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SCIENCE EDUCATION AND YOUNG PEOPLE'S IDENTITY CONSTRUCTION - TWO MUTUALLY INCOMPATIBLE PROJECTS?

INTRODUCTION[i]

This chapter is based on the view that teaching must build on an understanding of students' values, cultures, priorities and concerns. Rather than discussing how value issues can be addressed in science lessons (the subject of other chapters in this volume), we aim at describing aspects of *the spirit of our time*, and how these might influence young people's ways of seeing and valuing their science lessons and the role of science and technology (S&T) in society.

Europe needs more scientists! is the title of a report from an EU project that addressed the condition of science and technology in the European Union, with special attention to the number of people entering S&T education and careers (EU, 2004). The report title reveals the key issue: the falling recruitment of students to many S&T educations is seen as a major problem in most European countries. The same tendencies are noted in the US (NSB, 2004).

There are interesting and significant differences between countries in terms of the number of students choosing S&T education and careers and the public perception of S&T. In particular, the 'hard' S&T subjects, such as technology, engineering, physics, and to some extent chemistry, are stricken. In addition, gender effects vary from one country to another. In most countries, boys outnumber girls in physics and engineering studies, while the gender balance is shifted towards the girls in studies including medicine, veterinary medicine, environmental science and biology.

However, the overall picture in terms of interest in S&T is not unremittingly negative. Popular science magazines, books and radio and television programmes still attract large audiences, and science museums and science centres report increasing numbers of visitors. Interesting results can be gleaned from the Eurobarometer surveys. These studies monitor European citizens' views, values and attitudes related to many aspects of society. Some of these studies address issues concerning S&T. The surveys indicate a widespread respect for, and belief in, S&T issues.

The interest scores are, however, not the same for girls and boys. While girls express more interest in medicine and the environment, boys are more interested in technology (EU, 2001). An interesting result from the most recent Eurobarometer on S&T (EU, 2005) is that the level of knowledge about S&T in most European countries seems to be improving, although one often hears claims of an increasing scientific illiteracy. It seems that 'the problem' is not a general decline in interest in and respect for S&T as such, but rather a decline in the willingness to opt for S&T related studies and careers. Our contention is that the reluctance of young people in many of the more economically developed countries to enter S&T fields has more to do with the perceived values and images of S&T than with a lack of respect for S&T or lack of knowledge.

Our position is that *the spirit of the time* and the predominant *zeitgeist*, ideas and values in a society have major influences on young people's thinking about and understanding of the world, their surroundings and themselves. Consequently, the mentality among young people, that is, what young people regard as interesting, important and meaningful in their lives and for society, can be seen as a product of the prevalent societal discourses.

In this chapter, we will discuss some tendencies in the late modern[ii] zeitgeist that might be relevant to understanding the educational choices made by young people: is the low recruitment to S&T studies in more economically developed societies related to social development and the associated changes in the spirit, values and ideas of the society?

More specifically, we ask:

- Do young people value the outcomes of scientific and the technological development?
- Do young people value their science classes?
- What values guide young people in their choice of an education and a job?

Our focus will be on young people in Western, more economically developed countries, but in order to understand these young people better, they will be studied against a background of youth from other countries and cultures. Therefore, we will also report on data collected in less economically developed countries. In order to shed light on the questions raised above, we will draw on sociological perspectives describing aspects of youth culture in late-modern societies. We wish to emphasise that this perspective applies to Western modernised countries, while interpretations of results from less economically developed countries should be based on other theories. Next, we will present some results from our empirical data analysis and, finally, we will discuss the possible mismatch between science education and careers and young people's values and priorities. We will also suggest some possible ways forward.

The recruitment phenomenon has aroused our curiosity about how young people's perceptions of science and science education can be understood against a background of sociological perspectives on youth in late-modern societies. In another chapter in this volume, Michael Reiss discusses different purposes of school science education. We do not claim that the overall purpose of science education should simply be to equip society with more scientists or engineers. Although the decline in recruitment is a central issue in this chapter, we will not argue for directing science teaching towards *one* particular school science aim. The science curricula in most countries suggest that the students should develop values, awareness, knowledge and skills that may be sorted under *several* aims and purposes. What we do wish to promote is an awareness that, regardless of what schooling goals different actors in the science education community wish to advocate, one cannot ignore or disregard the values and views held by the learners.

Late-modern societies attempt to develop citizens who are self-directed and self-expressive individuals. Consequently, students in late-modern science classrooms might reasonably expect that their values and their voices should be taken into account in one way or another. We argue that school science should aim at addressing young people's values and concerns – not because this is a goal *per se*, but because such an approach is likely to be a prerequisite for *any* successful science teaching. Thus, in this chapter, we wish to make young peoples' values and

views more visible, to discuss their relevance to the decline in recruitment and examine what measures might be worth considering to improve the situation. Our empirical material has been collected through the ROSE project, and we will start with a brief presentation of the project.

ROSE – A BRIEF PRESENTATION

ROSE, The Relevance of Science Education, is an international comparative project designed to shed light on affective factors of importance to the learning of science and technology. The target population is students towards the end of secondary school (age 15). The research instrument used was a questionnaire mostly consisting of closed questions with four-point Likert scales. Among other issues, the questionnaire addressed young people's interests in learning about various topics, their experience with, and views of, school science, and their views and attitudes related to science in society. A description of the rationale behind the project, the questionnaire development, the theoretical background and the procedures used for data collection are given in Schreiner and Sjøberg (2004).

Qualitative data collected through interviews or focus group studies can provide an in-depth insight into people's view. Quantitative survey data do not provide such detailed knowledge and it is in the nature of quantitative research to describe *groups* of students rather than individuals. Students are categorised according to factors such as nationality, gender, age, socio-economic status of the home, religion, race, language, school type and environment (urban/rural). All research based on groups of respondents entails a loss of information at the level of the individual. Quantitative data facilitates descriptions of characteristics of the *typical* respondent *categories* – but inevitably at the expense of the *particular* at the level of the *individual*. In the parts of the ROSE study described in this chapter, *groups* of respondents were the unit of analysis. The individuals were grouped by gender. The characteristics of girls and boys are represented by mean scores for all students in the same gender category. This strategy unavoidably leads to injustice to the individuals. However, the focus of this study is on the *typical*, rather than on the particular. Thus, this injustice is a compromise that the study will make.

The participating researchers in the different countries were requested to apply random sampling methods. For various reasons, such as limited financial resources, some countries were not able to comply with the request. As a result, not all of the participating researchers provided data that without reservation can be regarded as representative of 15 year-old students in the country[iii]. The data analysis does, however, indicate that in spite of non-random sampling procedures, countries that are commonly compared to each other (for example African, Baltic or Scandinavian countries) do, in most instances, show similar or related response patterns. This phenomenon can be interpreted as a kind of validation of the data. In some of the diagrams in this chapter, results from a single country may differ from the general pattern. Here, we will not discuss whether such peculiarities might have been caused by errors in the measurement, the coding, the translation, and so on, or by particular cultural, political or school-related issues.

IDENTITY CONSTRUCTION AND EDUCATIONAL CHOICES

The processes characterising human development in many modern societies imply that society accentuates the individual's freedom and independence. The 'unit' of society is the individual – liberated from collective structures such as social class, gender, place of living, family institutions and so on. In pre-modern societies, one's identity was *ascribed* and determined on the basis of factors such as gender and parents' social status while in late modern societies identity is increasingly *managed* through personal choices (Côté, 1996).

As a result, young people in late-modern societies might feel culturally, socially and geographically liberated (Ziehe & Stubenrauch, 1993). They might think that, regardless of home background, they are free to choose their address, religion, social group, political affiliations, education, profession, sexuality, lifestyle and values (Beck & Beck-Gernsheim, 2002). Consequently, they might feel that their lives, including their choice of education, offer many possible ways ahead. From the cultural liberation of the individual it follows that one's identity is no longer perceived as something that is handed out or given, but rather something one has to choose and develop by oneself (Giddens, 1991). It is up to each person to decide who one wants to be and in what way and direction one will develop oneself and one's life.

Across all epochs and cultures, the youth phase is commonly seen as a period in one's life which is particularly occupied with identity construction (Coleman & Hendry, 1999). Even though a person's identity is a relatively stable perception of 'who' one is, the identity is in continuous development. In the light of new knowledge and new experiences, people constantly reconsider and redevelop their self (Giddens, 1991). The US sociologist, Erving Goffman, sees social life as performances with agreed rules for behaviour. Based on his empirical analyses of human interaction, Goffman describes how every facet of people's public choices and behaviour, such as language, actions, values and beliefs, are tacit symbols or codes of social identities (Goffman, 1959). Choices are continuously made and remade on everyday matters, such as clothing, physical appearance, leisure activities, taste in music, sports, sexuality and beliefs (Giddens, 1991). Also in the school and classroom context, young people define and express their identities through signs such as attainment, subject preferences, classroom and playground behaviour. All these signs can be seen as indicators of one's identity (Lyng, 2004). In order to communicate one's identity, signs of what one *is not*, are just as important as signs of what one *is* (Frønes, 1998).

Constructing and developing one's identity is, according to Illeris *et al*., at the heart of the late-modern youth project:

> [...] And precisely this identity development can be seen as the essence or the driving force behind all the choices that young people today are plunged into, as the very central task of youth today. (Illeris, Katznelson, Simonsen & Ulriksen, 2002, p. 26, our translation)

These authors argue that the traditional question 'What do you want to be when you grow up?' addresses a more far-reaching issue than before. Today, the answer to this question should be seen less as a perception about a job or an income, and more as an answer to the question '*Who* do you want to be when you grow up?' (ibid., 2002, p. 57, authors' emphasis, our translation). When young people choose

an education or a job, they simultaneously express important components of their identity. Education is seen as a means for self-actualization and for fulfilling and developing personal talents and abilities. Young people wish to find a study they can be passionate about*;* something exciting and enriching (Illeris *et al.*, 2002; Simonsen & Ulriksen, 1998; Ulriksen, 2003). An empirical study of Danish students' explanations for their educational choices showed that the majority had chosen their subject for 'existential and individualistic' reasons – they wished to 'develop themselves', 'get wiser', 'become deeply absorbed' and so on (Simonsen & Ulriksen, 1998).

Several studies of young people's educational choices have found that *subject interest* is a key criterion (Angell, Henriksen & Isnes, 2003; Lindahl, 2003). Abilities also play a crucial role (ibid.), but even students who perform well in mathematics and science often choose other studies and jobs. This is particularly the case for girls (Støren & Arnesen, 2003).

VALUES, INTERESTS AND PRIORITIES: SOME ILLUSTRATIVE DATA

This section is meant only to be an indication of the data and perspectives that have emerged from the ROSE study. We have presented summary statistics at the single variable level from only a few of the 250 questionnaire items. More details, more advanced analysis and more discussions addressing reliability and validity issues are published elsewhere (see, for example, Schreiner & Sjøberg, 2004, Schreiner, 2006). All the diagrams below show mean scores for 14-16 year-old girls and boys from a number of countries in the ROSE study. The countries are partly sorted geographically (with neighbouring countries listed together) and partly by level of development (with more economically-developed countries towards the bottom of the diagrams).

The Likert scales have four response categories. The responses are coded from 1 (Disagree) to 4 (Agree). This means that the value 2.5 lies in the middle of the scale. We interpret scores of 2.5 as indicating that, on average, the students in the country are *neutral* to the statement, that is, they neither agree nor disagree with the statement.

School science is somewhat interesting

One questionnaire item asked the students whether they agreed that *School science is interesting* (Figure 1). Compared to the less economically-developed countries, the students in the more economically-developed countries showed little interest in the subject. But the picture is not all bleak, since in nearly all countries the average scores for the girls as well as the boys lie on the 'agreeing' side of the neutral value. This means that although modern youth do not express the view that school science is especially interesting, the subject does nevertheless attract some curiosity.

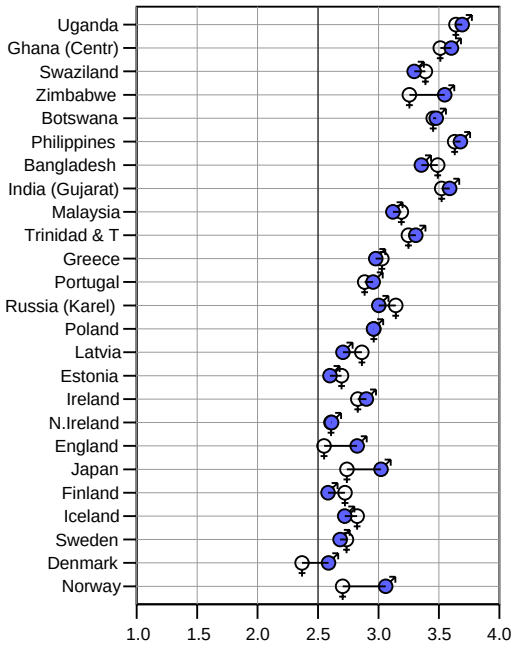

Figure 1. School science is interesting. Average scores for boys (filled symbols) and girls (open symbols). In countries with a set of brackets next to the name, data were sampled from a country region: Ghana has data from the Central Region, India has data from Gujarat, and in Russia the data were collected in Karelia. 'Trinidad & T' denotes Trinidad and Tobago.

Similarly, the responses to the items: *I think everybody should learn science at school; The things that I learn in science at school will be helpful in my everyday life* and *School science has increased my curiosity about things we cannot yet explain*, indicate that the students did not have completely negative views about school science. Even though young people in the less economically-developed countries were far more positive towards such statements than were young people in the more economically-developed countries, the average scores of the latter group also lie above the neutral value indicating that 'Western' youth are inclined to agree that school science offers something that they can appreciate.

Modern youth appreciate S&T in society

A possible explanation for young people's lack of interest in studying S&T could be that they hold a negative view of the role S&T play in society, and that they might blame S&T for unintended catastrophes and risks (for example, the Chernobyl disaster in 1986, BSE (Bovine Spongiform Encephalopathy or 'mad cow disease'), ozone layer depletion, global warming and overpopulation) following in the wake of the technological development (Beck, 1999; Sjøberg, 2004).

In all countries young people expressed a positive view of S&T. Average scores for girls and boys in nearly all countries show strong agreement with statements such as: *Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc; Science and technology are important for society; Thanks to science and technology, there will be greater opportunities for future generations; New technologies will make work more interesting; The benefits of science are greater than the harmful effects it could have;* and *Science and technology make our lives healthier, easier and more comfortable.*

Figure 2 illustrates this point using one example. The diagram shows responses to *Science and technology are important for society*. On average, girls and boys in all countries agreed that S&T are important for society, and the gender differences are negligible.

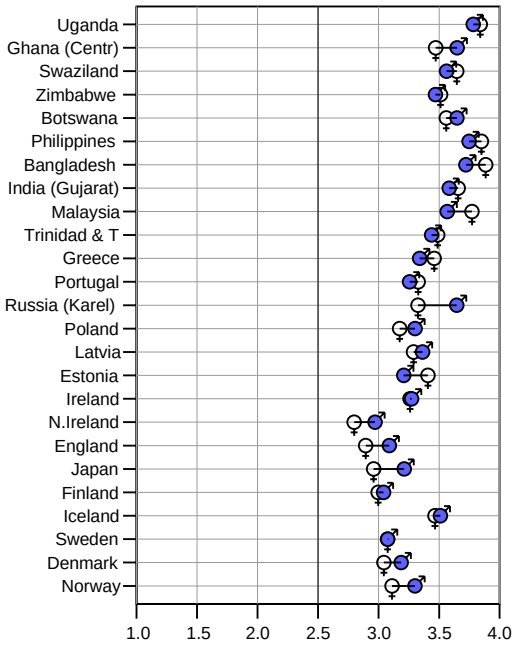

Figure 2. Science and technology are important for society. See caption 1 for diagram explanations.

Consequently, we may, on the basis of these items, conclude that modern youth are relatively positive to the influence of S&T on society.

Young people do not prefer school science above everything else!

We saw from Figure 1 that the students reported that they found school science relatively interesting. However, a somewhat different picture appears from Figure 3, where science is seen in comparison to other school subjects. Average scores in most Western countries show that the students disagreed with the statement, *I like school science better than most other subjects.*

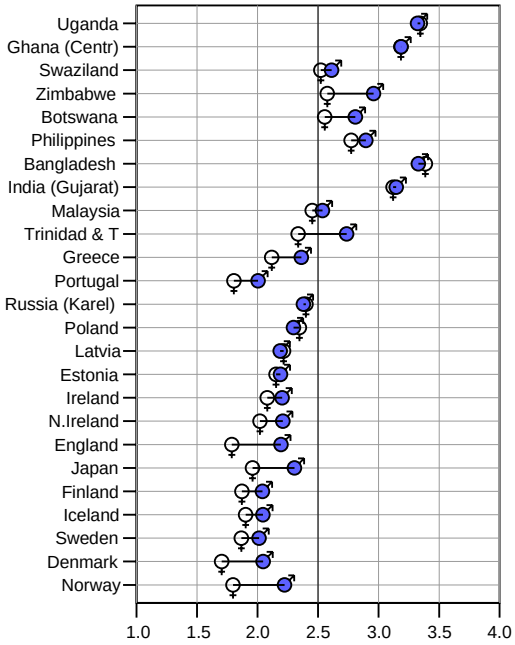

Figure 3. I like school science better than most other subjects. See caption 1 for diagram explanations.

A synthesis of the results shown in Figure 1 and Figure 3 might indicate that school science is somewhat interesting, but in comparison to other school subjects, science cannot compete. Western students do *not* like school science more than most other subjects. It is this point that might be crucial for their subsequent rejection of S&T studies, since other options might be even more attractive. As we described above, Western youth see numerous educational choices open to them, and their interests play a key role in their decision. As long as science is not *the* most interesting subject, they are unlikely to choose to pursue it further.

The good job

One question listed a range of job qualities and asked the students to indicate how important they perceived each of a range of qualities for their future job. *Not important* is coded 1 and *Very important* is coded 4. One of the items was, *Working with something I find important and meaningful*. The results for the statement are presented in Figure 4.

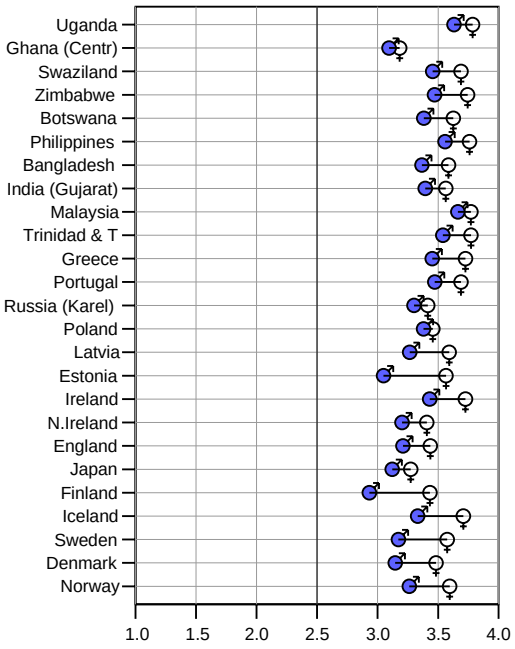

Figure 4. Working with something I find important and meaningful. See caption 1 for diagram explanations.

Figure 4 shows that in each and every country, young people hoped to find a job in which they could do something they found important and meaningful. Most of the countries' mean scores lie close to 3.5, a very high value on this scale. In all countries, girls found it somewhat more important than did boys, but the average scores indicate that this was *very* important for all the respondents; including the boys.

In addition, both girls and boys in modern societies strongly agreed that their future job should offer opportunities for: *Using my talents and abilities; Making my own decisions; Having lots of time for my friends,* and *Earning lots of money.* For some of the items, we found large and interesting gender differences, for example in: *Helping other people; Working with people rather than things,* and *Working artistically and creatively in art.* Here, the Western girls gave a higher priority to the factors than did the Western boys.

Our hypothesis is that the reason for the low number of students choosing to pursue S&T studies in many Western societies is that the aspects that they apparently value so highly will not be found in S&T subjects and careers.

Is working with S&T not meaningful?

We see from Figure 5 that there are large cross-national differences when it comes to students' agreement with the statement, *I would like to become a scientist.* The mean scores in the more economically-developed countries are extremely low, and the girls were even more negative than were the boys.

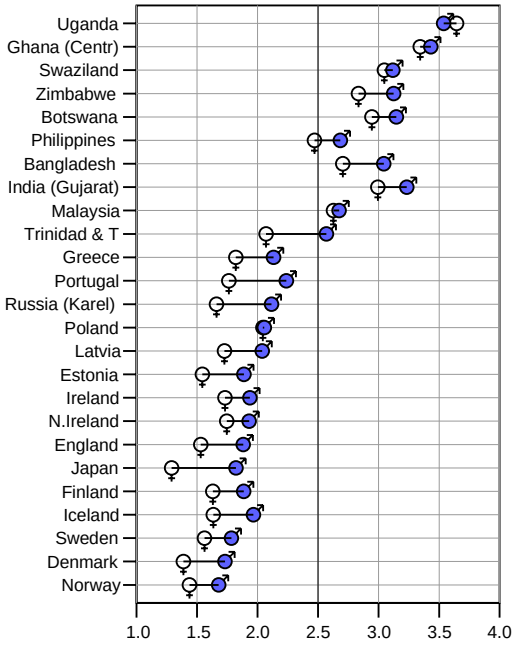

Figure 5. I would like to become a scientist. See caption 1 for diagram explanations.

Responses to the item, *I would like to get a job in technology*, are illustrated in Figure 6. Again, in this diagram, we note pronounced differences between countries and between girls and boys in each country. Whilst boys in more modernised countries gave average scores close to the neutral value, most girls in these countries did *not* want to work with technology. In the other countries, both girls and boys agreed with the statement. Also in the less economically-developed countries there were some gender differences, but they were by no means as large as in the more economically-developed countries.

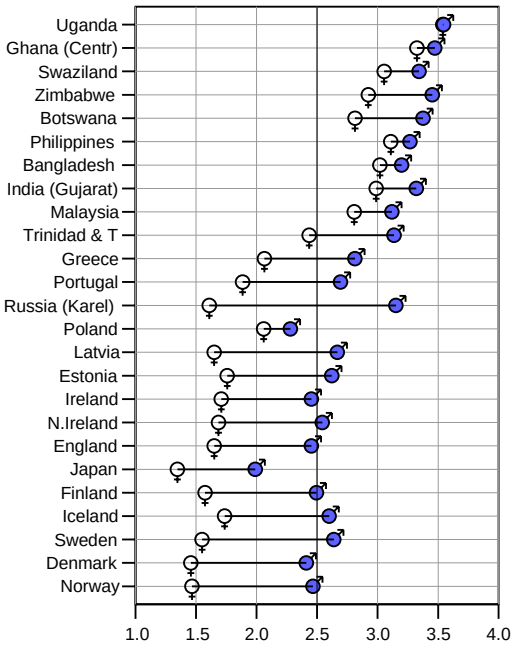

Figure 6. I would like to get a job in technology. See caption 1 for diagram explanations.

HOW CAN SCHOOL SCIENCE MEET YOUNG PEOPLE'S VALUES AND CONCERNS?

When today's Western youth choose an education, their decision is based on more than family traditions and a need to ensure a safe job with a stable income. We have pointed to *identity construction* and *interests* as two important factors influencing their educational choices. Their education and their future job have to be interesting and meaningful, to harmonise with their identity and to open up opportunities for self-actualisation and self-development.

Our empirical analysis indicates that Western youth consider school science to be interesting. However, contrary to young people in less economically-developed countries, they do not agree that school science is *more* interesting than other subjects. Furthermore, our data suggest that students in all countries hold a relatively positive view of many aspects of S&T in society. Not surprisingly, students in all countries wish to work with something they find important and meaningful, and girls, in particular, also wish to work with and help other people. Youth in less economically-developed countries report that they would like to work within the fields of S&T, while in more economically-developed countries some boys can see themselves working with technology, whilst the girls do not share this view. Moreover, neither girls nor boys in Western societies particularly want to be a scientist.

The mechanisms behind young people's priorities are multifaceted and difficult to understand, and no one theory alone has the capacity to give a complete explanation of young people's rejection of S&T studies and jobs. We will draw on

three perspectives that that might be significant in understanding our empirical results and the low recruitment of students to S&T studies in more economically-developed societies:

- Issues that are perceived as being meaningful to young people in a country are dependent on the culture and the material conditions in the country.
- An educational choice is an identity choice.
- Young people wish to be passionate about what they are doing, and they wish to develop themselves and their abilities. They have a range of possible and accessible futures, and among the many options, they choose the most interesting.

In the following section, we will briefly discuss these three perspectives and examine some implications for the science curriculum.

Meaning - linked to the level of development in a country

Young people's values, views and ways of understanding themselves, their surroundings and the world in general are products of the culture in which they are growing up. We have seen that young people in many countries wish to work with something they find meaningful. But what meaning do they put to the concept 'meaningful'? We interpret from our data that whether a job in S&T is perceived as meaningful for the individual is closely related to the country's level of development. The pronounced interest for a job in S&T in less economically developed countries might indicate that young people in these countries find S&T meaningful. An important challenge to poorer countries is, of course, related to the betterment of material conditions, economic growth and to the improvement of health and the welfare system. Further material development of society is naturally a main political and public issue, and in this respect S&T are seen as fundamental driving forces. One might assume that in such societies, a job in S&T is perceived as important for society and thereby also as meaningful for the individual.

When today's more modern societies were in the era of early industrialisation, the focus was directed towards *progress*, *growth* and *building the country*. Consequently, exactly this idea –building the country – was perceived as important for the society and thereby as meaningful for the individual. It might be that we have now passed the era in which the work of physicists, technicians and engineers is seen as crucial to people's lives and well-being. Studies also indicate that in poorer countries, young people have a rather heroic image of scientists as persons, while this is not the case in highly developed Western societies (Sjøberg, 2002). In modern societies, neither scientists nor engineers are necessarily heroes or attractive role models for the younger generation.

It is clear that the level of development influences people's expectations of the expected benefits of developments in S&T (Sicinski, 1976). The Eurobarometer survey (EU, 2005) also showed that the belief in the benefits of S&T was much stronger in the less developed EU countries than in the wealthier and more developed countries[iv]. According to Inglehart (1990), late-modern societies can be characterised as post-materialistic societies emphasising values such as the environment, democracy, care for others and self-actualisation. The recruitment of Western students to medicine, biology and environment studies are *not* falling, and

in these subjects girls often outnumber boys. This fact might indicate that modern youth believe that the most important challenges facing our society are related to health and environmental issues, and, consequently, that these fields can offer meaningful jobs.

Non-modern identities associated with S&T?

Boaler and her colleagues argue that young people's identity development is an important, but neglected, factor in mathematics education (Boaler, 2002; Boaler, Wiliam & Zevenbergen, 2000). In order to understand why some of the 'able' students continued with their mathematics studies, while others did not, the authors took note of the young people's identity construction. Through their mathematics lessons, the students learned 'how to *be* a mathematics student', that is, how to work, how to cope, how to act, how to think, how to discuss and so on (Boaler *et al*., 2000). Thereby, they developed an impression of the role and the identity of a mathematician. Boaler and her colleagues inferred that most high-achieving students want to be successful in school mathematics, so that they can have access to the job or education they desire. But when mathematics is no longer compulsory, they reject the subject, because they do not want to 'belong' to the mathematics culture, or to carry the identity of a mathematician.

Correspondingly, one may infer that young people, especially girls, do not want to have an *identity* that is seen to be connected with being a physicist or an engineer. It might be that young people, especially girls, perceive the identity of engineers and physicist as incongruent with their own? The masculine image of S&T and S&T careers is discussed in the literature (Lightbody & Durndell, 1996; Sjøberg, 2000). This image might, naturally, be related to the girls' rejection of identities connected with S&T educations and jobs.

Students recognise that S&T are important for society, and they value the goods and the welfare associated with the development. Nevertheless, they do not wish to have a job within these fields. We suggest that young people, especially girls, do not want to have an *identity* that is seen to be connected with being a physicist or an engineer. Is it possible that young people associate the tasks of these professions with the development of even broader bridges, even faster aircraft, newer techniques for pumping up oil, even smaller mobile phones and even faster computers with even larger storage capacities? Is it possible that young people, in particular girls, believe that today's health and environment problems overshadow the worries we may have about to 'slow' aircraft, computers' 'poor' storage capacity and 'limited' access to fossil fuels? It may be that young people, especially girls, although they appreciate the technology, would rather like to have an identity that conveys late-modern values? Such values might be self-realisation; creativity and innovation; working with people and helping others, and/or earning lots of money.

If this perspective is close to the truth, then the fall in recruitment to the hard S&T subjects might be met by changing the images associated with people working within these fields. In addition to computers and oil pumps, the physicist and the engineer develop methods for utilising alternative energy sources, they develop technologies for eliminating landmines, create methods for more animal-friendly food production, devise solutions for protection against deadly weapons, invent new instruments for treating diseases and so on. The driving force behind

their work is their internal motor fired by their values, creativity, interests and abilities. If young people are not concerned about further national economic growth, but desire an identity that is coherent with the late-modern post-material values, then school science could demonstrate to students that the S&T subjects play a crucial role in accomplishing exactly these values.

School science as the most interesting subject?

Illeris *et al.* (2002) argue that everyone working with young people and education in modern societies need to understand that education is continuously evaluated against how the subject contributes to students' self-development:

> what does it mean to *me*, how does it fit with *my* self-orientation, how can *I* apply this in my self-development project? (ibid., p. 60, authors' emphasis, our translation).

The fact that few of today's young people choose S&T subjects might indicate that the science which the students meet at school does not succeed in inspiring and exciting them. But what are the students interested in? What topics and teaching methods have the potential to inspire and excite them? ROSE, as well as several other studies, have empirical data that can shed light on such issues but this matter lies outside the scope of this chapter (see, for example, the review article of Osborne, Simon & Collins, 2003, and Jenkins, 2006). There is no doubt that young people are interested in many topics that might function as gateways into science teaching and learning. But can or should school science continually adapt to the prevailing spirit and ideas of the time? Would changes in the science curriculum driven by current youth culture be at the expense of high quality science? Naturally, the science curriculum cannot be designed merely for meeting the current values and interests of young people. We cannot base our teaching on opinion polls among students. Nevertheless, we argue that school science should, to some degree, be attentive to students' values and concerns (see a more in-depth discussion of this in Schreiner, 2006).

School science might appear more meaningful, in meeting young people's values, if, for example, it noted that although the quality of welfare in modern societies is relatively high, S&T are still facing huge, unsolved challenges to improve the conditions for life on earth. Such issues might show that S&T still can provide meaning and relevance for young people – in rich, modern societies as well as in less economically-developed countries.

When young people make their educational choice, they have a range of options. Young people wish to develop their abilities and their identities, and they want a future that they find important and meaningful. Only by being aware of the values and priorities of the young generation can we have a hope to show them that S&T studies may open up meaningful jobs in their lives.

We hope that this chapter can shed some light on the importance of paying attention to the values and the concerns of the learners, and deepen our understanding of young people's views. We believe that school science can thereby be better prepared for realising its potential and for reaching its many and diverse objectives.

FOR MORE INFORMATION

If you have any questions concerning the above, please do not hesitate to contact the authors, Camilla Schreiner: <camilla.schreiner@ils.uio.no> and Svein Sjøberg <svein.sjoberg@ils.uio.no>.

NOTES

i This chapter is a shortened and partly rewritten version of a Norwegian paper published in Nordina, Nordic Studies in Science Education (Schreiner & Sjøberg, 2005).

ii According to sociological theories on modernity, modernisation of societies is connected to the cultural, economic and political development in Western societies. The present-day post-industrial period is referred to as 'high modernity', 'late modernity' and 'reflexive modernity' (Giddens, 1991), 'second modernity' (Beck, 1999),'liquid modernity' (Bauman, 2001), etc. We will use the terms 'Western', 'developed', 'modern', 'modernised' and 'late modern' synonymously.

iii National reports on how the survey was organised in each country are available from the ROSE website www.ils.uio.no/english/rose/

iv The recent Eurobarometer (EU, 2005) has collected data in 32 countries: the 15 'old' EU countries, the 10 new member states (previously Eastern Europe), the four 'candidate countries', including Turkey, Croatia, Bulgaria and Romania and the three EFTA countries Iceland, Norway and Switzerland.

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