Organising ROSE (The Relevance of Science Education) survey in Finland

Researchers and support

The Survey was organised by the following researchers at the Department of Teacher Education, University of Helsinki:

- Prof. Jari Lavonen (expertise in physics, chemistry and technology education)
- Prof. Veijo Meisalo (expertise in mathematics, computer science, physics and chemistry education)
- Dr. Docent, Senior lecturer in Biology Education Anna Uitto (expertise in biology, geography and environmental education)
- M.Sc. Kalle Juuti (expertise in physics education and gender issues).

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Population of the ROSE survey

The survey was organised for the age group 15 to 16 (grade 9 in the Finnish compulsory school).

Altogether there were about 60 000 students at grade 9 in spring 2003.

We selected randomly 75 schools for the study but use weighting in this random selection Therefore, the schools do not have equal weight in selection because the schools were weighted by the number of students at grade 9. This means that big schools had higher possibility to be selected to the survey. Actually our approach means that the students were selected randomly from the whole age cohort (population). In each selected school about 65 students were asked to answer the survey. This means about 3 classes in a school. In one of the schools there were only 20 students, in two schools about 30 students and in two schools about 40 students at grade 9 . Altogether, we selected 4954 students to the survey (8 % of all population).

The population in Finland is rather homogeneous and 'mono-cultural'. On the basis of international surveys like PISA and TIMMS we may conclude that there are only minor differences between students' achievements in different parts of Finland. Therefore, it is reasonable to discuss about national averages.

Mailing and responses

The questionnaire was send to the schools at 27.3.2003 and the headmasters were asked to organise the survey and to send the filled questionnaires back by 20.4.2003. In the cover sheet the national and international purposes of the survey were carefully explained. For example, it was explained that new kind of in-service training can be organised by the National Board of Education based on the information acquired by the survey. The letter was signed by the head of the Department of Teacher Education and the chief director of the National Board of Education.

Altogether 26 reminders (37 % of selected schools) were send 10.5.2003 to those headmasters who had not organised the survey in time. The purpose of the survey was explained once more and they were again asked to return the filled questionnaires by 25.5.2333

3630 (73 %) students in 61 schools (81 % of selected schools) answered the survey. This is a very high response rate. We suppose that one reason for so high a response rate was the role of the National Board of Education in the covering letter. We are also quite known in schools and schools perhaps understand well the value of the survey.

Translation of the Rose questionnaire

The translation was made carefully with the aim to make as verbatim translation as possible:

1. Jari Lavonen in physics and chemistry education made the first version of the translation.
2. The other researchers read the translation carefully and compared it with the original questionnaire.
3. Jari Lavonen made the second version based on comments of the other researchers.
4. The other researchers read again the translation carefully and compared with the original questionnaire.
5. Jari Lavonen made the third version based on comments of the other researchers.

As a summary we think that we make the meaning in our own language as identical to the English items as possible.

National items and questions

At the end of questionnaire we added national items and items about teaching methods.

The open question

The open question ("Myself as a scientist"I) at the end of the questionnaire will be analysed later.

A short overview of the Finnish science and technology curriculum

The compulsory education in Finland provides a general education for the entire age group from 7 to 16 (grades 7 – 9). Moreover, there is a non-compulsory pre-school for children aged 6. Primary school teachers teach children aged 7 to 13 (grades 1 – 6) and the subject teachers children aged 13 to 16 (grades 7 – 9). The secondary level education is divided into general education carried out at upper (senior) secondary schools and vocational education provided by various vocational schools.

The framework curriculum for compulsory education for 1994 serves as the basis for school curricula, which are drawn up by local education authorities and individual schools. The guidelines contain only the general educational aims and basic contents. Consequently, the responsibility for teaching arrangements, exact course contents and the selection of teaching materials has been passed down to the local level, giving schools the opportunity to co-operate with each other, increase the educational resources needed in their respective areas and meet the students' individual needs. In practice, textbooks and traditions have a strong influence on what is taught at school.

The Framework Curriculum Guidelines for the compulsory education states in its general section that the technical development of society makes it necessary for all citizens to have a new readiness to use technical adaptations and to be able to exert an influence on the direction of technical development. And furthermore, all students without any regard to sex must have the chance to acquaint themselves with technology and to learn to understand and avail themselves of technology. What is especially important is to take a critical look at the effects technology has on the interaction between man and nature, to be able to make use of the

opportunities it offers and to understand their consequences. In the curriculum, it is also emphasised that extensive knowledge is necessary when participating in technology-related discussions and problem-solving Moreover, in the general part of the curriculum it is said that the ability to use different forms of technology and, especially, information and communication technology, ICT, gives students the chance to use the tools of modern society and, in general, offers a versatile environment for the understanding and development of different forms of technology. Environmental education is also said to give a view of man's living environment and the interaction between man and the environment. However, a clear definition, goal or content of technology education is not given.

At the primary school level, Science is taught as part of the Environmental and Natural Studies. This forms an entity which contains aims and contents from Bioloay, Geography, Environmental Studies and Civics. Schools have considerable autonomy in the material included in this subject because the guidelines issued by the National Board of Education are the foundation which is then interpreted, adapted, and added to at the local level. In practice, the subject is very much Biology oriented. The existing primary school curriculum has been in operation since 1994. The content areas of Environmental and Natural Studies are: Matter and energy; Organism and their environments; The globe and its areas; Man and the environment. Only the first area includes Physics, i.e., electricity, heat, light and sound.

There are four Science subjects at the lower secondary level in Finland. They are Biology, Geography, Physics and Chemistry and they are grouped as Environmental and Natural Studies. The minimum total for Biology and Geography together is 7 curriculum hours over three years and 6 for Physics and Chemistry, respectively. In the curriculum it is said that in planning the Physics and Chemistry teaching, special attention must be paid to the fact that the learning supports understanding interdisciplinary entities. These thematic entities can be formed in different ways in natural sciences. The contents are chosen so as to support the achievement of the aims of the school and Natural Sciences as well as those of teaching Physics and Chemistry. The main contents of Physics and Chemistry have been grouped into five different themes: structures and systems; interactions; energy; processes; and the method of scientific inquiry.

The framework curriculum specifies that (at grades 3 – 7) Technical Craft and Textile Craft should be combined into one subject, which should be taught to both boys and girls throughout their entire compulsory schooling. At grades 1 – 2, Craft is more like hobby craft and at grades 8 – 9 students can choose optional courses in Technical or Textile (Handi)craft. On the other hand, Handicraft in practice is also divided in many schools into Technical Craft and Textile Craft at grades 3 – 7.

At grades 1 – 6, technological themes are also taught as part of Environmental and Natural Studies. This forms an entity containing aims and content from science and technology, environmental studies and civics. The different areas of Environmental and Natural Studies are: matter and energy; organisms and their environments; the globe and its areas; man and the environment. In grades 7 – 9, there are three science subjects, biology, physics and chemistry, as well as geography and home economics, which contain technology education. The common aims of these subjects are to give a picture of man's living environment, and the interaction between man and the environment. Moreover, they help to realise the significance of individual and collective responsibility based on knowledge of the natural sciences and technology. One central purpose of the instruction is to help students understand the significance of the natural sciences and technology as part of human culture. The instruction should develop the knowledge and skills needed when students formulate their position regarding the values and questions related to life and the surrounding world. From the point of view of technology education, physics and chemistry teaching in grades 7 – 9 gives the student the necessary material to form a picture of the world, and helps him or her to understand the purpose of natural sciences and technology as part of the culture. In addition to the traditional areas of

physics and chemistry, the curriculum in grades 7 – 9 underlines the role of environmental education, entrepreneurship education, interaction of science technology and society and the utilisation of ICT. Furthermore, physics and chemistry should give students an understanding of the phenomena and apparatus in everyday life.

During 2001 and 2002, there has been an active discussion about the role of science and technology education in Finnish compulsory education. Spokesmen from the industry side, in particular, were active and organised national seminars for developing technology education in Finnish schools and, especially, its goals and content in the curriculum. Moreover, several development projects have been started aimed at developing the curriculum and technology education. The national discussion, the results obtained from the various development projects in the field of technology education and the international discussion about the role of technology education have had an effect on the formulation of the goals and contents of technology education in the national curriculum framework for compulsory school.

Short overview of the teacher education in Finland in science and technology

In grades 1 – 6 in the compulsory schooling, almost all subjects are taught by primary school teachers trained in eight universities. The main subject of the students in the primary teacher education curriculum is general education or educational psychology. The curriculum is based on a process shifting from school practice through theoretical studies and back to teaching practice, following the idea of the teacher as a researcher. The teacher-training programme (Master of Education) covers five years' full-time studies (320 ECTS credits). Basic studies in science and technology studies account for six to ten of the 70 European Credit Transfer System (ECTS) credits, allocated for studies in all school subjects. The number of credits depends on the university. These courses include studies in subjects and in the pedagogy of subject. According to the information gathered at the University of Helsinki, 70 to 80 % of the student teachers have little or no previous knowledge or experience in the content and methods of science and technology education.

Physics, Chemistry and Biology teachers (subject teachers) (grades 7-9 in compulsory school and in upper secondary school) receive their initial training in seven universities. Studies are divided into two parts: the subject is studied at the department of the particular subject (e.g. Physics) and the pedagogical studies are at the Department of Teacher Education. These two departments plan and are responsible for the contents of Science teacher education. Science teachers always take at least one other subject, such as Mathematics or Computer Science at the university. For example, in the Physics teacher education at the University of Helsinki, the basics of Physics are studied for the first two years together with students of all physical sciences. After that students study advanced courses, which are different for Physics teacher students and other Physics students. Courses in Physics teacher education introduce the students, for example, to the central notions of physics, its epistemology and methodology and the interaction between science and technology, conceptual and processual structures of the main areas of school Physics, methods for planning and carrying out experiments and demonstrations in the Physics classroom, the history of physics and its relations to society and technology. Typical themes in technology education, like design process and creativity, are presented in passing. Moreover, students do not become familiar with different production skills and the use of tools typical of technology education. Subject teacher training takes five years on the average, and students obtain as well as M.Sc. degree, for which they need 320 ECTS credits.

Handicraft teacher education is divided amongst four universities. The aims of the studies in Technical Craft teacher education include familiarising students with the relevant terminology, materials and technology, familiarising students with the physical, psychological and social development of children and young people, giving students a knowledge of society and the sectors of business, professions and production. The duration of Handicraft as well as Science

teacher training takes five years on average, and students obtain a M.Sc. or M.Ed. degree, for which they need 320 ECTS credits. There are 35 ECTS credits for traditional woodworking and metalworking technologies with the aim of also introducing general technology education themes allocated to all 120 ECTS credits for subject studies. Although the students also become familiar with different kits designed for technology education, for example, in the field of electronics, automation and mechatronics, the general approach in Technical Craft teacher education is “design approach”. In Textile Craft teacher education, the whole emphasis is on art and design education. Moreover, Handicraft teacher education only gives a limited knowledge and the skills to integrate science aspects, like energy and energy resources, chemical and physical properties of matter, to technology education.