within a socio-cultural approach has attempted to draw attention to the students' participation in assessment processes. A third way of looking at selection has been to see the mechanisms as attempts at freezing the system and resist developmental influences. This points towards a traditionally essentialist standpoint. All of these ways of explaining and describing selection mechanisms would be incomplete because they fail to address the *"explicit judgements of the academic tribunal"* as well as the individual tendency to *"eliminate themselves from the outset"* (Bourdieu & Passeron, 1990, p.157).

Selection and correspondingly exclusion imply the same duality as an external mandate versus internal autonomy and according to Bourdieu again: *"We have to grant the educational system the autonomy it asserts and manages to maintain in the face of external demands, in order to understand the characteristics of its functioning that it derives from its essential function. But were we to take its declarations of independence too literally, we should be in danger of losing sight of its external functions and particularly the social functions which academic selection and hierarchization always additionally perform, even when they seem to be exclusively obeying the logic, and even the pathology, proper to the educational system."* (Bourdieu & Passeron, 1990, p.152) According to this citation the necessity for scrutinizing educational assessment exists when seen from the point of view of the practitioner of the system as well as from that of external society. In this project I have attempted to illuminate some aspects of the first, but have to look at future projects in order to address the second empirically.

Dilemmas of student assessment are dilemmas of reflecting on the implicit values of the education system as well as those of the students and the teacher. Explicit statements about criteria, references and grading are a part of explicitness that may place educational society some of the way towards student assessment awareness. The next long statement by Bourdieu addresses the power of assessment with correspondence to the necessity for explicitness. *"When one knows how much examiners' judgments owe to implicit norms which retranslate and specify the values of the dominant classes in terms of the logic*

proper to the education system, it is clear that candidates are handicapped in proportion to the distance between these values and those of their class of origin. Class bias is strongest in those tests which throw the examiner onto the implicit, diffuse criteria of the traditional art of grading, such as the dissertation of the oral, an occasion for passing total judgements, armed with the unconscious criteria of social perception on total persons, whose moral and intellectual qualities are grasped through the infinitesimals of style or manners, accent or elocution, posture or mimicry, even clothing and cosmetics; not to mention orals like those of the École Nationale d'Administration of the literature aggregation, where the examiners almost explicitly insist on the right to implicit criteria.” (Bourdieu & Passeron, 1990, p.162)

Implicit criteria for control and guidance directed towards both teachers and students increase their alienation. Explicit statements do therefore have the potential means of increased equality. The evaluation system and the assessment procedures are consequently subject to interpretation and discussion. Regardless of their own values of education and of the subject teachers may nevertheless take a stand in these discussions. Increased ownership as well as increased equal opportunities of achieving according to the rules set by the system are the two benefits that according to Bourdieu may involve a wider range of students. This is yet another reason for making the implicit assessment criteria, whether of an epistemological or ideological nature explicit to the teacher as a start and then to the student. Implicitly criteria empower one of the participants in the game of education. Explicit assessment criteria may empower the learner as well as the teacher. Ownership of the educational setting is, according to the sociocultural paradigm, essential because sociocultural theories state that teachers and students have been formed in relationship to each other within the situations they interact. (Engeström et al., 1999; Wertsch, 1998) Empowerment and participation feed on each other. Participatory activity systems must, therefore, be based on explicitness, which again must be based on awareness. Assessment as one of the most powerful societal tools in education can, in Bourdieu's opinion, be either a suppressing tool or an empowering tool depending on the awareness of ideological and epistemological aspects of the practice.

16.2 The epistemological positions represented in the various cases

There is a relationship between the epistemological viewpoint embedded in the various practices of student assessment and the Alfa through Omega typologies. In this sense, Alfa through Omega form an empirical continuum in accordance with the three epistemological theories described (chapter 5). The conclusions here are discussions based on separate cases as well as the comparison of the cases. However, due to the intentionally created continuum the order of cases has been kept throughout the discussion. Alfa and Gamma have been given the same epistemological label of behaviorism. Pi has a dual position of behaviorist and cognitivist. Sigma has been labeled within a dual position of cognitivist and socio-cultural position, and Omega mainly a sociocultural theoretical oriented teacher.

16.2.1 The survival of the fittest; behaviorism and assessment techniques

The starting point is therefore Alfa. He is concerned with the reliability and objectivity of summative assessment and prefers group references as validation criteria for his assessment techniques. Grading is for him a valid objective measurement of a student's knowledge. Alfa wishes to bring the students one step further once they have acquired the basic skills and conceptual knowledge according to his implicit objectives for their learning. However, he seems to be trapped by the unfortunate consequences of behaviorism in that he never includes the next levels of cognitive competencies. Even the most able and clever high achievers among his students are not challenges in the higher order thinking skills. The intention of bringing the students up to a higher cognitive level becomes stranded due to the restrictions behavioral approaches put on him. Behavioral statements themselves constrain the other part of behaviorism, the stepwise inclusion of higher order thinking skills. This is the behavioral trap Alfa ends up in. He does not make any statements that signal an awareness of the limitations his view places on him and the students.

The responses students give to tests are a consequence of different stimuli and reinforcements. The sum score of the test by simple computation is the most valid measurement of their responses. Task solving is therefore a behavioral statement of students' knowledge. For Alfa the test equals the learning of the student. The test does not have to take the content from the learning situations such as the textbook is a more valid reference for the content covered in instruction for all his students across classes. For Alfa

teaching for a test is not relevant as the test is an objective measurement of the knowledge of the student and hence the learning of the student. As such, Alfa follows the tradition of behaviorist learning theory combined with a belief in the objective measurements of testing. He has taken on the reliability/validity concerns of testing procedures and made them relevant for addressing the educational challenges of individual learning. His practice explained with enthusiasm concerning the grading signals the view addressed by Tyler as follows: *“The achievement- testing movement provided a new tool by which educational problems could be studied systematically in terms of more objective evidence regarding the effects produced in pupils.”* (Tyler, 1938, p.349)

The case of Gamma resulted in the same main conclusions, but for different reasons. Gamma favors the programmatic systematic summative approach to assessment, but he has made some attempts at including cognitive in addition to behavioral statements. Yet it is his interpretation of the teacher’s identity in general that makes me draw the conclusion that he maintains a behaviorist position. His rigid administration of the educational program stated in the national curricula is a sign of Tyler’s educational rationale. Gamma does not use stated objectives as references nor does he evaluate his educational programming against the specificities in national curricula. He has not made his references for assessment explicit. Gamma’s assessment techniques, his tools and his use of grading within summative assessment purposes are very close to Alfa’s. The difference is Gamma’s attempt at revising his own techniques and tools. As procedural feedback mechanisms, his approaches are mainly based on behavioral statements.

Pi’s in class assessment of students’ work reflects the content of the activity itself. He monitors their learning by checking on their completion and format of questions identical to the assumed instruction. There are no higher order skills and competencies involved nor assumptions about checking the transfer of knowledge to other incidents or situations combining science concepts from one topic to another.

Alfa, Gamma and Pi are all three carriers of behaviorist beliefs of teaching and learning made visible in assessment. In the cases of Alfa and Gamma these beliefs are not in disharmony with their intentions. In the case of Pi such a disharmony is caused by the intentional belief of cognitive learning and teaching strategies. The atomistic, sequential and hierarchical learning model of behaviorism is in this case in opposition to an

individually based cognitive reasoning model. In the case of Pi as well as in the cases of Alfa and Gamma the behaviorist model wins in assessment practices. Alfa, Gamma and Pi are hence cases signaling the persistence and survivorship of behaviorist learning theory.

The discourse between Pi and me and the different viewpoints of Pi and his principal represent an important dilemma when applying behaviorist approaches to teaching, e.g. ability testing and differentiation, as these techniques predefine not only the students' ability to achieve according to a particular syllabus, but also their ability to achieve according to future testing and future work and educational possibilities. *"The use of readiness measures and achievement tests to categorize students' learning capacities still has the same negative effects as IQ based tracking had, because implicit in these assessments is the assumption that students in the lower strata should receive a simplified curriculum."* (Shepard, 2001, p.1070)

In this case, the test is hence used for categorizing students and as a device limits the students' possibilities of developing knowledge skills in higher order domains. This is the unfortunate effect of this organization of students as the teachers argue that it provides a best-fit curriculum. It is interesting to notice that the principal has questioned this organization principle of the science department. In this case such techniques may however not be seen as a direct result of the national curriculum. It is just as much a result of the science department's emphasis on instructional planning, and they argue that according to the improved student achievement results this works. Their interpretation of the result states that there a cause and effect relationship exists between their planning devices and the results of the students. Thereby the behaviorist model of learning and assessment has superceded the cognitive model emphasized by Pi in his actual instruction. Therefore, the behaviorist learning and assessment model is not only important for overall testing but has also been made implicitly valid for assessment as a part of instruction. Pi and his science department are true to the Tyler rationale. They evaluate the effectiveness as students results based on the criteria specified in their educational programming. The evaluation of educational programming has become the success criteria for their teaching.

In the extreme sense of behaviorism, grading represents the knowledge of a person within the aspects that are being tested. There is no direct representation between the grading itself and the knowledge, skills or attitudes of a person in the other epistemological

positions. Student assessment as an educational phenomenon does have its roots in the epistemological position that knowledge and comprehension may be based on quantifiable measures. This represents an empirically objective view of learning. For Alfa, Gamma and Pi this view is dominant.

The dominance of these learning theories reflected by empirical indications was commented on in the last Handbook of Research in teaching where Shepard referred to her own research. She stated that teachers seeking alternative assessment strategies are still working within a set of beliefs consistent with the traditional principles of scientific measurements. Teachers in her study believed in uniformly administering tests to ensure fairness, and they targeted testing according to specifically stated objectives. These teachers also avoided holistic student assessments as they regarded these as more subjective than the atomistic and thus objective assessment techniques. She therefore suggested *“the present dissonance between instruction and assessment arises because of the misfit between old views of testing and a transformed vision of teaching”*. Consequently, she has seen in her study that *“all three parts of the old paradigm- social efficiency, behaviorism, and scientific measurement- continue to provide a mutually reinforcing set of ideas that shapes current thinking and practice.”* (Shepard, 2001, p.1073)

16.2.2 Cognitive reasoning for learning, but for assessment?

Pi and Sigma share stated intentions of building their instruction on cognitive reasoning. Either they have predefined cognitive ideas before instruction or they emphasize student reasoning as an important factor for developing the communicative and task solving parts of classroom interaction. Pi's focus on cognitive reasoning as creating cognitive conflicts and misconceptions fails to take the abilities of the individual child into consideration. This is according to Pi due to ability grouping taking care of the diversities in what the learner already knows. He can then concentrate on cognitive reasoning in class according to the level of the group of students. He plans and executes his instruction within such a view of learning and knowledge in every part except the in class assessment. Sigma's emphasis on cognitive reasoning is carried through in the interaction in class assessment sequences. She intentionally elaborates the ideas of the students and gives feedback accordingly. She is however not able to follow the cognitive intention due to, in her own interpretation, an eagerness to progress that prevents her from stressing cognitive perceptions and conceptual

understanding. For Pi and Sigma then cognition, reasoning at several levels is important driving forces for classroom interaction, but to a limiting degree they follow this up into assessment procedures.

Even if assessment in a cognitive tradition could be based on one of the three reference traditions, in principle an ipsative reference stated as individual learning objective based on the single student ability is more valid according to a cognitive view of knowledge building. Neither Sigma nor Pi applies such references to their student assessment. The statement by Black at the end of section 5.2.2, stating that the teacher in his study lacked both a theoretical framework and a model to develop assessment criteria is valid also for these two teachers. This argumentation may bring us to the point where we could say that from Sigma and Pi's points of views cognitive theories may be manifested in formative student assessment approaches. The overall summative assessment will still have to be based on group references or external objectives and the validity and reliability concerns brings us then to the behavioral measurements of student knowledge that Pi frequently uses but that Sigma uses in a more modified version. She includes reasoning and thinking skills at several levels and is concerned with return strategies as part of testing as a learning experience. Further learning based on reasoning seems to be her rationale behind these strategies.

It is therefore still a question whether science teachers at lower secondary level are able to assess within a cognitive paradigm even if their intentions are to follow the cognitive theories when planning and executing classroom interaction. *"Instructional practices are guided by the new paradigm, while traditional testing practices are held from the old."* (Shepard, 2001, p.1067)

I have found it convenient to distinguish between the individual cognitive paradigm and a sociocultural paradigm following Greeno et al (1996). Shepard has chosen to develop a conceptual framework for the curriculum, learning and assessment in which she merges a cognitive and socio-constructivist paradigm under the arguments that they coexist as still emerging theories of learning and that this merging can account for cognitive development within social settings and both argue from a constructivist ontologically point of view (Shepard, 2001). The merging seems appropriate from an empirical point of view when

taking Sigma's practices into considerations. So far, I have commented on the cognitive aspects of her practices.

16.2.3 Assessing within sociocultural theories?

I have tried to create some order so as to draw further conclusions about the continuum of the typologies and what they represent epistemologically. It will be necessary to look again at Sigma, under this heading from a socio-cultural theoretical point of view. Formative assessment as a part of classroom instructional practice is the main contributions by Sigma and Omega that make me draw the conclusion of both of them being on a track of assessment leading to an assessment practice that draws on some of the core ideas of sociocultural perspectives. However, I will go no further than to say that they have started a journey on this track. To some extent they include the student in their definition of references and criteria stated for assessment. Omega practices this to a greater extent than Sigma. She is on the whole more concerned about making explicit the terms on which she teaches and which assessment criteria she employs. For Omega, this is a continuous exercise in professional development as well as in student participation in the assessment processes. Sigma lacks this requirement for student participation for her to be labeled a teacher possessing sociocultural preferences. Omega's contribution into the field of assessment practice representing sociocultural perspectives has to do with her involvement in assessment strategies as an integrated part of interactive teaching.

It has been stated that portfolio assessment is the ultimate student assessment tool that emphasizes sociocultural theories as part of student assessment. However, according to this overall project involving eight teachers, it remains to be seen whether these ideas are manifested in teaching practice. However, the written traditions of the natural sciences could be developed into such a method if students were allowed to write laboratory reports within a personally preferred structure that signaled their knowledge construction. This could happen if collective and collaborative learning were included and if teachers formatively assessed these lab journals. (Roth, 1999)

Holistic assessment is a challenge. The challenge lies in stating objectives and making explicit different aspects of holism. Holistic assessment is necessary in order to formulate a formative assessment strategy that is to be applied in classroom settings where the overall objectives and ideologies of an educational system are also to be assessed along with the

specific subject objectives. Judgmental evaluation exists as a consequence of this gap between the wider intentions and what is possible to state. The sociocultural theories are holistic, they attempt to underline the complexity of educational situations. The definitions of the consequences of the assessment of this complexity have still to be developed, provided this is considered valid for individual student process skills or the products of learning.

16.3 The ideological positions in science represented in the various cases; From essentialism to progressivism

In section 5.2.5. the dualism of essentialism and progressivism was introduced. These two terms have also been applied descriptively throughout the presentation of the teachers to characterize their main positions according to Roberts' seven categories of ideological emphases (Roberts, 1988). During the analysis of the teachers, a pattern evolved in which Roberts' original categories were divided into two main positions. The combination of some ideological positions that concentrate on presenting the subject itself has been labeled essentialistic and some positions that concentrate on presenting the subject with a particular student in mind have been labeled progressivism.

The first block of categories is a combination of 'solid foundation' with 'correct explanations', 'structures of science' and 'scientific skill development'. These categories address either the structure or the products and the processes of scientific knowledge and emphasize these ideological focuses as valid for teaching including assessing students. I have labeled different combinations of these emphases essentialistic. We find Alfa, Gamma and Pi in this part of the continuum of possible multifold positions that can be taken by teachers.

The other block of categories consists of 'everyday coping', 'self as explainer', 'science, technology and decisions' and 'scientific skill development'. Different combinations of these emphases have been labeled progressivism. In this block, we find Sigma and Omega. These categories have partly a child - centered main ideology or a society centered main ideology. They, however, all lie in the liberal ideological corner of educational ideologies.

Several of the teachers have applied this emphasis, 'scientific skill development', along the whole range of positions but for different reasons. 'Scientific skill development' is an emphasis that is applied within a positivist knowledge tradition as well as a sociocultural knowledge tradition. In the positivist tradition scientific skills as emphasis in science education has embedded various epistemologies. The pendulum going from laboratory exercises for the benefit of learning the conceptual knowledge to for the benefit of learning the processes of science as well as social implications of scientific enterprises is embedded here. Alfa would therefore adopt the first argumentation into his position while Sigma and Omega would see the last argumentation as legitimizing their position. According to Alfa the importance of doing experiments is the same as the importance of staying out in nature. By experiencing the phenomena, the students can obtain conceptual knowledge. Laboratory experiments can therefore be assessed as any other learning activity by the use of objective measurements and a grading system. The students learning by laboratory experiments are hence assessed according to a fixed view that laboratory experiments in themselves as educational processes promote the products of science. Sigma and Omega would not grade laboratory experiments and journal accounts of these procedures. Laboratory experiments are learning experiences that point towards the processes of science. Assessing the students' accounts is therefore too complicated and involves many dimensions that cannot be communicated using grades. 'Scientific skill development' is consequently emphasized by all the teachers but for different reasons.

In this thesis there is an additional message that is of importance here. In emphasizing the subject-matter and taking the essentialist standpoint we are stating aims and objectives for education that direct all guidance, all control and all methods of instruction based on an understanding of a topic that is fixed in the academic field at a specific time. This fixed position or reference point does not signal progression within academic domains. They are representations of one reality only. Also in emphasizing essentialist ideas of educational programming we give the matured and final product priority. From the progressivist point of view statements about aims based on the child's needs are just as problematic. We can only foresee to a certain degree what those challenges of the child would be. Therefore we cannot give infancy, the beginning point and the processes the ultimate position in educational programming. There is a meeting point here between an academic reference point and a child reference point that is necessary to reflect upon. There is a meeting point between the mature domain specific thinking and infant understanding. In the duality of

progressivist and essentialist positioning we also see the dilemma of student assessment stated as guidance and control. A progressivist position would be entirely concerned with the learning processes and the starting points of the child, and to the extent that it would use goal statements as reference points for instruction that would have to be entirely based on the challenges and needs of the child. In this situation, the structure or content of the academic subject would be neglected. Correspondingly, an essentialist position would be concerned with goal statements based on the internal logical structure of the academic discipline based on a standard fixed at some point in the academic discipline's history. In such cases the learning potential of the child would be lost both as a reference for educational programming and for assessment.

I am arguing for the use of typologies in order to illustrate positions that the participating teachers have taken according to my analysis. I am also arguing that I have done this for the sake of raising specific assessment dilemmas in order to use these typologies as a starting point for discussions about student assessment and teacher qualifications with regard to epistemological and ideological dimensions. However, I am also arguing that in the practices of teaching, one position finds its relevance in one situation and another position finds its relevance in other situations. The structural perspective fights against the situated perspective.

Furthermore, these analyses of Alfa through Omega therefore represent a continuum of the combination of epistemological and ideological positions from a situated perspective. This is in line with the Strauss and Corbin notion of dividing properties into different dimensions that lie along continuums (A. Strauss & Corbin, 1998). The continuum here can be understood on the one hand as positions of two extremes as well all the various middle positions teacher identities may represent. On the other hand, it may also be understood as a beginning and an end. Neither the beginning nor the end has a meaning without the other. They do not exclude each other. On the contrary, theoretically as well as in educational practices they complement each other. The extremes and the various middle positions carry different aspects of educational realities. For the individual teacher, as is in particular the case of the statements made by Delta in the introduction and end of chapter five, educational practices involve merging different positions and applying different ideologies and epistemologies according to the situation, its actors and their objectives. Alfa through Omega carry separately a part of the educational student assessment picture,

but combined these teachers represent some of the variety of ideological and epistemological student assessment positions. Theoretically the persuasiveness lies in both the single position and the combination of position. Didaktik practices and applications imply a reality that is more a combination of positions than typologies presented here.

A careful conclusion may be, based on the analysis of the teachers within this framing of progressivism and essentialism, that the teachers maintaining essentialist positions find their appropriate tools for assessment strategies within the summative register of tools. On the other hand, the teachers in the progressivist positions find their tools for assessment in the formative strategies. More importantly these teachers reflect upon their assessment practices in two different ways. The teachers in first group reflect on assessment within a positivist view on knowledge construction. The teachers in the second group reflect on their assessment within a sociocultural view of knowledge construction.

16.4 Combined ideological and epistemological positions?

What I have attempted to do is to look at epistemological implications and ideological implications in science for student assessment applied by the teachers in the classrooms. The idea is that in classrooms the learning theories and various emphases of science come to a final test of their applicability. The applicability is tested against the possibility of integrating assessment implications for learning theory and science ideologies. In addition, such tests happen according to the teachers' abilities to implement learning theories within a mandate given by curricula. That is not to say that any theory is relevant only to the extent that it can be implemented through formative and summative assessment strategies. Theories of learning and the emphasis of science education possess educational value for individuals beyond the point of assessment significance. Educational outcomes and processes also have a collective value beyond the manifestation of identifiable assessment techniques.

I have moreover looked at the integration of three theoretical perspectives and the way they are visible in the practices and reflection of the teachers. The previous three sections have argued for an emerging pattern among the participating teachers. Neither one is subordinate to the other. The implicitly or explicitly stated ideology of the subject influences the view of learning and of learning influences on the ideological position. What

the teacher emphasizes in his/her teaching, which aspects of a subject are made visible for the student through the practices of student assessment signals in themselves the viewpoints on learning. Certain epistemological positions seem to correspond to certain ideological positions like this:

Alfa's position is a combination of essentialism and behaviorism manifested in summative assessment approaches.

Pi represents the combination of cognitivist and behaviorist with an essentialist position also manifested in summative approaches.

Sigma is the progressivist who draws on both cognitive and sociocultural theories in her mixed formative and summative assessment agenda.

Omega draws mainly on sociocultural theories in her progressivist position with consequent formative assessment purposes.

So far, the behaviorist testing paradigm has been living parallel to the newer emphasis of learning as socially constructed and testing as individually cognitive. This dissertation has on the one hand illustrated that different teachers hold different positions as their main position concerning assessment. On the other hand, this dissertation shows that these different positions may exist in parallel, and each of them has a significant contribution in the totality of assessment purposes in teacher planning and instructional activities in the classroom. Hence, the ideological and the epistemological positioning that the teacher undertakes are intertwined at several reflective levels, a practical level, a didaktik level and a theoretical learning level.

The initial idea was that assessment is the heart of the instructional activities and may therefore never be disregarded. However, a controversy arises when a mismatch occurs between the epistemology driving the major part of the instructional activities and the epistemology driving the assessment. Such a mismatch will result in one of the two being the dominant force and motivation for teaching emphasis. In such a case, the controversy lies at the teacher level and there will constantly be a gap between the emphasis of teaching in general and the emphasis of assessing. Such controversies are illustrated by the cases of Pi and Sigma. **The controversy may prevent these teachers from putting assessment at the heart of instructional activity and reflection.** This is however more the case of Pi than of Sigma. Based on the fieldwork Sigma is fighting a gap she interprets as based on

personal dilemmas, whereas Pi is not himself aware of the mismatch. For Sigma and Omega student assessment is at the core of their planning and execution of instruction. In the case of Gamma the same is true, but at a practical technical level. For Alfa and Pi assessment is certainly not considered a core activity as in their summative approach it is separate from instruction itself.

In cases where a gap exists between the signs of student assessment and the epistemological viewpoint, a tension is created round which ideas draw the longest straw when stating values for educational programming. There will always be some science ideological position that influences the evaluative practices within the subject since it is impossible for either of the teachers to teach and assess without adding an idea of what is important in the subject. Hence, there is another relationship between the epistemological and ideological positions. The combined essentialist and behaviorist does not need ideological reflection to the same degree as the other teachers as the angling of the subject comes with the academic disciplines they are socialized within. The ideological reflection, in the case of Alfa, becomes the instrument of the teacher in order to make a rational behind the epistemological position in his subject. At the other extreme, the combined progressivist and socio-cultural position of Omega, there is no longer a direct representation between natural science as an academic discipline with a defined knowledge base and the student assessment of that knowledge. Ideological reasoning and reflection become important for explaining the reasoning behind the choices made accordingly.

With such an emerging pattern covering eight science teachers working in three different countries the overall question becomes what is the underlying worldview, the overall beliefs that constitute these teachers' positioning? In addition, because of this emerging pattern, the question of whether these combined theoretical approaches will have implications for didaktik approaches that would result represent a changed normative view of science education. I am tempted to briefly illustrate and indicate possible interpretations of these questions, but simultaneously emphasize that this is beyond the scope of the empirical indications and theoretical framing that this project has developed.

16.4.1 Science education at a turning point

For the teachers the combinations of curricula guidelines with assessment guidelines, as didaktik resource tools, to various extents form their ideas, values and attitudes about

science education. Gamma, Sigma and Omega are the three teachers that argue from their interpretation of national teacher mandated resources when reflecting on their assessment strategies. For these teachers mandated documents have a normative value in educational planning and execution. Gamma uses it in a practical administrative way. Sigma uses the curricula to reflect various possibilities of educational practice; hence she employs it at a didaktik level. Omega also uses curricula at a didaktik level for developing local assessment criteria. Apart from these main indications the interpretation and curriculum in themselves have not acted as an analytical focus.

Beyond the scope of the empirical indications, the combination of assessment and curriculum can be seen as two driving forces in educational planning mandated from educational authorities. (Darling- Hammond & Mc Laughlin, 1999) According to this the two forces are of relative importance for developing educational programming for the teachers and setting the premises for the content and the activities at teacher planning and classroom instructional level. One normative approach would be to look at the implications of the combined epistemological and ideological positioning for science curricula guidelines and assessment strategic documents as an authoritative validation approach. Another possible normative approach would involve the implications for didaktik modeling that would serve as guidelines for didaktik practice within instruction, textbook and curricula development as well as national assessment planning.

This is my claim: Science education is at a turning point. The essentialist position following on from the implementation of academic sciences does not fit in with a sociocultural or a cognitive view of education in general. If we are to take the challenges of the students in their specific cultural, societal and local context into the planning programming of instruction we need to turn to the progressivist positions. We would then specify our organization of education at all levels, including teacher education based on defined challenges as Klafki did with the key problems. (Klafki, 2001a) This implies a slight difference in the relative importance of material and formal bildung theories in the planning of curricula and other educational textual resources.

Moreover, to take this perspective further and make it relevant for assessment the sociocultural paradigm calls for formative approaches where the learning of the individual forms the references. Merging the cognitive with a social approach would give us the

frames for stating references for the individual's conceptual comprehension based on the local context in which the student lives and learns interactively. Developing such formative assessment techniques and strategies calls for emphases within the progressive block of ideologies. Re-designing assessment means re-considering the structure of curricula and textbooks towards an emphasis on empowering the learner, an on insight into the knowledge construction ideas of science communities, coping with the challenges of daily life and on insight into the relationship between social application and influence on scientific enterprise. This is connected to the second question I raised. What specific changes in overall ideas do science educators need in order to face the challenge of turning around their view of sciences along with the significance of the sciences for secondary education?

16.4.2 'Science-in-the-making' versus 'ready-made-science'.

The reflective teacher identity has implications for reflections as teacher and reflections as scientists. This transformation process of incorporating these two elements results in a corresponding incorporation of the epistemological viewpoints embedded in scientific communities with epistemological viewpoints stated within teacher profession. Even the work of scientists has to be understood within socio-historic and socio-cultural frames. (Kuhn, 1970; Latour, 1987) The view of knowledge construction within scientific communities has gradually shifted from a positivistic truth to a culturally diverse situated and norm influenced persuasiveness. (Latour, 1987, 1999) *"The negotiations of what counts as proof, fact or acceptable theory in science are always ordered social phenomena"* (Roth, 1995, p.175).

It has therefore been argued that a scientist's social dimension has at least three social aspects (Ibid). Firstly, it involves teamwork. Then this teamwork practice is embedded in a historical development informing and influencing the formation of the entire processes and products of scientific enterprise. In addition the social practice formed by cultural tools, and the knowledge and skills that have brought forward these tools is a social dimension. Scientific practice is a situated practice embedded in political circumstances as well as influencing politics by its products. (Latour, 1983, 1999)

The teachers' identity is influenced by perceptions of science as a subject within scientific communities and science as an academic discipline. In addition, teacher identity will be

influenced by perceptions of knowledge building. The didaktik approach addresses the combination of these or the transformation of these aspects of scientific knowledge building into educational activities and reflections. Latour's already outlined sociocultural approach to scientific enterprise may or may not be the individual teacher's view of science. Epistemological positioning and ideological emphases are theoretical frames of references that attempt to make positioning explicit within several possible viewpoints in knowledge construction. These positions thus become two aspects of didaktik competencies required for the transformation from scientist to teacher in order to illuminate the dilemmas of student assessment.

"Science-in-the making" versus *"ready-made-science"* is Latour's dual perspective of the processes of scientific reasoning versus the products of scientific enterprise (Latour, 1987). It is this duality of the philosophies of science that has found its twin in the duality of formation versus summation in assessment practices. Illuminating the students' learning results entirely as written accounts used in most summative approaches highlights a problem because scientific knowledge of nature may be reduced to 'ready made science'. *"When studied as products the student's plots, curves and written explanations can easily be mistaken as evidence for their abilities and process skills"* (Roth, 1995). But if students' learning is studied as collective processes possible within a sociocultural formative approach the social, historical and contextual nature of the written accounts may be illuminated and hence add the dimension of 'science-in-the-making' to the individualistic 'ready-made-science' position.

Within this dichotomy, Alfa and Gamma present the sciences as ready made and served presented to the students. Their students have to either accept the products of scientific enterprise or not. They are not provided with any 'science-in-the-making' information that they could use for evaluating the significance of the scientific findings for themselves. Pi on the other hand provides such information during instruction, as he would incorporate information about researchers and their research processes. This aspect of his teaching is, however, not considered important in the assessment procedures he applies. Alfa, Gamma and Pi therefore end up with 'ready-made-science' as the science that is important to assess and consequently as the scientific answer to what is important to know about sciences.

According to my analysis Alfa through Pi are therefore found in the position of presenting science as 'ready-made-science' through their assessment strategies. They avoid the controversies and processes going on in the scientific communities as a part of science knowledge building. Moreover, they also avoid the socioscientific discourse about scientific processes and products. They find that students favor basic knowledge and that the summative strategies are appropriate to assess this.

Sigma is the teacher that tries to combine 'ready-made-science' with 'science-in-the-making'. She is concerned with the products of science when in her teaching and assessment she singles out laws, knowledge about species and other factual knowledge. She makes occasional attempts at including 'science-in-the-making' perspectives when she assesses the students' presentation in the classroom. During this interaction, she draws on the students' perceptions of scientific facts as well as their discourses underlying these facts and the societal issues attached to the factual knowledge.

At the other extreme and in the case of Omega, scientific knowledge is no longer important as knowledge in itself. It is important to the extent that it can contribute to the understanding of oneself as humans in a society. She has therefore some aspects of 'science-in-the-making' built into her view of scientific knowledge. However, it can be claimed that she could be teaching any subject by highlighting the ideological positions she has taken. The sciences, especially as products, are disappearing and it could be claimed that she is no longer a science teacher, yet still a teacher. She would be teaching for the general bildung of her students.

With Omega as a starting point, it could therefore be argued that focusing only on 'science-in-the-making' without simultaneously focusing on 'ready-made-science' removes important basic knowledge from education leaving only knowledge about scientific enterprises as human interaction within a historic and societal context. As an extreme case the sciences could be presented as the sociological scrutiny of scientific enterprise. This is however not the case with Omega as she has the child and its challenges as her focus for educational programming. Consequently, she chooses eclectically the concepts of sciences that the student would benefit from understanding. She hardly mentions nature as relevant for her teaching. In her facilitation of learning nature is neither presented as the reason for the academic structure of sciences nor as consequence of academic sciences.

An analysis of the distinction within the positivist and socioconstructivist view of knowledge concludes that for socioscientific purposes the socioconstructivist position is complicated yet preferable when discussing the sciences from both a product and a process perspective. It is argued here that the sciences as school subjects are more ‘ready-made-science’ than ‘science-in-the-making,’ and that this has to do with the school subject presenting the products of scientific enterprise more than the processes of scientific enterprise. (Bingle & Gaskell, 1994) Positivism falls short when analyzing the controversies of scientific processes and when analyzing the implications of scientific products within society at a large. *“While the positivist position appears to offer the possibility of democratic participation in the evaluation of scientific disputes within a socioscientific issue, a close examination suggests that it ultimately maintains scientists in a position of privilege in the decision making process because only scientists themselves have access to the standards which are necessary to make an evaluation of what they do... A social constructivist view of science, on the other hand, challenges the scientists’ position of privilege because individual citizens have just as much access to the standards for evaluating the impact of the social context as do scientists themselves.”* (Bingle & Gaskell, 1994, p.198)

The identity of science teachers is connected to how they view themselves as bearers of the knowledge that the students should be introduced to. Science teachers who would prefer to be in the position of a scientist possessing knowledge would be reluctant to be open to a socio constructivist position. Allowing the scrutiny of scientific findings as ‘science-in-the-making’ as a part of teaching would, in addition to interfering with their epistemological position, interfere also with their identity as scientists. Alfa is the typical example of a scientist holding a teaching position in secondary education. Gamma does not talk about himself as a scientist. His essentialist position is tied to and legitimized in his view of strategic documents like national curricula. Pi’s interpretation of his identity as teacher facilitator and assessor signals a positivist knowledge view, which combined with his essentialist emphasis, leads me to put him in the same category as Alfa. However, as already indicated, his reflections on learning and assessment for learning in addition definitely gives him a professional teacher’s identity. The identities of Sigma and Omega are those of science teachers, and therefore the focus of their teaching is the opposite. Consequently, it is tempting at least in the case of Omega to put science in parentheses.

The summative and formative approaches to student assessment that have been analyzed as ideological and epistemological positions seem also to have a philosophical aspect attached to them. Latour's argument is that the sciences could be presented as mere facts and results of the sciences, or they could be presented as a human enterprise incorporating all the controversies that take place in scientific communities in order to develop knowledge. These processes are therefore a part of knowledge within scientific communities and could accordingly be addressed as knowledge of the scientific communities as well as of the results of sciences.

The emphases that bring the students to the natural sciences argue for knowledge as ideology that in turn makes the social dimension of scientific enterprises redundant. In this case, teaching is about presenting the closed conceptual system of knowledge as agreed on in scientific communities. They limit themselves to the 'ready-made –science' perspective of Latour. When considering factual knowledge nature is the reference for deciding what the researches have found. The teachers that emphasize science as mirroring nature itself will find them at home in essentialistic emphases.

On the other hand, the emphases that bring the subject to the students argue for an ideology that includes the human aspect of scientific enterprises. (Eggen & Knain, 2003) The following conclusion is in line with this argument: "*When considering social issues in the classroom, it is advantageous to maintain the critical stance made possible by accepting multiple perspectives on reality.*" (Geddis, 1991, p.172) These teachers will consequently find themselves in addressing subject related issues from a 'science-in-the-making' perspective entirely or in addition to a 'ready-made-science' perspective. Even if Sigma and Omega share some aspects of formative assessment approaches that such a combination calls for they fail however to fully give the dual perspective space in assessing students.

From the analysis of these teachers I could carefully draw the conclusion that as educators with the task of transforming the academic subject into a school subject they lack the ability to productively combine these two similarly important main aspects of scientific knowledge construction in their educational programming and their assessment of students. Incorporating such elements would involve a language that presents the sciences as an

openly critical social enterprise. Moreover, the assessment of such knowledge would involve defining corresponding competencies that would be process, critical and societal oriented in order to provide teachers with conceptual and terminological tools for such assessment.

17 Grounded theory and knowledge construction about teacher identity concerning reflections about student assessment

A critical view of Grounded theory leads to the conclusion that the methodology is “*separating the experience from the experiencing subject, the meaning from the story, and the viewer from the viewed*” (Charmaz, 2000, p.521). This raises the discussion of the relative importance or visibility of the voices of the researched and the researcher as an aspect of knowledge construction on the terms of the teacher or the researcher. Secondly, it raises the question of the relationship between the meaning created by interpretation versus the initial story as aspects of the educational and interview context under which the initial story was created. These are subsets of knowledge construction in this project that will be commented on in this chapter.

My identity as researcher has been highlighted as the main asset. I consider this research project more to have generated theory rather than have confirmed theory by implementing a predefined conceptual framework. The interpretive rather than confirmatory nature is asking for a revisit of the terminology used as an aspect of concept validity. (Merriam, 1998) Furthermore, different aspects of internal and external validity will be discussed. This initial methodological discussion is then commences within an ontological and epistemological scrutiny of this project. Firstly, however, there is an epistemological need to again revisit the conceptual understanding of the concept of theory itself.

17.1 The theory concept of Grounded theory again and revisited

Grounded theory has been known for its rigor that, together with its systematic approach, has been criticized for representing reminiscences of the knowledge construction that quantitative paradigms are based on. (Fontana & Frey, 2000) The rigor has, however, applied to the analytical thinking strategies and not to the data collection procedures. (A. Strauss & Corbin, 1998) (Charmaz, 2000) Grounded theory has also been criticized for not paying attention to data gathering techniques. (Fontana & Frey, 2000) This is true; data gathering techniques are not the primary concern of Grounded theory, although the methodology is concerned with the character and quality of the data before analysis.

Therefore, the rigor and systematic approach of Grounded theory has to be taken into consideration during fieldwork and data gathering. This however does not give any general directions for quantifiable data or any standardized, closed or structured interviews or observations.

The data across cases does not have to compare concepts in order to build theory, as the theory building is transferable only to the extent that the cases have undergone analysis within the same theoretical framework or have been used as cases to develop concepts within a comprehensive theoretical framework. This is however the most problematic point of Grounded theory. If the theory developed is based on the concepts and categories derived from a single case, how can we argue for the integration of concepts and categories across cases while in the next line argue for the application of theory to other cases and respondents? Consequently, as a continuation of the discussion of the theory concept and the relationship between theoretical framing and empirical indications given in Sections 6.2.1 and 6.2.2. as well as some reflections in 14.4, I will address this issue again in light of the recent discussions within qualitative epistemology.

Orthodox Grounded theory would claim that theory building is transferable and valid to other cases as a result of data collection and analysis by the constant comparative method. They introduced the distinction between substantive and formal theory. Substantive theories have a validity set by the substantive empirical area of inquiry, the academic discipline. Formal theory however is valid across academic fields and thus “*exists on distinguishable levels of generality, which differ only in terms of degree.*” (B. Glaser & Strauss, 1967, p.33) They both fall between working hypotheses and all-inclusive grand theories according to Glaser and Strauss of 1967.

In the Strauss and Corbin version of Grounded theory, the theory concept is less accurate and more diffuse. They have eliminated the concepts of substantive versus formal theory. In the 1998 version of Grounded theory “*theories are constructed, vary in nature, and are not all the same*”, and they state furthermore that “*A theory does more than provide understanding or paint a vivid picture. It enables users to explain and predict events, thereby providing guides to action.*” (A. Strauss & Corbin, 1998, p.24 and 25) Their theory concept is therefore based upon the theory’s ability to explain future cases, and they seem less concerned with the contextual information that would provide the reader with

frames for the interpretation and transferability of theories when presenting their theory concept. They write about three main steps of theory building, description, conceptual ordering and theorizing. Accordingly I have covered the first two steps in my project, but according to this theory concept I cannot claim that I have covered the third step.

A more recent addition to the discussions about the theory concept can be found in a definition of a constructivist Grounded theory approach where the “*relationship with and representation of subjects*”, “*the importance of situating qualitative research in historical and cultural contexts*” and “*reflexive about how we frame and write our studies*” (Charmaz, 2000, p.528) are considerations to be incorporated into the theory concept. Within such a modified theory concept the transferability is limited and bounded by the theoretical and purposive sampling, described contexts, a researcher positioning in field and various interpretation information to a more specific extent than was the case with former Grounded theory approaches. Also within such a constructivist Grounded theory approach the gap between ethnographic methodology and Grounded theory methodology gets narrower. In retrospect, I can reflect on my own ontological positioning and see the reason for my stomachaches in this gap that are also due to lack of scholarly bridge - building between these two approaches. The constructivist approach seems to be closer to the theory concept I have ended up using in chapter 15.

Grounded theory in the first version of Glaser and Strauss is hence closer to a grand theory paradigm than Grounded theory in the version of Strauss and Corbin. Finally constructivist Grounded theory is even further away by approaching pure action statements in its external validity. In the constructivist approach the researcher is present in all stages of the research and therefore the theories are seen as constructions based on the ‘spectacles’ of the researcher. Moreover, the theories of the constructivist Grounded theory approach require, like the ethnographic approach, the contextualization of the cases (14.8).

I will not claim that the categories or typologies are valid for cases other than Alfa, Gamma, Pi, Sigma and Omega. Nor will I claim that the typologies are valid for teachers in school subjects other than the natural sciences or for teachers teaching at levels other than lower secondary. Nor are they valid in countries other than Norway, Sweden or England. And so on. The typologies may, however, be used to frame a discussion about possible teacher positions. They may be used as examples in initial and in-service teacher

education as a resource for reflections about epistemological and ideological positioning. Therefore, they may be used critically to reflect upon own practices as well as the practices of other teachers. What they may not be used as is prescription of practice, as that would involve claims about a normative external validity beyond the initial concept of 'didaktik' and beyond the representativeness of the cases.

Five elements of a Grounded theory 'theory' concept were presented as the Glaser version in section 6.2.1. The first element, 'ability to predict and explain behavior,' has already been eliminated from this study as a consequence of the discussion above. This objectivist element of the theory has probably, between the lines, been substituted by an ability to describe and analyze and hence indicate the relevance of empirical results. The second, 'theoretical development in the academic discipline' is still valid but certainly has been modified by the premises set within the constructivist paradigm. The third, that of 'practically applicable in the sense of ability to inform the understanding of the practitioner', pointing back to its pragmatic root, is still valid if all information about the boundary of theoretical claim is provided. Within 'didaktik' research these elements are important for keeping an outlook on the relationship between the practical and theoretical fields, and thus make this a requirement for establishing persuasiveness and theory. The final two, 'provide a perspective on behavior applicable towards data' and 'guide and provide a style of research', are beyond the scope of this dissertation and have therefore not been evaluated against my discussion of knowledge construction.

17.2 Theory concept in constructivist Grounded theory and persuasiveness

The previous sub- chapter presented a modified theory concept of Grounded theory based on a constructivist approach to knowledge construction in qualitative research with elements like the dialogical elements of the fieldwork emphasizing actions and relational nature of data collection and data analysis, contextual and situational boundedness and practical applications. This theory concept will be applied in the following discussions about the quality and persuasiveness of this research project.

I would like to start by stating once more *"In qualitative inquiry the researcher is the instrument. Validity in qualitative methods, therefore hinges to a great extent on the skill,*

competence and rigor of the person doing fieldwork” (Patton, 1990, p.14) A consequence is therefore qualitative research as a reflective enterprise. Some aspects of the persuasiveness of this research project rely on ontological, epistemological, methodological, (Y. Lincoln & Guba, 2000) and axiological beliefs and the corresponding reflections. I am less concerned with labeling stances according to these dimensions and apply labeling in order to categorize my own research. However, some paradigmatic labeling is handy. What I am most concerned with is the choices that we make as qualitative researchers in our meetings with respondents and the social world they form and are formed in. This was put very simply and eloquently as “*We are confronted with the choices about how each of us wants to live the life of a social inquirer.*” (Schwandt, 2000, p.205)

The ontological question of whether we can reconstruct phenomena in education such as teachers’ reflections concerning assessment and thereby claim statements about the reality of the teacher or the reality of the researcher is such a basic belief. Another is how I position myself according to the different aspects of epistemology. This discussion has already been started through a final scrutiny of Grounded theory and its theory concept. The methodological beliefs and discussions of how we can claim that we are building knowledge within the ontological and epistemological beliefs are here embedded in discussions about the credibility and transferability of the process and products. These three sets of beliefs are mandatory exercises.

But, from where exists the dimension of axiomatic beliefs? Inherent in this overall attitude is, following on from the quotation of Schwandt, my notion of social inquiry as a political and ethical practice per se. Ethical and political considerations are embedded in the inquiry, whether explicit or implicit, as stated and elaborated on in chapter 7. Educational research takes place within institutional settings; a part of the contextual framing for the actions taken by the teachers has been shaped by the political educational agenda stated in their strategic documents. As researchers we become a part of this politically defined educational agenda. In addition we are also located in research communities operating within political circumstances; we influence the political educational agenda and shape educational matters and are formed by them in the way they have been emphasized or addressed politically. We have therefore an ethical- political commitment that cannot be disregarded.

The four terms of credibility, transferability, dependability and confirmability (Y. S. Lincoln & Guba) as well as a framework of “What is, what may be and what could be?” (Schofield, 1993), were introduced in the chapters on methodology. These authors have questioned the application of the terms of validity (internal, external and concept), reliability and objectivity in qualitative research. At this point I am not sure that the new terms introduced will add any perspectives to the discussions of the persuasiveness and quality of my research project beyond introducing other terms for the same phenomena. I will therefore use them interchangeably.

Within a constructivist paradigm Grounded theory becomes antifoundational in that aspects of persuasiveness like validity are not permanent but *“agreements about truth may be the subject of community negotiations regarding what will be accepted as truth. Or agreements may be eventuate as the result of a dialogue that moves arguments about truth claims or validity past the warring camps of objectivity and relativity.”* (Y. Lincoln & Guba, 2000, p.177) Hence a communicative and pragmatic validity concept is the consequence of constructivist Grounded theory. Lincoln and Guba argue here that validity has to be extended to include factors or measures of interpretative rigor. They call for a systematic approach to how our interpretative process influences the validity of the concepts and the validity of the enquiry. In addition a number of attempts at verbalizing validity concerns within qualitative paradigms have been presented, different forms of authenticity, the crystalline, ethical standards as validity concern, voice in the texts, reflexivity and textual representation. Some of these are extended textual techniques included for interpretative reasons, while others are genuine substitutes for the initial terms of quality, validity and reliability.

The credibility or validity of this research project has two dimensions that I wish to discuss. The first dimension is the aspect of trustworthiness related to the conceptual understanding embedded in the concepts applied before, during and as a result of the empirical enquiry. The theory building in itself implies a revision of the conceptual content according to the premises of the enquiry. (17.3.) The second dimension of credibility has to do with trustworthiness as the internal validity and the design of the study with particular emphasis on the empirical work. The use of triangulation, validating by respondents are two techniques of vital importance for the knowledge construction but have been applied

with hesitation due to their origin within a postpositivist paradigm. The methodological viewpoints underpinning such research strategies are, however, included in Grounded theory approaches. The constructivist Grounded theory approach again raises the discussion of the appropriateness of these strategies for increased validity and reliability in interpretative research. (17.4) These techniques point also to the transferability and applicability of the research project as aspects of external validity. (17.5)

17.3 Concept validity or invalid conceptualization!

A consequence of any interpretative qualitative approach is to revise or develop theory based empirical indications. The abductive strategy applied has consequences for the concepts used and developed. If a theory consists “*of sets of concepts used to define and /or explain some phenomenon*” (Silverman, 2000), the relationship between theoretical framing and conceptualization is complicated. Revising theories implies taking some concepts as a starting point and applying them in empirical settings, but at the same time remaining open to revising the content of the concepts or introducing other labels for similar phenomena.

The validity of the concepts used and applied during the course of the fieldwork is therefore not a result of a straightforward operation of theories nor has it been entirely built on concepts used in the field. Concept validity is not static, but in itself a concept in development. There are three contributors in the defining process of the content of the concept. These are the theoretical contribution synthesized in Chapters Two through Six, the teachers’ contributions and my contributions. During the fieldwork a meeting point existed between my conceptual understanding and the concepts used by the teachers. Similarly during the final analysis meetings occurred between my understanding and the theoretical framing. In general, however, these three contributing factors are present all the time regardless of the steps in the process. I carry with me a previous theoretical understanding that is continually being evaluated against the situations I am facing and the communication I am involved in.

In Grounded theory the initial concepts used are labeled sensitizing concepts. They have been redefined according to the respondents while new concepts may have been introduced. This overall process makes working within Grounded theory in itself a

combination of inductive and deductive reasoning and knowledge construction. I came to a point in the writing of cases where the overall reflections of the conceptual understanding of the researcher both interfered with the analysis and development of texts. The inductive voice told me not to go back and revise the first chapters, as the conceptual understanding here is a part of the knowledge construction. The deductive voice said to go back and reformulate according to my new understanding as this one is more qualified than the previous understanding.

This subchapter indicates that the inductive voice won! Therefore, I have included the revisiting of a few of the concepts that were introduced and discussed in the first main section, this time in light of the understanding that the empirical part of the project has been emphasizing. As much as this is a revisiting of the concepts introduced it is also a discussion about the content validity of the project, the concept validity. Did I use the concepts as intended? When I did not keep to the intentions, what are the factors that contributed to this development during the course of the project? I have chosen to do this alphabetically, but this time not in the order of the Greek alphabet.

The applied concept validity term here is as mentioned a term in flux. As we are here talking of process conceptual validity there are tensions involved. There are some tensions involved here not connected to the time aspect since each concept changes its significance during the research process. There are also some tensions to do with the nature of the concepts. Since each concept changes its content during the research process so also will the interrelationship between the concepts and hence the theory will be revised. The complexity is at a peak when the two tensions are combined. I will limit the following discussion to the terms that have been of significantly substantial importance and that simultaneously have troubled me; their renewed meaning was necessary due to theoretical and empirical contributions.

'Dilemmas'. I started out by defining some of the assessment dilemmas that had been implicitly or explicitly stated by some teachers. However, throughout the course of the project 'dilemma' has embraced those defined in Chapter 4 as well as some tensions stated by the teachers and some identified by me as a consequence of analysis. I have been working deductively and inductively with this concept. The alternative to use dilemmas as part of an overall ideology concept was considered late in the project. In such case,

dilemmas and ideology would be considered as linked concepts and the extremes of dilemmas as valid ideas, norms or values within education.

‘Epistemology’. The term epistemology exists at two levels. It is firstly my epistemological positioning the knowledge construction I am doing. Thereafter it is the epistemological frames for analysis of teachers. Concerning the frames for teacher analysis I have used the terms epistemology and theories of learning interchangeably.

‘Evaluation’. Thinking back to the development of this project I had started with the wider concept of evaluation and I was narrowing down the focus to student assessment during the whole project. Consistency in the use of these concepts is therefore due to the development of the research questions for the project. Different teachers use the term in different ways and that has been a concern in translating the statements of Norwegian and Swedish teachers. Translating involves interpretations, particularly at this point.

‘Identity’. The use of the term ‘identity’ has raised some difficulty due to two perspectives. The first is the relational situated perspective of a sociocultural identity concept. The teachers have been a part of an educational context that I have only had limited access to for analysis purposes, taking the character of the material into consideration. Simultaneously the teachers have been in a relationship with me as researcher, and so the material has been created during discourses. The other aspect of identity here is that it is only a theoretically selected part of the teachers' identities that has been described in the cases. When embarking on this journey I was concerned with the identity of the teacher as the research object. Throughout the process I have become increasingly concerned with the concept of sociocultural identities as an aspect of institutional and relational education, but in addition the relationship between the researcher and the researched. Therefore, I see now the teachers' identities as I have been able to construct it through the data-material and reconstruct it through typologies also as a consequence of his or her relationship with me during the time we shared. We have developed a communication based on collaboration and dialogue and have found and developed our new identities as teachers and as researcher also within this communicative relationship. Consequently, the identity concept is twofold here. I have not only looked at the identities of the teacher as socially constructed in relationship to their students and

colleagues, but also at the identities of the teachers as constructed in relationship to me (Angrosino & Mays de Pérez, 2000) (also section 17.4.).

'Ideology' was firstly introduced as a framework developed and applied in different science education projects. In the end the ideology developed into an overall discussion of teacher and assessment. Ideology could alternatively have been introduced as the overall ideas of education as a part of the sociocultural perspective in which case there would have been an integration of ideology, identity and dilemmas.

'I'. This is really one of the hard concepts to define due to the changes that take place during four years. 'I' at this point am definitely not 'I' when the journey was adjourned. The program 'I' have been involved in is called the researcher school. This is teaching 'I' how to become a researcher, and yet researching is really a state of mind. It is both something you are and something you are becoming. Life is lived, and lived experiences are part of research experiences as 'I' carry with me my identity in all situations. Throughout this process 'I' has gradually become more visible in my research and in the way 'I' have been writing this research.

'Sociocultural'. I am still in a process of discovering this concept and anticipate that within the academic discipline this epistemological (or is it ontological) concept has not found its meaning. Therefore its development has maybe been the most difficult to pinpoint. I see this as a symptom of the development in the field of sociocultural epistemological literature and this epistemological position's implications for educational research and educational practice. Writing has been a struggle between the structural need for categories to view the world within or from and the post-structural relations, processes, tensions, power and so on. I have continually been debating what the sociocultural positions will contribute and in my most honest moments I still do not know the final answer to that.

'Typologies'. The teachers presented in the cases were selected due to their specific interpretation of their teacher identity becoming visible in classroom practice and in discourses. This interpretation has indicated specific positions taken within my theoretical frames. Therefore, the teachers represent not only themselves but also possible positions when it comes to assessment, taking epistemological, science ideological dimensions and

dilemmas into consideration. The five cases are descriptions of five teachers, but they do not represent the five teachers' identities in general. Framing is bonding the presentation. The question arises as to whether the cases are typologies, ideals, or whether they are typical. The cases are somewhere in between these two extremes. They do not represent the person and they are not typical of teachers in general. They are specific, and yet they are specific according to these frames which make them typologies in the sense that to some extent they represent the possible positions teachers may take in different situations in educational practice.

17.4 Internal validity

The credibility of this research project in this section reviews the researcher's tasks of collecting data, analyzing data and authoring the accord of the data. The quality of this research project is based on the rigor embedded in the strategies of Grounded theory. However, interpreting the assessment dilemmas of the teacher and creating cases also implies, in addition to rigorous application of data collection procedures and a systematic approach to analysis, consensus between the teacher and me. This consensus is a part of validating the research process in the educational field I am studying. Hence including the teachers' perspectives does not threaten its quality and validity but is rather an asset of validity. The teachers adjust to the research agenda by focusing on assessment, and this focus gives me an entrance to their statements. The interpretative paradigms I rely on here is thus not in conflict with traditional validity requirements. The validity concept has been extended. Nevertheless, there is a big 'however' here. In order to claim that we are actually adding quality to our research by admitting the researched into setting premises, we must adjacently claim a constructivist, ethnographic, interpretative rigor that takes care of the effects of consensus making on research results.

As mentioned in the previous section about conceptual understanding the interpretative nature here allows for the development of the content of concepts. The conceptual validity as I see it does therefore not exist prior to the project, but is a combination of prior understanding with concepts used in the communication of the results. The aspect of internal validity mentioned above that has to do with the teacher influencing research agenda becomes visible also in the concept validity. The teachers bring their understanding

into the discourses, and I build on that understanding in the interview that in the next step is used for knowledge construction (see below).

Conducting fieldwork has been an exercise in structuring my work. Open-ended field-notes work as an introduction to a school, an environment and a classroom or to the teacher. The necessity to structure according to cues based on ongoing analysis and a specification of what to observe resulted in the development of forms used to limit factors of observation, issues to be discussed with the teachers and topics for further investigation. Hence, the instruments developed directed both my attention and a part of the ongoing in- field analysis. This systematic approach was my answer to the rigor needed and emphasized in interpretative enquiry.

Considering both interview and observations there are contextual strings attached to the texts created in the field. I started by using the term interview and occasionally conversations, but I have ended up using discourses as I realized that regardless of the number of question marks versus periods there was a joint constructed conversation going on. My interview technique had become “*a form of discourse between two or more speakers or as a linguistic event in which the meanings of questions and responses are contextually grounded and jointly constructed.*” (Schwandt, 1997, in Fontana & Frey, 2000, p.663) When interviewing becomes a negotiated activity the requirement for rigor in documentation of the events increases. For me the list of cues was important to keep the interview on a track between the information given during instruction and future taping, transcribing and analysis according to the emerging frames. Yet again forms were handy to structure and limit the number of derailments.

In a recent rethinking about observation, it is no longer considered a method but a set of attitudes and principles that are applied in fieldwork (Angrosino & Mays de Pérez, 2000). Within a socially constructed worldview it is easy to commit oneself to these principles as ethical principles and therefore forming the values on which the ethnographic study is based. Social ethnographic research implies a decision to take part in a social setting; it is a set of consistent behavioral patterns that make sense to all the participants; it is a continuous process of evaluating the relationships to other participants and the conceptions of the identities of the others, and these interactions of situated identity formation are contextual rather than socially and culturally normative. These principles therefore build a

bridge from validating ethnography to ethical principles of ethnography within a constructivist ethnographic and constructivist Grounded theory approach.

The following is a short note about the use of technology. When starting I was used to tape recorders and started to experiment with video recording. I omitted video recording for the reason that I find this device to be in conflict with the situatedness, the particular and relative ontological paradigm. Such technology can be used to complement the researcher's limited capacity to take in information, take notes and hence gather more information from more perspectives. It is my belief that the limitations will have to be defined as 'analytical spectacles' at some point. The particularity of information fights the battle with the number of cases and events to include, but even more importantly the technology may seduce us into thinking that technology compensates for research experiences laden with human value. What I will use the next time around will be the device that eliminates transcription of interviews by using soundtracks in Atlas.

I have come to like the term serendipities throughout this research process. As mentioned in the introduction serendipities have been a motor in motivating and in bringing the process forward- and these moments have certainly been unpredictable. Therefore, serendipities are somewhat contrary to the rigor. They represent two opposite but equally important aspects of this process of enquiry. They are therefore complementary parts of educational ethnography.

Another research strategy to take care of the rigor was the combined strategies of purposive and theoretical sampling as revised in section 15.5. The relationship between these sampling strategies, theoretical saturation based on abduction and constant comparative methods is the core of empirics informed theory generated by this methodology.

Quality questions in interpretative qualitative research projects are complex. Complexity, from my angle, is caused by inadequate, inappropriate and insufficient frameworks to comprehend questions about what factors of persuasiveness and authenticity quality rests on. Introducing metaphors like crystallization (Richardson, 1998) describes the complexity more than pinpointing the actual considerations. Crystallization allows for multiple substantial and methodological angles and more importantly it describes the

interrelationship between the stages, processes and levels of theories applied.

Considerations of methodological levels of consensus have a bearing on epistemological levels, for instance. Our task is therefore to constantly turn the crystal in order to look at knowledge construction from different angles. Hence, as a validity concept this concept nominates validity concerns as the overarching research combining reflection of all the other important aspects such as ontological, ethical, epistemological and methodological considerations. However, when looking at the teachers and their statements I have found the metaphor useful at least two levels, one allowing for theoretical diversity among cases due to development of different relations with teachers, and the other constantly returning to reflecting on quality criteria from different angles.

Likewise, throughout this project I have had repeated battles with the concept of triangulation as a strategy for increased validity. Contrary to my initial intentions I have ended up with triangulating data existing as a consequence of different methods; information created in different educational and interview contexts; combining different theories. I have even submitted to cross analytical strategies and hence to some extent compared teachers. I have been constantly debating the contribution of triangulation against my initial attempt at arriving at a more context-bounded paradigm. The controversy of structural and post structural knowledge building is mirrored in this battle. I still see triangulation as highly problematic epistemologically, but in facing the challenge of creating meaning based on longitudinal fieldwork and applying constant comparative methods the pragmatic and structural categorization approach to data comprehension won.

Equally problematic has been the strategy of respondent validation when choosing how to relate to the respondents with my preliminary analysis. I have chosen mainly to look at the meaning created for my purposes as separate from the meaning created by the teacher for his or her purposes. That implies not checking validity against the teacher's interpretation. Every visit has created new data material and I have interpreted and analyzed before returning so as to lend a new focus to the discourse and observations.

Continuous consent by the participating teachers has been an ongoing issue; consent is not a 'one for all occasions' issue. Continuous consent is rather a matter of ethical concerns: how do I relate to the teacher in the various situations we find ourselves within? This matter of ongoing informed consent is also a matter of the teachers influencing knowledge

construction. Because “...*the question of relations and representation can also be understood as a mystery about the union of knowing and being to be faced anew in each situation in which the researcher finds her-or himself. This approach understands the situation of “How shall I be toward these people I am studying?” as one that demands a particular kind of understanding noted above as practical –moral knowledge.*” (Schwandt, 2000, p.205)

The question about internal validity is, from an ontological point of view, a question about the relationship between the researched and the researcher and how this is reflected in the research design. The combined observation and interviewing has earlier been described as a continuous flow of communication characterized by discourses that have different status as analytical data material. The fieldwork has, for managerial reasons, been divided into different techniques and forms, but the overall strategy has been to develop dialogues that are by nature contextual. One consequence has been to make distinctions between the educational context, the conversation or interview context and the outer institutional and societal context. These definitions of contexts have not been theoretically funded, but practical and pragmatic context terms. The other fundamental consequence is the inappropriateness of the terms subject and object of enquiry. (Angrosino & Mays de Pérez, 2000)

I argued in section 15.6 that since my project is ethnographic by nature the categories of subject and object are not distinct. In light of the commonalities between the teachers and myself as researcher, we could even argue that their context and my context are shared to some extent. Likewise, their language and mine are also shared to a corresponding extent. School institutions exist separately from the research community and their own language, their specific discourse and cultural and contextual factors recognize the two communities. (M. J. Smith, 1998) However, we could argue that in ‘didaktik’ research we go one step further. The intention of ‘didaktik’ research is to consider implications on practice and applications in various practical fields of ‘didaktik’. There is an aspect of utilitarianism. Consequently the boundaries between the scientific research communities and the school/educational communities are blurred; links exist between these communities as shared language, shared cultures and shared outer institutional and societal contexts. In this research project this was the case to varying degree. In the case of the Norwegian teachers the boundaries between the research institution and the school as an institution were more

significant for the study and the analysis than in the case of the Swedish and English teachers.

In sum the traditional validity criteria have been extended by relational and ethical considerations, by shared control between the teacher and the researcher due to at least to some extent shared cultures, by requirements like authenticity and situational contextual discourse or dialogue, and finally I have permitted crystalline validity in giving different cases different theoretical foci. My application of ethnography is therefore as a collaborative enterprise that requires rigorous fieldwork routines encompassing information about the relational aspects. I see the researcher's identity more as an in-process formed identity; this researcher identity is formed in relation to the researched. Internal validity as a consequence of a collaborative research enquiry embraces the rigorous scrutiny of interpretative tools. This extended validity emphasizes the application of tools according to the developing relationship to the researched and to a continuous evaluation of these relationships, and of the developing research questions. I see this rigor as the main interpretative tool and the main factor on which the internal validity or credibility of this research is based. (Richardson, 1998) (Y. Lincoln & Guba, 2000) The integrated ethical and validity concerns is another reason that certainly justify the axiomatic dimension included in the 2000 edition of the Handbook for Qualitative Research by Lincoln and Guba.

17.5 External validity, applicability and transferability

Internal and external validity, credibility and transferability/applicability are basically resting on the same rigorous application of methods, interpretative tools and philosophy about the relationship between the researcher and the researched. The interpretative paradigm, as I presently understand it, as a relational situational enterprise in flux will, therefore, also rest on an extended concept of external validity. The extended concept of external validity is also a consequence of the substantial field. The fact that 'didaktik' itself forms a meeting point between educational practice and educational theory requires the application of research into the fields of educational practice, a utilitarian research approach. Such an approach has not been the basic idea behind this project nor has it in any systematic way been incorporated in the enquiry and fieldwork. It is present more as a

consequence of a general attitude to the field of 'didaktik' and as a consequence of dealing with in service and initial teacher training.

The initial external validity concept, of making the cases represent other teachers and draw conclusions about the general presence of the stated phenomena of dilemmas of student assessment as valid for other teachers is contrary to this interpretive research paradigm and therefore not counted for in the selection of teachers and in consistency across cases. The teachers are representing themselves and each case is a reconstruction of one particular teacher. The cases may, despite this boundedness, point towards possible applications due to the familiarity of the content and recognition of the situations and positions presented. For this reason I have come to use the term typology. This term may however draw the readers' attention towards typologies that have been validated as a part of formal theory building at a grand level. This is certainly not the intention, as this is more emphasizing examples of practices and of how teachers may position themselves within epistemological and ideological reflections about assessment. The general aspects so indicated rest upon recognizable factors that make the cases and their content invalid outside the case itself, but valid as possible positions from which to reflect own practice internally.

Introducing Grounded theory as the main approach implies the introduction of a bounded generalization, the term used by Strauss and Corbin (Strauss & Corbin, 1998). According to their concept the conclusions are valid in other national contexts, in other educational situations, and for other teachers according to a possible fit between the circumstances described and an evaluation of the situation or educator in mind. It is the context illustrated that enables the reader to map similarities and differences with the situation the reader may have in mind. If the question is whether we actually accumulate knowledge by applying Grounded theory in knowledge construction, the answer will be that knowledge may at best be valid within the limits created by both the interpretation of theoretical devices and the empirical indications. Furthermore, when the theories and empirics are combined into case descriptions a certain degree of case-typologies is involved. The cases first and foremost represent the individual teacher described, but they have been developed as a result of a constant comparative method a point of which is that similarities and differences underline the comprehended understanding and therefore is a part of the analysis and interpretation. This knowledge is transferable according to the validity of the phenomena described under changing conditions. A corresponding bounded transferability of the

knowledge construction has therefore been represented in the cases and across the cases. The cases have been labeled Alfa to Omega both to emphasize limitations in the identity concept used which is limited compared to the actual human being, and in addition to point at possibilities of applying the case-description in teacher education. This utilitarian aspect of applicability is also a part of Grounded theory approach.

The bounded generalization concept of Grounded theory is, however, a concept that brings us halfway to the cultural and contextual boundedness of educational ethnographic research. Educational ethnographic research is particular by nature, and local knowledge is needed in order to draw conclusions about most educational phenomena. In educational practice, situational factors are crucial and so addressing the practice in educational research are similarly crucial. This is an asset of research rigor in ethnographic, and therefore research findings are not externally invalid due to boundedness, both political implications and practical applications of ethnographic indications are hence desirable and valid. (Berlinger, 2002; Erickson & Gutierrez, 2002)

I have tried to describe the process of selecting the teachers as well as selecting the texts for analysis and presentation. All this information relates to how the teachers have selected me as their discussion partner as well as how I selected them for the discussions about student assessment. I have also tried to give an account of the country context and the institutional context in which the teachers are working, even if this is not a part of the intention. All this (chapters 8, 9 and 15) is information I can provide about the teacher that would give you as readers the ability to form your own opinion about the applicability and transferability of the cases constructed.

17.6 Grounded theory and my knowledge construction

A constant struggle to overcome when working within Grounded theory is the dilemma of combining theoretical framing with empirical indications based on ethnographic fieldwork in educational situations. It is desirable to retain the particular contextual nature of ethnographic educational research as an interpretative factor together with signals of the implications and applications of research findings. However, the chosen methodology is limiting possibilities for investigating such particularity. The more recent development into a constructivist Grounded theory has taken another step towards a preferred paradigm for

investigating the sociocultural approach of dilemmas of the reflective identity of the science educator.

Looking at the process of combining ethnography with Grounded theory has resulted in a number of features that correspond with a constructivist Grounded theory (Charmaz, 2000). The author argues for dual ontological perspectives embedded in the methodological approaches of Grounded theory. There is in addition to the objectivist ontological perspective a potential for a constructivist ontological perspective within the following understanding of constructivism. “*Constructivism assumes the relativism of multiple social realities, recognizes the mutual creation of knowledge by the viewer and the viewed, and aims toward interpretive understanding of subjects’ meaning.*” (Charmaz, 2000, p.510)

Grounded theory within this understanding does not prescribe analytical strategies or data collection methods. The rigor lies in the different analytical techniques that are outlined, the parallel processes of data collection and analysis, emphasis of memo writing as a reflective tool as well as a data source and combination of purposive and theoretical sampling. Theoretical sampling recognizes the existence of previous ideas and theoretical frames as well as taking the emerging empirically founded theoretical spectacles into consideration. Theoretical sampling is therefore a main technique for refining theory and for developing new theoretical frameworks. The flexibility of Grounded theory is therefore its openness in including new concepts and revising the definition of concepts according to the practitioner. The appreciation of multiple stories to reflect educational phenomena and hence despite one true story underlines an interpretative paradigm that disregards an objectivist stance.

This takes the preferred position of Strauss and Corbin already presented one step further and in the constructivist direction. Charmaz refers to the Strauss and Corbin tradition as “*assuming an objective external reality, aims toward unbiased data collection, proposes a set of technical procedures, and espouses verification.*” (Ibid, p.510) In line with this Strauss and Corbin aim at representing the respondents as accurately as possible and uncovering conflicting views between the researcher and researched becomes important. However, they also appreciate creativity and sensibility as necessary research strategies and hence allow for the personal judgments of the researcher as a part of knowledge

construction. Research as a subjective and reflexive process is included in the Grounded theory approach of the 1998 edition of *Basics of Qualitative Research: Grounded Procedures and Techniques* and emphasized by Corbin as referred to in section 7.2.3.

The Grounded theory approach that I have implemented is hence the interpretative and pragmatic approach that Strauss brought into the relationship with Glaser and that he maintained and further emphasized with Corbin. This pragmatic view, contrary to Glaser's orthodox view, underlines the tool-box attitude to the strategies of Grounded theory as well as Grounded theory's ability to merge with other methodological approaches. Grounded theory is therefore not a comprehensive closed "you have to buy the whole package" methodology but rather a flexible, interpretative, open-ended methodology allowing for different aspects of persuasiveness understood as different relationships between the researcher and the researched in the knowledge construction. Corresponding to this the researcher has on hand different analytical strategies; their application, either separately or combined, has to be evaluated against the nature of the data and the academic field.

The authors will include a critical paradigm embracing action research that emphasizes the empowerment and emancipation of the researched. But they will also allow ethnographic approaches that in contrast emphasize the researcher's task of knowledge construction. Another aspect of pragmatism remains important: the applicability of Grounded theory results. The indications based on the analysis have to be evaluated against their usefulness in the specific field. This aspect of a pragmatic approach has, however, not been included in the empirical project here beyond the conclusions drawn in the previous chapter that is itself based on the empirical chapters and personal communication with teachers and teacher educators.

Grounded theory is apt to take the meaning of the respondents into consideration and hence appreciates the various meanings or persuasiveness that is representative of that particular phenomenon by the different contributors including the researcher and the researched. Acts and facts, views and values of the teachers are built into the research process, the overall analysis and in the presentation of the cases. A merging of research agendas was necessary in order to refine theory according to the preferred Grounded theory approach, but also according to the ethical ground rules of ethnographic research. *"To seek respondents' meanings, we must go further than surface meanings or presumed meanings. We must look*

for views and values as well as for acts and facts. We need to look for beliefs and ideologies as well as situations and structures. By studying tacit meanings, we clarify, rather than challenge, respondents' views about reality.” (Charmaz, 2000, p.525)

I have been looking for the opinions of the individual teachers and tried to elaborate different aspect of these opinions during the fieldwork. The reconstruction, however, represents my opinion based on this. In co ordinance with this approach to the meanings of the researched it was found important for communication to build a relationship with the respondents that enabled them to use their terminology for the phenomena in question and apply this terminology in further communication. It was also deemed necessary to use the educational and instructional context of the teacher to facilitate the discourses and interviews. As already commented on, this situatedness has to some extent been disregarded in the analysis in order to create one story about each teacher. From the data collection to the analysis there has been a change of focus from the researched to the researcher. The meaning created during the analysis and the case construction is closer to the meaning of the phenomena represented by the researchers' theoretical glasses than by the teachers' theoretical understanding and educational practices.

As a consequence of this knowledge construction my research tools have been to develop the specific and analytic research questions along with the development of conceptual framing and an integration of conceptual framing into a theoretical and methodological framework. Again, collecting, interpreting and analyzing data are intertwined processes and this written account is entirely my knowledge construction. But as an ethnographer and teacher educator I hope that also the participating teachers constructed their knowledge as a consequence of interaction in each situation and reconstructed it during the fieldwork period.

I have argued that the intention of including teachers from England and Sweden was that I saw my material being saturated according to the initial research questions. Including other teachers working under different national circumstances implied expecting a variety, but the theoretical framing resulted in the teachers from Norway being almost at the extremes of the framework. There was a point here when saturation according to cases and according to theoretical perspectives provides the comprehensive framing that sets the frames. Further cases and analysis resulted in confirmation, refining, adding dimensions

according to individual preferences, nuances and therefore abductive analysis applied to the cases. In other words, it could be argued that the initial inductive process slowly embraced deductive elements and finally became totally deductive, contrary to the Grounded theory approach. The balance between inductive theory building and deductive theory confirmation is at question here.

As ethnographers we influence a teacher's actions and verbalization of reflections. The constructivist approach maintains that influencing actions is an integral part of the internal validity, and hence it does not threaten quality criteria like objectivity. There is not necessarily a "call for action" as within participatory paradigms like action research emphasizing empowerment of the participants (Y. Lincoln & Guba, 2000). However, the dual identity of researcher and teacher educator results in a blurring of these two paradigms.

17.7 Whose reality?

The construction of knowledge about the teachers' epistemological and ideological positioning when reflecting on student assessment represents constructions of one aspect of educational reality. Moreover, even within these theoretical frames the construction is just as much one reality of the researcher reflected in an interpretation of one reality of the researched. I have constructed one story about each teacher bounded by my theoretical framing and my overall background. Therefore, these cases reflect me as a researcher as well as a teacher. The single case is one of multifold potential stories about the identity of this teacher. The teachers are implicitly present in the development of the theoretical framing and explicitly present through their own statements. Each case is therefore my interpretation of one aspect of educational reality based on theoretical framing influenced by the teachers, but chosen and verbalized by me.

Each case is a reconstruction of the fieldwork events that are themselves constructions of meanings of educational reality. During the fieldwork the researcher and the researched make an effort to create meaning out of one aspect of social life by the use of individual terminology. This effort is sometimes common and shared but most often individual. The individual meaning the teacher constructs is a meaning to be applied in future instructional situations, planning situations and evaluations of own practices. The parallel individual

meaning constructed by the researcher during the fieldwork is a combined substantial and methodological meaning in the service of further exploration of the researched. Interview transcripts often consequently tell two stories, that of the meaning constructed by the researched in the situation and the meaning constructed by the researcher in the situation. Linking the two meanings takes place therefore in the interpretation and analysis process after leaving the field, and the case then becomes a reconstruction. (The fieldwork involving Delta was the exception to this description as there was a higher degree of commonality in the terminology applied concerning epistemological reflections.) Even if the meaning constructed and reconstructed is individual, the processes influence each other. As a researcher I am not separate from the teacher of the educational social world. I am a part of it influencing it and therefore influencing the teacher's actions and reflections. The experiences may be shared, but the meaning and the content of terms exist as two separate spheres of knowledge.

The researcher and the researched to the best of their abilities and within the limitations set by language verbalize aspects of student assessment of significance for the situation of the conversation. There is at least an intended link between this situation and the educational situation taking place immediately previously to the discourse. Conversations are intended to be contextually situated in the instructional setting of the teacher, yet within Grounded theory I have been looking for patterns of reflections about student assessment across these situations. I have been searching for connections across the educational events and the interview events that, pieced together, created a reconstruction of these events that gave the case a particular focus. This focus is grounded in the data material about that teacher but it is also significant for the overall presentation. Over the course of the fieldwork teachers change and their reflections are both contextually bounded and to some degree changing over time. As a social enterprise educational matters are always in progressing or in flux. Within the limitations of Grounded theory I have tried to describe and analyze this process of the individual teacher and simultaneously retain some of the information tied to the actual situations. Each situation is a snapshot of one aspect of the educational reality and the created knowledge here is an attempt at constructing meaning out of several of these snapshots. The constant comparative method is a main analytical tool in this process combined with the alternations between in field analysis and out of field analysis.

There is an existing social educational reality, and the reconstructed meaning attempts at analyzing one aspect of this reality. My ambition is to construct individual meaning out of one angle of educational reality. The underlying assumption that this meaning is relative according to the individual's perspective follows on from this ambition of constructing knowledge. The question then becomes: who's reality does the meaning represent? The answer is predominantly mine, but there are also aspects of methodological and epistemological concerns that bear signs of the researched meaning as an influence on the knowledge construction.

The knowledge construction is grounded in the respondents' social reality. The description of the contextual factors of these realities sets the premises for the limits for the generalization and application of research results. The contextual factors serve as conditions under which the teacher on the one hand and I on the other construct meaning out of the phenomena related to assessment. The application and transferability of cases will have to be evaluated against these conditions. When conditions can be compared, application is possible; when conditions change, further refinement of theory is appropriate.

To search for meaning in human actions and reflections is to search for words representing the gap between the phenomena itself and our comprehension of that phenomenon. *“To search for meaning is to bring to light a resemblance. To search for the law governing signs is to discover the things that are alike. The nature of things, their coexistence, the way in which they are linked together and communicate is nothing other than their resemblance.”* (Foucault, 1970, p.33) In our attempt to find meaning understood as valid representations of the phenomena a *“dark space appears”* (Ibid). *“That space is where nature resides, and it is what one must attempt to know. Everything would be manifest and immediately knowable if the hermeneutics of resemblance and the semiology of signatures coincided with the slightest parallax. But because the similitudes that form the graphics of the world are one ‘cog’ out of alignment with those that form its discourse, knowledge and the infinite labour it involves find here the space that is proper to them: it is their task to weave their way across this distance, pursuing an endless zigzag course from resemblance to what resembles it.”* (Ibid) Representing somebody's reflections is impossible. We may use the statements, and even that is, according to Foucault, controversial.

17.8 Reflection on reflection; the reflexive turn

Reflexivity in my research process has been overly important in driving the process forward, in piecing together the ontological, epistemological, methodological, substantial and ethical aspects of challenges for teachers concerning student assessment. *“Reflexivity forces us to come to terms ...with our selves and with the multiple identities that represent the fluid self in the research setting”*. (Y. Lincoln & Guba, 2000, p.183)

As commented on several times, logs are important tools in ethnography. In addition to all the other previously mentioned reasons comes the fact that writing logs is a process of discovery in itself. By expressing ideas, verbalizing observations and interpretations I have discovered my meaning of the teachers' statements and actions, **and** I have discovered the meaning, significance and highly appropriate investigation of myself in the process.

I see the controversy between Glaser's and Strauss and Corbin's version of Grounded theory also as a discussion about the status of reflection in knowledge construction. As Glaser wrote in the epilogue to his 2002 article called “Constructivist Grounded theory?” - *“from a GT point of view that researcher impact on data is just one more variable to consider whenever it emerges as relevant. It is like all GT categories and properties; it must earn its relevance.”* (B. Glaser, 2002, 47th paragraph) This positioning of the researcher as one factor among several is in contrast to the following quotation from the Basics *“the researcher is shaped by the data, just as much as the data is shaped by the researcher”* (A. Strauss & Corbin, 1998, p.42). Here the authors are placing the researcher as the main factor in data collection and analysis. Charmaz extends the latter viewpoint into a constructivist Grounded theory stating, *“The viewer then is part of what is viewed rather than separate from it.”* (Charmaz, 2000, p.524) and she adds in the summary *“We grounded theorists can profit from the current trend toward linguistic and rhetorical analysis by becoming more reflexive about how we frame and write our studies. This trend supports constructivist approaches in Grounded theory because it explicitly treats authors' works as constructions instead of as objectified products.”* (Ibid, p.528)

Within the ethnography tradition, the reflective turn has been discussed as a consequence of the discovery of the gap between the objective methodology and ethnographic research. Malinowski in his diaries published after his death, as a consequence of emphasizing the

mutual relational nature of fieldwork as well as the inclusion of academic fields and social environments more known to the researcher. The turn in ethnography implies therefore, in addition to the discussion of the term participant's observation, scrutiny of observation of the participation. This new intersubjective methodological position entails ethical, political, philosophical and personal reflections on the identity of the researcher. Another aspect is the development of inquiry reports in which different voices appear together. (Tedlock, 2000)

Reflexivity is therefore closely connected to the interpretative validity concept. Research reflections cannot validate the process nor the results, but the continuous reflective comments give the reader crucial information about the integration of theoretical levels within the crystalline metaphor. There is still a battle here between including the reflective comments in the text in order to signal reflexivity in excluding them in order to retrieve the main focus. The good news and the bad news arising from reflexivity are the same in that texts become "*dynamic, problematic, open-ended, and complex forms of writing and representation.*" (Y. Lincoln & Guba, 2000, p.184)

Some steps have been covered since "*the ethnographer is the research instrument*" (Wolcott, 1988, p.190) in addressing the complexity of the implications of this fact, stated here. Reflexivity as a tool, techniques and meta cognitive enterprise are implications that I feel may address the "*subjective nature of epistemic activity and its results to be treated in an aggressive and productive way.*" (Breuer, Mruck, & Roth, 2002, 4th paragraph)

Identity and epistemology are two terms used at two theoretical levels in this dissertation, the conceptual substantial level of theories framing the description and the analysis of the teachers and the level of scrutiny of the researcher's approaches to knowledge construction. A third term of dual theoretical importance is that of reflexivity. In a number of ways I have been reminded that not making something explicit is not the same as not having a reflexive mind, neither as a researcher nor as a teacher. One colleague said that assessment not stated as criteria, as emphasis, as statements of any kind concerning what is significant for learning in that particular language is the same as **remembering in oblivion** ('huske i glemsel'). We can keep that poetic expression for something that we all know. There will always be aspects of judgment, gut feeling and face value in student assessment, even if we are all striving for increased professional attitudes and skills in assessing our

students. Even if the field of interpretative qualitative research is striving for rigor in interpretative tools, in its scrutiny of the identities of the researcher versus the researched, in ethical and political implications etc there will also for a researcher always in this field be a corner not available for verbalization that still addresses significant aspects of dealing with humans in research.

17.9 Delta- The signposter

Delta has again a special task in this aspect of the presentation. As a sign-poster Delta was given an intermediate function. He is the mediator between the previous theoretical framing and understanding of the researcher and the voices of the various participating teachers. His ability to verbalize educational dilemmas, epistemological reflections and ideological controversies makes his statements suitable as introductory quotations to each concept or cluster of concepts. This reflects moreover his task of setting and revising the theoretical frames on which the ongoing theoretical sampling and overall integration of respondents into a comprehensive theoretical framework was based. Delta is the mediator between the terminology of the other teachers and the terminology of the researcher. The conversations with Delta served partly as a manifestation of the direction and partly even as a definition of the direction of this project. In retrospect, Delta's appearance and contributions were more significant in the theoretical framing than the other teachers. They have therefore been given specific identities in defining various epistemological and ideological positions depending on their professional identities. Delta's identity is not analyzed as such; in this presentation his voice and my voice have been combined. His statements have become part of my theoretical construction, and he then does not represent himself. The other teachers entirely represent themselves within the defined theoretical frames.

The use of Delta as a signposter implies a shared meaning between Delta and me at least at the ontological and the epistemological level. The common frame of reference facilitated discourses, dialogues and conversations characterized by common explorations of issues more than interviewing. Questions asked were questions asked to myself as much as of Delta, and the answers given were a joint effort of verbalizing the dilemmas of assessment.

The voice of Delta has been blended with the voice of the researcher in this presentation. In this relationship, the boundaries between the teacher and myself were almost non-existent. In the case of Delta there are even fewer subject – object distinctions. Throughout this presentation I have used these common frames of reference and shared culture as well as language to mix his statements with my theoretical construction. I have made his reality a part of my reality. Delta has his world of practice that is physically separate from my world of practice, but we shared a terminology and had a common urge of developing the terminology for increased understanding of the complexity of assessment phenomena. He was a visitor in my world just as I was a visitor in his. The collaboration was close to completion for the purposes of theoretical framing.

The discussion of the contribution of Delta versus that of the other participating teachers is also a discussion about who controls the research agenda. Control has several aspects, e.g. who sets the research questions, who determine the focuses and the theoretical framing. I have claimed that this knowledge construction is mine and that the teachers have different contributions in this process. Delta has controlled more of this process by influencing the definition of the theoretical frames in our discussions. I have been in control and made decisions about the research methods. However, in section 8.1.3, examples of interview techniques were presented. Controlling the interview by introducing specific concepts, by defining the terminology and by introducing specific themes is another way to look at interview techniques in order to define who controls the discourse. Who is defining the agenda in the individual situations? During the actual fieldwork control has been shared between the researcher and the researched, the agendas have been merged and some of the contextual factors as well as topics for scrutiny in the conversations have been defined by the teacher and some by me. Implicitly this has set the premises for the overall analysis, as the data had been created under these circumstances. Creating a common frame of reference for discourse was the initial idea, and realizing that the result is shared control is epistemologically a retrospective reflection. In this respect, the knowledge construction is the teachers' in addition to mine.

Usually when leaving Delta I had this main question ringing in my head. *Am I asking the right questions?* Not in the meaning of how to word my questions, but he always gave me the feeling that there were other aspects of assessment and education that were more important to raise, that would be more to the point or at the heart of what this is really

about. Delta has his own way of challenging his surroundings, and he challenged me on many occasions. He was hence, both a signposter and a driving force in building the knowledge and understanding I needed.

My qualitative research processes have a lot in common with my quilt making processes. I piece and I fit, I sandwich and I take a part, I stitch and I write, I create and I analyze, and I count and I measure. All the time in the back of my mind is a vision of the final product. This final comment from Delta puts the last piece into the quilt that this presentation has been forming. Delta is also more concerned with the fundamental questions of how we view the world and how we as humans can make representations of the world. To him education is more about presenting to the students the fact that subjects are merely one way to look at reality. So then again a final word from one of the main contributors in this process:

Delta: *“Because my criteria are a way to look at the world. It is a way to organize impressions. Science is a way to understand, yes the surroundings, life... Grading does not concern me, knowledge construction does. At this point I am really more concerned with thinking about learning. I think that student assessment is still really a nightmare. It has become even more difficult after talking with you. Before I managed to just do it cold and efficient, Now, I do it with bigger agony than before.” (21.5.01)*

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