

EXPLORING A ROSE-GARDEN

Norwegian youth's orientations towards science – seen as signs of late modern identities

Based on ROSE (The Relevance of Science Education),
a comparative study of 15 year old students' perceptions
of science and science education

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ABSTRACT

The thesis is based on the view that science teaching must build on an understanding of the students' culture, priorities and concerns.

The empirical material was data collected through the ROSE project. ROSE (The Relevance of Science Education) is an explorative comparative project meant to shed light on affective factors of importance to the learning of science and technology. The target population is students towards the end of lower secondary school (age 15). The research instrument was developed through working conferences, drafting, piloting and several revisions assisted by an international group of science educators. The resulting ROSE instrument is a questionnaire, mostly consisting of closed questions. They address the students' interests, attitudes, plans, views on science, technology and the environmental challenges, etc. This thesis uses data from more than 26 000 students in 25 countries in Europe, Africa, Asia and South America.

The research aims were to develop a student typology based on the Norwegian data, to characterise the student types' orientations towards science, and to study Norwegian youth's interests against a background of students from less modernised countries. The results can be summarised under three main conclusions:

- Norwegian students can be divided into five student types with distinct orientations towards science.
- Students' interests in science are sex-specific.
- There are characteristic cross-national patterns in youth's interests that follow a modern–traditional divide.

The results are discussed in the light of sociological theories on youth in late modern societies, especially by drawing on perspectives on the late modern project of identity construction. The students' responses in the questionnaire are interpreted as identity expressions, and the typology is seen as signs of five different social identities.

The study has an explorative and data-driven approach. The next step of the analysis has been successively adjusted according to the previous step and results. The following is a brief account for the way through the data material and a summary of the results.

Exploring the data material

The students were not divided into categories of sex or any other background variable. This choice was based on the belief that there might be other and more appropriate ways of categorising students for describing their orientations towards science. One question in the questionnaire, *What I want to learn about*, is an inventory of more than a hundred possible topics to learn about. By k-means cluster analysis, the Norwegian respondents were divided into clusters based solely on their interests in these topics, irrespective of sex, school, home background, etc. After some trials, it was decided on *five* clusters. This number was not "given" from the data. One could have decided on fewer and one could

have decided on more, but the five clusters seemed distinctive and interesting. Each cluster was seen as representing one *student type*. The student types have been described by their scores in different parts of the questionnaire.

Two clusters turned out to be sex-specific – one girls' and one boys' cluster. The most salient features of their orientations towards science were their selective interest and their conscious preferences and attitudes. These student types were labelled the *Selective Girl* and the *Selective Boy*. The three other clusters were mixed, and the main characteristic of these student types was the unselective general level of interest and concern: Almost regardless of topic, they showed low, medium and high interest, and almost regardless of issue, they showed reluctant, undecided and enthusiastic attitudes. The student types were labelled the *Unselective Reluctant*, the *Unselective Undecided* and the *Unselective Enthusiast*.

The interest profiles of the three Unselective student types were standardised by removing the differences in general interest levels. Next, the three clusters were merged and divided into new clusters by k-means cluster analysis (with the same interest variables as in the first analysis). Again, by constructing two clusters, the result was two more or less sex-specific clusters: the Unselective Girl and the Unselective Boy. Although the Unselective Girl and the Unselective Boy fluctuated with much smaller span between the extreme values than the two Selective student types did, the interest profiles of the two sex-specific Unselective clusters turned out to be remarkably similar to the corresponding profiles of the Selective Girl and the Selective Boy.

This means that although the five *student types* would not have appeared if the students from the outset were categorised according to their sex, sex appeared as an important factor for understanding the students' typical *interests*.

The five Norwegian student types

The individuals in one cluster are diverse. Characterisations of *student types*, represented by mean scores of all students in one cluster, will inevitably do injustice to the individuals. The focus of the study is on the *typical*, rather than on the particular. Thus, this injustice is a compromise that the study makes. The student characteristics can broadly be summarised as follows:

The Unselective Enthusiast:

- S/he is a school-committed student type: Has an unchanging positive, progressive and willing attitude towards all matters raised in the questionnaire. Responds with eagerness and interest almost regardless of subject matter.
- Represents the socially accepted and politically correct attitudes, and wants to make a good impression on the science teacher and others.
- Sees the benefits of science in society, is personally engaged in the environmental issue and ranks environmental protection before her/his personal economy.
- School science is interesting, useful and not too difficult; but the science classes are not more interesting than most other school subjects.

- Plans to take an advanced education. Wants to work with and help other people, and is less concerned about power, glory and money than the other student types are.

The Unselective Reluctant:

- S/he is a school-rejective student type: Aloof and unwilling.
- "Superb" does not exist in her/his vocabulary, at least not when the questionnaire is answered in the school science context. Expresses little interest regardless of topic.
- Has negative attitudes towards school science in particular and possibly also towards school in general. Strongly disagrees that science is better than other school subjects.
- Does not see much benefit of science in society, shows little engagement for environmental protection.
- Wishes, like all students, to realise her/himself in a future job, but most of all s/he wants to earn lots of money. Maybe work with something involving the use of hands and tools. Will not be a scientist or work with technology. Does not plan for a profession that requires an advanced education.

The Unselective Undecided:

- S/he is undecided, indifferent and avoids taking clear stances. Invisible, appears with an unclear contour.
- Not enthusiastic, not reluctant – but in-between.
- Not interested and not disinterested – but in-between.
- Science classes are not useful, not easy, not useless, not difficult – but in-between.
- Perhaps, s/he is not school-committed, not school-rejective – but in-between.

The Selective Girl:

- She is modern, reasonable, outspoken and self-expressive. Critical and with conscious preferences and attitudes. Expresses herself through strong commitments and rejections.
- Has typical girls' interests (see below) and rejects the masculine topics.
- Knows who she is and wants to be, and who she is *not* and does *not* want to be. Has an identity connected to the late modern female expressions, and emphasise this also by refusing the masculine symbols.
- School science is somewhat difficult, and not very interesting; she prefers other subjects much more.
- In her future job, she wants to realise herself through working with people. The chance that she will become a scientist or an engineer is negligible.

The Selective Boy:

- He is a male version of the Selective Girl: Self-expressive, with critical and conscious attitudes and with intense, precise and discriminating preferences.
- High interest in masculine topics and rejects feminine topics (see below).
- School science is not very difficult, rather it is interesting – but not his favourite when compared to other subjects.
- Wishes to fulfil himself through his work. Would like to work with his hands and with tools, and with technology. Working with people is not important for him.

The Selective Girl cluster was divided into two sub-clusters representing different student types. These serve as examples of how one cluster contains a range of different kinds of student types and identities, and how femininity has a variety of expressions. Also the other clusters could have been divided into sub-clusters; and with a large enough sample, one could continue and continue to divide clusters into sub-clusters, and presumably continue and continue to find different and interesting student profiles.

Norwegian girls' and boys' interests

Even with the explorative approach to the data, sex emerged as an important factor for understanding youth's interests in science. Girls' and boys' interests can broadly be summarised as follows:

Many of the subjects that are of greatest interest to students of one sex are of least interest to those of the other sex. There are, however, also some meeting points:

- Both girls and boys are interested in learning about enigmas and phenomena science still cannot explain, such as dinosaurs, the origin of life and mysteries in outer space. They are also interested in earthquakes, volcanoes, tornados and hurricanes.
- Neither girls nor boys are much interested in: The weather, the sunset, how mountains and rivers develop and change; botany and farming; environmental protection; the work and life of scientists and how scientific knowledge develops; general everyday matters such as detergents and soaps, plants in the local area and how food is produced and conserved.

The interest profiles for girls and boys form sex-stereotypes: Boys are interested in the masculine and the "tough stuff" and girls are interested in the feminine.

Boys:

- Spectacular phenomena, such as supernovas, bombs, weapons, shocks and explosives.
- Technology, including satellites, rockets and space technology, TV, radio, computers, mobile phones and DVDs as well as petrol and diesel engines, and repairing everyday mechanical equipment.
- Influential discoveries and recent inventions, cutting-edge science.

- Boys' interest increases when a topic is framed as cutting-edge science. For example, they are not interested in environmental protection in general, but they are interested in new sources of energy.
- They are not interested in animals in general, but if the subject is angled more provocatively, e.g. towards cloning of animals or dangerous animals, their interest increases.
- Not interested in the human body in general, but interested in how to exercise to keep the body fit.
- Do not share the girls' interests in mysteries (see below).

Girls:

- Topics related to the human body, including human biology, health issues and how to keep and shape a fit body.
- Mysteries and things we still cannot explain, e.g. what our dreams may mean, thought transference, ghosts and witches, the human soul, alternative therapies, astrology and horoscopes.
- Girls do not share boys' interest in explosives and other horrifying matters.
- They are not interested in technology or in recent inventions and cutting-edge science.
- Not interested in atoms, molecules and chemicals.

Cross-national patterns in youth's interests

Western students' disenchantment with school science, and declining recruitment of students to science and technology studies, are widely described in the literature. The background for this study's use of theories on late modernity is the assumption that students' orientations towards science and school science are related to modernisation processes. Therefore, in the final analysis, the Norwegian students were studied against a background of students from a range of other countries, including some less developed, more traditional countries. The results show some characteristic cross-national patterns in youth's interests that follow a modern-traditional divide, with respect to both sex differences and what subject matters young people are interested in learning about.

The UNDP (United Nations Development Programme) Human Development Index is used as an indicator of a country's level of modernisation. The analysis does not allow firm and absolute conclusions, but it seems like students' interests in some topics may be related to modernity, others not. This outlines some rough and tentative results:

- The more modernised a country is, the more interested both girls and boys are in mysteries, enigmas and the universe, and the less interested they are in learning about environmental protection, the work and life of scientists, plants and farming.
- Girls in modernised countries are more interested in the human body, human health and in animals, and less interested in technology.
- Boys in modernised countries are more interested in explosives, and less interested in the human body.

- Boys' level of interest in technology is not related to the degree of development: The interest in advanced technology is high among boys in more *and* less modernised countries.

There is a tendency for all girls in all countries to be interested in the same subjects, and similarly for all boys, but we often find that the more modernised a country is, the larger the sex differences are. There were no topics with the opposite pattern; i.e. with a tendency for girls and boys to approach each other's interests with an increasing level of development. When interests are interpreted as signs of late modern identities, this result can be understood as follows: The more modernised a country is, the more girls accentuate that they are girls and boys accentuate that they are boys.

Reflections

The underlying purpose of the research is to promote a science education that aims to empower students to make a better world, and make students see themselves as actors, not onlookers. The last section discusses how sociological perspectives on modern youth can inform the area of science education and how science teachers can use the youth culture as a teaching resource for making the students more actively engaged. Schools can:

- meet young people in their culture – *and* represent a counterculture
- accommodate youth's identity projects – *and* challenge them to deviate from their student roles
- accentuate collective efforts for the future – *and* develop the students to become autonomous individual actors

Based on knowledge about how young people understand themselves, their surroundings and the world, school science can aim to develop in young individuals their sense of autonomy and independence to make priorities and to choose actions in accordance with these.