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Existing models of teacher professional development on IBST in seven European countries

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I) Introduction

Teacher professional development (TPD) in science education at secondary level is at the core of the Mind the Gap network group. In the network are partners from the following European countries: Denmark, Norway, UK, Hungary, Spain, France, and Germany. These countries represent a variety of educational systems and traditions in Europe. So, for example, the Scandinavian countries represent traditions of student autonomy and crossdisciplinary work in science education while in France, Germany and Spain models of conceptual comprehension have been more important models. In contrast, England has a long tradition of activity based science teaching (Jorde & Klette, 2008). In the following report we will focus on summary activities of work package 6: dissemination and professional development. Currently, the knowledge on teacher professional development is fragmented and nonspecific. The European countries lack knowledge and evidence concerning the efficiency of traditional approaches as well as new models for TPD and in-service training. While, for example, traditional approaches to TPD often follow a top-down strategy and the sessions are organized as stand-alone events, current practices of effective TPD follow the idea of teachers becoming members of a community of learners (Jorde & Klette, 2008). Empirically founded knowledge about different approaches to TPD is of high relevance in order to implement new models in European countries (Jorde & Klette, 2008). Related to this fact, the aims of WP6 are, first, to systematically summarise knowledge about (TPD) in the network group and, second, to report on existing models of TPD. Based on this it is the goal to compare and analyse these existing models and to explore potentials of research based models of TPD (Jorde & Klette, 2008). Therefore, we had interviewed 16 experts from all seven Mind the Gap network countries and collected additional information about the general conditions of TPD and in-service training at a project workshop in Lyon (deatilled, see next chapter). Our report will be based on this information and the qualitative analyses of the interview data. Work package 6 is led by Germany with participation from all members of the network. All countries should describe their national models for use of Inquiry Based Teaching and Learning (IBST) in teacher training. Of particular importance was the assessment of the German "SINUS" program as a possible and successful model for teacher professional development in other countries (Jorde & Klette, 2008). In chapter 5, we will give more detailed information about the SINUS-program. The work package 6 explored possibilities for transfer of the SINUS project to other countries.

II) Expert interviews and summaries of workshop

Our report is firstly based on paper presentations from a project workshop in France (Lyon, May 2009). This workshop organised by Andree Tiberghien, Matthias Stadler & Manfred Prenzel (Lyon, May 2009) built on summary the expertise of policy makers, stakeholders & teacher educators on TPD in their countries. There have been held discussion groups about national particularities in teacher professional development, the possibility to transfer the SINUS model to respective countries and presented products from other work packages. 31 participants from the Mind the Gap network took part at the workshop in Lyon. The Second bases for our qualitative analyses are expert interviews with the participants from the workshop in Lyon (2009). The guided interviews have been realized in period of June/July 2009 with 16 Experts who all are stakeholders in the area of European Science Teacher Education: teacher educators who teach in practice, active researchers related to science teaching, members of teacher organisations and policy makers. The interviews lasted on average 40 -50 minutes and were realized in a standarised form. For this report, we selected those interview questions which are relevant for the work in our work package 6. The following table shows the whole interview guide. The relevant questions for the report have been marked in italics.

Table 1: Guide for Interview Questions: *Teacher professional Development in Science Education in European countries.* (Lipowski & Seidel, 2009).

| |
|---|
| <p>General conditions of teachers in service training in science education</p> <ul style="list-style-type: none"> ○ <i>How TPD is in general organized in your country? (e.g. compulsory/voluntary, single courses or sets of aligned courses, with individual teachers or groups from the same school)</i> ○ Which main conditions are necessary to support continuous learning in the teacher profession? ○ How do you currently assess conditions leading to successful TPD in your country? ○ <i>Do you see the necessity for improving the way your country implements TPD?</i> |
| <p>IBST in Science Education</p> <ul style="list-style-type: none"> ○ How does TPD support the use of IBST in Science Education (Instruction)? ○ <i>In which way is IBST represented in science education in your country? (a) curriculum frameworks, (b) teacher education programs, (c) TPD</i> |
| <p>The future of TPD</p> <ul style="list-style-type: none"> ○ Which developments do you envision for teacher professional development in your country in 10 years? ○ Which kinds of TPD will teachers in science education need in future? ○ Which aspects of continuous learning in teacher profession do you consider to be successful in your country? |
| <p>Outstanding programs of professional development in science education</p> <ul style="list-style-type: none"> ○ <i>Are you able to provide 2 examples of what you would consider as good practice programs in TPD in science education in your country?</i> ○ <i>Which criteria do you use to determine success of these examples? / Why are these good examples?</i> |
| <p>SINUS program /developed in Germany) relation to our Lyon meeting</p> <ul style="list-style-type: none"> ○ <i>Is the SINUS model for TPD one you could use in your country?</i> ○ If you are familiar with the SINUS TPD project developed in Germany, which ideas |

from the SINUS program do you find particularly fruitful?

TPD in science education under consideration a European perspective

- Which European country (s) do you consider to be successful in their TPD programs? Why?

Professional biography

- Are you able to tell me your professional biography in some short notes?

III) General conditions of Teacher Professional Development in science education in European countries

Currently, the knowledge on teacher professional development in European is fragmented and nonspecific. Therefore it is essential to use the specific advantages of coordinated programs in the EU in order to summarise fragmented knowledge. Based on our gathered data it is possible to describe the actual state of teacher training in the seven EU- countries. Thereby we decided not to summarizing published reports about TPD in European countries but to focus on inert and tacit knowledge of leading experts in this field. Using this approach we identified central basic conditions of professional development and in-service training in these countries. Thus, in the following chapter we will give an overview of teacher education, in-service activities and conditions under which these activities take place. Furthermore, we will identify the need for development in this context from the perspective of interviewed experts, and additionally we will give a quick glance about the role of IBST in the context of teacher professional development in the respective countries. In a first part, we will describe general conditions of TPD in each involved country (sorted in alphabetical order). In addition we will illustrate the country profiles with some interview statements from the experts. After that a summary outline is presented in Figure 1 till 6. For reason of data protection the interview partner are listed not with their name. Each interview partners was attributed a number (see appendix I)

How is Teacher Professional Development in general organized in the participating countries?



Denmark

The system in Denmark can be characterized as decentralized. The authority over education is with the Ministry of education. Professional development usually is organized at university colleges in Denmark. At the moment there are five university colleges in Denmark spread over the country. Denmark in view of professional development and teacher training is in the process of improvement and change. In the last years the ministry of education has intensified the support to in-service training in science education. However, the system is organized as a free market.

“Everybody was allowed to announce courses for teacher training. They could also apply some money in the ministry for making the courses or they could just put it in the market and then the teachers and the schools choose which courses they wanted to follow. So it is free market now and that’s interesting. That has meant really big increase in the price of the courses” (3).

The participation in in-service training in principal is voluntary. But the head of school has to decide in the end which teachers want to go to which course. Likewise to most of the other European countries in Denmark most courses are single courses and the teachers typically go for one day. Merely some courses are organized over longer periods (e.g. one day weekly over a year). Some courses actually allow for groups of teachers to go to the courses and they would give them first priority. But in other courses they care for individual teachers. *“It’s very different from school to school and from subject to subject” (3).*

What is apparent in the Danish system is that most teachers who are teaching science in Denmark not actually have an education in science. Regarding the use of IBST it experts state that there is no systematic way is reflected there is no a systematic way neither in teacher training nor in in-service training of science teachers. Certainly, the Danish school system has a long tradition from problem based learning; project orientated learning which show strong relations to aspects of IBST.

“But it is not formulated as inquired based science teaching. It’s very much likely for instance practical work in science or how can you investigate your local environment and stuff like that. But there is a long tradition for doing that. We should develop some programs and a national plan” (3).

Professional Development in Denmark

- The education system in Denmark is decentralized and organized at the university colleges
- Process of improvement - more support for in-service training
- Offering professional development courses is a free market
- Participation is voluntary
- Most courses are single courses – some with group of teachers
- Long tradition for problem-based learning and project oriented learning – but not formulated as inquiry based science teaching

Main problems:

- Many Teachers who are teaching science actually where not trained intensity (pre-service) in science
- Many teachers take an in-service course in their free time or they paid for it
- No systematic way to use IBST in teacher training and in-service
- Lack of cooperation between ministry of education and university colleges
- No kind of official guide for line teacher training

Figure 1: Professional Development in Denmark



In France, policy and teacher community is stated by experts as quite traditional. Professional development is in charge mainly by local inspectors, there are no mentioned systematic and structural approaches to TPD. Participation in courses is voluntary. Teachers can choose days of in-service activity on a domain. In which way is IBST represented in science education in which they are intended in France:

“IBST is represented in curriculum at the level of middle school (11- 15 years). The curriculum is oriented towards scientific Literacy.” (14)

The experts pointed out the reflection of the gap between teaching and learning. This means, for example the gap between in-service teacher and new ideas wants to bring into the schools. IBST is indeed a subject in pre-service training of teachers. But teachers first learn how to carry out activities according to IBST only later when they are in-service. Another difficulty are pointed out by experts in France is the distinct line between science subjects (physics, biology, chemistry).

Professional Development in France

- Policy and Teacher community is traditional
- Participation is voluntary
- Teachers can choose different types of in-service training

Main problems:

- Gap between theory and practice
- Distinct line between science subjects
- No structural approaches to PD
- Lack of collaboration between teacher community and teachers and researchers

Figure 2: Professional Development in France



The education system in Germany is a difficult field due to the federalism and the federalism reform. Therefore, TPD is in the authority of countries and they have more or less their own system. There are basically three levels:

*“One level is a **central level** where just teacher in-service training is organized for a whole region, mostly for a federal state. **The regional level** is organized by smaller unities. (e.g. administrative districts). And the **third level** is the school level where TPD takes place in the single school, internal teacher in-service training” (8).*

The Standing Conference of the Ministers of the federal states passed standards for teacher training in December 2004. The standards in educational sciences have been adopted by the federal states at the beginning of the beginning of the school year 2005/2006. Teacher in-service training is not systematically a pre-requisite for further qualification of teachers. In

Germany traditional concepts of in-service training dominate. The curriculum is prevalent content driven. Just small shares of in-service trainings are pursued from the universities. All universities have centers for teacher education. The participation in TPD is obligatory.

In science education, TPD is mainly oriented to individual participation in one day courses. These are rather components which are not necessarily built on each other. With regard to IBST, German experts indicate that:

“IBST indeed is represented in the curriculum, but not in a systematic way but rather as idea as a structured concept” (11).

Experts described need for developmental of TPD in Germany. For example, they refer to the necessity to have science teaches of different subjects work stronger interdisciplinary. This would results in using time resources for inquiry oriented learning and teaching. Teacher education in Germany in general has an academic character and has little practical links. Furthermore, stronger cooperation between institutes which are involved in teacher education (universities, research and schools) is regarded as important for improving TPD. Future challenges are to improve the coordination of TPD activities.

Professional Development in Germany

- Standards for teacher training since 2004 – adopted at the beginning of school year 2005/2006
- Prevalent content driven curriculum
- PD is obligatory - defined requirement of hours do not exist
- Education in general has academic character and has little practical links
- Characteristic are single courses

Main problems:

- Lack of cooperation between universities, schools and research (different phases)
- Lack of input from research in teacher education
- IBST is represented in curriculum but not in a systematic way
- Lack of cross disciplinary work in science subjects
- High degree of diversification per levels and types of schools
- Lack of autonomy for school – budget for in-service training

Figure 3: Professional Development in Germany



Hungary

Currently the professional development in Hungary is rather disorganized. There are a lot different stakeholders (e.g. training companies, school management, publishers, official boards, schools, universities). A problem is a lack of coordination between these stakeholders. For example:

“The universities and schools have lost their role as stakeholder which involving that the schools are abounded with their problems” (1).

The professional development courses are compulsory for Hungarian teachers. It's obligatory to have 120 hours of TPD in seven years of time with the following exceptions:

age over 50 years old, they have a PhD or new degree. In Hungary there are usually single courses and sometimes the most usual arrangement is a one-week course. There is in the most cases an individual participation. Sometimes friend's colleagues from one school go together but that's not characteristic.

The interviewed persons in Hungary stated that they see future challenges with regard to funding, lack of session advises and not in each case a guarantee for participation. For the reason of different systems of teacher trainings, different contents and backgrounds there are risks for systematic development. With regard to the role of IBST in science instruction it becomes visible that the application in Hungary is limited for the moment. IBST is represented in the national core curriculum and also in the strain curricula. The experts see a need for development with regard to in view of official criteria for IBST or proposed methodology.

Professional Development in Hungary

- TPD-is locally disorganized (independent organizations can start courses).
- Teachers are individually responsible for what they do and how they organize participation
- Lack of advise – no guarantee
- Lack of coordination between different stakeholders.
- Universities have lost their position as stakeholder.
- PD is generally obligatory. (120 hours every 7 year with exceptions: new degree, PhD, age -over 50 years old.
- Usually single courses - sometimes the most usual arrangement is a one-week course
- In the most cases a individual participation.

Main problems:

- TPD is expensive and needs a lot of administration
- Influenced by different interests
- No official criteria for IBST
- Lack of coordination and systematic development
- Lack of networking between schools
- PD is not compulsory for aged science teachers

Figure 4: Professional Development in Hungary



Norway

In Norway, there is generally a distinction between further education for teachers and in-service training for teachers (very short over a few days).

“In-service training for teachers - that is responsibility of each local education authority. Each local education authority is supposed to have information and overview of what kind of

needs there are for updating, for in-service training and then organize that for all their teachers” (9).

So that is a fairly homogeneous system, but local educational authority is approached this task very differently. This can be quite a problem because local authorities have a large autonomy to organize PD. The education system is organized more at the local level.

“They are mandated in many ways by the national level but the money is then sent out to the local level and the local levels needs then to identify the needs of the teachers and then try to find appropriate courses for the teachers to take. So that they use the money to buy the courses” (13).

A bottom up strategy is now implemented in PD system which means that individual schools have responsibility to plan what they need and then ask universities and colleges for requirement courses. Professional development is voluntary. Each school has five days a year they use for in-service training. These five days can be used by each school and each teacher. Usually, teachers are together in groups. In most cases the teachers participate in single courses (one or two days that’s about the most now). In which way is IBST represented in Norway? In Norway IBST plays an important role:

“We’re not sure about the implementation of that, but at least at the frame work level, at the curriculum level it’s very explicitly explained” (13).

Despite the fact that IBST is explicitly explained in frame way in curricula, teachers actually do not use the term IBST:

“We use a different type of thing that has come into our national curriculum... and it’s all about how to teach science” (13).

Teachers in Norway, so the questioned experts, seldom haven an identity as science teacher just a few classify themselves as such. In view of IBST it is the problem that it is represented in the curriculum but does not necessarily that it is in practice also. *“Our task for the future will be to implement it in classroom” (9).*

Professional Development in Norway

- New curriculum in all subjects
- PD is voluntary
- Mostly single courses (1-2 days)
- Bottom up strategy in PD
- IBST has a large role
- Long tradition of cross disciplinary work in science

Main problems:

- IBST represented in curriculum but not implemented in practice
- Missing an identity as science teachers
- Money for professional development comes from national budget – Lack of autonomy of the schools
- Lack of relevance and quality in the teaching courses
- Lack of substitute teachers

Figure 5: Professional Development in Norway



Spain

In Spain, teacher professional development is in the hands of the different partners of education in the 17 autonomous communities (shared between central government and the 17 regions).

"Each community has some courses. That is normally design by the central office. And other courses are decided by the person in charge in teacher centre" (5).

The stakeholders are the director of innovation in each D.E., teacher education offices, science teacher associations (not in all regions) and assessment agencies. There are no systematic approaches for TPD but a high proportion of courses about scientific updating. Professional development in Spain is voluntary but:

"In fact you need it for promotion. People need to have a certain number of hours or credits of the end of six years in order to apply for promotion" (5).

Most courses are organized as single courses in some case there are sets of courses. Usually, individual teachers are participating but there are also some special actions that involve a group of teachers of a school. Professional development only randomly supports IBST (some courses do, depending on teacher educators).

In Spain there is less support for IBST, which means for example little emphasis and lesson time devoted to IBST due to the length of curriculum. In view of assessment it becomes clear that

"There are a minimal proportion of questions related to practical tasks in external tests" (5). Furthermore a general problem is the perception of teaching as a profession with lower status than the sciences.

Professional Development in Spain

- TPD is shared between central government and 17 autonomous communities.
- No systematic approaches – high proportion of courses about scientific updating.
- TPD is voluntary but required for promotion.
- There are mostly single courses.
- Usually have individual participation
- Only randomly supports IBST (depending on teacher educators)

Main problems:

- Little emphasis on inquiry
- Length of curriculum (no time for inquiry)
- Perception of teaching as profession with lower status than the "sciences"
- Minimal proportion related to practical tasks

Figure 6: Professional Development in Spain



United Kingdom

Professional development in UK has a long tradition.

“It’s organized at the level of the school. The schools themselves determine particular professional development agendas and there are in-service training days that they allocate to stuff” (15).

The schools themselves have professional development agendas and professional development as part of their remit. At the national level there are science learning centers (10 regional centers) which collaborate with the universities in this region. In the science learning centers teachers can go and take courses. The learning centre also has mobile TPD. But the system is also complicated because there are lots of different ways of doing in-service training for teachers.

“There is a number of institutions who offer professional development and you got professional development that happens in school so in-service training so school might allocated what they called in set days” (10).

For this reason it is sometimes difficult for teachers to choose which way to go. The issue is the balance between in school provision and the outreach provision. In UK in-service training is compulsory because:

“the in-service that comes in your school is been written into teachers contracts and schools have to provide it five days and this is goes back to some time back ago in the schools provision was a sorted the number of teaching days per year and there is a number of what they call in set days” (7).

The majority of courses are half-day, single day sessions. Some are longer term or multi-day programs. It’s not easy to get the teachers out of school. Currently, the system is moving away from courses form to more long lasting structure. Sometimes it is just single teachers send out, but these courses actually cost money.

“So the schools have to provide them funding for the teachers to go. So it can be restrictive in certain ways to send several teachers at the same time. Some schools take use of these restores” (15).

The science learning centers evaluate their PD activities. Teachers give an outline of the impact on their own learning and their own professional development. What do the experts describe in view of further development of TPD in their country? For example, the experts see that most in-service training is are actually based on a short term model. The perspective should be more long-term sessions. Furthermore there is few time for experimentation and investigation in lessons because the education system in UK is very assessment driven. In addition, the curriculum is content driven which undermines the pupil’s role at the same time. UK has a long tradition of activity based science teaching and learning. IBST is represented in the curriculum in the section named - *How science works*.

This section is a key aspect of the curriculum and included all about scientific inquiry processes of science, serious explanations, models how scientific knowledge gets constructed and evaluated.

Professional Development in UK

- Lots of opportunities for teachers for PD
- Culture for Professional development
- Long tradition of activity based science teaching
- Close cooperation between science learning centers and universities
- PD is semi-compulsory
- Majority of courses are single day sessions

Main problems:

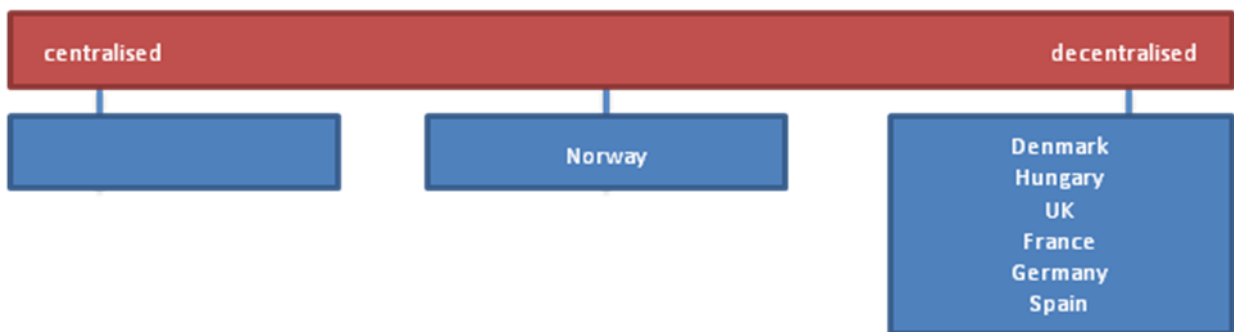
- Large number of institutions which offer PD -> difficult for teachers to choose
- In-service-training is mostly based on the short term model
- Strong focus on content rather than practical work
- Very assessment driven culture in UK
- Very content driven curriculum

Figure 7: Professional Development in UK

Summary of professional development criteria:

In conclusion, it is to say that the organization of professional development shows a large variety across European countries. In view of this we will summarise the obtained results and compare several dimensions of professional development in the respective countries. In Figure 8 we classify the results of the comparison on the basis of criteria of professional development.

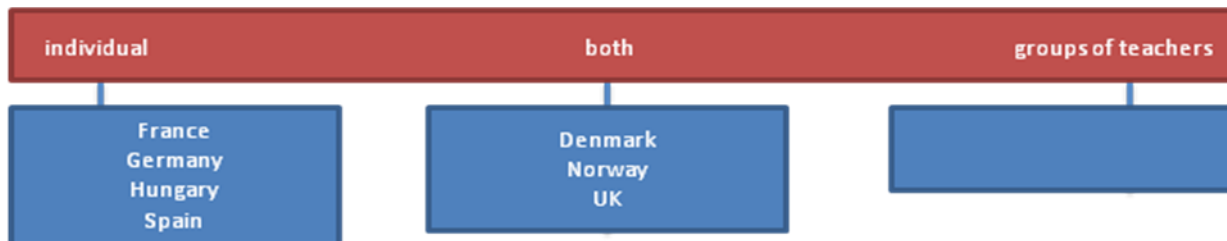
(1) Form of organization



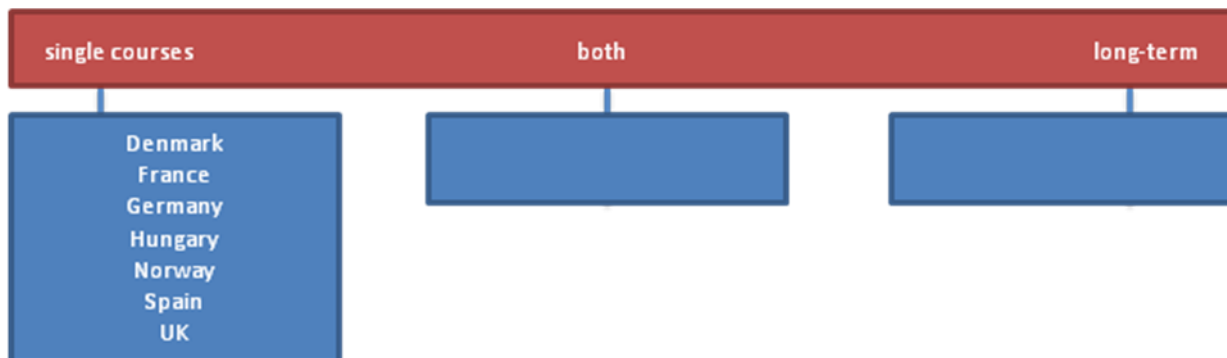
(2) Obligation of TPD



(3) Participation



(4) Duration of TPD courses



(5) Content focus of TPD



(6) Strategy for implementation



(7) Role of IBST in TPD

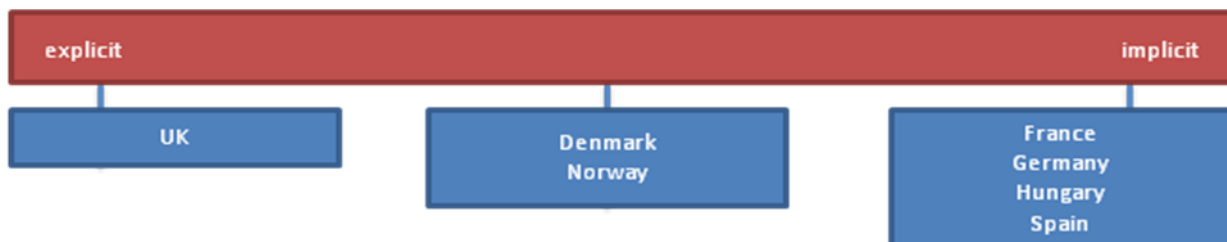


Figure 8: Summary of professional development criteria across countries

IV) Necessity for Improvement Regarding the Implementation of TPD in respective countries

All partners in the Mind the Gap project are actively involved in science education and they represent a variety of educational systems and educational traditions in Europe. The involvement of teacher educators, active researchers, members of teacher organisations and policy makers in the project network allow working together, learning from each other, and reflecting on different practices and existing policies. So it is interesting to examine in which areas interviewed experts see necessity for improvement of TPD in their countries. In what way do commonalities or differences appear? Do all experts see a need for development? The following chapter illustrates the perception of interviewed experts whether they see necessity for improving TPD and if so, what needs to change?

How do the experts see the necessity for improving the way your country implements TPD?

The **Danish** interview partners attached importance to the necessity for improvement in their country. For example, they get a need for greater involvement from the ministry of education to provide courses and in-service training, in fact in cooperation with universities. Furthermore, *“it would be nice with some kind of official guide line of a level of teacher training necessary”* (3). Because currently the *“teachers who have finished their education, are very often let alone by themselves and nobody takes hand that they actually develop. When you have finished university you go to upper second as a teacher and in principal you can now teach for 30, 40 years without any in-service training”* (3).

Furthermore the **French** spokesperson sees the necessity for improvement to implement teacher professional development. *“We should think about possibility taking into account the teacher’s point of view, the trade union point of view and the state of school. The conditions should really take into account the actual situation”* (14).

Following we will have a look on the statements of the **German** experts. Consistently with all the others they also see the necessity for improving the way to implement TPD in Germany, basically in two areas: *“one is the teacher training. The second field is the teacher in-service training”* (8). General we need in Germany a *“change from the classical idea of the in-service training (collect a group of teachers who have interest and they qualify a small little piece further) to the question: how do we initiate schools in her professional activity really?”* (12). A further point concerns a stronger linkage between the several phases in teacher training or the *“interlinking between school groups on the regional level which manage mutually, educate further, work together”* (11).

The **Hungarian** experts emphasize concordantly the necessity for improvement in their country. *“So it would be better teachers have a carrier in front of them when they start “(2). Another main point is that “there is a need to have a kind of centre that’s responsible for the whole thing and coordinates”* (1). *“Furthermore we need a system as a portfolio or some kind*

of checking what happens to people taking the courses or tracing them” (1). Finally it would be necessary to find a way to motivate teachers and schools to participate in professional development courses.

From the **Norwegian** perspective the conditions in Norway are not optimal yet. For example: *“There are still teachers who cannot go away because there is a lack of substitute teachers or does not have money to pay for substitute teachers” (9). Another way for enhancement of the situation in PD is that “The system in Norway should be more centralize. The teacher trainers at universities and teacher colleges know a lot about the new strategy in science and the new curriculum and they could offer good in-service training courses so if they had got a lot more money for doing this and then offer this in-service training to the schools. So my assessment is that the structure in our professional learning is not so good for the time (4)”. Further priorities sees one of the asked experts in a strong need for more national control, some kind of founding (e.g. to finance long-term courses) about how to implement these.*

Equal to the Hungarian ambassadors also the **Spanish** expert said” *Definitely, we need to improve a lot” (5). As the biggest problem was described by the perception of teaching as a profession. The professionalism is not supported with a framework for TPD and “has a lower status than the sciences” (5). In view of that there is definitely a need for improvement in Spain. Another aspect is that “we need more emphasis for inquiry based things, more lab work and relation with practical tasks” (5).*

“We have absolutely the necessity for improvement in our country” also the interview partner from UK agreed. “We need a change of the culture of professional development in this country which we try to give teachers active the professional development so the standard if you are in business or in medicine” (7). “We have only been going for four years and we just start to make an impact in school” (7). Furthermore “We need more support and wider acceptance of longer-term and sustained models of PD. We needed in this country creating a space for teachers to develop their own professional learning experiences as a model of PD” (15). In addition it is unsatisfactory that “there is no real long-term sustainable government-led professional development, framework for everyone has to do. Everything is just compulsory, semi-compulsory, and optional” In my perception here we need desperately a change in UK” (10).

To sum up, it became visible that the seven countries agreed on the necessity for improvement. Conditions and cultural traditions of the different education systems were described as well as different starting points for improvement. In the following a summary outline is presented.

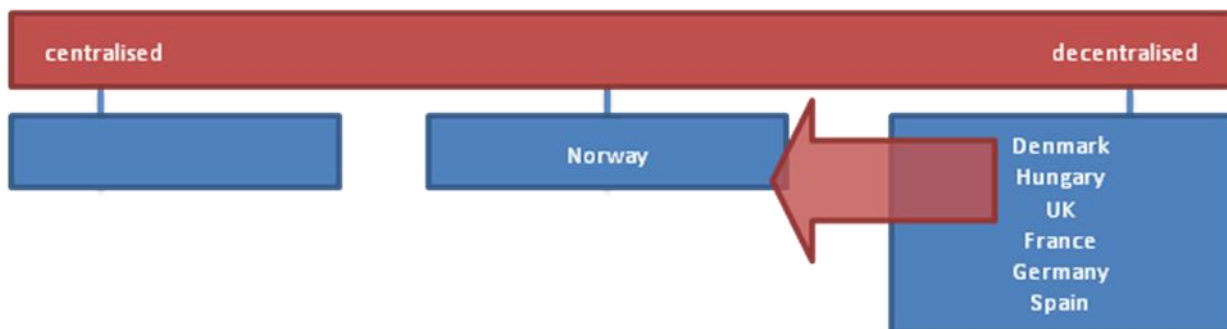
Summary – necessity of improvements

| | |
|---------|---|
| Denmark | <ul style="list-style-type: none"> • More cooperation between ministry of education and universities (e.g. provide in-service sessions) • Necessity of official guide line of a level of teacher training • Continues in-service training also for experienced teachers |
| France | <ul style="list-style-type: none"> • Implement TPD • Better conditions take in to account |
| Germany | <ul style="list-style-type: none"> • Need of development in teacher education and in-service training • Change from classical idea in in-service training to initiate schools to activity |
| Hungary | <ul style="list-style-type: none"> • Teachers should have more possibilities of a carrier • More systematic coordination in view of TPD • Some kind of checking (e.g. portfolio) • Find a way for more motivation teacher's and general of participation of TPD sessions |
| Norway | <ul style="list-style-type: none"> • More substitute teachers • More money for schools to pay substitute teachers • The system in Norway should be more centralized • Improvement of the general structure in professional learning • Need for more national control • Need other kinds of founding |
| Spain | <ul style="list-style-type: none"> • Need more emphasis for inquiry based things • Better status for teaching as profession • More lab work and relation with practical tasks |
| UK | <ul style="list-style-type: none"> • Need of change of culture of professional development • Need a higher standard in this area (e.g. similar medicine) • Need wider acceptance of longer-term and sustained models of PD • Creating a space for teachers to develop their own professional learning experiences |

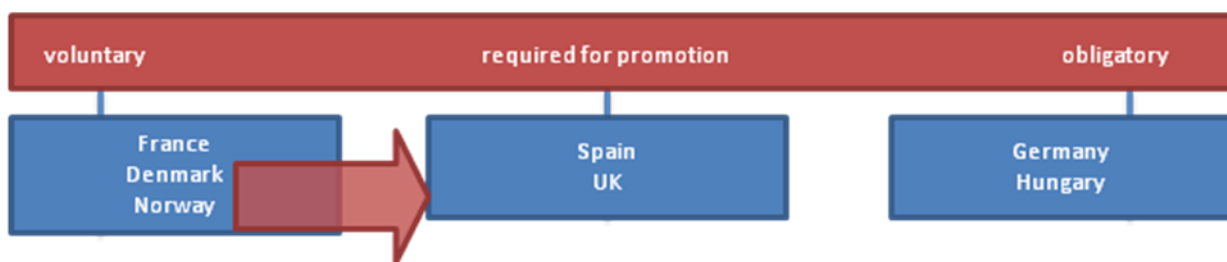
Figure 9: Summary – necessity of improvements

Figure 10 summarizes the results regarding the question, in which areas interviewed experts see necessity for improvement of TPD. Again, we use diagram style of the previous chapter but here progress in certain countries is illustrated by red arrows.

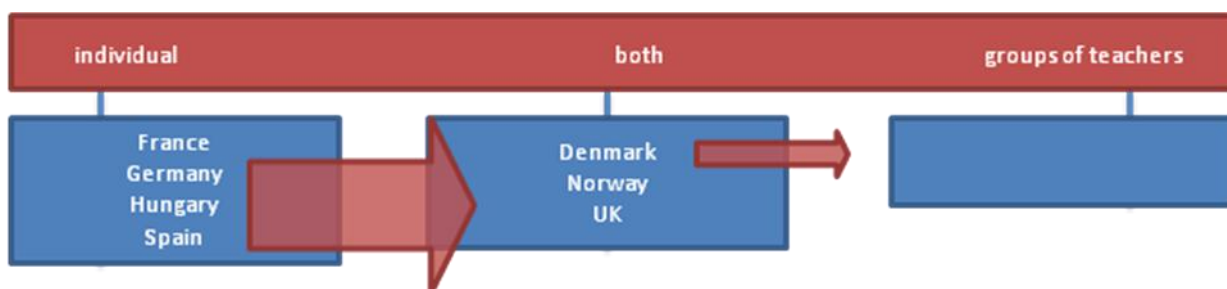
(1) Form of Organization



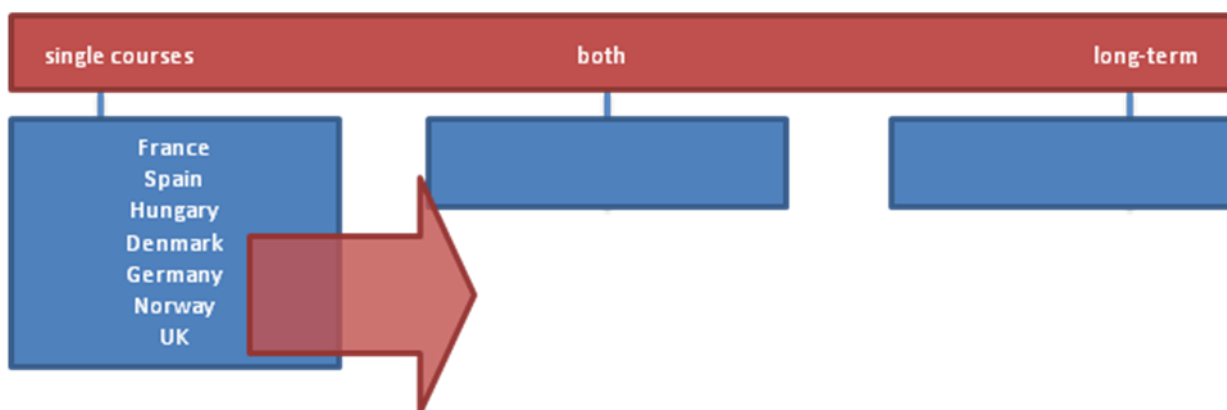
(2) Obligation of TPD



(3) Participation



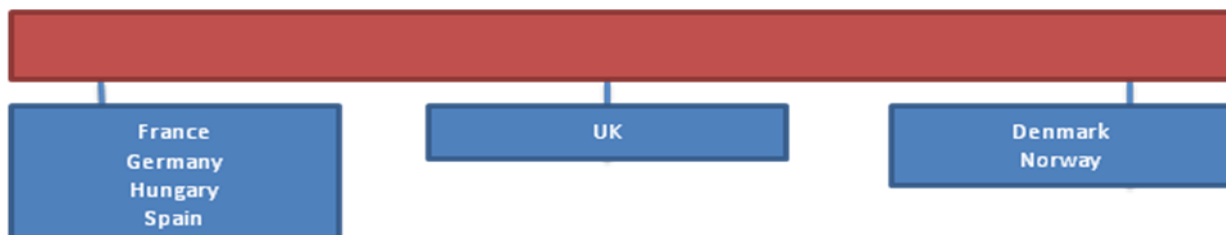
(4) Duration of TPD courses



(5) Content focus of TPD



(6) Strategy for implementation



(7) Role of IBST in TPD

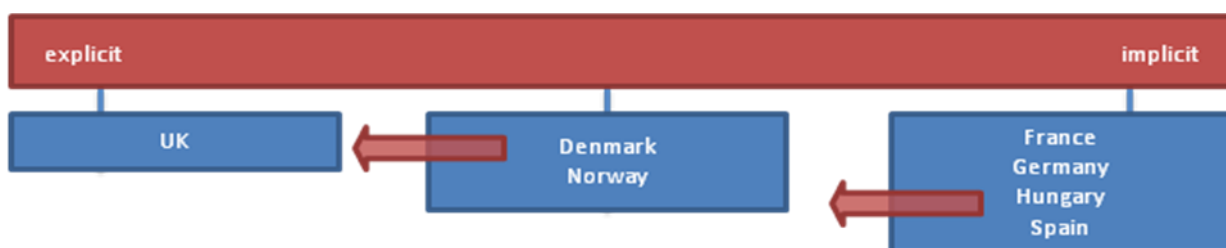


Figure 10: TPD criteria in view of progress

V) Good practice programs

Research provides evidence that intensive professional development can help teachers to increase their knowledge and change their instructional practices. When we have established useful models of TPD in educational research, we should try to disseminate these in different European countries. In connection with this it is important to explore how successful programs might be exported from one country to another? Therefore, we need a broader knowledge about mechanism for modification to meet cultural differences (Jorde & Klette, 2008). This includes in a basic step that we need to systematically summarise knowledge about existing models and programs of teacher professional development in European countries participating in the network. In the interviews all experts were questioned to provide two examples of what they would consider as good practice programs of TPD in science education in their country. Based on this question we have summarized the answers from all experts and provide in the following schedule an overlook of existing national models or programs of TPD in the network countries. In the middle column we presented the name of the programs or projects with the associated web link. The third column provides information about the language in which information about this are available. Under the schedule we will give a short description about the programs which are available in English.

| Country | Good practice programs | Availability |
|---------|--|---|
| Denmark | In Denmark we have only two courses in whole Denmark: <ul style="list-style-type: none"> ○ <i>“Master course in science education”</i>, University of Aarhus ○ <i>“Master course in upper secondary education”</i>, University of Southern Denmark | |
| France | <ul style="list-style-type: none"> ○ <i>“PEGASE – pour les Professeurs et leurs Elèves un Guide pour l'Apprentissage des Sciences et leur Enseignement”</i> http://www.inrp.fr/pegase-en/ ○ <i>“SESAMES- Situations d'Enseignement Scientifique: Activités de Modélisation, d'Évaluation, de Simulation”</i>, ICAR Université Lyon http://www2.ac-on.fr/enseigne/physique/phychi2/spip.php?rubrique27 | <ul style="list-style-type: none"> ○ English/ French ○ French |
| Germany | <ul style="list-style-type: none"> ○ <i>„SINUS -Steigerung der Effizienz des mathematisch-naturwissenschaftlichen Unterrichts”</i>, IPN Kiel (1998 bis 2003) ○ <i>„SINUS Transfer“</i>, IPN Kiel (ab 2003) http://www.sinus-transfer.de/ ○ <i>„SINUS Transfer Grundschule“</i>, IPN Kiel http://www.sinus-grundschule.de/ ○ <i>„PING- Praxisintegrierte naturwissenschaftliche Grundbildung“</i>, (1993-1997) http://www.ping.lernnetz.de/pages/index_DE.html ○ <i>„CHiK - Chemie im Kontext“</i>, http://www.chik.de/Englisch/index2.htm ○ <i>„IMST- Innovations in Mathematics, Science and Technology Teaching“</i> http://imst.uni-klu.ac.at/english.php | <ul style="list-style-type: none"> ○ German/ some doc. in English ○ German/ English ○ German ○ German ○ German/ English ○ German/ English |
| Hungary | In Hungary there are no programs or projects as such, but two successful courses for Teachers and PhD: <ul style="list-style-type: none"> ○ <i>“Course for teachers teaching inter relative science subjects”</i> - organized by alternative economy secondary school, Budapest ○ <i>“Doctor-ship school for physics teachers”</i> | |
| Norway | <ul style="list-style-type: none"> ○ <i>“VITEN”</i> http://www.viten.no/ | <ul style="list-style-type: none"> ○ Norwegian |

| | | |
|-------|---|---|
| | <ul style="list-style-type: none"> ○ <i>“great big database- NATURFAG”</i> http://www.naturfag.no/ ○ <i>“Georg- Geology in senior high school”</i>, national centre for science education, Norway) | <ul style="list-style-type: none"> ○ Norwegian |
| Spain | <ul style="list-style-type: none"> ○ <i>“Climantica, Environmental education project”</i>, of the Autonomous community of Galicia http://www.climantica.org/climanticaFront/en/page/Weblog ○ <i>“ALDEA- Environmental Education project”</i>, from the Autonomous Community of Andalucia” http://www.iuntadeandalucia.es/averroes/programasyactuaciones/aldea.php3 ○ Roda USC, Universidade de Santiago de Compostela (webpage although still in construction) http://rodausc.eu | <ul style="list-style-type: none"> ○ Galego/ Castellano/ English ○ Spanish ○ Spanish |
| UK | <ul style="list-style-type: none"> ○ <i>“CASE - cognitive acceleration in science education”</i>, based at King’s college , London http://www.kcl.ac.uk/schools/sspp/education/research/projects/case.html ○ <i>“IDEAS -Ideas, Evidence and Argument in Science”</i> (Osborne, Erduran and Simon,2004), King’s college, London http://kcl.ac.uk/schools/sspp/education/research/projects/ideas.html /resources’ available in different languages – international impact) ○ <i>“CSciTeach -Chartered Science Teacher”</i>, ASE in collaboration with the Science Council http://www.ase.org.uk/htm/thease/siteguide.php | <ul style="list-style-type: none"> ○ English ○ English ○ English |

The French project **“PEGASE”** is aimed for science teachers and trainers at secondary level. There teachers can find resources in terms of teaching sequences with comments and videos. Two areas are clickable: Teaching and professional development.

“Climántica” is an environmental education project in Spain. The sections addressed to Secondary Education students, deals with the main environmental problems related to the global climate change through eight teaching units. These can be used as a whole by a teachers’ team coordinating the project, so that it can be taught in different Secondary

Education subjects. In addition, its structure also makes possible for teachers to use isolated chapters, or extract those parts considered more useful for students.

“CASE” is an intervention program of 30 activities (thinking lessons) to be used within the science curriculum at grade seven and eight. Each lesson is designed to take between 50 minutes and an hour. There is a particular teaching model involving careful and strategic use of group work.

In project named **“IDEAS”** developed materials to assist teachers of science at elementary and secondary schools. The materials should help to develop teacher’s skills to teach about ideas, evidence and argument in science education. The materials consist of an in-service workshop pack, which is supported by a DVD.

“CSiTeach” a chartered designation in line with other awards, that recognizes the professional standing of an individual working in that field. CSiTeach provides an opportunity for individuals to gain an award which accredits and values their expertise in science education and their commitment to updating the knowledge, skills and understanding.

The aim of the program **“SINUS-Transfer”** is to improve the competence in mathematics and science by disseminating the results of the program SINUS on a much larger scale. The SINUS program basically focused on a frame of modules. The modules represent “problem areas” in mathematics and science education as pointed out by expert groups. Next to these contents of TPD SINUS built on the cooperation between teachers, subject staff at a school, and school networks. Furthermore, the program was characterized by systematic formative and summative evaluation components.

“ChiK” is a German project to further develop chemistry education. Accompanied by colleagues from school authorities and science educators, they developed new teaching units for chemistry education - by and by for all grades and types of schools. The lessons are characterized by as much methodological variety as possible.

VI) Criteria for success of good practice programs

One of the aims of work package 6 in the Mind the Gap network it is to compare and analyse existing models and programs of teacher professional development in the network. A key role takes the question of criteria for successful programs in the participating countries. All referred programs or projects in the schedule are characterized by being particular successful in the respective European country. Which criteria determine the success of these projects in the eyes of the leading experts in the professional development in science education? Which requirements for success do the questioned experts see? The following chapter shows (based on the interview statements) which indicators were pointed out by the interview partners. Also in this chapter we have sorted the countries in alphabetical order.

Similar to the most of the participating countries in the Mind the Gap network, also in Denmark the most mentioned criteria for successful programs is the relevance for teachers which means *“that they can use it in their practice”*(3). Related to this prospects offers *“the motivated participants from courses to use as developing agents at the schools”*(3). That’s in turn it offers quite potential for impact.

Summary – Criteria for success/Denmark

- Relevance for teachers practice
- Satisfied participants as developing agents at schools

The French participants in the Mind the Gap Network accentuate as one important criterion the evaluation of student achievement and comparison with other students. Additional to it: *“The use of the teacher resources which are produced. Are they used by other researchers”* (14). Likewise to the interview partner from UK also the French expert see teacher involvement as strong indicator for success: *“One important criteria is own perception of the teachers who participate what they extend... but they have improve or modified, have changed their way of teaching”* (14).

Summary – Criteria for success/France

- Evaluation of student achievement
- Teacher resources
- Teacher involvement (perception, change in practice)

The German interview partners classified as important criteria the following: *“a high acceptance with teachers and students, positive effects on achievement of the students, high innovation potential, a coherent concept and evaluation about to prove the impact”* (12). Consistently with research findings in view of the effectiveness of teacher professional development the experts also describe the importance of long term structured programs, based on active learning and collaboration, as well as general a good cooperation between all involved partners in teacher education (Desimone, 2009). In addition, the German experts emphasize particular to scientifically based expertise as background for each program concept. From this expertise background the module system was developed which is a core of the SINUS program from Germany. In SINUS program there are eleven modules which address the major deficiencies of science and mathematics instruction in Germany. These modules concern the methods of teaching and learning and selected certain topics and contexts in which teaching is embedded (e.g. learning from mistakes). In the chapter V (next one) we will give more detailed information about the SINUS – Program, Germany. Which particular benefit of the module system was described from the German ambassadors?

“The benefit is that one sees a starting point. If we tell a teacher global, she should improve a lessons, this has no effect. If, however, we tell a teacher, look, sometimes especially at your

tasks which you use in the lessons, than this has an effect! This specific task and globally focus allowed the teacher a lot rather to improve own lessons than to improve global lessons“(8). Summarizing, one German expert said: “The main success factors are: Together one gets with external support a whole piece further, it better works, the profession gives more pleasure, one is able to solve problems together” (11).

Summary – Criteria for success/Germany

- High acceptance with teachers and students
- Positive effects on achievement of the students
- High innovation potential
- Coherent concept
- Evaluation
- Long-term programs
- Active learning in programs
- Collaboration and cooperation
- Scientific funded bases
- Module structure
- Teachers need starting points not global Improvement
- External support

The Hungarian experts mentioned that “the teachers courses feel successful and constant about what they do in practice as well as they are more motivated and satisfied with the own work” (1). Furthermore it’s important that the teachers are more willing to cooperate with colleagues, that they are more open to cooperation. Another interesting perspective was highlighted:

“In my opinion it is important criteria to produce new teaching materials that the teachers could use while they are teaching. And so support their teaching continuously (e.g. it home). Currently this is a general problem in Hungary, that we would need new type of teaching materials as well “(2).

Summary – Criteria for success/Hungary

- Support teachers in the sense that they are feeling successful and constant about own practice
- Cooperation between teachers
- Production and dissemination of new teaching materials

From the Norwegian point of view a first criteria is “the numbers of teachers using it” (13)! In relation with this it is necessary to have research which looks at classroom use. In addition, a good project must establish a culture which fosters that teachers come together and discuss projects. Finally, it is from Norwegian perspective an essential part for success of a good program to spread this example through magazines or net websites.

Summary – Criteria for success/Norway

- Numbers of teachers using it
- Research looking for classroom use
- Spread over country
- Discuss projects from practical perspective

In view of the Spanish interview partner important criteria for success are *“that the produce is change in practice and some ownership of the teachers”* (5).

Summary – Criteria for success/Spain

- Change in practice
- Ownership of the teachers

For the interview partner from UK one of the most important criteria is that the programs are evidence-based. This means that *“they have been tested and shown to improve teacher’s practices and students learning, using skill development of particular skills as a measure of success”* (15). Another point is the involvement of the teachers which guaranties a better linking with daily life in the school. For example the teachers were asked: What is good science in your school? *“Is it when you’re asking questions or when you’re outside or when you do something practical?”* (7). Then using those as the criteria against which you measure your success rate.

“So we are trying to be sort of base top down and bottom up at the same time, if you see what I mean in terms of using the research but applying it on a local practical level so which relevant to that school and their circumstance”(15).

A further criterion is the evaluation of each course for example with teacher feedback. *“We use the impact to valuate every course that we do and we use that to said how it’s gone to take a count that teacher feedback”* (7). In addition to this there is follow up research with the teachers to find out their impressions of the course. So from this particular one there is a lot of quantities and qualities data about what teachers thought about the program. So it is possible to have an overlook on the success of several aspects.

Summary – Criteria for success /UK

- Evidence based (measure of success)
- Linking with daily life in school – involvement of teachers
- Mix of top down and bottom up
- Research based and applying on local level
- Evaluation of the courses with teachers feedback

Summarizing the results it becomes clear once again a wide consensus spread over the participating countries. The most frequent called criterion was the relevance and acceptance for teachers and students. Just with this requirement it is possible to make a change in practice. Furthermore agreement in view of positive effects on achievement of the students was found. This also applies to the evaluation of the programs.

VII) SINUS-one effective model of teacher professional development in Germany

One aim of the Mind the Gap project is to explore the possibilities of transferring successful models of professional development from one European country in other countries. Therefore the project networks held some workshops in different countries. SINUS was introduced to all researchers, educators and policy makers at the workshop in Lyon. Therefore two researchers from the IPN Kiel gave a presentation of the central ideas and the concept of the project. In connection with this all participants at the workshop discussed together about SINUS and the possibilities to transfer this program in the own educational system. Based on this workshop discussions about SINUS we questioned in the interviews all participants whether the SINUS model would be one they could use in their country? Where do the experts see in this regard possibilities, where barriers?

In the following chapter we will first give a short introduction about the SINUS program which was developed and implemented in Germany (Prenzel et al., 2009). Based on interview statements we will examine the question whether the SINUS program, which is a successful model of teacher professional development in Germany, is an interesting model for other European countries. Which aspects from the SINUS program are especially interesting for the questioned researchers, educators and policy makers? Which limitations do they see for dissemination in their own country?

The program named "SINUS – Increasing the efficiency of mathematics and science instruction" started 1998 and ended in 2003. The idea of SINUS was to change and improve the instruction in mathematics and science education. 180 schools from 15 federal states in Germany participated in the first phase of SINUS. These schools were organized into 30 sets of 6 schools each. A total of 1000 teachers participated in SINUS. The module system (11 modules) is at the core of the SINUS conception. The starting point for their development was provided by problem areas in mathematics and science instruction which were identified in the middle of the 1990s by international school comparison studies (e.g. TIMSS). The modules are connected by having the common aims of improving learning and promoting students' motivation. They can be combined flexibly. So it's possible for schools to start their common work at various points (vgl. Prenzel et al. 2009). An important principle of the work with SINUS is the cooperation between the teachers of a school and with teacher of neighborhood schools (school sets). In these networks teachers learn from

each other, discuss together and reflect their own instruction as well as share experiences (For more detailed information see Prenzel et al. 2009).

In the following we will give an overlook about the results of the analyses of interview data in view of the question of dissemination in other countries. This is reported in alphabetical order and illustrated with statements of the interview partner.

Is the SINUS- model one what could be used in other European countries?

The Danish experts describe the SINUS model as very inspiring. They reported on a quiet similar model at the upper secondary school which they have had 10 years ago. This model was a kind of *“cascade model where we have those developmental notes, where teachers met around problems and they have got resources for instance they could have a lecture and they could buy books together and so on”* (3). The difference between these two models is that in the Danish model *“the teachers themselves formulated the problem responded to deal with. While SINUS kind of has developed some packages they use, then the teachers develop their own packages”* (3). The reason is that there is a lack of money in area of teacher in-service training in Denmark *“we will do not exactly the same project maybe something like that”* (6).

From the French perspective there is more reserve in view of implementation of SINUS. *“But the structure of SINUS as a whole seems for me as not easy to develop like that or to take some main ideas certainly... but not the structure like that it seems rather difficult.”* (14) However some ideas from the program the French experts referred as very useful (e.g. cooperation between teachers).

Now we will consider also the German expert group although SINUS program was already implemented in all federal states. Therefore, we have modified the question in direction: What do you think could the other partner countries use and implement the SINUS program? *“Yes, I think in view of the basic principles”* (12). Because the general conditions are in some European countries better developed as in Germany. For example *“I think that it is already a lot disseminated in the Scandinavian or in the Swiss schools. There is the school not only a half day company like in Germany”* (11). This means for example, that the teachers generally stayed at the schools in longer time. One expert comment to rather critical for an implementation of SINUS in the network group: *“My impression with the workshop in Lyon was that the people have belonged with interest, but whether they draw from it some conclusions for her future work, there I am simply unsure”* (12).

“Yes, this it is, definitely” (1), so a questioned expert from Hungary. Particular for Hungary it is a very interesting model, *“because now the situation in Hungary is quiet similar to that in Germany in the 90s when the SINUS started”* (1). In this view there are many parallels. *“It would be a good idea to introduce it here. We would like to use some elements and also the whole idea of SINUS”* (1).

Also the Norwegian expert group sees the SINUS program as a very interesting concept and approach. They pointed out to use parts of it but in a Norwegian way. *"I don't think we could start from page one and then implement the program, sort of mechanically. But I think we can use these ideas and they fit in with so many things that we do"* (9). However they critically noted that the model is very expensive. Namely in two facts: *"in terms of money and in terms of people time"* (13). *"So we're right in a transition I think right now if we're looking at that"* (13).

"I think the SINUS is a big program „but if we do it here in Spain it would be a different thing, it's then not SINUS" (5). The expert describes SINUS as useful for his country but equal to the Danish system there is a lack of money in Spain and altogether not an easy way because the seventeen autonomous regions are taking this.

In similar perception with the majority of the network group also the experts from UK see SINUS as an interesting and inspiring model. But rather it could be adapted to use certainly parts of the SINUS model as the whole program. In UK *"it would be difficult to implement in the same way sort of financially and practically because we have a local and regional administrative boundaries and areas"* (10).

In summary, it becomes clear that all experts see SINUS as a useful model. Most statements also show some reservation in view of the implementation in their own country. They referred that a dissemination is possible but not in a mechanical way. The ideas of SINUS are regarded as useful. The implementation however, would have to be adapted to the specific conditions of TPD in the respective countries.

Summary

In the report we focused on activities of work package 6: dissemination and professional development. We described in a first part systematically summarised knowledge about teacher professional development in the Mind the Gap network countries (chapter I and II). In a second part we illustrated which successful models of teacher professional development were pointed out from the questioned experts. Based on discussions about the SINUS program in Lyon and deepening interviews we explored the question of possibilities to use this program in partner countries. It was noticeable that the majority of the questioned experts see SINUS as an inspiring model. However, to implement it as a whole program in other countries adaptations are necessary because structures of the educational systems are different. Nonetheless their ideas of SINUS (e.g. module system, school networking, long-term) were regarded as useful. In view of existing models in European countries it was expressed there are some similar projects but no cooperate long-term like the SINUS project. Regarding the question, which criteria determine the success of all these effective models of teacher professional development there a broad conformance spread over the countries was indicated. In this regard most of our experts refer to evaluation and measuring, linking with everyday practice of teachers, research based concepts, teacher's involvement, long-term activities, cooperation between teachers and institutions which are involved in teacher education. To sum up we can notice that all researchers, educators and policy makers conformed in view of important indicators for successful teacher professional development (Desimone, 2009). In the several education teacher education & professional development systems are different but we can see a broad conformance concerning the aims and ideas. The same applies for the common exchange and fruitful discussions in the Mind the Gap workshops. There is the necessity of more and regular meetings across Europe to bring together existing research and development projects and so to create synergy effects on a European level (Jorde & Klette, 2009). In this way the project can contribute to systematic and specific knowledge on teacher professional development which can help teachers to increase their knowledge and change in instructional practices. Substantiated knowledge about teacher professional development in science education contains the chance to transfer in other learning domains.

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Appendix I

Anonymisation scheme for qualitative interviews Mind the Gap

| Short cut | Number | Expert from: |
|-----------|--------|--------------|
| MR | 1 | Hungary |
| LS | 2 | Hungary |
| JD | 3 | Denmark |
| AI | 4 | Norway |
| JA | 5 | Spain |
| OG | 6 | Denmark |
| BB | 7 | UK |
| CH | 8 | Germany |
| MD | 9 | Norway |
| KT | 10 | UK |
| MP | 11 | Germany |
| GB | 12 | Germany |
| DJ | 13 | Norway |
| AT | 14 | France |
| SE | 15 | UK |
| BE | 16 | Denmark |