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**GRADE NINE STUDENTS' OPINIONS RELATING TO  
THE RELEVANCE OF SCIENCE EDUCATION**

**M.Sc. Thesis**

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# 1. INTRODUCTION

Several international meetings and conferences held in the 21<sup>st</sup> century have highlighted the need to develop science education in a way to make it relevant for students, for the needs of industry and for society. Among these are:

1. In March 2001 at an European Summit in Lisbon, Portugal, heads of state and governments highlighted the concern about sustainable economic growth with more and better jobs and greater social cohesion (European Commission, 2004).
2. XI IOSTE Symposium “Science and Technology Education for a Diverse World – dilemmas, needs and partnerships” held in Lublin, Poland, highlighted the concerns of rapid developments of science and technology education for future changes. This suggested the need to examine the aims of Science and Technology education and accompanying optimal teaching processes (IOSTE, 2004).
3. The ICASE 2003 World Conference in Science and Technology Education, held in Penang, Malaysia, recognised the critical need for increased relevance of science and technology education (ICASE, 2003).
4. At a meeting in 2001 in Uppsala, Sweden, European Ministers of Science, Research and Education, discussed current challenges and possible policy solutions for science education. An outcome was a list of 13 possible reasons for disenchantment with science and technology (Sjöberg, 2002a).
5. A World Conference on Science (1999), held in Budapest, Hungary, emphasised the unpopularity of science in schools and suggested that Governments should accord the highest priority to improving science education at all levels, with particular attention to the elimination of the effects of gender bias and bias against disadvantage groups, raising public awareness of science and fostering its popularisation (UNESCO, 2000).

The American Association for the Advancement of Science, in their publication, *Benchmarks for Science Literacy* (AAAS, 1993), identified meaningful science literacy for all persons as the foremost goal of the science education community. Why do we need such scientifically literate people? Because students of today become the

public of tomorrow and will need to make informed political decisions regarding developments in science & technology and all the other fields of science (Mattern & Schau, 2002). Also, persons who are sufficiently scientifically literate are better able to understand and participate in discussions about issues of our rapidly changing technological world (Jarvis & Pell, 2002). For youngsters to attain a high degree of scientific literacy as adults, they must be motivated to do well in science at school and encouraged to choose to take science courses as electives, usually at the beginning of their high school careers (Mattern & Schau, 2002).

Since 1990, country after country has revised its national curriculum for school science to bring it into line with a policy statement that acknowledges that science in schooling is important for every student, and not just the minority who will go on to further tertiary and career studies in the sciences (Fensham, 2004).

In fact, one of the problems with school science might be that curricula and teaching processes focus too much on the future of scientists and not on students' interests. Several research studies have shown that traditional school science content is dominating over students needs, remains unchanged in the face of societal change, and is overloaded with facts and theories taken from the past (Sjøberg, 2002a; Krajcik *et al.*, 2001; Rannikmäe, 2001). Students' perceptions of science have shown that school science has been a subject dominated by content with too much repetition and too little challenges (Fensham, 2004; Osborne & Collins, 2001). Therefore we need to consider how to change science curricula in a way which enables science education to be appropriate for all, as well as being important for students everyday life, their career perspective and also covering the needs of society and industry.

Many studies have reported that students don't see school science useful for their lives and future developments (Fensham, 2004; Osborne & Collins, 2001; Holbrook, 2003, 2001, 1998; Sjøberg, 2002a; Ramsden, 1998; Yager, 1996) and therefore less and less students (especially girls), when given a choice, engage in studies of science related subjects, and consider science and technology related careers (European Commission, 2004).

In view of these worldwide issues, science educators are still concerned about the decline of students' interest and lack of relevance in science education and towards school science (Fensham, 2004; Holbrook, 2003, 2001; Sjøberg, 2002a). Studies have indicated that students' interest and attitude towards school science are generally low (Simpson & Oliver, 1990, 1985) and there is a decline in attitude towards school science during middle or high school (Reid, 2003; Atwater *et al.*, 1995; Simpson & Oliver, 1990, 1985; Yager & Yager, 1985).

Taking note of the existing problems in science education, the following research goals have been put forward:

1. To investigate learning interests of grade nine students (what students are interested to learn about) and gender differences between girls and boys.
2. To find out grade nine students' opinions about learning in science classes (how classroom environment influences students' interest to learn through the science disciplines).
3. To determine important factors that may influence grade nine students' career choices and the degree of interest towards science related careers.
4. To develop a model describing grade nine students' opinions of relevant science education.

The following research questions are put forward for this research:

1. What learning interests do grade nine girls and boys have? Are there statistically significant differences between girls' and boys' interests towards school science?
2. What opinions do grade nine students have towards school science and do these opinions influence their interests in learning science?
3. What factors influence grade nine students' career choices and how do these vary between boys and girls?
4. Is it possible to develop a model describing grade nine students' opinions about relevant science education?

To accomplish the research questions, the current research was carried out during the 2002/2003 school year with a target group of 675 grade nine students (340 girls and 335 boys) from randomly selected 25 schools.

The data collection was carried out using part of the ROSE (The Relevance of Science Education) (Appendix 1) international comparative questionnaire to determine grade nine students' interests about school science, their perception of future career and their attitudes towards school science.

This research would not have been possible without the involvement of many nine graders who agreed to reveal their opinions about school science.

My biggest thanks goes to my supervisor, Miia Rannikmäe, who encouraged and supported me for finishing my study. I would also thank my colleagues from the Science Didactics Department for relevant comments and suggestions.

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## 2. LITERATURE REVIEW

### 2.1. Relevance in science education

#### 2.1.1. The concept of relevance

Relevance as a catchword has several meanings. For example Collins Cobuild Student's Dictionary (1990) says: 'if something is relevant, it is connected with what you are talking or writing about'. A dictionary by Silvet (2002) defines relevance as something what is pertinent, important, or meaningful. Thus relevance can be defined in several ways, depending on the context in which it is used.

A number of science educational literature studies have basically equated relevance with students' interest (Matthews, 2004; Sjøberg & Schreiner, 2002; Osborne & Collins, 2001; Hanrahan, 1998; Ramsden, 1998). However, relevance can be also interpreted as importance, usefulness or meaningfulness to the needs of the students (Levitt, 1999). A more personal interpretation of relevance was put forward by Keller (1983) who defined relevance as a student perception of whether the content or instruction satisfied her/his personal needs, personal goals and/or career goals. Johnson (1995) defined relevance as anything that motivated students to learn simply for the sake and joy of learning and it was closely linked with individual interests.

Why is the word 'relevance' so topical nowadays and to whom is it directed? A humanistic approach to school science represented many different views on relevance (Aikenhead, 1994; Bybee, 1993; Yager, 1996). For example, Mayoh & Knutton (1997) characterized relevance as having two dimensions: *Relevant to whom?* and *Relevant to what?* Fensham (2000) raised a question by asking, "*Who* decides what is relevant?". He suggested that relevance could be classified into seven categories as represented in table 1.

All the categories of relevance (except *Personal-Curiosity Science*) are directed to scientists, teachers, experts etc. whose opinions about relevant science education are quite different when comparing such opinions with those of students. For *Personal-*

*Curiosity Science*, students themselves decide on the topics of interest for school science, and relevance takes on a personal, though perhaps idiosyncratic, meaning, because students' cultural self-identities are expressed (Carlone, 2003; Brickhouse, 2001; Häussler & Hoffmann, 2000).

**Table 1. Categories of Relevance**

Type of Relevance	Who decides What is Relevant?
<i>Wish-They-Know Science</i>	Academic scientists, education officials, many science teachers
<i>Need-To-Know Science</i>	The general public who have faced and resolved real-life problems/decisions related to science and technology
<i>Functional Science</i>	People in science-based occupations
<i>Enticed-To-Know Science</i>	The media and internet sites
<i>Have-Cause-To-Know Science</i>	Experts who have interacted with the general public on real-life issues
<i>Personal-Curiosity Science</i>	Students themselves
<i>Science-As-Culture</i>	Interpreters of culture who can determine which aspects of science comprise features of a local, national, and global culture

Taking note of this, most curricula are created by people who in themselves don't know what is interesting and useful for students. Thus if we want to make science learning relevant in the eyes of students we should follow relevance of *Personal-Curiosity Science* type.

Besides the Fensham (2000) classification, relevance has been considered from three perspectives in the science educational literature (Holbrook, 2003; ICASE 2003; Osborne, 2003; Webb, 2003; Bennett, 2001; Yager, 1989), which partly overlap with the categories given in table 1:

- 1) **Personal relevance** (relevance to the perceived needs and interests of the student) – relates with the *Personal-Curiosity Science*;
- 2) **Professional relevance** (relevant to industry or student careers) – relates with the *Need-To-Know Science* or *Functional Science*;
- 3) **Social relevance** (relevant to the needs of society or the culture) – relates with *Science-As-Culture*, *Have-Cause-To-Know Science* or *Enticed-To-Know Science*.



Both classifications of relevance have similar aspects. Difference between those two appears only on the way of approach, while the context is the same.

### **2.1.2. Personal, professional and social relevance**

#### ***Relevant to students***

Relevance to students means that part of science education, which is perceived to be relevant, in the eyes of students. In this sense, students can perceive science education as relevant to themselves through three areas (Holbrook *et al.*, 2003):

- from a useful in society perspective – this means that students are more interested to learn if the context is related with societal issues or areas;
- an interest perspective – this means that students have motivation to learn or do something;
- seen as important for the course they are studying perspective – this means that the science content has to be meaningful and useful for students.

All areas of relevance have to reflect the goals of science education, which is seen as part of the total educational system (Holbrook, 2003). Scientific literacy has become increasingly a goal of science education in the last 30 years. It is suggested that school science needs to embrace STL (Scientific and Technological Literacy) as a major paradigm change. The STL philosophy is put forward to mean ‘developing the ability to creatively utilize sound science knowledge in everyday life, to solve problems, make decisions and hence improve the quality of life’ (Holbrook & Rannikmäe, 1997). Teaching based on the STL philosophy has shown to be more effective and interesting for students (Rannikmäe, 2001). It is further suggested that STL teaching needs also to meet the demands of relevance.

#### ***Relevant to industry and future careers***

Relevant to industry focuses on the ways of working by personnel in industry. This not only relates to acquisition of science conceptual skills, but also includes cooperative and collaborative skills. Industry needs skilled science personnel - not only with a sound understanding of science concepts, but also personal and social

skills. According to this, employers need to consider workers awareness and appreciation of the industry output (Holbrook, 2003). Therefore it is important to teach not only scientific concepts, but also develop social skills to manage in industry or some other domains.

On the other hand, a future concern will be the lack of highly qualified scientists. Several studies have shown (Teppo & Rannikmäe, 2004; Jarvis & Pell, 2002; Sjøberg, 2002b; Jones *et al.*, 1999) that students don't want to relate their future careers with science & technology; neither do they want to become scientists. The European Union (EU) wishes to see an increase in the science related workforce and to get more students choosing science & technology related careers (European Commission, 2004).

Thus how can school science play a better role in engaging and attracting students for science & technology related careers? It was suggested by Powell (2003) that we have to raise students' interest firstly allowing them to acquire the skills, attitudes and knowledge needed to be successful, for example, in industry and secondly teach students the history of science and technology thought.

### ***Relevant to the needs of society***

Education in science and technology is a matter of concern. International measures of achievement reveal disturbing trends in many countries and yet at the same time more and more national governments and Ministries of Education are looking to science and technology education to improve the conditions of their communities (Webb, 2003).

The needs of society depend on the development of society and inevitably with the developments in science and technology. Therefore students need to be adaptable, confident with dealing with changes and capable of making responsible decisions where socio-scientific issues arise. Thus the goals of education are interested to reflect society's will and therefore science education should follow the same goals as those of education (Holbrook, 2003).

An awareness of science and technology is important for society, and if this is to be promoted as a part of science courses, then student interest in school science must play a strong role. Society is, in essence, the guardians of the school curriculum. The society elected education officials to work on its behalf to develop the educational programs that are appropriate for society. The goals of education reflect society's will.

Therefore science education should follow the same goals as those of education (Holbrook, 2003). Thus suggestions have been forward for the renewal of the current science curriculum in order to meet the needs of modern society as expressed, for instance, in the STS (Science-Technology-Society) movement (Aikenhead, 1994, Yager, 1996) and the STL (Scientific and Technological Literacy) approach (Bybee, 1997).

### **2.1.3. How to make science learning relevant for students?**

Much has been written about the unpopularity of science in schools and the lack of relevance of science curricula. Basically the research indicates that there is a wide gap in a number of countries between what is taught in school science and what students learn (Yager, 1989). Curricula, despite their broader intentions, have maintained the acquisition of scientific knowledge as the dominant learning outcome, but have given little attention to motivational aspects of science (Fensham, 2004). Similarly Hong *et al.* (1998) suggested that the construct of the curriculum must reflect students' scientific, psychological and social needs.

Much has been written in the literature on how to make science learning more interesting, useful and meaningful for students. Holbrook (2003) suggested that this could be achieved through science education meeting one, or all, of the following three criteria:

- 1) It directly relates to concerns in the students' immediate environment or area of interest;
- 2) It is a perceived need for society;

- 3) It is shown to be an interesting and useful component of the curriculum, especially for the more able students.

But how to achieve relevance? The ICASE (2003) 'Way Forward' document suggested that this needs to be a combined effort among many stakeholders. Teachers have an important role to play in the sequencing and executing of their teaching in a relevant manner; policy makers have a responsibility for an appropriate vision for science education, and curriculum developers need to put this vision into a curriculum that reflects the defined goals.

Science academies, industry, and science centres need to appreciate and understand the vision of science education which makes science more popular in the eyes of students and to support its development (Holbrook, 2003). Science centres and museums are considered to have the potential to fulfil a major role in the informal learning of science (Lederman, 1998; Wellington 1990). Several studies have indicated the positive outcomes from visits to science centres - students became more aware of and interested in science (Rennie & Williams, 2002; Rennie & McClafferty, 1996). Thus informal learning possibilities can help to improve and promote relevant science education for students.

## **2.2. Students' interest and attitudes towards science**

### **2.2.1. Motivation**

Motivation as a term has been interpreted and defined in many ways. According to Bandura's socio-cognitive theory (1986) student motivation is neither an innate concept, nor a trait of personality, but rather a construct that is built out of individual learning activities and experiences, and that varies from one situation or context to another. Zusho & Pintrich (2003) considered that motivation could be discerned through students' reports of their beliefs as well as through behaviours such as choice of activities, level and quality of task and engagement, persistence, and performance.

Thus the concept of motivation is multidimensional and consists of different components.

### ***Theories of motivation***

Several theories exist about motivation and its components (Zusho & Pintrich, 2003; Paris & Turner, 1994; Keller, 1983). For example Keller (1983) suggested there are four motivational components:

- ***interest*** – refers to whether the learner’s curiosity is aroused, and whether this arousal is sustained appropriately over time;
- ***relevance*** – refers to the learner’s perception of personal need satisfaction in relation to the instruction, or whether a highly desired goal is perceived to be related to the instructional activity;
- ***expectancy*** – refers to the perceived likelihood of success, and the extent to which success is under learner control;
- ***satisfaction*** – refers to the combination of extrinsic rewards and intrinsic motivation, and whether these are compatible with the learner’s anticipations.

Each of the four components of this model is a category that subsumes several specific concepts or micro theories of motivation. An alternative look at motivation was put forward by Paris and Turner’s (1994) whose theory emphasized that motivation is highly personalized and there were four characteristics that influenced motivation:

- ***choice*** – defined as intrinsic value or interest;
- ***challenge*** – students are motivated when they experience success;
- ***control*** – students who have control over the learning strategies are motivated;
- ***collaboration*** – social interaction with peers affects motivation (peers can enhance students’ interest).

The Paris and Turner’s theory is helpful for explaining why students in science classrooms may be motivated to learn some topics and not others, or why students are motivated by some activities and not others.

Model of achievement motivation and learning by Zusho & Pintrich (2003) consisted of five main components:

- **Personal Characteristics** – like age, gender, ethnicity, prior knowledge;
- **Classroom Context** – includes academic tasks, reward structures, instructional methods and instructional behaviour;
- **Motivational Processes** – includes self-efficacy, task value beliefs, goal orientation and affect;
- **Cognitive Process** – consists of cognitive and self-regulatory strategies;
- **Outcomes** – like choice, effort, persistence and achievement.

The first two components of Zusho & Pintrich's model describe influences, the next two processes and last one outcomes of the motivational process. This theory is more complex and broader, embracing variety of environmental aspects than the first two aforementioned theories.

### **2.2.2. Concept of interest and attitude**

#### ***The concept of interest***

Several researchers have defined and investigated the phenomenon of 'interest'. The term 'interest' has a wide range of different meanings, for example including curiosity, motivation or attitude.

Rust (1977) has referred to interest as 'patterns of choice among alternative patterns that demonstrate some stability over time and do not appear to result from external pressures'. Gardner & Tamir (1989) have identified the term 'interest' with the preference to engage in some types of activities rather than others, regarding interest with an emotional feeling or state. They also put forward the notion that attitude variables such as enjoyment or satisfaction were not synonymous with interests.

Ramsden (1998) summarize that neither 'interest' nor 'motivation' is one-dimensional and there is a relationship between the two concepts in the way that interest is a component of motivation. Thus it is possible that a pupil to be motivated to do well in science without necessarily being particularly interested in science (Ramsden, 1998; Gardner & Tamir, 1989).

### ***The concept of attitude***

Studies in the science educational literature emphasize that the development of a positive attitude towards science should be an important goal for the school curriculum (Koballa, 1988; Laforgia, 1988).

Like ‘interest’, the concept of ‘attitude’ is also defined widely as used in the science educational literature. Oliver & Simpson (1988) have defined ‘attitude’ simply as the degree to which a student *likes* science. Salta & Tzougraki (2002) have summarized that ‘attitude’ is a tendency to think, feel, or act positively or negatively toward objects in our environment.

Oppenheim (1992) pointed out that the definition of attitudes has ‘a long and complex history’ and suggests the following interpretation, which has been acceptable to most researchers: “Attitudes are a state of readiness or predisposition to respond in a certain manner when confronted with certain stimuli. Attitudes are reinforced by beliefs (the cognitive component) and often attract strong feelings (the emotional component) which may lead to a particular behaviour intent (the action-tendency component)”.

These definitions demonstrate considerable areas of overlap between the description of ‘attitude’ and the definitions of ‘interest’ given earlier. It is clear that measurement of attitude (or interest) is unlikely to be a simple task. An attitude is an abstract concept and it cannot be measured directly and therefore the measurement of attitude needs to gather data on a variety of different aspects and then to look for underlying trends and patterns (Ramsden, 1998).

Summarizing the aforementioned, attitudes can be viewed as having three main components:

- 1) ***cognitive component*** – is a set of beliefs about the attributes of the attitudes and its assessment can be performed using paper-and-pencil tests (questionnaires);
- 2) ***affective component*** – includes feelings about objects and its assessment can be performed using psychological indices (heart rate);

- 3) ***behavioural component*** – pertains to the way people act toward objects and its assessment can be performed by directly observing behaviours (Salta & Tzougraki, 2002).

One approach to improving students' interest in science is through engaging the affective domain (Alsop & Watts, 2000). Matthews (2004) put forward that while trying to increase interest in science as such, an addition is to engage students with their emotions through the content of the science lessons, for example, by getting them to feel happy, sad, angry or improve their social and emotional skills.

### **2.2.3. Studies of students' interest and attitudes towards science**

The investigation of students' interest and attitudes towards studying school science has been a substantive feature of the work of science education research community for the past 30-40 years. Thus what are the findings regarding students' attitude and interest towards school science?

#### ***Attitudes towards school science***

Research studies have identified a number of factors influencing students' attitudes towards science in general. Most frequently, researchers have compared gender (girls *versus* boys), and/or age (primary, elementary, high school level) and/or schools' (private *versus* state schools) or peer influences towards school science.

Several studies have focused on the **relationship between students' grade level and attitudes towards science**. For example, Simpson and Oliver (1985, 1990) found that attitude towards school science becomes less positive from grades 6 through 10 and throughout each school year in those grades. Similarly, Yager & Yager (1985), Reid (2003) and Greenfield (1997) reported that positive attitudes towards school science declined, the longer students remain in school.

The relationship **between peer and individual attitudes towards science** has been investigated also (Breakwell & Beardsell, 1992; Talton & Simpson, 1985). The studies showed that the strength of the relationship increased during each school year



(from grades 6, 8 and 9); as the year progressed, individual attitudes became more like peer attitudes.

Documenting **gender differences in attitudes towards science** has long been a common focus of attitude measures. Overwhelmingly, the results have shown that boys' attitudes are significantly more positive than girls' attitudes towards school science (Francis, 2002; Stark, 1999; Ramsden, 1998; Havard, 1996; Hendley *et al.*, 1996; Weinburgh, 1995; Colley *et al.*, 1994; Breakwell & Beardsell, 1992; Simpson & Oliver, 1990, 1985; Johnson, 1987; Yager & Bonnstetter, 1984).

These positive attitudes for boys have not always been evident when the populations have been subdivided further. For example, Greenfield (1997) found that elementary school (grade 4-6) girls liked science more than boys of a similar age. Whereas both groups' interest levels declined during intermediate school (grades 7-8), boys' interest rose again during high school (grades 9-12), but the interest of girls didn't. Similarly, Weinburgh (1995) found that high-performance girls showed more positive attitudes than did boys at all levels.

### ***Subject preference studies***

Subject preferences of students have been an extensively investigated domain in science education. The typical measurement of attitudes towards school science can be obtained by asking pupils to rank their liking of school subjects, or just to name the most and the least favourite subject.

One of the earliest studies carried out by Whitfield (1980) indicated that physics and chemistry were two of the least popular science subjects, while biology and geography were the most popular for post 14 years old students. A more recent study by Colley *et al.*, (1994) using a sample of 11-13 years-olds indicated that boys gave significantly higher rankings to physics education and science than girls, while girls gave significantly higher rankings to English. The investigation of attitudes of 4023 Key Stage 3 pupils (age 13-14) in the UK towards mathematics, English, science and technology carried out by Hendley *et al.*, (1995) indicated that out of these four core subjects, science was the least popular. Boys expressed a more positive attitude towards mathematics, science and technology, while girls' preferred English.

Lannes and his colleague's study (2002) with 2302 Brazilian elementary (10-15 years old) and high school (15 –19 years old) students indicated that high school students preferred to study biology the most.

A study by Lamanuskas *et al.*, (2004) investigated grades 11 and 12 Lithuanian and Latvian students' interest towards natural science subjects. The results indicated that girls in both countries were more interested in biology and geography while boys in physics. The results showed also that chemistry was the least popular subject.

Going further, a study by Salta & Tzougraki (2004) investigated 11<sup>th</sup> grade Greek students' attitudes regarding the difficulty, interest, and usefulness of the chemistry course. The results indicated that the significant difference between boys' and girls' attitudes towards the chemistry course were only at the level of difficulty; girls held a less positive attitude than boys. The results showed also that students believed the chemistry course was not useful for their future career, but recognized the importance of chemistry in their lives.

### ***Students' interest towards science topics***

Most studies have investigated students' interest towards all science topics (Dawson, 2000). Not many studies have been carried out to investigate students' interest towards chemistry, physics, geography or biology as separate entities.

More recent studies have recognized that gender differences in interest cannot be simply categorized on the basis of physical science versus biology, and topics need to be looked at individually in terms of their perceived relevance to the respondents (Qualter, 1993). He suggested it was important to investigate boys' and girls' interests towards science topics separately.

One of the recent studies carried out by Reid (2003) investigated boys' and girls' interest towards 12 topics related with physics themes. The results showed that girls were much more drawn to those topics that were perceived to have high social relevance (for example 'how to solve the world food problems', 'why we usually have a rainbow after rain' or 'why the use of X-rays can be harmful for the human

body', etc.), while boys tended to be more attracted to those themes, which were perceived to have a high mechanical or practical relevance (like 'how to understand the way electrical equipment works' or 'how can we increase the power of the car engine').

More studies have investigated students' interests towards biology topics (Gardner & Tamir, 1989; Hong *et al.*, 1998). For example, Hong *et al.*, (1998) investigated Korean middle school students' interests towards 64 biological topics. The results indicated that the highest interest domain was genetics and the lowest, plant morphology. A study by Gardner & Tamir (1989) indicated similar results - students showed greater interest towards genetics, while the lowest interest was towards plants.

The results from the SAS-study indicated that girls were more interested in learning about health, nutrition and most aspects of biology than boys (Sjøberg, 2002b). It showed also that the least popular things to learn about were related with content like plants and animals, while the most popular ones with spectacular or natural phenomena.

### **2.3. International projects connected with relevance in science education**

Students' interest, attitudes or perceptions towards school science have been researched from different points of view. International large-scale studies like TIMSS (Third International Mathematics and Science Study) (TIMSS, 1999; 2003), or PISA (The Program for International Student Assessment) investigate and assess students' knowledge and/or skills in mathematical and scientific literacy (OECD, 2001).

Smaller and less ambitious comparative studies like SAS (Science and Scientists) and ROSE (The Relevance of Science Education) provide information about students S&T-related out-of-school experiences, their interests in learning different S&T topics, opinions about school science, their views and attitudes towards science and scientists in society, their future hopes etc. (Sjøberg, 2002b,c).

### ***Science and Scientists: The SAS-study***

The SAS-study is an international collaborative project with the objective to investigate students' interests and experiences related with S&T, their priorities for future careers and their perception of science and scientists. The SAS-study also emphasised the rationale that science curricula should be relevant and meaningful for pupils in different cultures, and the content of school science and technology needs to be adapted to the culture and context (Sjøberg, 2002a,b).

Several results based on the SAS-study have been reported by Sjøberg (2002c) and by Jones *et al.*, (2000). The results indicated significant gender differences between girls and boys in science experiences, attitudes, and perceptions of science courses and careers. For example, Sjøberg (2002c) reported differences between developed and developing countries students' interest, attitudes and perceptions:

- For students in developed countries, the least popular things to learn about seems to be issues relating to plants and animals, while children in developing countries expressed the interest in learning almost all topics related to S&T;
- Students in developing countries have a very positive image of scientist and this is expressed in a variety of ways. At the same time students in developed countries have negative and stereotyped image of scientists.
- Girls in all countries were more person-oriented (helping people, working with people etc.), while boys were more ego-oriented (earn money, become famous etc.).
- In all countries, boys had considerably more experiences related with mechanics and electricity, while girls held greater experiences with household activities (knitting, sewing, cooking etc.).

### ***ROSE: The Relevance of Science Education***

ROSE is another international comparative research project meant to shed light on factors of importance to the learning of science and technology – as perceived by the learners. ROSE is a further development of the SAS study with the objective to investigate 15-16 years old students' experiences, interests, priorities, images and perceptions that are of relevance for their learning of S&T and their attitudes towards

the subjects from a wide range of countries all over the world (Sjöberg & Schreiner, 2002).

The ROSE instrument consists of seven different sections - in total comprising 250 items, answered on a 4-point Likert-type scale (except parts I and J) with categories ‘Not interested – Very interested’, ‘Disagree’ – ‘Agree’ and ‘Not important’ – ‘Very important’ (Appendix 1). Table 2 gives the simple description and overview of each section of the instrument.

**Table 2. An overview of different parts of the ROSE instrument**

<b>Section</b>	<b>Title</b>	<b>Description</b>
<b>A, C, E</b>	<b>‘What I want to learn about’</b>	This part gives information about the extent students are interested in learning about the given science topics.
<b>B</b>	<b>‘My future job’</b>	This part provides information about students’ potential future occupation or job based on the extent they find the given statements important or unimportant.
<b>D</b>	<b>‘Me and the environment’</b>	This part gives an overview about student’s agreements and disagreements related with the environmental problems.
<b>F</b>	<b>‘My science class’</b>	This part provides information about students’ opinions regarding their school science.
<b>G</b>	<b>‘My opinions about science and technology’</b>	This part of the instrument gives information on the extent to which students agree or disagree with the statements about science and technology.
<b>H</b>	<b>‘My out-of-school experiences’</b>	This part gives an overview about students’ out-of-school experiences in relation to how often they have done the given activities outside school.
<b>I</b>	<b>‘Myself as a scientist’</b>	Open written response where students are asked to write a few sentences about what they would like to do as a researcher and why.
<b>J</b>	<b>‘How many books are there in your home?’</b>	This part provides information about the books that students have in their home.

The ROSE instrument has been used in several countries all over the world for different purposes. For example, Jidesjö & Oscarsson (2004) have investigated Swedish students’ attitudes and interest towards school science. They reported that

both Swedish girls and boys showed the highest interest towards space and life in other planets in the universe. However, the most favourable items for girls related with health, fitness, dreams and occultism, while boys displayed a keen interest in cosmology, technology and the human body.

Studies from Alonso & Manassero Mas (2004) and Schreiner & Sjøberg (2004) investigated students' opinions about environmental challenges. Both surveys indicated students' positive attitude towards the need for environmental protection and solutions to environmental problems. According to this, Japanese students showed rather sound attitudes towards environmental issues (Ogawa & Shimode, 2004).

A survey by Trumper (2004), based on ROSE, investigated Israeli students' interest in physics and its relation to their attitudes towards science and technology and to science classes. It became evident that boys showed higher interest towards physics items than girls. He reported also that students' attitudes towards their science classes were generally low, while boys showed significantly more interest than girls. Interesting finding became evident also for Israeli students' opinions about science and technology which were somewhat higher than their attitudes towards school science and that students' middle interest towards physics correlated negatively with attitudes.

In summary, it is possible to say that students' interest, attitudes or opinions related with science & technology have a lot of similarities between countries, but on the other hand, several differences exist depending highly on the culture, economical and social development of state, educational system etc. Therefore relevance of school science in the eyes of students in different countries is not the same.

### ***TIMSS and PISA as the large-scale studies***

The need for international comparative studies in education is important and needful. TIMSS (Third International Mathematics and Science Study) and PISA (The Program for International Student Assessment) are large-scale studies with the objective to compare students' attitudes, interests, knowledge or skills towards science and mathematics from wide range of countries.

TIMSS (Third International Mathematics and Science Study) is the largest and ambitious international study with the purpose to collect data from the fourth and eighth grade students' attitudes about mathematics and science in different countries. Conducted on a four-year cycle, the first round of TIMSS was in 1995 and the second in 1999 (TIMSS, 1999; 2003).

PISA's aim is to measure how well students perform beyond the school curriculum towards three literacy domains - reading literacy, mathematical literacy and scientific literacy (OECD, 2001). In contrast to TIMSS, the underlying framework for PISA is not bound to school curricula (Sjøberg, 2002a).

Harlen (2001) has put forward the main points that distinguish PISA from the TIMSS study and justified a further survey:

- It comprises a program of surveys, not a single one-off event; the ability to provide comparable data from one survey to another is built in;
- It is concerned with the outcomes of the whole of basic education given to students during the years of compulsory education; therefore it assesses students at the end of this period, aged 15;
- What is assessed is not restricted to the common core of what is taught in participating countries but rather to a common view of what the education system should provide to prepare its future citizens for adult life and for life-long learning;
- It assesses skills and knowledge in the context of extended units designed to reflect real-life contexts rather than performance in isolated test items;
- It will go beyond providing indicators of educational outcomes to supporting policy analysis;
- As the program develops it will attempt to assess cross-curricular competencies and explore how self-regulated learning can be included.

Nonetheless, TIMSS and PISA do have several common characteristics, like:

- TIMSS and PISA are both high-level initiatives 'from the top' monitor scholastic achievement for satisfying or informing interests of Ministries of Education;

- Main results are published as rankings or league tables;
- The studies are also confined to rich countries in the OECD, but in the most countries are initiated and heavily funded by governments and Ministries of Education (Sjøberg, 2002a).

There has been much argument whether TIMSS and PISA are good for measuring students' knowledge or attitudes towards science and mathematics in such a variety of countries. Sjøberg (2002a) argued that international and cross-cultural studies, such as TIMSS has necessarily required the development of test items that can be used independently of educational or social context in an attempt to avoid 'cultural bias'. Going further, he considered that this approach runs contrary to recent thinking about teaching, learning and curriculum development, in which personal and contextual relevance is emerging as a key educational concern.

Summarizing, it is possible to say that large-scale studies like TIMSS and PISA are relevant for the needs of science, while ROSE and SAS are based on relevance in the eyes of students.



## **3. METHODOLOGY**

### **3.1. Stages of research**

The main goal of this study was to determine relevant science education for Estonian grade nine students, both girls and boys. To accomplish the research goal, the current study was carried out in the following four stages:

1. Formulating a representative sample of Estonian grade nine students.
2. Preparation of the instruments (translation, validation and piloting).
3. Using the instruments to determine grade nine students' interests, both girls and boys, towards science learning, their opinions about school science and perceived priorities towards future career (Appendix 1).
4. Handling results.

### **3.2. Sample**

The research was carried out during the 2002/2003 school year with Estonian grade nine students. The target group of students was age 15-16. This is, in Estonia, the last year students attend lower secondary school, and it is the end of compulsory schooling. Grade nine is the year where important educational choices and other forms of selection related to students' future career take place.

At the beginning of the 2002/2003 school year, there were approximately 14 535 grade nine students in 526 Estonian-speaking schools (Statistical Office of Estonia, 2004). From these, 25 Estonian-speaking secondary or basic schools were randomly selected from the database of the Estonian Ministry of Education and Research and the headmaster was invited to involve the school as part of the research study. Students were taken to be a random representative sample of Estonian grade nine students.

In March 2003, questionnaires from an international project ROSE (The Relevance of Science Education) were sent directly to the headmasters in each of the 25

participating schools. The questionnaire was administered to one nine-grade class selected by the school in which the research was carried out. Attached to the questionnaires was a letter giving guidance instructions for administering the questionnaires. Completing the questionnaires was anticipated to take approximately 45 minutes (one lesson).

The representative sample included 675 (340 girls and 335 boys) Estonian grade nine students from 25 schools.

### **3.3. Preparing the Instrument**

The instrument for the current study was based on the following sections of the international ROSE instrument – “What I want to learn about”, “My future job” and “My science classes” (Appendix 1). However several new items were added and in some cases the wording of items was modified to better suit the Estonian situation.

As this instrument had not been used in Estonian schools before, the questionnaire was first translated into Estonian and then translated back to English. The translation was validated by two researchers and three Estonian science teachers. Before final use, the instrument was also piloted by 32 grade nine students from one Estonian school. After considering the comments or misunderstandings of students, the final version of the instrument was drawn up (Appendix 1a).

There was a need to interpret the meaning of science for Estonian students. During the pilot it was found that, as chemistry, biology and physics are taught as separate school subjects, students when answering science related items, often focussed their opinions related to one school subjects - biology, due to phonetical similarities between the terms in Estonian. Due to this finding, all teachers who administered the questionnaires were asked to give appropriate instruction to students.

### **3.4. Using the questionnaire**

Based on the research goals for the current study, only three domains were developed based on 5 sections of the total ROSE study:

- 1) **Domain A comprising Sections A, C and E from ROSE** (“What I want to learn about”) from the ROSE instrument was used to find out students’ interests towards school sciences.
- 2) **Domain B comprising Section B from ROSE** (“My future job”) from the instrument was used to determine the factors that influences students’ future career choices;
- 3) **Domain C comprising Section F from ROSE** (“My science classes”) was used to find out grade nine students’ attitudes towards school science.

Other sections were not considered relevant to the research goals and were disregarded.

### **3.5. Handling the Results**

For statistical analysis, responses to the most negative statements (disagree, not interested, not important) were coded with 1 and the most positive responses (agree, very interested, very important) with 4. Responses to the intermediate statements were coded accordingly with 2 (more negative) or 3 (more positive). This meant that the neutral middle point, the 'Do not know' category, was omitted. However, in the introduction to each question it was stated that students might refrain from ticking any boxes if they did not know how to answer. Any ‘no response’ was coded as 9.

The 2 Independent Samples (Mann-Whitney U-test) test was used to determine statistically significant differences between means of the responses given by girls and boys. Differences between means of student responses per school were examined with nonparametric statistics from the K Independent Samples (Kruskal-Wallis) test. Standard deviations (SD) were given to indicate the distribution of responses from the mean results for Likert type scale scores. The data was analysed by using the SPSS and Microsoft Excel programs.

As the domain “**What I want to learn about**” consisted of 108 items, further classification was needed to group the items. This domain was divided into 9 sub-domains - five traditional science subjects (physics, biology, human study, chemistry and earth science) and four cross-curriculum subjects (technology, science &

scientists, environment and exceptional phenomena) based on Estonian curriculum (Põhikooli ja gümnaasiumi riiklik õppekava, 2002) and elementary science textbooks.

The cross-curriculum subjects consisted of those items that:

- 1) were discussed in different disciplines through the whole schooling, or
- 2) don't relate directly with Estonian science curriculum, neither were they included in science textbooks. Subjects like biology and physics were again divided into sub-categories and therefore the analysis of the results was made based on those. The classification of the items into subject areas is shown in table 2.1, given in appendix 2.

The validation of the sub-domains and sub-categories was undertaken by three different science teachers.

The items in the domain “**My future job**” were grouped using factor analysis. This part was also analysed for comparing students' interest and future career priorities. A deeper overview of the factor analysis is given in the results chapter.

The domain “**My science classes**” was analysed item-by-item by comparing the means between girls and boys and between schools. The items were also analysed by comparing with other domains, such as ‘What I want to learn about’.

Reliability for those three parts of the instrument was determined by calculating internal consistency - Cronbach's  $\alpha$  coefficient indicated the value of 0,97.

To develop the model of relevant science education, correlation and factor analyses were attempted across all questionnaire items.

## 4. RESULTS

### 4.1. Students' interest towards school science

Students' interest towards science is analysed in four areas:

- 1) Students' interest based on traditional school-science content (biology, chemistry, physics, earth science and human study) and cross-curriculum subject content (technology, science & scientists, environment, exceptional phenomena);
- 2) Students' interest related to the style of presentation of the items (daily life-student-oriented, or school-subject-oriented context);
- 3) Differences in students' interests between the schools;
- 4) The most popular and unpopular items for students (single item analysis);

#### 4.1.1. Students' interest towards science subjects

Table 3 indicates the differences between girls' and boys' interests in science. The results show that boys are more interested in physics as a school subject than girls, especially with respect to electricity and nuclear physics. Girls' interests towards school physics are quite low (mean less than 2,5), except for astronomy. At the same time, biology and human study are more interesting for girls (mean greater than 2,5) than for boys (mean less than 2,5). Standard deviations are similar in most cases and confirm the areas of interest. Whereas a high standard deviation (0,87) for the sub-category nuclear physics is shown among boys and girls, the least deviation occurs with the sub-domain of human study for boys (0,53).

The least interesting school subject, in the eyes of girls and boys, is chemistry, although boys show the least interest in learning about the sub-category of botany. There are also differences in gender interests for sub-categories; for example, girls dislike electricity, while boys are less interested in learning about light.

Table 3 also illustrates statistically significant differences between girls' and boys' interests towards cross-curriculum subjects. For example, grade nine girls are most interested in exceptional phenomena, while boys show a preference towards

technology. Nevertheless, exceptional phenomena are popular among all students (mean greater than 2,5), whilst environment related issues are little valued in the eyes of all students (mean less than 2,5).

**Table 3. Boys' and girls' interest towards science**

Subject	Mean*(SD)			Gender differences in means	p
	Girls N=340	Boys N=335	All N=675		
<b>1. Physics</b>					
Astronomy	2,79 (0,66)	<b>2,83</b> (0,63)	<b>2,81</b> (0,65)	-0,04	0,50
Light	2,40 ( <b>0,59</b> )	<b>2,21</b> (0,58)	2,31 (0,59)	0,19	<0,001***
Electricity	<b>2,12</b> (0,64)	2,67 (0,68)	2,40 (0,71)	<b>-0,55</b>	<0,001***
Acoustics	2,31 (0,69)	<b>2,22</b> (0,69)	2,27 (0,69)	0,09	0,10
Nuclear physics	2,20 ( <b>0,82</b> )	<b>3,01</b> (0,72)	2,61 ( <b>0,87</b> )	<b>-0,81</b>	<0,001***
<b>2. Biology</b>					
General biology	<b>2,85</b> (0,61)	2,52 (0,56)	<b>2,69</b> (0,60)	0,33	<0,001***
Zoology	2,63 (0,64)	2,48 (0,58)	2,56 (0,62)	0,15	0,002***
Botany	2,14 (0,64)	<b>1,94</b> (0,56)	<b>2,04</b> (0,61)	0,20	<0,001***
<b>3. Human study</b>	<b>2,97 (0,59)</b>	2,41 ( <b>0,53</b> )	<b>2,69</b> (0,63)	<b>0,56</b>	<0,001***
<b>4. Earth science</b>	2,38 (0,61)	2,38 (0,59)	2,38 (0,60)	0,00	0,95
<b>5. Chemistry</b>	<b>2,09</b> (0,60)	2,29 ( <b>0,55</b> )	<b>2,19 (0,59)</b>	-0,20	<0,001***
<b>6. Technology</b>	2,16 (0,60)	<b>2,68</b> (0,59)	2,42 (0,65)	<b>-0,52</b>	<0,001***
<b>7. Science and scientists</b>	2,29 (0,73)	2,34 (0,63)	2,32 (0,68)	-0,05	0,34
<b>8. Environment</b>	2,17 (0,70)	2,28 (0,64)	2,23 (0,67)	-0,11	0,03**
<b>9. Exceptional phenomena</b>	<b>2,99</b> (0,67)	2,52 ( <b>0,78</b> )	<b>2,76 (0,77)</b>	<b>0,47</b>	<0,001***

\* Likert style responses ranging from “not interested” to “very interested” were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,01 level of confidence (2-tailed)

\*\*\* Significant difference at the 0,05 level of confidence (2-tailed)

#### 4.1.2. Students' interest related to the style used in developing the item

Some items in the questionnaire are presented in the form of statements, some as questions or problems/issue based activities. Table 3 shows that areas of concern (low interest exhibited by students) are related to traditional school subjects, but not so much related to cross curriculum domains. Noting this, the items describing the traditional science subjects are divided into two groups against the style used in developing the items – school-subject-oriented (usually following the textbook headings style) and daily-life-related (connected with social and students' everyday life). Division of items towards these groups are shown in table 2.2. in appendix 2.

Table 4 indicates the distribution of students' interest towards school subject-based and daily life connected items (issues). Grade nine girls and boys have higher means scores towards daily-life-oriented items, than subject-oriented ones. For example major differences occur in the mean scores for chemistry, electricity, astronomy and acoustics between subject-oriented and students-related items. Those differences were statistically significant ( $p < 0,001$ ).

Based on the results from table 4, it is possible to consider that students in the ninth grade are more interested about student related issues than purely subject-oriented topics. It seems, therefore, important for textbook writers to consider the titles of their various sections for attracting students to study school science.

**Table 4. Students' interest related to the presentation-style of the items**

Subject	School-subject-oriented items			Daily-life-oriented items		
	Girls Mean*SD	Boys Mean*SD	Total Mean*SD	Girls Mean*SD	Boys Mean*SD	Total Mean*SD
<b>1. Physics</b>						
Astronomy	2,72 (0,68)	2,75 (0,65)	2,73 (0,66)	<b>3,32</b> (0,89)	<b>3,35</b> (0,91)	<b>3,34</b> (0,90)
Light	2,22 (0,65)	2,32 (0,61)	2,27 (0,63)	<b>2,62</b> (0,68)	2,05 (0,68)	<b>2,34</b> (0,74)
Electricity	1,90 (0,71)	2,51 (0,75)	2,20 (0,79)	<b>2,77</b> (0,92)	<b>3,09</b> (0,89)	<b>2,93</b> (0,92)
Acoustics	2,09 (0,94)	2,05 (0,96)	2,07 (0,95)	<b>2,42</b> (0,76)	<b>2,30</b> (0,76)	<b>2,36</b> (0,76)
Nuclear physics	2,08 (0,89)	<b>3,14</b> (0,80)	<b>2,61</b> (0,99)	<b>2,43</b> (0,98)	2,75 (0,91)	2,59 (0,96)
<b>2. Biology</b>						
General biology	2,78 (0,66)	2,48 (0,67)	2,63(0,68)	2,78 (0,59)	<b>2,54</b> (0,51)	<b>2,64</b> (0,57)
Zoology	2,63 (0,64)	2,48 (0,58)	2,56 (0,62)	-	-	-
Botany	2,14 (0,64)	1,94 (0,56)	2,04 (0,61)	-	-	-
<b>3. Human study</b>	-	-	-	2,97 (0,59)	2,41 (0,53)	2,69 (0,63)
<b>4. Earth science</b>	2,38 (0,61)	2,38 (0,59)	2,38 (0,60)	-	-	-
<b>5. Chemistry</b>	1,98 (0,62)	2,28 (0,58)	2,13 (0,62)	<b>2,53</b> (1,03)	<b>2,33</b> (0,99)	<b>2,43</b> (1,02)

\* Likert style responses ranging from “not interested” to “very interested” were ranked from 1 to 4 respectively.

#### **4.1.3. Students' interest differences between the schools**

Table 2.3 (appendix 2) indicates differences in students' interest between schools towards science subjects. The biggest differences in mean values were found for nuclear physics (0,87), exceptional phenomena (0,77), electricity (0,71) and acoustics (0,69). At the same time, there is little difference for light (0,59), chemistry (0,59), earth science (0,60) and general biology (0,60). The last mentioned subjects have also significant differences between schools. The less diverse interest towards chemistry has schools number 5, 9, 10, 16, 19, 23 (SD is less than 0,50 in each school); schools 5 (0,46), 16 (0,44), 18 (0,48) towards light and schools 7 (0,48), 13 (0,47) and 23 (0,44) towards general biology. As those named schools belong to different types of schools therefore it is not possible to make similar conclusions.

It is seen that there are remarkable mean scores distributions between schools towards science subjects. For example the topic of nuclear physics has the largest students' interest within and between schools. At the same time, subjects like chemistry, general biology, earth science and the topic of light have the smallest distributions of means. This tends to indicate that the students' interest is quite homogenous towards these subjects within schools.

Students in some schools have more homogeneous interest towards all the science subjects than in others. For example, students from school numbers – 2, 16, 18, (total SD less than 0,63 within each school) have very similar interest towards all science subjects, whereas students from school 3 (total SD within school 0,80) are the most diverse in their interests. All the named schools belong to the small towns or countryside group of schools.

#### **4.1.4. Students' interest towards single science items**

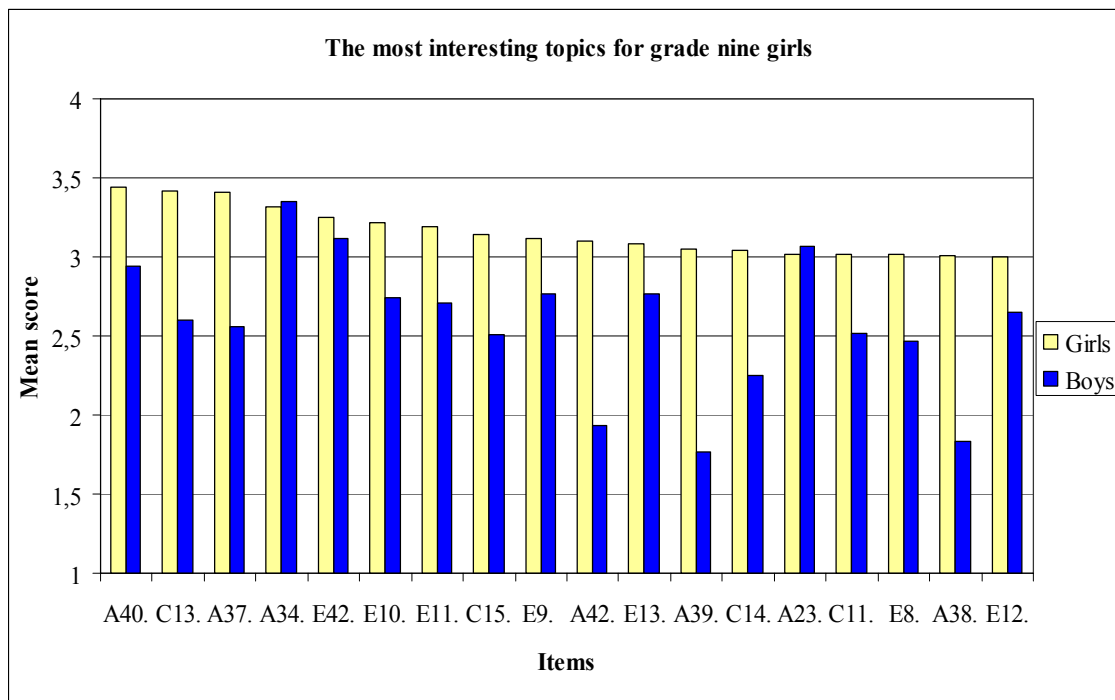
To find out in which items students' are interested the most and the least (table 2.4., appendix 2), student responses to the Likert type scale questionnaire were divided into three interest levels:

- high interest (mean >3)
- average interest (2 < mean < 3) and
- low interest (mean < 2)



Figure 1 shows that girls are highly interested in all items, which are connected with human physical nature (body, health, sexuality, diseases, etc) and in exceptional phenomena (dreaming, witches and ghosts, thought transference, mind-reading, sixth sense, intuition, etc.) which by and large are linked with mental, not scientific explanations of the nature of human beings.

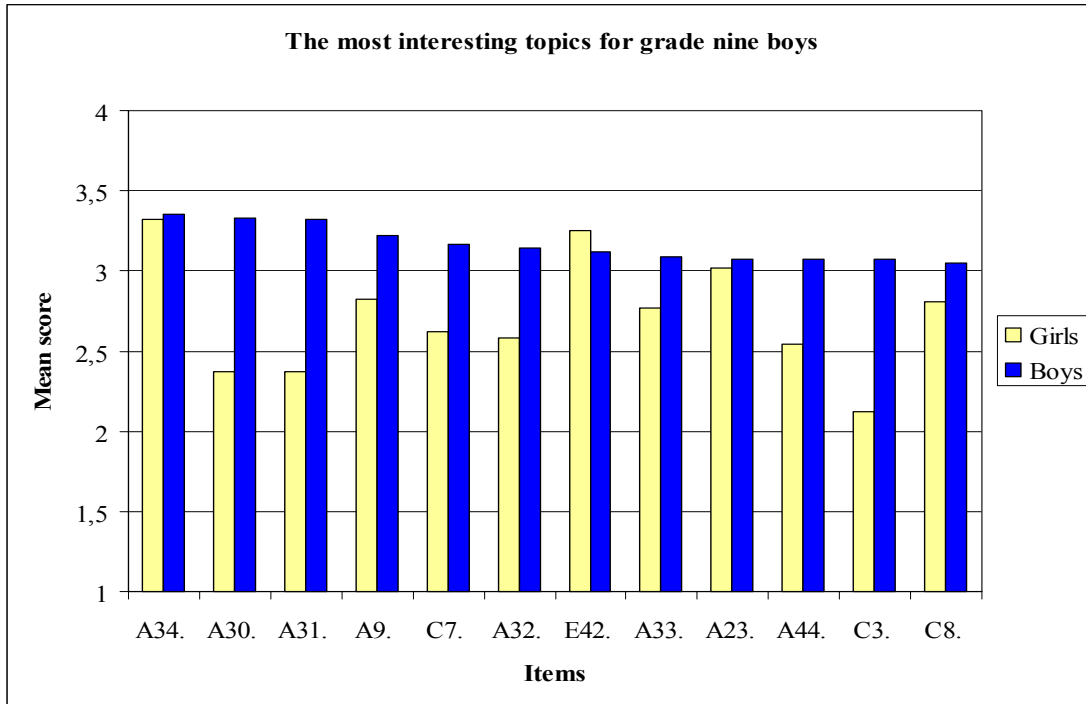
For boys, the most interesting topics relate to technological problems (computers, the use of lasers) and risk or danger-considered issues (atom bomb, explosive chemicals, meteors and comets etc) (Figure 2).



**Figure 1. The most interesting topics for grade nine girls comparing with boys**

A40. How to exercise to keep the body fit and strong, C13.Why we dream while we are sleeping, and what the dreams may mean, A37. What to eat to keep healthy and fit, A34.How it feels to be weightless in space, E42. Phenomena that scientists still cannot explain, E10.How to perform first-aid and use basic medical equipment, E11.What we know about HIV/AIDS and how to control it, C15.Thought transference, mind-reading, sixth sense, intuition, etc., E9.Sexually transmitted diseases and how to be protected against them, A42.How radiation from solariums and the sun might affect the skin, E13.How different narcotics might affect the body, A39.The ability of lotions and creams to keep the skin young, C14.Ghosts and witches, and whether they may exist, A23.How meteors, comets or asteroids may cause disasters on earth, C11.Life and death and the human soul, E8.Cancer, what we know and how we can treat it, A38.Eating disorders like anorexia or bulimia, E12.How alcohol and tobacco might affect the body.

Figure 1 and 2 indicates that items A23, A34 and E42 are interesting both for boys and girls – these items go beyond traditional school science and are heavily related to the modern technological world and expectation with the life in space.

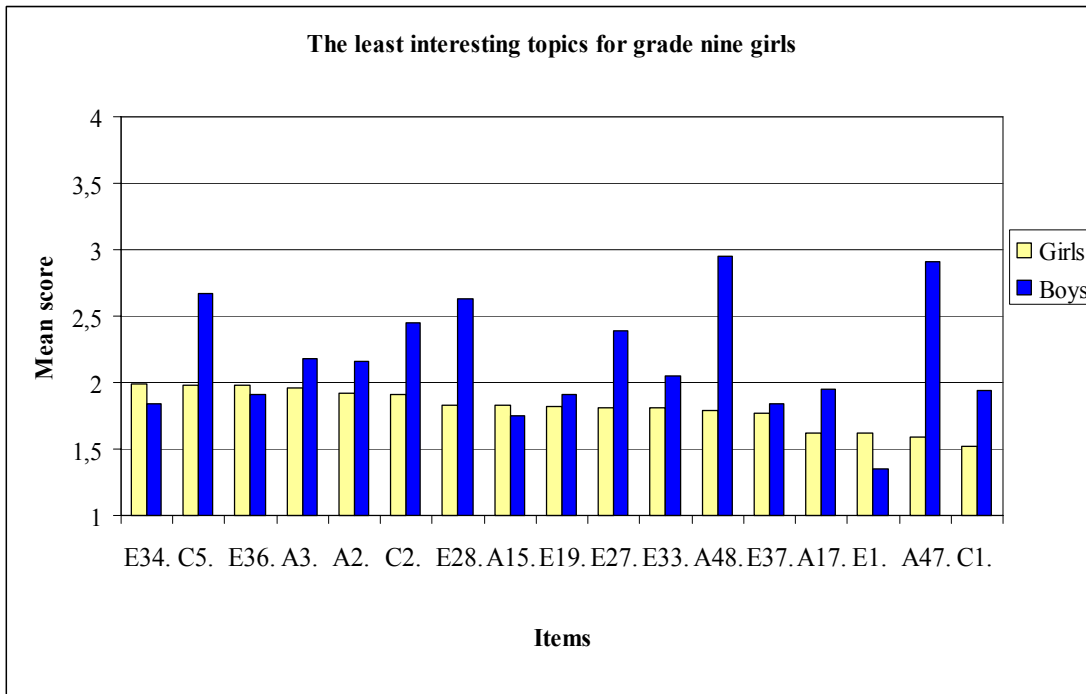


**Figure 2. The most interesting topics for grade nine boys comparing with girls**

A34. How it feels to be weightless in space, A30.How the atom bomb functions, A31.Explosive chemicals, A9. Sex and reproduction, C7.How computers work, A32.Biological and chemical weapons and what they do to the human body, E42.Phenomena that scientists still cannot explain, A33.The effect of strong electric shocks and lightning on the human body, A23.How meteors, comets or asteroids may cause disasters on earth, A44.Rockets, satellites and space travel, C3.The use of lasers for technical purposes (CD-players, bar-code readers, etc.), C8.The possibility of life outside earth.

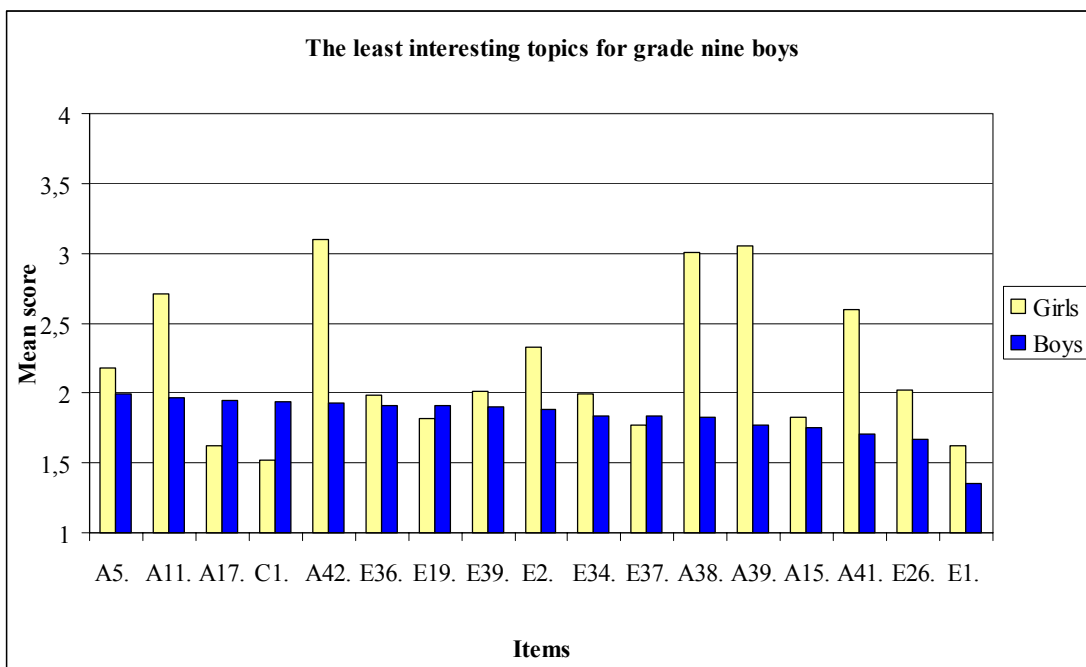
Figure 3 indicates that girls have low interest mostly towards technological items that are related to applications of knowledge (the working of petrol and diesel engines, crude oil converting) and towards traditional school subject items (inside of the earth, chemicals, atoms and molecules, electricity etc). At the same time, boys show the lowest interest towards human study (eating disorders, plastic surgery and cosmetic surgery, lotions and creams, babies growth and mature) (Figure 4).

The mean values for items differ between boys and girls and emphasise the need for considering gender differences in the teaching of science.



**Figure 3. The most uninteresting topics for grade nine girls**

E34. Why religion and science sometimes are in conflict, C5. How things like radios and televisions work, E36. Why scientists sometimes disagree, A3. The inside of the earth, A2. Chemicals, their properties and how they react, C2. Optical instruments and how they work (telescope, camera, microscope, etc.), E28. How to use and repair everyday electrical and mechanical equipment, A15. How plants grow and reproduce, E19. Organic and ecological farming without use of pesticides and artificial fertilizers, E27. Electricity, how it is produced and used in the home, E33. Benefits and possible hazards of modern methods of farming, A48. How a nuclear power plant functions, E37. Famous scientists and their lives, A17. Atoms and molecules, E1. Symmetries and patterns in leaves and flowers, A47. How petrol and diesel engines work, C1. How crude oil is converted to other materials, like plastics and textiles.



**Figure 4. The most uninteresting topics for grade nine boys comparing with girls**

A5. Clouds, rain and the weather, A11.How babies grow and mature, A17.Atoms and molecules, C1.How crude oil is converted to other materials, like plastics and textiles, A42.How radiation from solariums and the sun might affect the skin, E36.Why scientists sometimes disagree, E19.Organic and ecological farming without use of pesticides and artificial fertilizers, E39.How scientific ideas sometimes challenge religion, authority and tradition, E2.How the sunset colours the sky, E34.Why religion and science sometimes are in conflict, E37.Famous scientists and their lives, A38.Eating disorders like anorexia or bulimia, A39.The ability of lotions and creams to keep the skin young, A15.How plants grow and reproduce, A41.Plastic surgery and cosmetic surgery, E26.Detergents, soaps and how they work, E1.Symmetries and patterns in leaves and flowers.

## 4.2. Students' career priorities

### 4.2.1. Students' opinions towards career items

Grade nine girls and boys both indicated that the most important aspect for their future career is to earn lots of money (total mean 3,50). The least important aspects for girls in their future careers are: to use one's hands for building or repairing objects (1,78) and to work with machines or tools (1,78). The least important for boys are working with animals (1,83), in the area of environmental protection (1,88) and working artistically or creatively in art (1,86) (Table 5).

**Table 5. Students' opinions about their future career**

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
B1. Working with people rather than things	3,08	0,85	2,45	0,90	2,77	0,93	<b>0,63</b>	<0,001***
B2. Helping other people	3,09	0,75	2,68	0,80	2,89	0,80	0,41	<0,001***
B3. Working with animals	2,26	0,95	<b>1,83</b>	0,82	2,05	0,91	0,43	<0,001***
B4. Working in the area of environmental protection	2,01	0,94	<b>1,88</b>	0,94	1,94	0,94	0,13	0,08
B5. Working with something easy and simple	2,01	0,88	2,14	0,90	2,07	0,89	-0,13	0,05
B6. Building or repairing objects using my hands	<b>1,78</b>	0,88	2,37	0,92	2,07	0,95	<b>-0,59</b>	<0,001***
B7. Working with machines or tools	<b>1,78</b>	0,84	2,57	0,96	2,18	0,98	<b>-0,79</b>	<0,001***
B8. Working artistically and creatively in art	2,47	1,05	<b>1,86</b>	0,93	2,17	1,04	0,61	<0,001***
B9. Using my talents and abilities	<b>3,47</b>	0,71	3,25	0,82	3,36	0,77	0,22	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
B10. Making, designing or inventing something	2,93	1,01	2,93	0,93	2,93	0,97	0,00	0,96
B11. Coming up with new ideas	3,11	0,88	3,06	0,88	3,09	0,88	0,05	0,45
B12. Having lots of time for my friends	<b>3,23</b>	0,82	3,16	0,81	3,19	0,82	0,07	0,24
B13. Making my own decisions	3,00	0,80	2,79	0,82	2,90	0,82	0,21	0,001***
B14. Working independently of other people	1,91	0,88	1,91	0,86	1,91	0,87	0,00	0,94
B15. Working with something I find important and meaningful	<b>3,56</b>	0,67	3,06	0,87	3,31	0,82	<b>0,50</b>	<0,001***
B16. Working with something that fits my attitudes and values	<b>3,36</b>	0,72	2,81	0,81	3,09	0,81	<b>0,55</b>	<0,001***
B17. Having lots of time for my family	3,14	0,76	2,98	0,84	3,06	0,80	0,16	0,010**
B18. Working with something that involves a lot of travelling	3,02	0,87	2,64	0,93	2,83	0,92	0,38	<0,001***
B19. Working at a place where something new and exciting happens frequently	3,25	0,80	2,97	0,84	3,11	0,83	0,28	<0,001***
B20. Earning lots of money	<b>3,47</b>	0,67	<b>3,52</b>	0,70	<b>3,50</b>	0,68	-0,05	0,32
B21. Controlling other people	2,16	0,90	2,37	0,92	2,27	0,91	-0,21	0,003***
B22. Becoming famous	2,01	0,93	2,20	0,98	2,10	0,96	-0,19	0,01**
B23. Having lots of time for my interests, hobbies and activities	3,00	0,77	3,01	0,83	3,01	0,80	-0,01	0,88
B24. Becoming 'the boss' at my job	2,43	0,96	2,69	0,93	2,56	0,95	-0,26	<0,001***
B25. Developing or improving my knowledge and abilities	<b>3,50</b>	0,59	3,29	0,71	3,39	0,66	0,21	<0,001***
B26. Working as part of a team with many people around me	2,96	0,78	2,83	0,84	2,89	0,81	0,13	0,04**

\* Likert style responses ranging from “not important” to “very important” were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,05 level of confidence (2-tailed)

\*\*\* Significant difference at the 0,01 level of confidence (2-tailed)

#### 4.2.2. The results of factor analysis

Grade nine students' opinions about their future career choices were analysed using factor analysis. In addition to the questionnaire items, an additional item on "gender" was also included in the analysis. Principal component analysis (varimax rotation) resulted in eight common factors with eigen values >1, which altogether explained ~62% of the variance (Table 6). Factors were named accordingly to their main context:

- *Factor 1* is described as a '**self-development**' factor, reflecting students' priority for developing their values, attitudes, knowledge, abilities etc. during a future job.
- *Factor 2* is named a '**power**' factor, because it reflects students' priority on becoming famous or 'boss', controlling others, etc.
- *Factor 3* is a '**creativity factor**', because it characterizes students' ability to design, invent or work artistically.
- *Factor 4* is named as a '**tool**' factor, because it reflects students (especially boys') priority to work with machines or tools using ones hands.
- *Factor 5* describes students' orientation to work with animals or in the environmental protection area and is therefore named as a '**nature**' factor.
- *Factor 6* is named as '**friends and free time**' factor, characterizing students' future job with easiness and simplicity while having time for friends, family, hobbies etc.
- *Factor 7* is an '**others-oriented**' factor, reflecting students' future career connection with other people (helping others, work with others, etc).
- *Factor 8* is an '**entertainment**' factor, which characterizing students' future career with travelling and excitement.

Factorial analyses for boys and girls separately confirmed the presence of all above described factors (appendix 2, table 2.6. and 2.7.). In both cases, the most important (highest weighting) factor was the power factor. The major difference between the structures of factors (expressed in terms of loadings) was related to the tools factor, which was higher for boys and friends and entertainment, higher for girls.

**Table 6. The results of the factor analysis**

<b>Name of the factor</b>	<b>Questionnaire items</b>	<b>Loadings</b>	<b>Cumulative %</b>
<b>1. Self-development priority</b>	B15. Working with something I find important and meaningful	0,72	<b>17,09%</b>
	B16. Working with something that fits my attitudes and values	0,71	
	B25. Developing or improving my knowledge and abilities	0,59	
	B13. Making my own decisions	0,56	
<b>2. Power priority</b>	B24. Becoming ‘the boss’ at my job	0,82	<b>28,23%</b>
	B21. Controlling other people	0,80	
	B22. Becoming famous	0,73	
	B20. Earning lots of money	0,43	
<b>3. Creativity priority</b>	B10. Making, designing or inventing something	0,83	<b>36,58%</b>
	B11. Coming up with new ideas	0,71	
	B8. Working artistically and creatively in art	0,66	
	B9. Using my talents and abilities	0,51	
<b>4. Tools priority</b>	B7. Working with machines or tools	0,87	<b>43,34%</b>
	B6. Building or repairing objects using my hands	0,80	
	Gender	0,62	
<b>5. Nature priority</b>	B3. Working with animals	0,88	<b>49,12%</b>
	B4. Working in the area of environmental protection	0,86	
<b>6. Friends and free time priority</b>	B12. Having lots of time for my friends	0,72	<b>53,97%</b>
	B23. Having lots of time for my interests, hobbies and activities	0,71	
	B17. Having lots of time for my family	0,66	
	B5. Working with something easy and simple	0,38	
<b>7. Other people priority</b>	B2. Helping other people	0,66	<b>58,22%</b>
	B26. Working as part of a team with many people around me	0,64	
	B1. Working with people rather than things	0,57	
	B14. Working independently of other people	-0,51	
<b>8. Entertainment priority</b>	B18. Working with something that involves lots of travelling	0,74	<b>61,98%</b>
	B19. Working at a place where something new and exciting happens frequently	0,71	

#### 4.2.3. Gender differences towards career priorities

Table 7 shows that there are significant differences in means between girls and boys priorities across items within most factors, except 'Friends and free time'. It seems that students have given the most positive evaluation to items describing the career factor 'self-development'. The least positive evaluation has been given by girls to items related to the factor 'tools priority' and by boys to 'nature priority'. It is evident that girls have tended to give more positive responses to all careers related items in the questionnaire than boys.

**Table 7. Girls' and boys' priorities towards their future career**

Factors	Questionnaire items mean* (SD)			Gender differences in means	p
	Girls N=340	Boys N=335	All N=675		
<b>1. Self-development priority</b>	<b>3,35</b> (0,46)	<b>3,00</b> (0,57)	<b>3,18</b> (0,55)	<b>0,35</b>	<0,001**
<b>2. Power priority</b>	2,52 (0,67)	2,70(0,65)	2,61 (0,67)	-0,18	0,001**
<b>3. Creativity priority</b>	3,00 (0,69)	2,78 (0,64)	2,89 (0,68)	0,22	<0,001**
<b>4. Tools priority</b>	<b>1,78</b> (0,73)	2,47 (0,85)	<b>2,13</b> (0,86)	<b>-0,69</b>	<0,001**
<b>5. Nature priority</b>	2,14 (0,87)	<b>1,85</b> (0,82)	<b>2,00</b> (0,86)	0,29	<0,001**
<b>6. Friends and free time priority</b>	2,85 (0,56)	2,82 (0,54)	2,84 (0,55)	0,03	0,56
<b>7. Other people's priority</b>	2,76 (0,46)	2,47 (0,51)	2,62 (0,51)	0,29	<0,001**
<b>8. Entertainment priority</b>	<b>3,14</b> (0,74)	2,80 (0,77)	2,97 (0,77)	<b>0,34</b>	0,001**

\* Likert style responses ranging from "not important" to "very important" were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,01 level of confidence (2-tailed)

#### 4.2.4. Differences in students' perceptions of career priorities between schools

Table 2.8 in appendix 2 indicates differences in the means of responses by students, by school, for those items identified by factor analysis as indicating students' career priorities. It is seen that the differences in the means for almost all factors are statistically significant between schools except for 'self-development', 'tools' and 'entertainment' priorities.



However it seems, in general, that students' responses are less distributed towards 'other people's priority' factor and more distributed towards 'nature priority' and 'tools priority' factors, although these priorities vary because girls and boys have different attitudes towards these career priorities within schools. For example, in schools 4, 5, 11, 15, 23 and 25, students' opinions are the most heterogeneous related to their future careers linked to 'tools' or 'nature'. The most similar opinions by grade nine students are towards 'other people's priority', especially in schools 4, 6, 7 and 24. The last mentioned schools (except school number 24) belong to the small towns or countryside group of schools. Whereas students' opinions are diverse within and between schools towards future career priorities, it is not possible to indicate relevant tendencies towards different type of schools.

#### **4.2.5. Relationship between students' interest and future career priorities**

One of the goals of the current study was to find out the possible relationship between students' interest towards science subjects and their future career priorities. To accomplish the goal, Spearman rank correlation analyses was undertaken to compare students' interest with career priorities.

The results indicate that the correlations are not very strong ( $0,35 < r < 0,65$ ) (Cohen *et al.*, 2000) between the two domains (appendix 2, table 2.9.). It would seem that interest in school science is not the major or only important factor that impinges on future career priorities.

However, these results suggest that there are links between interest and career priorities. For example, there is a tendency for students who would not wish to relate their future job with nature, to also not wish to learn about botany ( $\rho=0,41$ ;  $p<0,001$ ) or zoology topics ( $\rho=0,45$ ;  $p<0,001$ ). Another stronger relationship becomes evident between tools priority and interest in electricity or technology. This shows that students who have suggested they would like to work with tools (machines) are interested in learning about technology ( $\rho=0,45$ ;  $p<0,001$ ), or electricity ( $\rho=0,40$ ;  $p<0,001$ ). A third relevant relationship is connected with self-development priority and general biology or human study. This indicates that students, who keep in mind self-development as an important priority in their future career, want to study more about human ( $\rho=0,40$ ;  $p<0,001$ ) or general biology ( $\rho=0,41$ ;  $p<0,001$ ).

### 4.3. Students' opinions about school science

This part of the questionnaire was used to find out the kind of attitudes grade nine students have towards their school science.

The results from table 8 show that, in general, students agree with the statements that school science is interesting and easy to learn. They also think that school science will be helpful in their everyday life and will guide students how to take better care of themselves. At the same time, students have negative attitudes towards the relationship between school science and future careers. For example, they do not relate their future career with science, nor technology.

**Table 8. Comparison of girls' and boys' opinions about school sciences**

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
F1. School science is a difficult subject	2,30	0,74	2,15	0,85	2,23	0,80	0,15	0,01**
F2. School science is interesting	2,70	0,83	2,58	0,86	2,64	0,85	0,12	0,07
F3. School science is rather easy for me to learn	2,58	0,73	2,66	0,79	2,62	0,76	-0,08	0,16
F4. School science has opened my eyes to new and exciting jobs	2,22	0,89	2,15	0,90	2,19	0,90	0,07	0,37
F5. I like school science better than most other subjects	2,17	0,94	2,19	0,93	2,18	0,94	-0,02	0,76
F6. I think everybody should learn science at school	<b>2,91</b>	<b>0,94</b>	2,55	<b>0,95</b>	2,73	0,96	<b>0,36</b>	<0,001***
F7. The things that I learn in science at school will be helpful in my everyday life	<b>3,04</b>	<b>0,82</b>	<b>2,71</b>	<b>0,89</b>	<b>2,88</b>	0,87	<b>0,33</b>	<0,001***
F8. I think that the science I learn at school will improve my career chances	2,60	0,91	2,37	0,87	2,48	0,90	0,23	<0,001***
F9. School science has made me more critical and sceptical	2,21	0,85	2,14	0,83	2,18	0,84	0,07	0,43

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
F10. School science has increased my curiosity about things we cannot yet explain	<b>2,92</b>	0,86	2,64	0,95	<b>2,78</b>	0,92	0,28	<0,001***
F11. School science has increased my appreciation of nature	2,90	0,90	2,58	0,88	2,74	0,90	<b>0,32</b>	<0,001***
F12. School science has shown me the importance of science for our way of living	2,64	0,86	2,45	0,87	2,55	0,87	0,19	0,01**
F13. School science has taught me how to take better care of my health	2,93	<b>0,85</b>	2,74	<b>0,89</b>	2,84	0,88	0,19	0,01**
F14. I would like to become a scientist	1,59	0,86	1,91	0,93	<b>1,74</b>	0,91	<b>-0,32</b>	<0,001***
F15. I would like to have as much science as possible at school	1,76	0,81	1,83	0,85	1,80	0,83	-0,07	0,29
F16. I would like to get a job in technology	1,77	0,87	2,64	0,96	2,21	1,01	<b>-0,87</b>	<0,001***

\* Likert style responses ranging from “disagree” to “agree” were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,05 level of confidence (2-tailed)

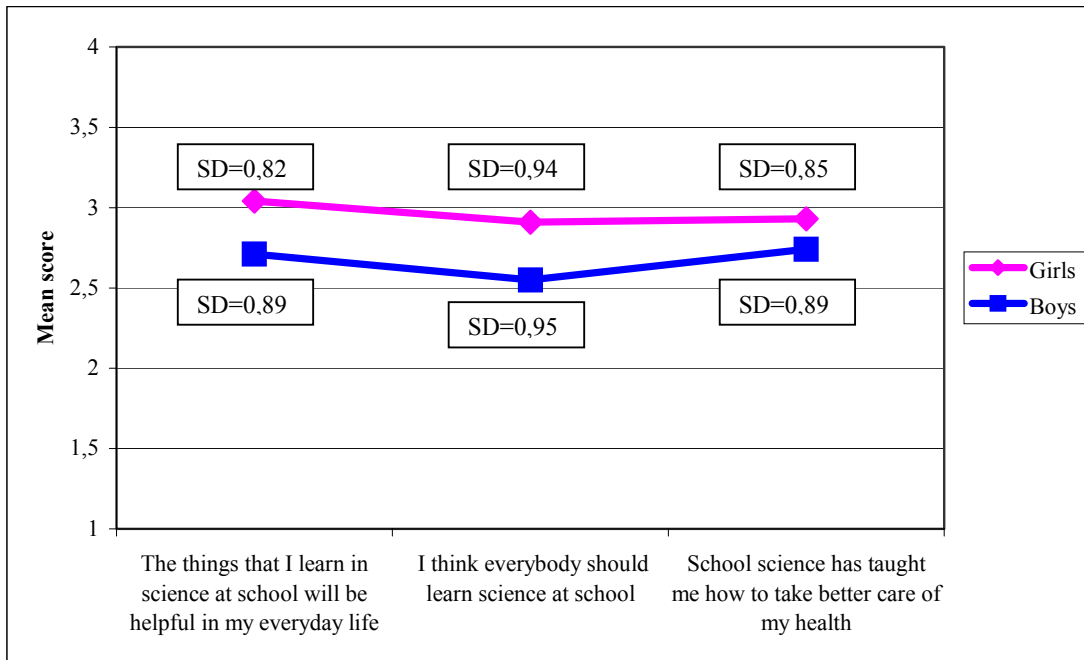
\*\*\* Significant difference at the 0,01 level of confidence (2-tailed)

#### 4.3.1. Gender differences

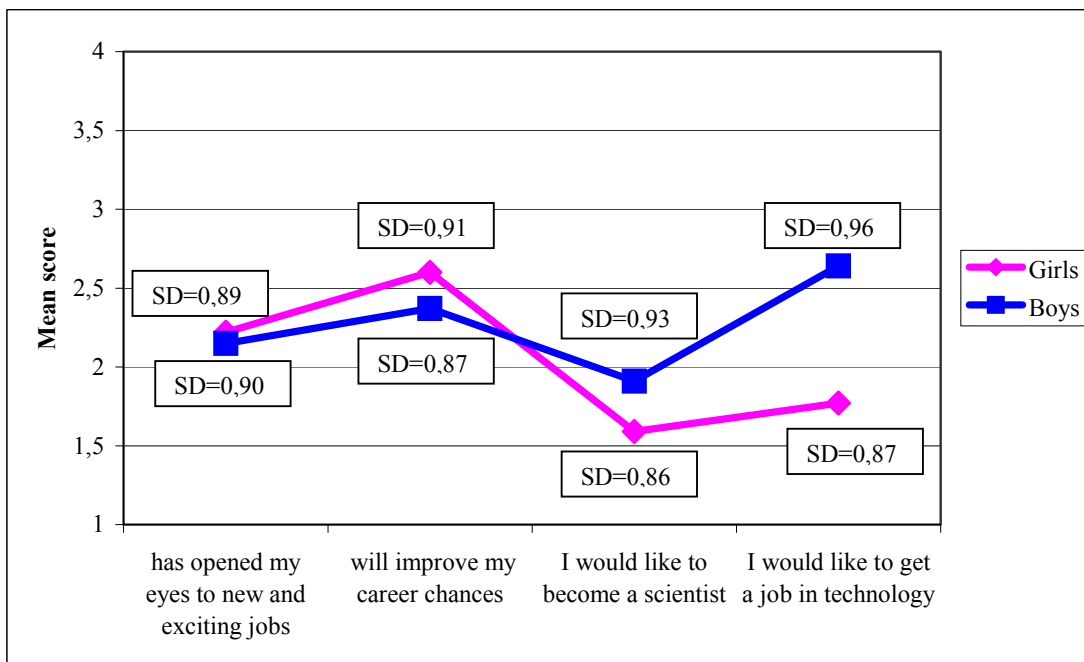
Table 8 shows the gender differences between boys and girls opinions towards school science. In general, girls, more than boys, think that everybody should learn science at school, the learning will be helpful in their everyday life and school science has taught them how to take better care of themselves (Figure 5). Girls also think school science has increased their appreciation of nature more than boys. It is seen from table 8 that standard deviations towards these items largely varies (also towards other items), so it is not possible to make similar conclusion for all girls or boys.

On the other hand, boys, in general, agree more with the statements that they would like to get a job in technology and would like to become a scientist (Figure 6). The results indicated that grade nine students wouldn't like to become scientist, to get a

job in technology or that school science hasn't opened their eyes to new and exciting jobs.



**Figure 5. Students' opinions about the everyday usefulness of schools science**



**Figure 6. Students' opinions about school science**

#### **4.3.2. Differences in means of students' opinions towards school science between schools**

While the majority of students think that school science is interesting (especially in small towns' and countryside schools like 4, 6, 11 and 16) and important to learn (except schools 8, 10, 15 and 19), there are significant differences in the means of students' opinions between the different schools towards school science, except for items F8, F9, F10, F12, and F16 (appendix 2, table 2.10.).

Against this, school science is seen as particularly difficult in the eyes of all participating schools' students, except in schools 2, 19 (small towns' schools) and 23 (big town school). Thus students think that school science is interesting, but at the same time difficult to learn.

The results indicate also that no student in the 25 schools would like to become a scientist nor like to get a job in technology (except students from schools 23 [big town' school] and 25 [countryside school]). It seems the majority of the students think that school science will improve their career chances, but at the same time school science had not opened their eyes to new and exciting careers.

It is seen that students' opinions about school sciences is variable, especially related to item F16 (I would like to get a job in technology). The more homogenous opinions were with item F3 (school science is rather easy to learn). However, as students' opinions were so diverse towards school science, it is not possible to make meaningful conclusions.

#### **4.3.3. Relations between students' interest and their opinions about school science**

The Spearman rank correlation analyses showed that there were few high correlations ( $0,35 < r < 0,65$ ) (Cohen *et al.*, 2000) between students' interests towards science subjects and their opinions about school science (table 2.11., appendix 2). But it appears that the highest relationships relate with botany, general biology, environment and with science & technology sub-domains towards school science items.

For example:

- Students, who wouldn't like to get a job in technology, don't want to learn about electricity ( $\rho=0,40$ ;  $p<0,001$ ), nuclear physics ( $\rho=0,45$ ;  $p<0,001$ ) or technology ( $\rho=0,43$ ;  $p<0,001$ ) related topics.
- Students, who think that school science wouldn't improve their career chances in the future, don't want to learn about botany ( $\rho=0,39$ ;  $p<0,001$ ) or environmental protection ( $\rho=0,35$ ;  $p<0,001$ );
  - Students, who think that school science hasn't increased their appreciation of nature, don't want to learn about human botany ( $\rho=0,434$ ;  $p<0,001$ ) and environmental protection ( $\rho=0,37$ ;  $p<0,001$ );
  - Students, who wouldn't like to become a scientist, don't want to learn about nuclear physics ( $\rho=0,35$ ;  $p<0,001$ ), science and scientists ( $\rho=0,43$ ;  $p<0,001$ ) and about environmental protection ( $\rho=0,38$ ;  $p<0,001$ ).

The relationships show clearly that for grade nine students science and technology related domains are unpopular and uninteresting to study.

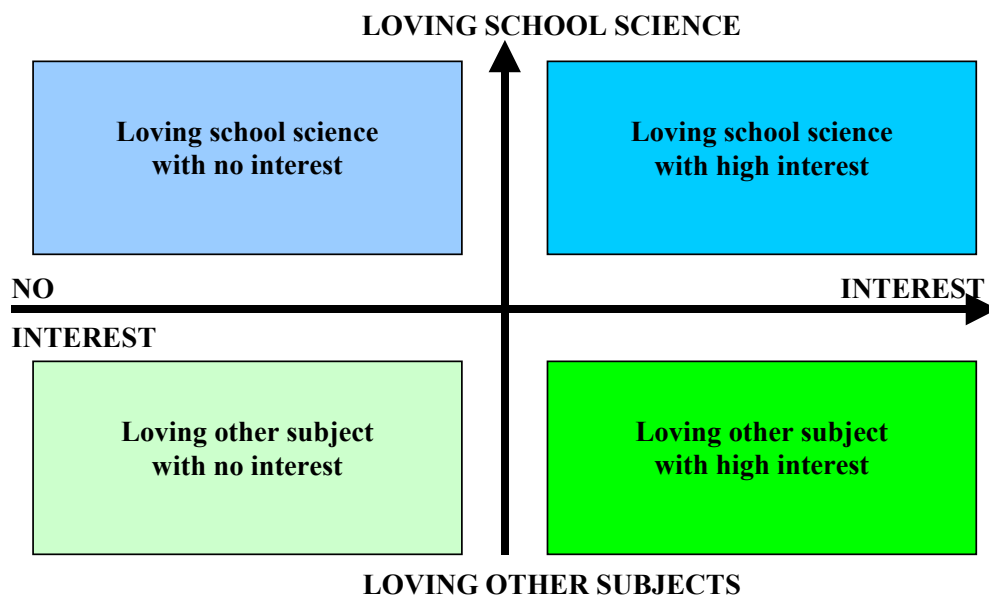
#### **4.4. Relevant science education for Estonian grade nine students**

##### **4.4.1. Categorization of grade nine students in terms of school science preferences**

To find out students' opinions about relevant science education, students' responses were classified, based on two aspects, into four homogenous groups. From this point of view, F2 ('school science is interesting') and F5 ('I like school science better than most other subjects') were cross-tabulated to construct a new variable called 'school science preference' (appendix 2, table 2.12.). Figure 9 shows the classification of students into the four groups in terms of their opinions of school science with the following:

- 1) ***Loving school science with high interest*** – including the group of students whose responses indicating they both like to study and are interested in school science;

- 2) ***Loving other subject with high interest*** – including the group of students whose responses indicating they are interested in and like other subjects more than school science;
- 3) ***Loving other subject with no interest*** – including the group of students whose responses indicating they don't like school science, neither are they interested in it;
- 4) ***Loving school science with no interest*** – including the group of students whose responses indicating they like school science, but are not interested in it.



**Figure 9. Framework for ‘school science preference’**

Table 9 shows that similar numbers of students were placed in the first three groups (ranging from 195 to 220 in total), while the last group (‘Loving school science with no interest’) consists of only 44 students. It is seen also that about 30% of nine graders both like to study and are interested in school science, while approximately the same amount of students like other subjects more than school science.

From the viewpoint of science educators and teachers, the ‘loving other subject with high interest’ group is of interest, because they like other subjects more than school science.

**Table 9. Categorisation of Estonian grade students in terms of their opinions about school science (numbers are given only for responding students)**

<b>Gender</b>	Loving school science with high interest	Loving other subject with high interest	Loving other subject with no interest	Loving school science with no interest	<b>Total</b>
<b>Girls</b>	109 32,6%	104 31,1%	106 31,7%	15 4,5%	<b>334</b> <b>100%</b>
<b>Boys</b>	91 28,0%	91 28,0%	114 35,1%	29 8,9%	<b>325</b> <b>100%</b>
<b>Total</b>	<b>200</b> <b>30,3%</b>	<b>195</b> <b>29,6%</b>	<b>220</b> <b>33,4%</b>	<b>44</b> <b>6,7%</b>	<b>659</b> <b>100%</b>

It seems important to find out the characteristics of such students in terms of school science, because they have potential to move into the ‘loving school science with high interest’ group. Another interesting group of students are those who don’t like school science, nor are they interested in it. Here the question is how to encourage them to like science?

#### **4.4.2. Relevant science education for grade nine students**

Further analysis was carried out to find out what is relevant science education in the eyes of the four groups of students. Relevant science education is determined by three components – students’ interest about school science, their attitudes towards school science and opinions about future career (Table 10).

It is seen that there are differences in students’ opinions relating to relevant science education. Students from groups 1 and 3 have opposite interests, attitudes and future career choices. Group 1 students have high interest towards all the science subjects, they agree with most statements about school science and found almost all future career priorities important. On the other hand, students from group 3 have the most negative interests and attitudes towards school science. Students from groups 2 and 4 belong to intermediate groups. They have both positive and negative attitudes towards science learning in school, for group 2 attitudes are positive towards science related careers, while in group 4 the attitudes towards science related careers was generally negative.

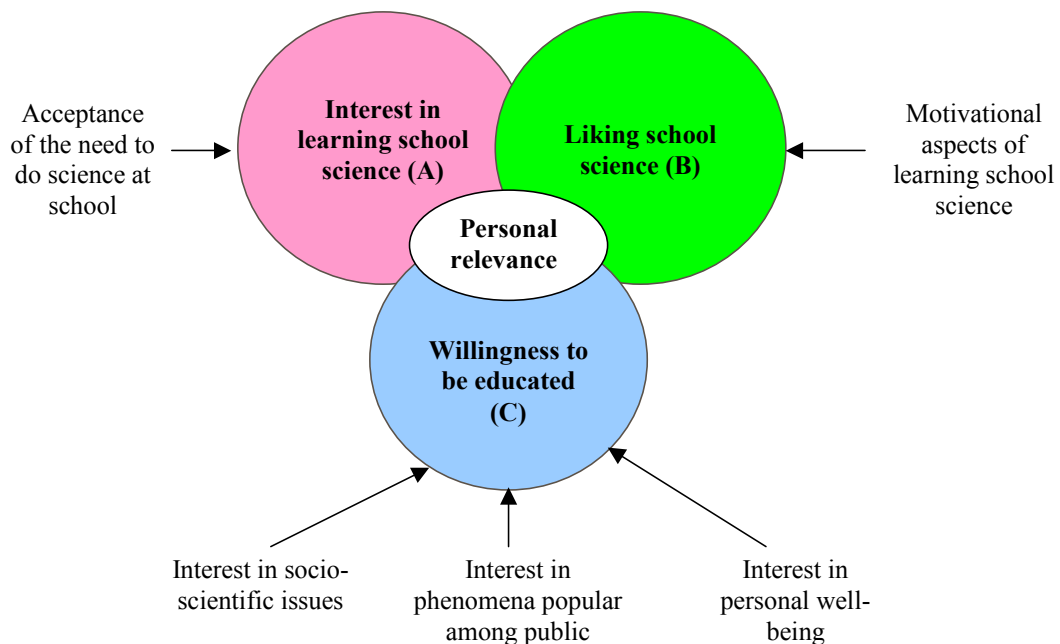


**Table 10. Relevant science education based on the separate opinions of the four groups of students (based on tables 2.13., 2.14. and 2.15. in appendix 2)**

<b>Domain Category</b>	<b>Interest towards school science</b>	<b>Attitudes towards school science</b>	<b>Opinions of future career</b>
<b>1. Loving school science with high interest</b>	Highest interest towards all the science subjects, especially for astronomy, general biology and human study.	Students agree with most statements about school science. Most students think that school science is easy to learn, will be helpful in their everyday life and have been taught how to take better care of themselves.	Students indicated that learning science is most important for future career priorities, especially for self-development.
<b>2. Loving other subject with high interest</b>	Students tend to be not interested, rather than interested, in the study of science subjects, especially chemistry and botany.	Students have both positive and negative attitudes towards school science. They indicated school science was important for their everyday life, but they did not want to have additional science lessons at school.	Students found all the priorities important for their future career, except tools and nature priorities.
<b>3. Loving other subject with no interest in science</b>	The lowest interest group towards all science subjects, and especially towards chemistry and botany.	Students disagree with almost every statement about school science. For example, they don't want to become scientist, neither would they like to have as much science as possible at school.	Students want to have lots of free time for hobbies, friends and family in their future career, but don't want to relate their future career with nature.
<b>4. Loving school science with no interest</b>	Not interested to learn most topics, exceptions are human study, nuclear physics and general biology.	Students agree with half of the statements about their school science. School science is easy for them to learn and important for their everyday life. They have negative attitude towards science & technology related future careers.	Students don't want to work tools, nor follow nature related careers. Self-development is the most important priority in the eyes of this group of students.

The overall interpretation tends towards recognising that science education is not really relevant for any of the 4 groups. Only the first group gives sufficiently positive responses to indicate their learning had relevance but even here the responses do not cover all domains. The other groups are more negative, with the third group seeing little meaningful relevance for science education at all.

The developed model shows (Figure 10) that relevant science education in the eyes of students is heavily determined by classroom atmosphere and the manner in which school science has been taught. Circle C highlights the need to keep science teaching updated by the incorporation of new trends in science, taking account of changes in attitudes in the social environment where students live. The model also shows that the composite component referred to as personal relevance is the main factor, which builds career preferences by students.



**Figure 10. The model of relevant science education in the eyes of grade nine students**

Justification for creating the model:

1. As factor analyses across all questionnaire items did not give meaningful and significant outcomes, the different parts of the questionnaire were taken as separate entities.
2. Factor analyses undertaken separately across each part of questionnaire did give significant outcomes except in the case of the part related to career preferences: here eight factors were found and used for the construction of a model.
3. Not all items within the questionnaire part A, B and C related to interest in science, were perceived as relevant by students, and therefore only relevant items (expressing in daily life or personal welfare terms which related to the contextual side of science) were undertaken for constructing the model.
4. From the questionnaire part F, only items having the greatest variance in student responses were used for constructing the model.
5. Correlations regarded as meaningful between different components of the questionnaire and between individual questionnaire items were used for constructing the theoretical framework of the model.
6. The model describes all students, but has different characteristics for student groups based on a 2 component analyses between liking school science and being interested in studying science.

## 5. DISCUSSION

*Research question 1: What learning interests do grade nine girls and boys have? Are there statistically significant differences between girls' and boys' interests towards science?*

The current research indicated that there were statistically significant differences between boys' and girls' learning interests. This was an expected outcome, as many international studies carried out in developed countries have expressed similar findings (Lamanauskas *et al.*, 2004; Sjøberg, 2002b; Weinburgh, 1995; Colley *et al.*, 1994). This particular study concentrated on an Estonian grade nine students' representative sample and as similar studies had not been studied earlier in Estonia, nor considered in the curriculum development process, the findings were considered important for Estonian educational developments.

Grade nine boys showed the highest interest towards physics (especially astronomy and nuclear physics related topics) and technology, while girls showed greater interest towards human studies and general biology. Similar results geared to students' interest towards science subjects were indicated by several researchers (Lamanauskas *et al.*, 2004; Osborne, 2003; Lannes *et al.*, 2002; Sjøberg, 2002b; Havard, 1996; Whitfield, 1980). The current study went further than all mentioned researchers and found that it was an oversimplification to consider students interests towards school science, without analysing the context of the school subject related items in the questionnaire.

Chemistry and botany were seen as the most unpopular subjects in the eyes of grade nine students. All responses to chemistry related questionnaire items (except explosive chemicals) received a lower than average evaluation. Findings by Salta & Tzougraki (2004) explained this tendency from the point of view that chemistry was seen as not useful and difficult for students and was perceived as having little relationship with their everyday life. In the current study, students exhibited negative attitude towards learning about atoms and molecules; in the study by Osborne &

Collins (2001) it was shown that the periodic table attracted antipathy among students, because they didn't perceive its relevance to their everyday lives.

It is suggested that the gender difference can be interpreted as the assignment of subjects as masculine or feminine by the students. This is in line with findings in the literature. For example, Francis (2002) argues that the choices of both girls and boys reflect, to some extent, a deeply embedded gender dichotomy through which male students identify with words like rationality, objectivity, science or 'hard', while females identify with emotions, subjectivity, nature or 'soft'. This would provide a rationale why girls are interested in biology and boys in physics as shown in this study.

The comparison of boys and girls interests utilising components of an international questionnaire made it possible to determine the views of Estonian students in a world-wide context. It is interesting to note that similarities were found with developed countries e.g. selectiveness of science related interests for both girls and boys, as well as with developing countries geared to the common high interest towards computers by both boys and girls (Sjøberg, 2002b).

Another aspect that was shown to influence students' interest towards science was related to the manner in which items in the questionnaire were presented. The results from the current study indicated that students were more interested to learn if the items were presented in a student-related manner (connected with students' everyday life), rather than as merely content-related (titles of textbook). This finding is very much along the lines of the outcomes of STL research (Holbrook & Rannikmäe, 2001; Rannikmäe, 2001) and confirmed the need to pay attention to the presentation of science content by the teacher.

Reid (2003) considered that students were attracted by topics, which can be described as 'modern' – it means the topics that are perceived to have high relevance to the lifestyle of the learners are attractive. Similar conclusions could be put forward based on the current study, which showed that grade nine girls were attracted to topics which were related with their health, appearance, beauty etc. and boys about the modern technological problems related with physics.

Thus the general impression from the current study indicates that much of what goes on in science classrooms is not particularly attractive to either boys or girls.

***Research question 2: What factors influence grade nine students' career choices and how these vary between girls and boys?***

The results from the current study reinforce European Commission concerns (2004) - students don't want to become scientist, do not want to work in science related areas, nor like to get a job in technology. Students also admitted that school science had not introduced them to new and exciting careers, neither had it improved their career chances. It appears we need to raise students' interest towards science careers as well as ensure school education provides students with an authentic view of science-related careers and a background of knowledge, competencies and attitudes about science.

Based on factor analysis of student responses to items in the questionnaire, grade nine students' future career priorities could be described by eight common factors: 'Self-development', 'Power', 'Creativity', 'Tools', 'Nature', 'Friends and free time', 'Other people' and 'Entertainment' priorities. The importance of these factors for boys and girls differed – boys were more power-oriented (be a 'boss', to control, become famous etc.), while girls were more self-development oriented towards their future careers. Questionnaire items that could be seen to be related to a factor called "science career" were in practice divided between the 8 factors found and were insufficiently correlated with each other. This might lead to the interpretation that Estonian students do not have clear expectation about science related careers.

Each of the eight factors found consisted of a small number of items, all characterised by relatively high loadings (between 0,38 to 0,88) and hence illustrate a wide discrepancy between Estonian students views of careers and lead to the conclusion that general education dominates career choices over the science education provision in eyes of students. This finding differs from Sjøberg's earlier study (2000c) where he pointed out that clearly identified statements can capture students' career choices.

This points to a need for more complex follow up research among Estonian students for an in-depth examination of factors which influence student career choices.

Estonian students showed the least interest towards nature related careers, even though biology was one of the favourite subjects for girls. Similar tendencies have been presented by Svein Sjøberg (2002c) in the SAS-study. This shows there are similar tendencies between Norwegian and Estonian students and questions whether cultural factors (including education) are influencing students' career priorities.

The correlation analysis between students' interest in science subjects and future career priorities indicated that students, who have low orientation towards nature related careers, don't have an interest in learning about plants and animals and issues related to those. This highlights that for these students everything connected with nature is not a preferred area of study, nor a career choice to pursue careers.

***Research question 3: What opinions do grade nine students have towards school science and do these opinions influence their interests in learning science?***

The results from the current study indicated antagonistic attitudes of students towards school science. It became evident that school science is rather difficult to learn, but on the other hand they thought that school science is interesting and useful in their everyday life. Study from Yager & Yager (1985) showed similar results - school science was interesting and useful for about two-thirds of the respondent students.

But at the same time the results from the current study indicated that students don't want to learn science subjects more than other subjects. Thus it seems there is an overall positive attitude towards schooling, but a preference towards non science subjects. A factor to consider here is that Estonian science subjects are taught separately and while answering to items in which the word science appeared, students kept in mind one or two specific school subjects in which they were interested. If the items had specifically included the separate school science subjects, the results could have been different.

The relationship between students' interest towards science subjects and their opinions about school science were investigated. The correlations between these two areas were not strong, suggesting students were not committed to a strong opinion about school science subjects. This contrasts with Trumper's (2004) study based on Israeli ROSE data, which showed that there was a strong correlation between students' middle interest in physics and their somewhat negative attitudes towards school science.

***Research question 4: Is it possible to develop a model describing grade nine students' opinions about relevant science education?***

A model developed, based on students' interests, attitudes and opinions, and their liking for school science subjects, illustrated there were four groups of students' opinions towards three aspects – students' interest and attitudes towards school science and opinions about future career. Earlier it was pointed out that relevance can be considered related to these three aspects and hence it is evident that students in each of the four groups held different opinions about the relevance of science education.

Students from group 1 ('Loving school science with high interest') held the highest interest towards all science subjects, they agreed with most statements about school science and indicated that learning science was most important for their future career priorities. Contrasting with group 1, students of group 3 ('Loving other subject with no interest in science') held low interest towards all science subjects; they disagreed with almost every statement about school science and wanted to have lots of free time for hobbies, friends and family. Groups 2 ('Loving other subject with high interest') and 4 ('Loving school science with no interest ') are considered intermediate groups. These students held a degree of interest towards certain subjects (human study and general biology), agreed in some case with aspects of school science (for example - school science is easy for them to learn and important for their everyday life) and didn't want to work tools, nor follow nature related careers.

The model developed showed that relevance of science education in the eyes of students was not linked with relevance to learning conceptual science – components



expressing science ideas were not interesting for students and did not characterise any student groups accordingly to the model, including the group who exhibited the highest liking for, and interest in, school science. When the personal relevance of all students in learning school science was compared against their career preferences, it was found that such preferences were mainly derived from the relevance gained from general education outcomes. This model differed from ideas on relevant science education expressed by Fensham (2000) and Holbrook (2003) and highlighted the need to consider a much wider range of factors in guiding students' interest towards science related careers. Estonian students appreciated the importance of receiving an education, but did not understand the role of school science as part of this education.

## 6. CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

### 6.1. Conclusions

The main conclusions drawn from the current research are the following:

1. The results showed statistically significant differences between girls' and boys' interest towards science learning - girls were more interested than boys in topics which were connected with human health, beauty, appearance, etc. which are part of human studies or general biology curricula, while boys liked to study more about nuclear physics, electricity and technological problems. The most uninteresting topics for grade nine students were related to plant study and chemistry.
2. Students responded more positively to items, which were presented in student daily life-related manner compared with those presented in a school-subject-oriented way. Hence it seems that much of what goes on in science classrooms is not particularly attractive to either boys or girls.
3. Grade nine students' future career priorities could be described by eight common factors described as 'Self-development', 'Power', 'Creativity', 'Tools', 'Nature', 'Friends and free time', 'Other people' and 'Entertainment' priorities. Those factors have different weightings for boys and girls - boys were more power-oriented (be a 'boss', to control, become famous etc.), whereas for girls, the most important aspects in their future career were self-development and entertainment priorities. Students did not like career priorities with nature-related areas.
4. Estonian students do not hold stable opinions related to school science. Students perceived school science both interesting and useful for them, but on the other hand they don't want to have as much science as possible at school neither like school science better than most other subjects. This suggests they

hold narrow meanings about science and do not see school chemistry, physics and biology as science. Their general attitude is not negative, but again varies across school subjects. Chemistry is the most unpopular and uninteresting school subject for all, if presented in traditional science content manner.

5. Relationships between students' interest towards science subjects and future career priorities and between students' interest and opinions about school science didn't indicate strong correlations between those domains.
6. The model of relevant science education for grade nine students highlights three important components for students: interest towards school science, liking the school science and willingness to be educated. The model differs from educationalists expectations and does not include relevance to traditional science content.
7. Based on the model, four groups of students and their career priorities could be described: – 'Loving school science with high interest', 'Loving other subject with high interest', 'Loving other subject with no interest', and 'Loving school science with no interest'. The first group of students had the most positive attitude and interest towards school science, while the third group of students were the most negative. It is essential for teachers to be aware of the existence of these groups of students and relate their science teaching based on the groups identified in the model so as to make school science relevant for all students.
8. The most important component for relevant science education was the manner in which science issues were presented to students.

## **6.2. Recommendations**

The current research provides a clear message to science educators, curriculum designers, science teachers and textbook authors. To make science relevant, meaningful and popular for students, it is important to know their interests towards science learning. Therefore it is suggested to develop syllabuses and science

textbooks with an application-led approach and a tendency towards social issues. Also suggested is that science teachers pay more attention on student' everyday life related teaching.

### **6.3. Limitations of the study**

1. The current study involved a representative number of students from all Estonian students. Although the selected schools covered all economic areas of Estonia, the sample was not representative against the total number of Estonian schools.
2. The biggest limitation comes from the instrument used. Outcomes of the study show that the internationally validated instrument did not give answers to all issues and views among Estonian students. Due to differences in school systems, the balance between different questionnaire items should be modified according to the division into the three science subjects taught in Estonian schools at the grade 9 level. This study gives original and important outcomes for international science education research and educational developments in Estonia, but also raises several research questions for follow up studies.

## KOKKUVÕTE

Mitmete uurimistööde tulemustena on leitud, et loodusteaduste õppimine on muutunud õpilaste jaoks üha enam ebapopulaarseks ja irrelevantseks. Õpilased ei näe loodusteaduste õppimisel seost oma igapäevaelu ega tulevase karjääriga. Samuti leiavad õpilased, et loodusteadusi on raske õppida seetõttu, et nendes õpitav on igav ja abstraktne. Kuna tegemist on kaasajal väga aktuaalseks muutunud probleemiga hariduses, on see leidnud kajastamist ka mitmetel rahvusvahelistel konverentsidel.

Käesolev uurimistöö (“9. klassi õpilaste arvamused loodusteadusliku hariduse relevantsusest”) viidi läbi 2002/2003 õppeaasta kevadel põhieesmärgiga selgitada välja põhikooli lõpuklassi õpilaste arvamused loodusteadusliku hariduse relevantsusest. Antud töö käigus küsitleti 675 (340 tüdrukut ja 335 poissi) 9. klassi õpilast juhuslikult valitud 25 üldhariduskoolist üle Eesti.

Uurimistööle püstitati järgmised eesmärgid:

1. Välja selgitada 9. klassi õpilaste huvid loodusteaduste õppimise vastu, tuues välja poiste ja tüdrukute vahelised erinevused.
2. Välja selgitada põhikooli lõpuklassi õpilaste hinnangud kooli loodusteaduste tundide suhtes ja uurida võimalikke seoseid õpilaste loodusteaduslike huvide ja hinnangute vahel.
3. Selgitada välja faktorid, mis mõjutavad 9. klassi õpilaste tulevase karjääri valikuid ning nende seoseid õpilaste huviga loodusteaduslike õppeainete vastu.
4. Välja töötada mudel, mis iseloomustab 9. klassi õpilaste arvamusi loodusteadusliku hariduse relevantsusest.

Nimetatud eesmärkide täitmise kontrollimiseks esitati tööle järgmised uurimisküsimused:

1. Millistest loodusteaduslikest õppeainetest ja teemadest on huvitatud 9. klassi tüdrukud ja poisid?
2. Kuidas hindavad 9. klassi õpilased oma kooli loodusteaduste tunde ning kuidas seostuvad omavahel õpilaste hinnangud ja huvid?

3. Missugused faktorid mõjutavad 9. klassi õpilaste tulevase karjääri valikuid ja kuidas need seostuvad õpilaste huviga loodusteaduste vastu?
4. Missugune mudel iseloomustab 9. klassi õpilaste arvamusi loodusteadusliku hariduse relevantsusest?

Uurimisküsimustele vastuste leidmiseks kasutati ROSE (*The Relevance of Science Education*) instrumenti, mis on välja töötud rahvusvahelises koostöös eesotsas prof. Svein Sjøbergiga Oslo Ülikoolist. ROSE küsimustik koosneb kokku kaheksast osast, millest käesoleva uurimistöö tarbeks kasutati kolme.

Osasid A, C ja E (“Mida ma tahan õppida”) kasutati 9. klassi õpilaste loodusteaduslike huvide välja selgitamiseks, osa B (“Minu tulevane töö”) õpilaste tulevase karjääri valikute määratlemiseks ning osa F (“Minu loodusteaduste tunnid”) kooli loodusteaduste tundide hindamiseks. Õpilastel tuli vastata küsimustele, mis kõik olid esitatud 4-pallise Likert tüüpi skaalana.

ROSE küsimustikud saadeti juhuslikult valitud 25 üldhariduskooli, kus need täideti ühe 9. klassi õpilaste poolt. Õpilastel kulus aega antud küsimustikule vastamiseks keskmiselt 45 minutit. Tulemuste analüüsimisel kasutati korrelatsioon- ja faktoranalüüsi ning aritmeetiliste keskmiste võrdlust. Poiste ja tüdrukute vastuste vahelise statistilise erinevuse kindlaks määramiseks kasutati Mann-Whitney U-testi ning koolide vahelise statistilise erinevuse määratlemiseks Kruskal-Wallis testi.

Käesoleva uurimistöö põhitulemustena selgus, et:

1. 9. klassi poiste ja tüdrukute huvides loodusteaduslike õppeainete vastu esines statistiliselt olulisi erinevusi. Selgus, et tüdrukud on enam huvitatud õppimast teemade kohta, mis seostuvad õpilase tervise, väljanägemise ja muude esteetiliste aspektidega. Poisid seevastu on rohkem huvitatud õppimast tehnoloogia, tuumafüüsika ja elektriõpetusega seonduvat. Kõige vähem on 9. klassi õpilased huvitatud õppimast keemiat ja botaanikat.
2. Õpilaste huvi loodusteaduste õppimise vastu on sõltuvuses küsimuste esitamise viisiga. Teemad, mis olid esitatud õpilaste igapäevaeluga seotud vormis, pakkusid rohkem huvi, kui traditsioonilised õpikute pealkirjad.

3. Õpilaste arvamus tulevase karjääri kohta oli võimalik esitada läbi kaheksa faktori, mille suhtes esinesid statistiliselt olulised erinevused poiste ja tüdrukute vahel. Selgus, et 9. klassi poisid peavad tüdrukutest olulisemaks oma tulevase elukutse juures nn. 'võimu' (saada kuulsaks, olla ülemus, juhtida) ja 'vahendite' (masinate või tööriistade kasutamine) prioriteete, tüdrukud aga enesearendamise vajalikkust ning meelelahutust. Kõige vähem seostavad 9. klassi õpilased oma tulevast elukutset keskkonnakaitse ja loomadega.
4. 9. klassi õpilaste hinnangud loodusteaduste tundidele olid vastandlikud. Õpilased leidsid, et kooli loodusteaduste tundides õpitu on neile igapäevaelus vajalik ning kasulik, kuid samal ajal ei meeldi neile loodusteaduslikud õppeained rohkem kui teised koolis õpitavad ained. Samuti pole 9. klassi õpilased huvitatud saamaks teadlaseks ega seostama oma tulevast elukutset teaduse & tehnoloogiaga. See viitab asjaolule, et õpilastel esineb piiratud ettekujutus (loodus)teadusest ning nad ei seosta kooli keemiat, bioloogiat ning füüsikat teadusega üldiselt.
5. Korrelatsioonanalüüs õpilaste loodusteaduslike huvide ja arvamuste kohta tulevase elukutse vahel ning huvide ja hinnangute vahel loodusteaduste tundide ei näidanud tugevaid seoseid. Ühe olulisema seosena selgus, et õpilased, kes ei kavatse oma tulevast elukutset seostada 'loodusega', ei ole samal ajal ka huvitatud õppimast botaanikat ega zooloogiat.
6. Mudel relevantsest loodusteaduslikust haridusest 9. klassi õpilaste arvamuste kohaselt koosneb kolmest olulisest komponendist – huvist kooli loodusteaduste õppimise vastu, kooli loodusteaduste tundide meeldivusest ning vajalikkusest (valmisolekust) olla haritud. Käesolev mudel erineb pedagoogide arvamustest ja ei sisalda relevantset traditsioonilisele loodusteaduslikule sisule.
7. Relevantse loodusteadusliku hariduse mudelit oli võimalik kirjeldada läbi kolme valdkonna (huvi loodusteaduslike õppeainete suhtes, hinnangud

loodusteaduste tundidel ning arvamused tulevase karjääri kohta) nelja grupi õpilaste arvamuste kohaselt. Esimese grupi õpilastele meeldisid loodusteaduste tunnid kõige rohkem ning nad olid huvitatud õppimast kõiki loodusteaduslikke õppeaineid. Seevastu kolmanda rühma õpilastele ei meeldinud loodusteaduste tunnid ja nende huvi loodusteaduslike õppeainete õppimise vastu oli kõige väiksem.

8. Kõige olulisem komponent relevantse loodusteadusliku hariduse mudeli juures on viis, kuidas loodusteaduslikud teemad on õpilastele esitatud.



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## **APPENDIX**

**Appendix 1** – The ROSE (Relevance of Science Education) questionnaire

**Appendix 1a** – The ROSE (Relevance of Science Education) questionnaire (in Estonian)

**Appendix 2** - Tables of results (Tables 2.1-2.15)



# ROSE

## The Relevance of Science Education

This booklet has questions about you, and about your experiences and interests related to science in school and outside school.

*There are no correct or incorrect answers, only answers that are right for you.  
Please think carefully and give answers that reflect your own thinking.*

This questionnaire is being given to students in many different countries. That is why some questions may seem strange to you. If there is a question you do not understand, just leave it blank. If you are in doubt, you may ask the teacher, since this is not a test!

For most questions, you simply put a tick in the appropriate box.

The purpose of this questionnaire is to find out what students in different parts of the world think about science at school as well as in their everyday life. This information may help us to make schools better.

Your answers are anonymous, so please, do not write your name on this questionnaire.

THANK YOU!  
Your answers will be a big help.

### START HERE:

I am a  girl  boy

I am \_\_\_\_\_ years old

I live in \_\_\_\_\_ (write the name of your country)

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## A. What I want to learn about

### How interested are you in learning about the following?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Not inter- ested</i>			<i>Very inter- ested</i>
1. Stars, planets and the universe .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Chemicals, their properties and how they react .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The inside of the earth .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. How mountains, rivers and oceans develop and change .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Clouds, rain and the weather .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The origin and evolution of life on earth .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. How the human body is built and functions .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Heredity, and how genes influence how we develop .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Sex and reproduction .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Birth control and contraception .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. How babies grow and mature .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Cloning of animals .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Animals in other parts of the world .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Dinosaurs, how they lived and why they died out .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. How plants grow and reproduce .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. How people, animals, plants and the environment depend on each other .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Atoms and molecules .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. How radioactivity affects the human body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Light around us that we cannot see (infrared, ultraviolet) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. How animals use colours to hide, attract or scare .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. How different musical instruments produce different sounds .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Black holes, supernovas and other spectacular objects in outer space .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. How meteors, comets or asteroids may cause disasters on earth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Not inter- ested</i>			<i>Very inter- ested</i>
24. Earthquakes and volcanoes .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Tornados, hurricanes and cyclones .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Epidemics and diseases causing large losses of life .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Brutal, dangerous and threatening animals .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Poisonous plants in my area .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Deadly poisons and what they do to the human body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. How the atom bomb functions .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Explosive chemicals .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Biological and chemical weapons and what they do to the human body.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. The effect of strong electric shocks and lightning on the human body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. How it feels to be weightless in space .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. How to find my way and navigate by the stars .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. How the eye can see light and colours .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. What to eat to keep healthy and fit .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Eating disorders like anorexia or bulimia .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. The ability of lotions and creams to keep the skin young .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. How to exercise to keep the body fit and strong .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Plastic surgery and cosmetic surgery .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. How radiation from solariums and the sun might affect the skin ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. How the ear can hear different sounds .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Rockets, satellites and space travel .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. The use of satellites for communication and other purposes .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. How X-rays, ultrasound, etc. are used in medicine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. How petrol and diesel engines work .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. How a nuclear power plant functions .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## B. My future job

How important are the following issues for your potential future occupation or job?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Not important</i>			<i>Very important</i>
1. Working with people rather than things .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Helping other people .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Working with animals .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Working in the area of environmental protection .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Working with something easy and simple .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Building or repairing objects using my hands .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Working with machines or tools .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Working artistically and creatively in art .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Using my talents and abilities .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Making, designing or inventing something .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Coming up with new ideas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Having lots of time for my friends .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Making my own decisions .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Working independently of other people .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Working with something I find important and meaningful .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Working with something that fits my attitudes and values .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Having lots of time for my family .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Working with something that involves a lot of travelling .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Working at a place where something new and exciting happens frequently .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Earning lots of money .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Controlling other people .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Becoming famous .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Having lots of time for my interests, hobbies and activities .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Becoming 'the boss' at my job .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Developing or improving my knowledge and abilities .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Working as part of a team with many people around me .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### C. What I want to learn about

#### How interested are you in learning about the following?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Not inter- ested</i>			<i>Very inter- ested</i>
1. How crude oil is converted to other materials, like plastics and textiles .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Optical instruments and how they work (telescope, camera, microscope, etc.) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The use of lasers for technical purposes (CD-players, bar-code readers, etc.) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. How cassette tapes, CDs and DVDs store and play sound and music .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. How things like radios and televisions work .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. How mobile phones can send and receive messages .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. How computers work .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. The possibility of life outside earth .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Astrology and horoscopes, and whether the planets can influence human beings .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Unsolved mysteries in outer space .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Life and death and the human soul .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Alternative therapies (acupuncture, homeopathy, yoga, healing, etc.) and how effective they are .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Why we dream while we are sleeping, and what the dreams may mean .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Ghosts and witches, and whether they may exist .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Thought transference, mind-reading, sixth sense, intuition, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Why the stars twinkle and the sky is blue .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Why we can see the rainbow .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Properties of gems and crystals and how these are used for beauty .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D. Me and the environmental challenges**

To what extent do you agree with the following statements about problems with the environment (pollution of air and water, overuse of resources, global changes of the climate etc.)? (Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Disagree</i>		<i>Agree</i>	
1. Threats to the environment are not my business .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Environmental problems make the future of the world look bleak and hopeless .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Environmental problems are exaggerated .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Science and technology can solve all environmental problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I am willing to have environmental problems solved even if this means sacrificing many goods .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I can personally influence what happens with the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. We can still find solutions to our environmental problems .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. People worry too much about environmental problems .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Environmental problems can be solved without big changes in our way of living .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. People should care more about protection of the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. It is the responsibility of the rich countries to solve the environmental problems of the world .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I think each of us can make a significant contribution to environmental protection .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Environmental problems should be left to the experts .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I am optimistic about the future .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Animals should have the same right to life as people .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. It is right to use animals in medical experiments if this can save human lives .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Nearly all human activity is damaging for the environment .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. The natural world is sacred and should be left in peace .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## E. What I want to learn about

### How interested are you in learning about the following?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Not inter- ested</i>			<i>Very inter- ested</i>
1. Symmetries and patterns in leaves and flowers .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. How the sunset colours the sky .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The ozone layer and how it may be affected by humans .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The greenhouse effect and how it may be changed by humans ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. What can be done to ensure clean air and safe drinking water ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. How technology helps us to handle waste, garbage and sewage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. How to control epidemics and diseases .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Cancer, what we know and how we can treat it .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Sexually transmitted diseases and how to be protected against them .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. How to perform first-aid and use basic medical equipment .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. What we know about HIV/AIDS and how to control it .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. How alcohol and tobacco might affect the body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. How different narcotics might affect the body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. The possible radiation dangers of mobile phones and computers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. How loud sound and noise may damage my hearing .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. How to protect endangered species of animals .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. How to improve the harvest in gardens and farms .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Medicinal use of plants .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Organic and ecological farming without use of pesticides and artificial fertilizers .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. How energy can be saved or used in a more effective way .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. New sources of energy from the sun, wind, tides, waves, etc. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. How different sorts of food are produced, conserved and stored	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. How my body grows and matures .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



	<i>Not inter- sted</i>			<i>Very inter- sted</i>
24. Animals in my area .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Plants in my area .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Detergents, soaps and how they work .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Electricity, how it is produced and used in the home .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. How to use and repair everyday electrical and mechanical equipment .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. The first landing on the moon and the history of space exploration .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. How electricity has affected the development of our society .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Biological and human aspects of abortion .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. How gene technology can prevent diseases .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Benefits and possible hazards of modern methods of farming .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Why religion and science sometimes are in conflict .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Risks and benefits of food additives .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Why scientists sometimes disagree .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Famous scientists and their lives .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Big blunders and mistakes in research and inventions .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. How scientific ideas sometimes challenge religion, authority and tradition .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Inventions and discoveries that have changed the world .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Very recent inventions and discoveries in science and technology .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Phenomena that scientists still cannot explain .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## F. My science classes

To what extent do you agree with the following statements about the science that you may have had at school?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	<i>Disagree</i>			<i>Agree</i>
1. School science is a difficult subject .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. School science is interesting .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. School science is rather easy for me to learn .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. School science has opened my eyes to new and exciting jobs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I like school science better than most other subjects .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I think everybody should learn science at school .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The things that I learn in science at school will be helpful in my everyday life .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I think that the science I learn at school will improve my career chances .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. School science has made me more critical and sceptical .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. School science has increased my curiosity about things we cannot yet explain .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. School science has increased my appreciation of nature .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. School science has shown me the importance of science for our way of living .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. School science has taught me how to take better care of my health .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I would like to become a scientist .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I would like to have as much science as possible at school .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I would like to get a job in technology .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## G. My opinions about science and technology

To what extent do you agree with the following statements?

(Give your answer with a tick on each row. If you do not understand, leave the line blank.)

	<i>Disagree</i>		<i>Agree</i>	
1. Science and technology are important for society .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Thanks to science and technology, there will be greater opportunities for future generations .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Science and technology make our lives healthier, easier and more comfortable .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. New technologies will make work more interesting .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The benefits of science are greater than the harmful effects it could have .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Science and technology will help to eradicate poverty and famine in the world .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Science and technology can solve nearly all problems .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Science and technology are helping the poor .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Science and technology are the cause of the environmental problems .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. A country needs science and technology to become developed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Science and technology benefit mainly the developed countries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Scientists follow the scientific method that always leads them to correct answers .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. We should always trust what scientists have to say .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Scientists are neutral and objective .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Scientific theories develop and change all the time .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## H. My out-of-school experiences

### How often have you done this outside school?

(Give your answer with a tick on each line. If you do not understand, leave the line blank.)

I have ...

	<i>Never</i>			<i>Often</i>
1. tried to find the star constellations in the sky .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. read my horoscope (telling future from the stars) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. read a map to find my way .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. used a compass to find direction .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. collected different stones or shells .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. watched (not on TV) an animal being born .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. cared for animals on a farm .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. visited a zoo .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. visited a science centre or science museum .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. milked animals like cows, sheep or goats .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. made dairy products like yoghurt, butter, cheese or ghee .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. read about nature or science in books or magazines .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. watched nature programmes on TV or in a cinema .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. collected edible berries, fruits, mushrooms or plants .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. participated in hunting .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. participated in fishing .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. planted seeds and watched them grow .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. made compost of grass, leaves or garbage .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. made an instrument (like a flute or drum) from natural materials ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. knitted, weaved, etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. put up a tent or shelter .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. made a fire from charcoal or wood .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. prepared food over a campfire, open fire or stove burner .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. sorted garbage for recycling or for appropriate disposal .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. cleaned and bandaged a wound .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. seen an X-ray of a part of my body .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Never</i>			<i>Often</i>
27. taken medicines to prevent or cure illness or infection .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. taken herbal medicines or had alternative treatments (acupuncture, homeopathy, yoga, healing, etc.) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. been to a hospital as a patient .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. used binoculars .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. used a camera .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. made a bow and arrow, slingshot, catapult or boomerang .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. used an air gun or rifle .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. used a water pump or siphon .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. made a model such as toy plane or boat etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. used a science kit (like for chemistry, optics or electricity) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. used a windmill, watermill, waterwheel, etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. recorded on video, DVD or tape recorder .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. changed or fixed electric bulbs or fuses .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. connected an electric lead to a plug etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. used a stopwatch .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. measured the temperature with a thermometer .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. used a measuring ruler, tape or stick .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. used a mobile phone .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. sent or received an SMS (text message on mobile phone) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. searched the internet for information .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. played computer games .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. used a dictionary, encyclopaedia, etc. on a computer .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. downloaded music from the internet .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. sent or received e-mail .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. used a word processor on the computer .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. opened a device (radio, watch, computer, telephone, etc.) to find out how it works .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Never</i>			<i>Often</i>
53. baked bread, pastry, cake, etc .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. cooked meal .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. walked while balancing an object on my head .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. used a wheelbarrow .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. used a crowbar (jemmy) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. used a rope and pulley for lifting heavy things .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. mended a bicycle tube .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. used tools like a saw, screwdriver or hammer .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61. charged a car battery .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**I. Myself as a scientist**

Assume that you are grown up and work as a scientist. You are free to do research that you find important and interesting. Write some sentences about what you would like to do as a researcher and why.

I would like to .....

.....

.....

Because .....

.....

.....

.....

.....

**J. How many books are there in your home?**

There are usually about 40 books per metre of shelving. Do not include magazines. (Please tick only one box.)

- None .....
- 1-10 books.....
- 11-50 books.....
- 51-100 books.....
- 101-250 books.....
- 251-500 books.....
- More than 500 books.....



Selles ankeedis on küsimused sinu ja su kogemuste ning huvide kohta loodusteadustest nii koolis kui ka väljaspool seda.

*Ei ole olemas õigeid ja valesid vastuseid, on ainult vastused, mis tunduvad sinu jaoks õiged.*

*Palun mõtle hoolikalt ja vasta nii, et vastused kajastaksid sinu enda mõtlemist ja seisukohti.*

Seda ankeeti täidavad paljude erinevate maade õpilased. Sellepärast võivad mõned küsimused sulle kummalised tunduda. Kui sa mõnest küsimusest aru ei saa, jäta sellele vastamata. Kui kahtled, võid õpetajalt abi paluda, kuna see ei ole kontrolltöö!

Vastamiseks tuleb enamasti teha sobivasse kastikesse lihtsalt märke (linnuke või rist).

Selle ankeedi eesmärgiks on uurida, mida õpilased maailma erinevates piirkondades arvavad loodusteadustest koolis ja oma igapäevaelus. Selle info abil saame me koolis õpetatavat paremaks muuta.

Küsimustik on anonüümne, nii et palun ära sellele oma nime kirjutada.

SUUR TÄNU!

Sinu vastused on meile suureks abiks.

## ALUSTA SIIT:

Olen  tüdruk  poiss

Olen \_\_\_\_\_ -aastane

Ma elan \_\_\_\_\_ (kirjuta oma riigi nimi)

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## A. Mida ma tahan õppida?

### Kuivõrd pakuks Sulle huvi järgmiste teemade õppimine?

(Vastates tähista igal real vaid üks kastike. Kui küsimus on arusaamatu, jätta kastid tühjaks.)

	<i>Ei huvita üldse</i>			<i>Huvitab väga</i>
1. Tähed, planeedid ja universum .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Keemiliste ainete omadused ja reageerimine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Planeet Maa siseehitus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Kuidas mäed, jõed ja ookeanid tekivad ja muutuvad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Pilved, vihm ja ilmastik .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Maapealse elu päritolu ja evolutsioon .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Kuidas inimese keha on üles ehitatud ja funktsioneerib .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Pärilikkus ja kuidas geenid mõjutavad meie arengut .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Seks ja järglaste soetamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Sündivuse reguleerimine ja rasestumisvastased vahendid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Kuidas beebid kasvavad ja arenevad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Loomade kloonimine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Loomad maailma erinevates piirkondades .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Saurused: kuidas nad elasid ja miks välja surid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Kuidas taimed kasvavad ja paljunevad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Inimese, loomade, taimede ja keskkonna vastastikune sõltuvus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Aatomid ja molekulid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Kuidas radioaktiivsus mõjutab inimese keha .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Meile nähtamatu valgus (infrapunane, ultraviolet) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Kuidas loomad kasutavad peitumiseks, saagi või partneri ligimeelitamiseks ning vaenlaste peletamiseks värvusi.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Kuidas erinevad muusikainstrumendid tekitavad helisid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Mustad augud, supernoovad ja teised avakosmose objektid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Kuidas meteoriidid, komeedid või asteroidid võivad maal katastroofe põhjustada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



	<i>Ei huvita üldse</i>			<i>Huvitab väga</i>
24. Maavärinad ja vulkaanid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Tornaadod, tsüklonid ja orkaanid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Palju elusid nõudvad epideemiad ja haigused .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Kiskjad ja teised ohtlikud loomad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Minu elukoha ümbruse mürgised taimed .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Surmavad mürgid ja nende mõju inimesele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Kuidas funktsioneerib aatompomm .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Plahvatavad ained (kemikaalid) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Bioloogiliste ja keemiliste relvade mõju inimesele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Tugevate elektrišokkide ja välgu mõju inimesele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Milline tunne on olla kosmoses kaaluta olekus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Kuidas tähtede järgi leida õige tee .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Kuidas silm tajub valgust ja värve .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Mida süüa, et olla heas vormis ja terve .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Toitumishäired nagu anoreksia ja buliimia .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Kreemide ja salvide toimest nahka noorena hoida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Kuidas trenni teha, et keha oleks tugev ja vormis .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Plastiline kirurgia ja iluravi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Kuidas solaarium ja päikesekiirgus mõjutavad nahka .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. Kuidas kõrv tajub erinevaid helisid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Raketid, satelliidid ja kosmoses reisimine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. Satelliitide kasutamine suhtlemisel ja teistel eesmärkidel .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. Kuidas röntgenkiirgust, ultraheli jms. meditsiinis kasutatakse ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Kuidas töötab bensiini- ja diiselmootor .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. Kuidas töötab tuumaenergiatehas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## B. Minu tulevane töö

Kui olulised on järgmised väited sinu tulevase töönaose töökoha või eriala osas?

(Vastates tähistab iga real vaid üks kastike. Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Pole oluline</i>		<i>Väga oluline</i>	
1. Töötamine pigem inimeste kui tehnikaga .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Teiste inimeste aitamine.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Töö loomadega .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Töö looduskaitsealal .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Millegi lihtsa ja kergega tegelemine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Esemete parandamine või oma kätega valmistamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Masinate või tööriistadega töötamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Loominguline töö kunsti vallas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Oma annete ja võimete kasutamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Millegi valmistamine, disainimine või leiutamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Uute ideede väljamõtlemine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Palju aega sõprade koosviibimiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Sage oma otsuste langetamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Iseseisvalt, omaette ja teistest inimestest eemal töötamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Töötamine millegagi, mis on minu jaoks tähtis ja oluline .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Tegelemine oma suhtumise ja väärtushinnangutele sobivaga ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Palju aega perekonnaga koosviibimiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Töötamine alal, mis eeldab palju reisimist .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Töötamine kohas, kus tihti juhtub midagi uut ja huvitavat .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Teenin palju raha .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Teiste inimeste üle kontrolli omamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Kuulsaks saamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Hobide, huvide ja meelistegevuste jaoks jääb palju aega .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Oma töökohas "ülemuseks" saamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Oma teadmiste ja võimete arendamine ja parandamine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Töötamine meeskonnas, koos paljude teistega .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### C. Mida ma tahan õppida

#### Kui suur huvi on Sul järgnevate teemade vastu?

(Vastates tähistä igal real vaid üks kastike. Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Ei huvita üldse</i>		<i>Huvitab väga</i>	
1. Kuidas töötlemata õli muudetakse teisteks materjalideks nagu näiteks plastmass ja tekstiil .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Optilised instrumendid (teleskoop, kaamera, mikroskoop jne.) ja kuidas need töötavad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Laserite kasutamine tehnilisel otstarbel (CD-mängijad jne) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Kuidas kassetid, CDd ja DVDd salvestavad ja mängivad heli ja muusikat .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Kuidas töötavad teler ja raadio .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Kuidas mobiiltelefon sõnumeid saadab ja vastu võtab .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Kuidas töötavad arvutid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Elu võimalikkusest kosmoses .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Astroloogia ja horoskoobid: kas planeedid on võimelised inimesi mõjutama .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Lahendamata müsteeriumid avakosmoses .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Elu ja surm ning inimhing .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Alternatiivsed teraapiad (nõelravi, jooga, posimine jne) ja nende efektiivsus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Kuidas me näeme und ja mida meie unenäod võivad tähendada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Vaimud ja nõiad: kas nad tõepoolest eksisteerivad? .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Mõtete ülekande ja lugemine, kuues meel, intuitsioon jne .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Miks tähed vilguvad ja taevas on sinine? .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Miks me näeme vikerkaart? .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Kristallid ja vääriskivid: nende omadused ja kasutamine ehtimiseks ja kaunistamiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### D. Keskkonnaprobleemid ja mina

Mil määral Sa nõustud järgnevate väidetega keskkonnaprobleemidest (vee- ja õhureostus, ressursside ülekasutamine, globaalsed kliimamuutused jne)? (Vastates tähista igal real vaid üks kastike. Kui küsimus on arusaamatu, jätta kastid tühjaks.)

	<i>Ei nõustu üldse</i>			<i>Täiesti nõus</i>
1. Keskkonda ähvardavad ohud ei puutu minusse .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Keskkonnaprobleemide tõttu näib maailma tulevik lootusetu .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Keskkonnaprobleemidega liialdatakse .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Loodusteaduste ja tehnoloogia abil on kõik keskkonna- probleemid võimalik lahendada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Nõustuksin, kui keskkonnaprobleemid lahendataks, isegi kui see peaks tähendama mulle paljudest hüvedest loobumist .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ma saan isiklikult keskkonnaga juhtuvat mõjutada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Me võime oma keskkonnaprobleemidele siiski lahendusi leida ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Inimesed muretsevad liiga palju keskkonnaprobleemide pärast ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Keskkonnaprobleeme on võimalik lahendada suuremate muutusteta meie elustiilis .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Inimesed peaksid keskkonna kaitsmisest rohkem hoolima .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Maailma keskkonnaprobleemide lahendamise eest peaksid vastutama rikkad riigid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Arvan, et igaüks meist saab anda olulise panuse keskkonna kaitsmiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Keskkonnaprobleemid tuleks jätta ekspertide lahendada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Ma olen tuleviku suhtes optimistlik .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Loomadel peaks olema samasugune õigus elule nagu inimestelgi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Pean õigeks kasutada loomi meditsiinilistes eksperimentides, kui see aitab inimesi päästa .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Peaaegu kogu inimtegevus on keskkonnale kahjulik .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Loodus on püha ja selle peaks rahule jätma .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## E. Mida ma tahan õppida

Kui suur huvi on Sul järgnevate teemade vastu? (Vastates tähistab igal real vaid üks kastike. Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Ei huvita üldse</i>			<i>Huvitab väga</i>
1. Sümmeetria ja mustrid lehtedel ja õitel .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Kuidas päikeseloojang taeva värviliseks teeb .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Osoonikiht inimeste mõju sellele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Kasvuhooaeg ja kuidas inimesed seda muuta saaksid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Mida on võimalik teha puhta õhu ja joogivee tagamiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Kuidas tehnoloogia aitab meil toime tulla jäätmete ja prüügiga .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Kuidas epideemiaid ja haigusi kontrolli all hoida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Mida me teame kasvajatelt ja kuidas me saame neid ravida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Sugulisel teel levivad haigused enda kaitsmine nende vastu .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Kuidas anda esmaabi ja kasutada tavalisemaid ravimeid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Mida me teame AIDSist/HIVist ja kuidas seda kontrolli all hoida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Kuidas alkohol ja tubakas võivad meid mõjutada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Kuidas erinevad narkootikumid võivad meid mõjutada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Mobiiltelefon ja arvuti kui võimalikud radiatsiooniallikad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Kuidas valju heli ja müra võivad kuulmist kahjustada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Kuidas kaitsta väljasuremisohus olevaid loomaliike .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Kuidas aedades ja taludes saaki parandada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Taimede kasutamine meditsiinis .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Pestitsiidide ja kunstlike väetisteta mahepõllundus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Kuidas energiat säästa või efektiivsemalt kasutada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Uued energiaallikad – päike, tuul, lainetus jms .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Kuidas erinevaid toitusid toodetakse, konserveeritakse ja säilitatakse .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Kuidas mu keha kasvab ja areneb .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Ei huvita üldse</i>			<i>Huvitab väga</i>
24. Loomad minu elukohas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Taimed minu elukohas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Detergendid ja seebid ning nende toime .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Kuidas elektrit toodetakse ja kodus tarbitakse .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Kuidas kasutada ja parandada iga päev kasutatavaid elektrilisi ja mehhaanilisi vahendeid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Inimese esimene maandumine Kuul ja kosmoseavastuste ajalugu .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Kuidas on elekter mõjutanud meie ühiskonna arengut .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Abordi bioloogilised ja inimlikud aspektid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Kuidas geenitehnoloogia võib haigusi ennetada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Moodsate talupidamismeetodite eelised ja võimalikud ohud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Miks mõnikord tekivad konfliktid usu ja loodusteaduste vahel .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Toidulisandite kasutamise riskid ja kasu .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Miks ei ole teadlased alati ühel meelel? .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Kuulsad teadlased ja nende elulood .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Suured vead uurimustöodes ja leiutistes .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Kuidas loodusteaduslikud ideed võivad mõnikord panna kahtluse alla usu, võimu ja traditsioonid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Leiutised ja avastused, mis on maailma muutnud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Hiljutised leiutised ja avastused loodusteaduste ning tehnoloogia vallas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Nähtused, millele seni puudub teaduslik selgitus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## F. Minu loodusteaduste tunnid

Mil määral nõustud järgnevate väidetega koolis õpitavate loodusteaduste kohta?

(Vastates tähistä iga real vaid üks kastike. Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Ei nõustu üldse</i>		<i>Täiesti nõus</i>	
1. Kõik loodusteadused on koolis rasked ained .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Kooli loodusteadused on huvitavad .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Loodusteadusi on mul küllaltki lihtne õppida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Koolis õpitud loodusteadused on mulle tutvustanud uusi ja huvitavaid töökohti .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Loodusteadused meeldivad mulle enamikust teistest õppeainetest rohkem .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ma arvan, et kõik peaksid koolis loodusteadusi õppima .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Loodusteaduste tundides õpitu on mulle igapäevaelus kasulik .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Loodusteaduste õppimine parandab mu väljavaateid karjääri tegemisele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Loodusteaduste tunnid on muutnud mind kriitilisemaks ja skeptilisemaks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Kooli loodusteadused on muutnud mind uudishimulikumaks nähtuste vastu, mida me veel ei oska seletada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Loodusteadused on pannud mind loodust rohkem hindama .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Kooli loodusteadused näitavad ilmekalt, kui tähtsad on loodusteadused meie elustiilile .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Loodusteaduste tundides olen õppinud, kuidas oma tervise eest paremini hoolt kanda .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Ma tahaksin saada teadlaseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Tahaksin, et mul oleks koolis nii palju loodusteaduste tunde kui vähegi võimalik .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Ma tahaksin saada töökohta tehnoloogia valdkonnas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## G. Minu arvamused loodusteadustest ja tehnoloogiast

Mil määral nõustud järgnevate väidetega? (Vastates tähistatakse igal real vaid üks kastike. Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Ei nõustu üldse</i>			<i>Täiesti nõus</i>
1. Loodusteadused ja tehnoloogia on ühiskonna jaoks olulised .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Loodusteaduste ja tehnoloogia abiga leitakse kindlasti ravi haigustele nagu näiteks HIV/AIDS, kasvajad jne .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Tänu loodusteadustele ja tehnoloogiale on tulevastel põlvkondadel rohkem võimalusi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Loodusteadused ja tehnoloogia teevad meie elu tervislikumaks, kergemaks ja mugavamaks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Uus tehnoloogia teeb töötamise huvitavamaks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Loodusteadustest on suurem kasu kui selle võimalikud kahjulikud mõjud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Loodusteadused ja tehnoloogia aitavad maailmast vaesust ja nälga kõrvaldada .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Loodusteaduste ja tehnoloogia abil saab lahendada peaaegu kõiki probleeme .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Loodusteadused ja tehnoloogia aitavad vaeseid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Loodusteadused ja tehnoloogia on keskkonnaprobleemide põhjustajaks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Riigil on arenemiseks vaja loodusteadusi ja tehnoloogiat .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Loodusteadused ja tehnoloogia toovad kasu eelkõige arenenud riikidele .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Teadlased järgivad teaduslikku meetodit, mis juhib neid alati õigete lahendusteni .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Me peaksime alati uskuma, mida teadlastel öelda on .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Teadlased on neutraalsed ja objektiivsed .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Loodusteaduslikud teooriad arenevad ja muutuvad pidevalt .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## H. Minu koolivälised kogemused

**Kui tihti sa oled seda teinud väljaspool kooli?** (Vastates tähistä iga real vaid üks kastike.

Kui küsimus on arusaamatu, jäta kastid tühjaks.)

	<i>Mitte kunagi</i>		<i>Tihti</i>	
1. proovinud leida taevast tähtkujusid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. lugenud oma horoskoopi (tulevikuennustus tähtede järgi) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. lugenud kaarti, et teed leida .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. kasutanud suuna leidmiseks kompassi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. kogunud erinevaid kive või tigude ja karpide kodasid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. vaadanud pealt looma sündi (mitte TVst) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. talus loomade eest hoolt kandnud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. külastanud loomaaeda .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. külastanud teaduskeskust või –muuseumi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. lüpsnud loomi (lehmad, kitsed jt) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. ise valmistanud piimatooteid (jogurt, või, juust) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. lugenud looduse või loodusteaduste kohta raamatutest või ajakirjadest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. vaadanud kinos või telerist loodussaateid .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. korjanud söödavaid marju, puuvilju, seeni või taimi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. käinud jahil .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. käinud kalal .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. külvanud seemneid ja jälginud nende idanemist .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. teinud lehtedest, murust või prügist komposti .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. valmistanud looduslikest materjalidest muusikainstrumendi (nt. flöödi või trummi) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. kudunud, heegeldanud vms .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. telki või varikatet üles seadnud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. teinud lõket söe või puudega .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. laagritule või lõkke kohal toitu valmistanud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. sortinud prügi selle taastöötlemiseks või korrektseks jäätmetöötluks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. haava puhastanud ja sidunud .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. näinud oma kehaosast tehtud röntgenpilti .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Mitte kunagi</i>			<i>Tihti</i>
27. võtnud arstirohtu, et ennetada või ravida haigust või nakkust .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. kasutanud ravimtaimi või alternatiivseid raviviise (nõelravi, punktravi, jooga jne) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. olnud patsiendina haiglas .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. kasutanud binoklit .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. kasutanud fotoaparaati .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. valmistanud vibu ja noolt, katapult, ragulkat või bumerangi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. kasutanud õhupüssi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. kasutanud veepumpa .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. teinud mudelit, näiteks mängulennukit või -laeva .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. kasutanud loodusteaduslikku katsekomplekti (nt keemias, optikas, elektriõpetuses) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. kasutanud tuuleveskit, vesiveskit, vesiratast jne. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. salvestanud video-, DVD- või magnetofoniga .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. vahetanud või sättinud elektripirne .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. ühendanud elektrijuhet pistikusse vms .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. kasutanud stopperit .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. mõõtnud termomeetriga temperatuuri .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. kasutanud mõõtmiseks joonlauda, mõõdulinti jne. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. kasutanud mobiiltelefoni .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. mobiiliga saatnud või vastu võtnud SMS-e (tekstsõnumeid) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. otsinud internetist informatsiooni .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. mänginud arvutimänge .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. kasutanud arvutisõnastikku, entsüklopeediat vms .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. laadinud internetist muusikat alla .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. saanud või saatnud e-maili .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. kasutanud arvutispellerit (õigekirja programmi) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. avanud seadet (raadio, kell, arvuti, telefon jne), et uurida kuidas see on ehitatud või töötab .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	<i>Mitte kunagi</i>		<i>Tihti</i>	
53. küpsetanud leiba, saiakesi, kooki jne. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. küpsetanud rooga .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. kõndinud, hoides oma pea peal mingit eset tasakaalus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. kasutanud (käsi)käru .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. kasutanud raudkangi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. kasutanud köit ja vintsi raskete asjade tõstmiseks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. parandanud jalgratta õhukummi .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. kasutanud tööriistu nagu saag, kruvikeeraja või haamer .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61. laadinud auto akut .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### **I. Mina ise teadlasena**

**Kujutle end täiskasvanuna, kes töötab teadlasena. Sa võid teostada uurimust just sel teemal, mis sulle oluline on ja huvi pakub. Kirjuta paar lauset selle kohta, mida sa uurijana teha tahaksid ja miks.**

Ma tahaksin,

.....  
 .....

Sellepärast, et

.....  
 .....

### **J. Kui palju raamatuid sul kodus on?**

Tavaliselt on ühel meetril riulil umbes 40 raamatut. Jäta ajakirjad välja. (Palun tee linnuke ainult ühte kastikesse.)

- Mitte ühtegi .....
- 1-10 raamatut.....
- 11-50 raamatut .....
- 51-100 raamatut .....
- 101-250 raamatut.....
- 251-500 raamatut.....
- Üle 500 raamatu .....

Table 2.1. Classification of students' interest towards science subjects

Subject area	Description	Items
<b>1. Physics</b>		
Astronomy	Stars, planets, meteors, comets; twinkle of the stars, history of the space exploration.	A1, A22, A23, A34, A35, A44, C16, E29
Light	Visible and invisible light (infrared and ultraviolet), colours, rainbow, optical instruments.	A19, A36, A42, C2, C17, E2
Electricity	Usage and production of electricity.	A33, E27, E28, E30
Acoustics	Different sounds, how musical instruments produce sounds, loud noise and hearing	A21, A43, E15
Nuclear physics	Nuclear power plant, atom bomb, radioactivity.	A18, A48, A30
<b>2. Biology</b>		
General biology	Evolution of life, heredity and genes, diseases and epidemics, human anatomy, sex and reproduction, babies and their mature, growth of the body.	A6, A7, A8, A9, A10, A11, A26, A29, A32, E7, E8, E23, E31, E32
Zoology	Cloning of animals, spreading and protection of animals, dangerous animals.	A12, A13, A14, A20, A27, E16, E24
Botany	Plants reproduction, usage and spreading.	A15, A28, E1, E18, E25
<b>3. Human study</b>	Eating and eating disorders, food, creams, sporting, surgery, first-aid, AIDS/HIV, tobacco, alcohol, narcotics.	A37, A38, A39, A40, A41, E9, E10, E11, E12, E13, E35
<b>4. Earth science</b>	Earth, clouds, rain, water, mountains, earthquakes.	A3, A4, A5, A24, A25
<b>5. Chemistry</b>	Molecules, atoms, reactions, chemicals, detergents, crystals.	A2, A17, A31, C18, E26
<b>6. Technology</b>	Computers, mobile phones, work of television and radio, use of lasers and satellites, petrol and diesel engines.	A45, A46, A47, C1, C3, C4, C5, C6, C7, E14, E22
<b>7. Science and scientists</b>	Religion and science, famous scientist and their lives, scientific inventions and discoveries, scientific phenomena.	E34, E36, E37, E38, E39, E40, E41, E42.
<b>8. Environment</b>	Energy, water, air pollution, ozone layer, greenhouse effect, garbage, farming.	A16, E3, E4, E5, E6, E17, E19, E20, E21, E33.
<b>9. Exceptional phenomena</b>	Astrology, horoscopes, alternative therapies, dreaming, ghosts and witches, intuition, mind-reading, six sense.	C8, C9, C10, C11, C12, C13, C14, C15

**Table 2.2. Classification of students' interest based on the presentation-style of the items**

<b>Subject area</b>	<b>School-subject-oriented items</b>	<b>Daily-life-related items</b>
<b>1. Physics</b>		
Astronomy	<b>A1, A22, A23, A35, A44, C16, E29</b>	A34
Light	A19, A36, C2, C17, E2	A42, A36
Electricity	E27, E28, E30	A33
Acoustics	A21	A43, E15
Nuclear physics	A48, A30	A18
<b>2. Biology</b>		
General biology	A6, A26, E7	A7, A8, A9, A10, A11, A29, A32, E23, E8, E31, E32
Zoology	A12, A13, A14, A20, A27, E16, E24	
Botany	A15, A28, E1, E18, E25	
<b>3. Human study</b>		A37, A38, A39, A40, A41, E9, E10, E11, E12, E13, E35
<b>4. Earth science</b>	A3, A4, A5, A24, A25	
<b>5. Chemistry</b>	A2, A17, A31, E26	C18

**Table 2.3. School differences towards science subject**

School	Statistics	Astronomy	Light	Acoustics	Electricity	Nuclear physics	General biology	Botany	Zoology	Human study	Chemistry	Earth science	Technology	Science & scientists	Environment	Exceptional phenomena	Total
1 <sup>1)</sup>	Mean*	2,64	2,35	2,34	2,42	2,56	2,65	2,21	2,72	2,68	2,23	2,41	2,42	2,35	2,37	2,56	<b>2,46</b>
	SD	0,66	0,69	0,67	0,75	0,84	0,70	0,70	0,66	0,75	0,67	0,74	0,61	0,65	0,70	0,81	<b>0,72</b>
2 <sup>2)</sup>	Mean*	2,97	2,50	2,56	2,69	2,95	2,97	2,25	2,68	2,84	2,42	2,66	2,76	2,55	2,58	2,86	<b>2,68</b>
	SD	0,47	0,53	0,73	0,60	0,71	0,58	0,57	0,61	0,61	0,52	0,43	0,57	0,65	0,64	0,72	<b>0,63</b>
3 <sup>2)</sup>	Mean*	2,78	2,34	2,35	2,27	2,55	2,49	1,95	2,39	2,59	2,12	2,30	2,44	2,17	2,14	2,72	<b>2,38</b>
	SD	0,76	0,73	0,71	0,83	1,14	0,73	0,74	0,76	0,58	0,80	0,60	0,75	0,79	0,81	0,85	<b>0,80</b>
4 <sup>2)</sup>	Mean*	2,98	2,38	2,33	2,45	2,88	2,97	2,26	2,71	2,85	2,61	2,56	2,38	2,42	2,22	2,85	<b>2,59</b>
	SD	0,61	0,64	0,66	0,80	0,86	0,66	0,62	0,63	0,58	0,56	0,59	0,73	0,70	0,68	0,80	<b>0,72</b>
5 <sup>1)</sup>	Mean*	2,82	2,16	2,04	2,30	2,51	2,68	1,95	2,43	2,58	2,13	2,06	2,16	2,44	2,23	2,74	<b>2,35</b>
	SD	0,54	0,46	0,61	0,72	0,87	0,55	0,59	0,66	0,61	0,45	0,46	0,60	0,61	0,61	0,69	<b>0,66</b>
6 <sup>2)</sup>	Mean*	2,70	2,20	2,08	2,10	2,38	2,61	1,92	2,49	2,55	2,22	2,37	2,23	2,21	2,11	2,98	<b>2,35</b>
	SD	0,80	0,65	0,59	0,69	0,83	0,58	0,51	0,54	0,60	0,54	0,57	0,63	0,62	0,64	0,72	<b>0,69</b>
7 <sup>2)</sup>	Mean*	2,59	2,04	2,24	2,21	2,26	2,47	2,04	2,54	2,61	2,02	2,33	2,19	2,11	2,23	2,65	<b>2,30</b>
	SD	0,68	0,55	0,67	0,71	0,73	0,48	0,69	0,43	0,60	0,60	0,44	0,57	0,84	0,81	0,84	<b>0,67</b>
8 <sup>1)</sup>	Mean*	2,95	2,46	2,53	2,51	2,58	2,81	2,18	2,76	2,66	2,31	2,39	2,61	2,35	2,38	2,95	<b>2,57</b>
	SD	0,67	0,60	0,66	0,66	0,85	0,59	0,72	0,55	0,67	0,67	0,69	0,62	0,64	0,53	0,81	<b>0,69</b>
9 <sup>2)</sup>	Mean*	2,76	2,30	2,23	2,24	2,48	2,81	2,05	2,62	2,92	2,11	2,61	2,29	2,31	2,19	2,80	<b>2,45</b>
	SD	0,73	0,64	0,66	0,68	0,84	0,64	0,70	0,65	0,58	0,49	0,70	0,62	0,62	0,72	0,81	<b>0,72</b>
10 <sup>2)</sup>	Mean*	2,59	2,13	2,07	2,13	2,30	2,23	1,75	2,26	2,32	2,01	2,00	2,26	2,09	1,88	2,43	<b>2,17</b>
	SD	0,62	0,53	0,70	0,72	0,88	0,57	0,58	0,63	0,54	0,49	0,56	0,58	0,62	0,67	0,76	<b>0,66</b>

School	Statistics	Astronomy	Light	Acoustics	Electricity	Nuclear physics	General biology	Botany	Zoology	Human study	Chemistry	Earth science	Technology	Science & scientists	Environment	Exceptional phenomena	Total
11 <sup>2)</sup>	Mean*	2,83	2,40	2,40	2,43	2,42	2,91	2,11	2,59	3,05	2,14	2,45	2,45	2,27	2,20	2,97	<b>2,51</b>
	SD	0,54	0,61	0,67	0,85	0,87	0,56	0,73	0,73	0,48	0,56	0,65	0,66	0,68	0,72	0,74	<b>0,73</b>
12 <sup>1)</sup>	Mean*	2,65	2,22	2,19	2,30	2,47	2,54	2,10	2,59	2,50	1,93	2,18	2,34	2,18	2,29	2,61	<b>2,35</b>
	SD	0,78	0,61	0,80	0,68	0,86	0,56	0,66	0,61	0,67	0,55	0,63	0,79	0,44	0,74	0,71	<b>0,70</b>
13 <sup>1)</sup>	Mean*	2,56	2,33	2,35	2,47	2,32	2,69	1,92	2,35	2,83	2,12	2,38	2,41	2,34	2,11	2,70	<b>2,40</b>
	SD	0,59	0,57	0,68	0,74	0,89	0,47	0,48	0,50	0,58	0,52	0,45	0,59	0,80	0,65	0,74	<b>0,66</b>
14 <sup>3)</sup>	Mean*	2,84	2,36	2,14	2,46	2,72	2,67	2,05	2,72	2,69	2,15	2,36	2,46	2,45	2,24	2,72	<b>2,47</b>
	SD	0,61	0,61	0,71	0,77	0,91	0,54	0,53	0,57	0,46	0,76	0,55	0,69	0,69	0,65	0,72	<b>0,70</b>
15 <sup>2)</sup>	Mean*	2,90	2,30	2,10	2,50	2,74	2,66	2,06	2,57	2,82	2,11	2,52	2,48	2,22	2,22	2,86	<b>2,48</b>
	SD	0,47	0,51	0,57	0,78	1,08	0,58	0,59	0,67	0,66	0,60	0,50	0,53	0,53	0,56	0,58	<b>0,68</b>
16 <sup>2)</sup>	Mean*	2,61	2,12	2,17	2,36	2,55	2,75	2,06	2,50	2,79	2,16	2,38	2,39	2,10	2,22	2,45	<b>2,38</b>
	SD	0,51	0,44	0,64	0,62	0,80	0,58	0,50	0,56	0,69	0,44	0,58	0,62	0,50	0,54	0,67	<b>0,62</b>
17 <sup>1)</sup>	Mean*	2,96	2,24	2,17	2,37	3,06	2,69	2,09	2,52	2,69	2,09	2,17	2,45	2,65	2,65	3,00	<b>2,52</b>
	SD	0,79	0,43	0,75	0,64	0,98	0,60	0,51	0,64	0,71	0,78	0,61	0,55	1,02	0,59	0,83	<b>0,76</b>
18 <sup>2)</sup>	Mean*	2,67	2,08	2,35	2,37	2,54	2,58	1,94	2,51	2,73	2,14	2,50	2,34	2,34	2,16	2,43	<b>2,38</b>
	SD	0,53	0,48	0,73	0,57	0,70	0,61	0,42	0,43	0,55	0,54	0,53	0,59	0,64	0,61	0,65	<b>0,61</b>
19 <sup>2)</sup>	Mean*	3,03	2,45	2,33	2,53	2,68	2,72	2,18	2,62	2,78	2,29	2,65	2,60	2,24	2,27	2,86	<b>2,55</b>
	SD	0,62	0,51	0,68	0,78	0,94	0,55	0,59	0,59	0,53	0,43	0,35	0,73	0,66	0,66	0,79	<b>0,68</b>
20 <sup>3)</sup>	Mean*	2,61	1,96	1,99	2,09	2,51	2,23	1,68	2,14	2,16	1,97	2,16	2,17	2,14	1,92	2,64	<b>2,16</b>
	SD	0,77	0,54	0,63	0,74	1,00	0,50	0,55	0,60	0,56	0,56	0,66	0,73	0,68	0,60	0,64	<b>0,70</b>
21 <sup>2)</sup>	Mean*	3,18	2,55	2,25	2,52	2,92	2,87	2,07	2,67	2,87	2,49	2,42	2,65	2,40	2,25	3,10	<b>2,62</b>
	SD	0,59	0,72	0,83	0,73	0,72	0,67	0,66	0,74	0,56	0,53	0,61	0,62	0,79	0,74	0,70	<b>0,74</b>

School	Statistics	Astronomy	Light	Acoustics	Electricity	Nuclear physics	General biology	Botany	Zoology	Human study	Chemistry	Earth science	Technology	Science & scientists	Environment	Exceptional phenomena	Total
22 <sup>1)</sup>	Mean*	3,05	2,51	2,53	2,63	2,79	2,99	2,14	2,64	2,93	2,24	2,46	2,45	2,54	2,37	2,95	<b>2,62</b>
	SD	0,58	0,61	0,69	0,59	0,69	0,55	0,66	0,61	0,54	0,66	0,64	0,51	0,71	0,64	0,81	<b>0,68</b>
23 <sup>1)</sup>	Mean*	3,10	2,46	2,45	2,60	2,67	2,78	2,00	2,63	2,75	2,08	2,43	2,55	2,55	2,10	2,79	<b>2,54</b>
	SD	0,56	0,53	0,76	0,61	0,65	0,44	0,52	0,63	0,58	0,46	0,61	0,62	0,72	0,64	0,86	<b>0,68</b>
24 <sup>1)</sup>	Mean*	2,64	2,21	2,10	2,35	2,67	2,55	1,92	2,49	2,40	2,31	2,11	2,44	2,21	2,08	2,61	<b>2,52</b>
	SD	0,71	0,62	0,61	0,55	0,87	0,56	0,52	0,62	0,64	0,59	0,60	0,82	0,67	0,70	0,95	<b>0,70</b>
25 <sup>2)</sup>	Mean*	2,88	2,45	2,30	2,47	2,75	2,70	2,14	2,61	2,57	2,26	2,63	2,46	2,38	2,26	2,88	<b>2,52</b>
	SD	0,58	0,59	0,76	0,75	0,95	0,61	0,62	0,49	0,73	0,63	0,57	0,67	0,84	0,77	0,72	<b>0,72</b>
Total	Mean*	<b>2,81</b>	<b>2,30</b>	<b>2,26</b>	<b>2,39</b>	<b>2,60</b>	<b>2,69</b>	<b>2,04</b>	<b>2,55</b>	<b>2,69</b>	<b>2,19</b>	<b>2,38</b>	<b>2,41</b>	<b>2,32</b>	<b>2,22</b>	<b>2,76</b>	<b>2,45</b>
	SD	<b>0,65</b>	<b>0,59</b>	<b>0,69</b>	<b>0,71</b>	<b>0,87</b>	<b>0,60</b>	<b>0,61</b>	<b>0,62</b>	<b>0,63</b>	<b>0,59</b>	<b>0,60</b>	<b>0,65</b>	<b>0,68</b>	<b>0,67</b>	<b>0,77</b>	<b>0,70</b>
p value		0,002***	0,01**	0,10	0,16	0,09	<0,001***	0,07	0,03**	<0,001***	0,01**	<0,001***	0,05	0,23	0,05	0,03**	

\* Likert style responses ranging from “not interested” to “very interested” were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,01 level of confidence (2-tailed)

\*\*\* Significant difference at the 0,05 level of confidence (2-tailed)

Note: <sup>1)</sup> Big towns' schools (Tallinn, Tartu, Pärnu, Narva, Kohtla-Järve); <sup>2)</sup> Small towns' and countryside schools; <sup>3)</sup> Schools without service district



**Table 2.4. Students' interests towards different science topics**

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
A1. Stars, planets and the universe	2,72	0,87	2,69	0,90	2,71	0,89	0,03	0,618
A2. Chemicals, their properties and how they react	1,92	0,83	2,16	0,90	2,04	0,87	-0,24	<0,001***
A3. The inside of the earth	1,96	0,80	2,18	0,82	2,07	0,82	-0,22	0,001***
A4. How mountains, rivers and oceans develop and change	2,13	0,82	2,14	0,80	2,13	0,81	-0,01	0,87
A5. Clouds, rain and the weather	2,18	0,79	1,99	0,77	2,08	0,79	0,19	0,002***
A6. The origin and evolution of life on earth	2,66	0,91	2,57	0,90	2,62	0,91	0,09	0,17
A7. How the human body is built and functions	2,73	0,85	2,40	0,84	2,56	0,86	0,33	<0,001***
A8. Heredity, and how genes influence how we develop	2,78	0,91	2,37	0,88	2,58	0,92	0,41	<0,000***
A9. Sex and reproduction	2,82	0,81	3,22	0,79	3,02	0,83	-0,40	<0,000***
A10. Birth control and contraception	2,32	0,86	2,12	0,81	2,22	0,84	0,20	0,002***
A11. How babies grow and mature	2,71	0,96	1,97	0,79	2,35	0,95	0,74	<0,000***
A12. Cloning of animals	2,56	1,08	2,56	1,05	2,56	1,07	0,00	0,96
A13. Animals in other parts of the world	2,67	0,90	2,39	0,85	2,53	0,89	0,28	<0,000***
A14. Dinosaurs, how they lived and why they died out	2,58	1,02	2,78	0,96	2,68	0,99	-0,20	0,01**
A15. How plants grow and reproduce	1,83	0,78	1,75	0,70	1,79	0,74	0,08	0,14
A16. How people, animals, plants and the environment depend on each other	2,14	0,85	2,03	0,80	2,08	0,82	0,11	0,07
A17. Atoms and molecules	1,62	0,83	1,95	0,89	1,78	0,88	-0,33	<0,001***
A18. How radioactivity affects the human body	2,43	0,98	2,75	0,91	2,59	0,96	-0,32	<0,001***
A19. Light around us that we cannot see (infrared, ultraviolet)	2,28	0,96	2,77	0,90	2,53	0,96	-0,49	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
A20. How animals use colours to hide, attract or scare	2,46	0,92	2,24	0,88	2,35	0,91	0,22	0,002***
A21. How different musical instruments produce different sounds	2,09	0,94	2,05	0,96	2,07	0,95	0,04	0,64
A22. Black holes, supernovas and other spectacular objects in outer space	2,88	1,00	2,98	0,98	2,93	0,99	-0,10	0,17
A23. How meteors, comets or asteroids may cause disasters on earth	3,02	0,93	3,07	0,89	3,05	0,91	-0,05	0,49
A24. Earthquakes and volcanoes	2,82	0,90	2,83	0,88	2,83	0,89	-0,01	0,93
A25. Tornados, hurricanes and cyclones	2,82	0,92	2,79	0,90	2,81	0,91	0,03	0,64
A26. Epidemics and diseases causing large losses of life	2,96	0,88	2,48	0,89	2,72	0,92	0,48	<0,001***
A27. Brutal, dangerous and threatening animals	2,59	0,92	2,61	0,87	2,60	0,90	-0,02	0,75
A28. Poisonous plants in my area	2,40	0,92	2,32	0,92	2,36	0,92	0,08	0,27
A29. Deadly poisons and what they do to the human body	2,94	0,85	2,81	0,91	2,88	0,88	0,13	0,05
A30. How the atom bomb functions	2,37	1,07	3,33	0,82	2,85	1,07	-0,96	<0,001***
A31. Explosive chemicals	2,37	1,00	3,32	0,82	2,84	1,03	-0,95	<0,001***
A32. Biological and chemical weapons and what they do to the human body	2,58	0,99	3,14	0,85	2,86	0,97	-0,56	<0,001***
A33. The effect of strong electric shocks and lightning on the human body	2,77	0,92	3,09	0,89	2,93	0,92	-0,32	<0,001***
A34. How it feels to be weightless in space	3,32	0,89	3,35	0,91	3,33	0,90	-0,03	0,67
A35. How to find my way and navigate by the stars	2,90	1,01	2,63	1,01	2,77	1,02	0,27	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
A36. How the eye can see light and colours	2,35	0,93	2,19	0,87	2,27	0,90	0,16	0,02**
A37. What to eat to keep healthy and fit	3,41	0,84	2,56	1,00	2,99	1,02	0,85	<0,001***
A38. Eating disorders like anorexia or bulimia	3,01	0,93	1,83	0,81	2,42	1,05	1,18	<0,001***
A39. The ability of lotions and creams to keep the skin young	3,05	0,98	1,77	0,82	2,42	1,11	1,28	<0,001***
A40. How to exercise to keep the body fit and strong	3,44	0,81	2,94	0,98	3,19	0,93	0,50	<0,001***
A41. Plastic surgery and cosmetic surgery	2,60	1,07	1,71	0,85	2,15	1,06	0,89	<0,001***
A42. How radiation from solariums and the sun might affect the skin	3,10	0,94	1,93	0,84	2,52	1,07	1,17	<0,001***
A43. How the ear can hear different sounds	2,30	0,88	2,13	0,90	2,22	0,89	0,17	0,02**
A44. Rockets, satellites and space travel	2,54	0,99	3,07	0,98	2,80	1,01	-0,53	<0,001***
A45. The use of satellites for communication and other purposes	2,23	0,97	2,81	0,97	2,52	1,01	-0,58	<0,001***
A46. How X-rays, ultrasound, etc. are used in medicine	2,26	0,95	2,37	1,42	2,32	1,21	-0,11	0,21
A47. How petrol and diesel engines work	1,59	0,82	2,91	0,96	2,24	1,11	-1,32	<0,001***
A48. How a nuclear power plant functions	1,79	0,94	2,95	0,98	2,36	1,12	-1,16	<0,001***
C1. How crude oil is converted to other materials, like plastics and textiles	1,52	0,71	1,94	0,89	1,73	0,83	-0,42	<0,001***
C2. Optical instruments and how they work (telescope, camera, microscope, etc.)	1,91	0,84	2,45	0,91	2,18	0,91	-0,54	<0,001***
C3. The use of lasers for technical purposes (CD-players, bar-code readers, etc.)	2,12	0,95	3,07	0,82	2,59	1,01	-0,95	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
C4. How cassette tapes, CDs and DVDs store and play sound and music	2,32	0,95	2,94	0,90	2,63	0,98	-0,62	<0,001***
C5. How things like radios and televisions work	1,98	0,83	2,67	0,87	2,32	0,92	-0,69	<0,001***
C6. How mobile phones can send and receive messages	2,34	0,97	2,72	0,95	2,52	0,98	-0,38	<0,001***
C7. How computers work	2,62	0,96	3,17	0,91	2,89	0,97	-0,55	<0,001***
C8. The possibility of life outside earth	2,81	0,99	3,05	0,99	2,93	1,00	-0,24	0,003***
C9. Astrology and horoscopes, and whether the planets can influence human beings	2,89	1,01	2,34	1,09	2,62	1,08	0,55	<0,001***
C10. Unsolved mysteries in outer space	2,80	1,06	2,77	1,08	2,79	1,07	0,03	0,78
C11. Life and death and the human soul	3,02	0,98	2,52	1,04	2,77	1,04	0,50	<0,001***
C12. Alternative therapies (acupuncture, homeopathy, yoga, healing, etc.) and how effective they are	2,81	1,02	2,12	1,01	2,47	1,07	0,69	<0,001***
C13. Why we dream while we are sleeping, and what the dreams may mean	3,42	0,74	2,60	1,04	3,01	0,99	0,82	<0,001***
C14. Ghosts and witches, and whether they may exist	3,04	0,97	2,25	1,11	2,65	1,11	0,79	<0,001***
C15. Thought transference, mind-reading, sixth sense, intuition, etc.	3,14	0,95	2,51	1,09	2,83	1,07	0,63	<0,001***
C16. Why the stars twinkle and the sky is blue	2,67	0,99	2,32	1,00	2,50	1,01	0,35	<0,001***
C17. Why we can see the rainbow	2,41	0,97	2,04	0,94	2,23	0,97	0,37	<0,001***
C18. Properties of gems and crystals and how these are used for beauty	2,53	1,03	2,33	0,99	2,43	1,02	0,20	0,01**
E1. Symmetries and patterns in leaves and flowers	1,62	0,82	1,35	0,61	1,48	0,73	0,27	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
E2. How the sunset colours the sky	2,33	0,93	1,88	0,83	2,11	0,91	0,45	<0,001***
E3. The ozone layer and how it may be affected by humans	2,31	0,96	2,20	0,88	2,25	0,92	0,11	0,13
E4. The greenhouse effect and how it may be changed by humans	2,13	0,98	2,21	0,94	2,17	0,96	-0,08	0,24
E5. What can be done to ensure clean air and safe drinking water	2,57	0,92	2,43	0,90	2,50	0,92	0,14	0,04**
E6. How technology helps us to handle waste, garbage and sewage	2,21	0,95	2,42	0,93	2,31	0,95	-0,21	0,004***
E7. How to control epidemics and diseases	2,94	0,88	2,47	0,93	2,71	0,93	0,47	<0,001***
E8. Cancer, what we know and how we can treat it	3,02	0,86	2,47	0,96	2,75	0,95	0,55	<0,001***
E9. Sexually transmitted diseases and how to be protected against them	3,12	0,85	2,77	0,94	2,95	0,91	0,35	<0,001***
E10. How to perform first-aid and use basic medical equipment	3,22	0,82	2,74	0,88	2,98	0,88	0,48	<0,001***
E11. What we know about HIV/AIDS and how to control it	3,19	0,82	2,71	0,94	2,95	0,91	0,48	<0,001***
E12. How alcohol and tobacco might affect the body	3,00	0,86	2,65	0,93	2,83	0,91	0,35	<0,001***
E13. How different narcotics might affect the body	3,08	0,85	2,77	0,95	2,93	0,91	0,31	<0,001***
E14. The possible radiation dangers of mobile phones and computers	2,72	0,93	2,75	0,98	2,74	0,96	-0,03	0,67
E15. How loud sound and noise may damage my hearing	2,54	0,86	2,48	0,89	2,51	0,88	0,06	0,42
E16. How to protect endangered species of animals	2,92	0,93	2,53	0,91	2,73	0,94	0,39	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
E17. How to improve the harvest in gardens and farms	2,00	0,94	2,24	0,96	2,12	0,96	-0,24	0,001***
E18. Medicinal use of plants	2,54	0,98	2,24	0,90	2,39	0,95	0,30	<0,001***
E19. Organic and ecological farming without use of pesticides and artificial fertilizers	1,82	0,98	1,91	0,93	1,87	0,96	-0,09	0,21
E20. How energy can be saved or used in a more effective way	2,30	1,01	2,61	0,96	2,45	0,99	-0,31	<0,001***
E21. New sources of energy from the sun, wind, tides, waves, etc.	2,40	1,03	2,75	0,94	2,57	1,00	-0,35	<0,001***
E22. How different sorts of food are produced, conserved and stored	2,03	0,92	2,13	0,89	2,08	0,90	-0,10	0,15
E23. How my body grows and matures	2,89	0,90	2,52	0,91	2,71	0,92	0,37	<0,001***
E24. Animals in my area	2,58	0,92	2,24	0,90	2,42	0,92	0,34	<0,001***
E25. Plants in my area	2,32	0,93	2,03	0,90	2,18	0,93	0,29	<0,001***
E26. Detergents, soaps and how they work	2,02	0,91	1,67	0,75	1,84	0,85	0,35	<0,001***
E27. Electricity, how it is produced and used in the home	1,81	0,85	2,39	0,89	2,09	0,91	-0,58	<0,001***
E28. How to use and repair everyday electrical and mechanical equipment	1,83	0,85	2,63	0,90	2,23	0,96	-0,80	<0,001***
E29. The first landing on the moon and the history of space exploration	2,29	1,00	2,53	1,01	2,41	1,01	-0,24	0,002***
E30. How electricity has affected the development of our society	2,06	0,83	2,50	0,93	2,28	0,91	-0,44	<0,001***
E31. Biological and human aspects of abortion	2,86	1,00	2,05	0,95	2,46	1,05	0,81	<0,001***
E32. How gene technology can prevent diseases	2,93	0,93	2,47	0,95	2,70	0,97	0,46	<0,001***

Items	Girls N=340		Boys N=335		Total N=675		Gender differences in means	p
	Mean*	SD	Mean*	SD	Mean*	SD		
E33. Benefits and possible hazards of modern methods of farming	1,81	0,83	2,05	0,91	1,93	0,88	-0,24	<0,001***
E34. Why religion and science sometimes are in conflict	1,99	0,97	1,84	0,93	1,91	0,95	0,15	0,04**
E35. Risks and benefits of food additives	2,57	0,97	2,05	0,90	2,32	0,97	0,52	<0,001***
E36. Why scientists sometimes disagree	1,98	0,99	1,91	0,93	1,95	0,96	0,07	0,41
E37. Famous scientists and their lives	1,77	0,94	1,84	0,90	1,81	0,92	-0,07	0,35
E38. Big blunders and mistakes in research and inventions	2,24	1,05	2,48	0,96	2,36	1,02	-0,24	0,002***
E39. How scientific ideas sometimes challenge religion, authority and tradition	2,01	1,02	1,90	0,95	1,95	0,98	0,11	0,18
E40. Inventions and discoveries that have changed the world	2,61	0,92	2,81	0,93	2,71	0,93	-0,20	0,01**
E41. Very recent inventions and discoveries in science and technology	2,50	1,03	2,83	0,96	2,66	1,01	-0,33	<0,001***
E42. Phenomena that scientists still cannot explain	3,25	0,94	3,12	0,95	3,18	0,95	0,13	0,08

\* Likert style responses ranging from “not interested” to “very interested” ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,05 level of confidence (2-tailed)

\*\*\* Significant difference at the 0,01 level of confidence (2-tailed)

**Table 2.5. Rotated component matrix (boys and girls together)**

Items	Factors							
	1	2	3	4	5	6	7	8
B16. Working with something that fits my attitudes and values	<b>0,72</b>	-0,18	0,10	-0,20	0,07	0,13	-0,01	0,11
B15. Working with something I find important and meaningful	<b>0,71</b>	-0,17	0,10	-0,08	0,12	0,10	0,17	0,09
B25. Developing or improving my knowledge and abilities	<b>0,59</b>	0,15	0,12	0,02	-0,08	-0,03	0,24	0,18
B13. Making my own decisions	<b>0,56</b>	0,27	0,15	0,02	0,04	-0,01	0,04	0,07
B24. Becoming 'the boss' at my job	0,09	<b>0,82</b>	-0,01	0,08	-0,04	0,07	0,02	0,05
B21. Controlling other people	0,01	<b>0,80</b>	-0,05	0,04	0,01	0,03	-0,06	0,07
B22. Becoming famous	-0,08	<b>0,73</b>	0,08	-0,05	0,09	0,04	0,06	0,07
B20. Earning lots of money	-0,05	<b>0,43</b>	0,01	0,04	-0,19	0,28	-0,01	0,34
B10. Making, designing or inventing something	0,05	0,08	<b>0,83</b>	0,16	0,01	0,11	0,05	0,04
B11. Coming up with new ideas	0,32	0,22	<b>0,71</b>	0,09	0,02	0,13	0,00	-0,07
B8. Working artistically and creatively in art	0,06	-0,20	<b>0,66</b>	-0,12	0,20	-0,10	0,04	0,30
B9. Using my talents and abilities	0,42	-0,14	<b>0,51</b>	0,05	-0,05	0,07	0,20	-0,01
B7. Working with machines or tools	0,02	0,01	0,01	<b>0,87</b>	0,04	-0,03	0,01	0,02
B6. Building or repairing objects using my hands	-0,04	-0,04	0,28	<b>0,80</b>	0,17	-0,02	0,03	0,05
gender	-0,26	0,19	-0,11	<b>0,62</b>	-0,20	0,08	-0,18	-0,26
B3. Working with animals	0,06	0,00	0,05	-0,07	<b>0,88</b>	0,07	0,12	0,03
B4. Working in the area of environmental protection	0,05	0,01	0,06	0,12	<b>0,86</b>	0,04	0,10	-0,04
B12. Having lots of time for my friends	-0,12	0,08	0,12	0,00	0,01	<b>0,72</b>	0,18	0,25
B23. Having lots of time for my interests, hobbies and activities	0,11	0,23	0,08	-0,05	0,05	<b>0,71</b>	-0,03	0,12
B17. Having lots of time for my family	0,32	-0,12	-0,02	0,00	0,07	<b>0,66</b>	0,20	-0,07
B5. Working with something easy and simple	-0,24	0,12	0,01	0,23	0,31	<b>0,38</b>	-0,19	0,35
B2. Helping other people	0,23	-0,07	0,12	0,05	0,32	0,07	<b>0,66</b>	0,14
B26. Working as part of a team with many people around me	0,21	0,27	-0,01	0,16	0,03	0,13	<b>0,64</b>	0,08
B1. Working with people rather than things	0,19	-0,06	0,12	-0,24	0,15	0,03	<b>0,57</b>	0,17
B14. Working independently of other people	0,34	0,15	0,02	0,17	0,30	-0,18	<b>-0,51</b>	0,19
B18. Working with something that involves a lot of traveling	0,18	0,13	0,06	-0,09	0,06	0,12	0,11	<b>0,74</b>
B19. Working at a place where something new and exciting happens frequently	0,27	0,15	0,09	7,28 E-06	-0,04	0,18	0,15	<b>0,71</b>



**Table 2.6. Rotated Component Matrix for girls**

Items	Factors							
	1	2	3	4	5	6	7	8
B24. Becoming 'the boss' at my job	<b>0,84</b>	0,02	0,09	-0,05	0,01	0,02	-0,03	-0,06
B21. Controlling other people	<b>0,80</b>	-0,10	0,03	-0,01	-0,07	0,01	-0,05	0,13
B22. Becoming famous	<b>0,73</b>	0,05	0,03	0,04	-0,09	0,15	0,03	-0,12
B20. Earning lots of money	<b>0,48</b>	0,01	0,13	-0,22	0,03	0,22	0,03	0,41
B13. Making my own decisions	<b>0,41</b>	0,33	-0,09	0,01	0,32	-0,07	0,03	0,11
B10. Making, designing or inventing something	0,07	<b>0,81</b>	0,09	0,07	-0,10	0,06	0,04	-0,07
B11. Coming up with new ideas	0,22	<b>0,74</b>	0,04	-0,03	0,09	-0,01	-0,04	-0,09
B8. Working artistically and creatively in art	-0,24	<b>0,71</b>	0,00	0,08	0,09	0,03	0,10	0,11
B9. Using my talents and abilities	-0,17	<b>0,51</b>	0,02	-0,04	0,46	-0,08	0,23	0,02
B12. Having lots of time for my friends	0,07	0,08	<b>0,75</b>	0,01	-0,07	0,06	0,15	0,28
B17. Having lots of time for my family	-0,12	-0,02	<b>0,73</b>	0,02	0,24	-0,01	0,02	-0,05
B23. Having lots of time for my interests, hobbies and activities	0,22	0,07	<b>0,69</b>	0,11	0,12	0,15	-0,04	0,01
B4. Working in the area of environmental protection	-0,05	0,06	0,04	<b>0,87</b>	0,05	-0,10	0,06	-0,04
B3. Working with animals	-0,05	0,01	0,08	<b>0,85</b>	0,00	0,04	0,11	0,11
B16. Working with something that fits my attitudes and values	-0,11	0,00	0,15	-0,03	<b>0,79</b>	0,06	0,03	-0,04
B15. Working with something I find important and meaningful	0,01	0,02	0,11	0,07	<b>0,75</b>	0,03	0,15	-0,03
B25. Developing or improving my knowledge and abilities	0,17	0,18	0,03	0,14	<b>0,51</b>	0,13	-0,05	-0,48
B18. Working with something that involves a lot of travelling	0,17	0,25	0,29	0,17	0,05	<b>0,66</b>	-0,11	0,07
B7. Working with machines or tools	0,01	0,26	0,08	0,25	-0,02	<b>-0,60</b>	-0,14	0,00
B6. Building or repairing objects using my hands	0,02	0,49	0,14	0,26	0,04	<b>-0,56</b>	0,00	0,19
B19. Working at a place where something new and exciting happens frequently	0,20	0,30	0,27	0,15	0,15	<b>0,54</b>	0,08	0,02
B1. Working with people rather than things	0,00	0,10	-0,07	0,11	0,22	0,16	<b>0,75</b>	0,17
B2. Helping other people	0,06	0,19	0,11	0,37	0,20	-0,05	<b>0,63</b>	0,00
B14. Working independently of other people	0,24	0,20	-0,16	0,31	0,21	0,01	<b>-0,53</b>	0,20
B5. Working with something easy and simple	0,12	0,09	0,30	0,24	-0,07	-0,05	0,07	<b>0,70</b>
B26. Working as part of a team with many people around me	0,31	0,12	0,32	0,01	0,02	-0,10	0,40	<b>-0,43</b>

**Table 2.7. Rotated Component Matrix for boys**

Items	Factors							
	1	2	3	4	5	6	7	8
B21. Controlling other people	<b>0,82</b>	-0,01	0,03	0,08	0,10	0,03	-0,01	0,02
B24. Becoming 'the boss' at my job	<b>0,79</b>	0,06	0,00	0,07	0,13	0,02	0,05	0,12
B22. Becoming famous	<b>0,59</b>	0,01	0,12	-0,19	0,05	0,25	-0,16	0,37
B2. Helping other people	-0,09	<b>0,70</b>	0,11	0,04	-0,01	0,22	0,18	0,20
B1. Working with people rather than things	0,05	<b>0,63</b>	0,06	0,10	0,05	0,06	-0,06	-0,04
B26. Working as part of a team with many people around me	0,25	<b>0,62</b>	0,00	0,05	0,14	0,08	0,19	0,21
B17. Having lots of time for my family	-0,19	<b>0,47</b>	0,11	0,20	0,43	0,12	-0,10	0,02
B10. Making, designing or inventing something	0,02	0,05	<b>0,84</b>	0,03	0,17	0,02	0,19	-0,03
B11. Coming up with new ideas	0,16	0,13	<b>0,70</b>	0,33	0,18	0,08	0,05	-0,08
B9. Using my talents and abilities	-0,02	0,26	<b>0,58</b>	0,27	-0,02	-0,14	0,07	0,08
B8. Working artistically and creatively in art	-0,04	-0,16	<b>0,55</b>	-0,06	-0,16	0,19	0,03	0,41
B16. Working with something that fits my attitudes and values	-0,12	0,02	0,25	<b>0,71</b>	0,02	0,04	-0,09	0,24
B13. Making my own decisions	0,27	0,29	0,05	<b>0,64</b>	0,05	-0,05	0,02	-0,06
B15. Working with something I find important and meaningful	-0,20	0,25	0,30	<b>0,59</b>	-0,03	0,08	0,06	0,21
B14. Working independently of other people	0,16	-0,34	-0,07	<b>0,54</b>	-0,09	0,26	0,22	-0,06
B25. Developing or improving my knowledge and abilities	0,21	0,32	0,17	<b>0,38</b>	0,02	-0,22	0,10	0,37
B12. Having lots of time for my friends	0,09	0,24	0,12	-0,15	<b>0,73</b>	-0,07	0,04	0,07
B23. Having lots of time for my interests, hobbies and activities	0,12	0,05	0,13	0,10	<b>0,67</b>	0,08	-0,23	0,18
B5. Working with something easy and simple	0,11	-0,29	-0,12	-0,03	<b>0,54</b>	0,33	0,22	0,18
B20. Earning lots of money	0,41	0,05	-0,02	0,00	<b>0,52</b>	-0,20	0,19	0,04
B3. Working with animals	0,07	0,17	0,02	0,05	0,01	<b>0,86</b>	0,05	-0,01
B4. Working in the area of environmental protection	0,03	0,14	0,05	0,05	0,02	<b>0,86</b>	0,11	0,00
B6. Building or repairing objects using my hands	-0,03	0,04	0,25	-0,02	-0,02	0,15	<b>0,84</b>	0,04
B7. Working with machines or tools	0,03	0,09	0,05	0,09	0,02	0,03	<b>0,84</b>	0,09
B18. Working with something that involves a lot of travelling	0,15	0,17	-0,01	0,10	0,16	0,04	0,06	<b>0,73</b>
B19. Working at a place where something new and exciting happens frequently	0,17	0,12	0,03	0,24	0,37	-0,12	0,12	<b>0,64</b>

**Table 2.8. Schools differences towards career priorities**

School	Statistics	Self-development	Power	Creativity	Tools	Nature	Friends and free time	Others	Entertainment
1 <sup>1)</sup>	Mean*	3,14	2,85	2,76	1,98	2,07	2,63	2,56	3,00
	SD	0,66	0,77	0,72	0,75	0,96	0,61	0,55	0,89
2 <sup>2)</sup>	Mean*	3,16	2,79	2,92	2,33	2,19	2,91	2,75	3,02
	SD	0,49	0,54	0,58	0,81	0,92	0,56	0,52	0,69
3 <sup>2)</sup>	Mean*	3,16	2,57	2,84	2,33	1,92	2,85	2,57	2,81
	SD	0,54	0,55	0,55	0,93	0,87	0,52	0,54	0,91
4 <sup>2)</sup>	Mean*	3,34	2,39	3,17	2,14	2,21	2,77	2,76	3,00
	SD	0,41	0,79	0,66	0,93	1,03	0,65	0,44	0,71
5 <sup>1)</sup>	Mean*	3,30	2,46	2,85	1,85	1,90	2,74	2,46	2,86
	SD	0,52	0,68	0,64	0,76	0,97	0,50	0,45	0,70
6 <sup>2)</sup>	Mean*	3,18	2,37	3,08	2,05	1,79	2,75	2,65	2,93
	SD	0,44	0,66	0,59	0,72	0,58	0,42	0,39	0,64
7 <sup>2)</sup>	Mean*	2,94	2,59	2,50	2,40	1,97	2,79	2,42	2,47
	SD	0,54	0,54	0,68	0,88	0,79	0,53	0,33	0,75
8 <sup>1)</sup>	Mean*	3,18	2,60	2,93	1,82	2,32	2,87	2,72	3,20
	SD	0,56	0,59	0,50	0,80	0,78	0,46	0,49	0,76
9 <sup>2)</sup>	Mean*	3,13	2,52	2,77	2,03	2,08	2,86	2,68	2,94
	SD	0,56	0,63	0,64	0,60	0,94	0,60	0,52	0,66
10 <sup>2)</sup>	Mean*	2,99	2,84	2,56	1,97	1,98	2,88	2,49	3,00
	SD	0,58	0,59	0,71	0,74	0,88	0,52	0,44	0,72
11 <sup>2)</sup>	Mean*	3,34	2,63	3,18	2,30	2,20	2,96	2,80	2,98
	SD	0,49	0,69	0,67	1,00	0,86	0,56	0,54	0,82
12 <sup>1)</sup>	Mean*	2,97	2,50	2,97	2,10	1,96	3,13	2,68	2,98
	SD	0,70	0,83	0,71	0,87	0,79	0,51	0,58	0,89
13 <sup>1)</sup>	Mean*	3,27	2,73	2,88	2,19	1,59	2,82	2,64	2,98
	SD	0,58	0,67	0,65	0,87	0,65	0,54	0,48	0,78
14 <sup>3)</sup>	Mean*	3,15	2,51	2,90	2,17	2,12	2,80	2,64	3,09
	SD	0,54	0,68	0,76	0,85	0,82	0,57	0,47	0,73
15 <sup>2)</sup>	Mean*	3,23	2,86	3,04	2,52	2,17	3,15	2,70	3,07
	SD	0,62	0,59	0,52	1,04	0,76	0,44	0,65	0,68
16 <sup>2)</sup>	Mean*	3,25	2,55	2,79	1,97	1,66	2,60	2,50	2,73
	SD	0,63	0,67	0,81	0,79	0,92	0,67	0,56	0,86
17 <sup>1)</sup>	Mean*	3,09	2,72	2,71	2,40	1,83	2,33	2,65	3,17
	SD	0,64	0,68	0,65	0,78	0,72	0,60	0,47	0,96
18 <sup>2)</sup>	Mean*	3,08	2,70	2,78	1,98	1,88	2,85	2,66	2,88
	SD	0,43	0,59	0,67	0,80	0,77	0,35	0,52	0,59
19 <sup>2)</sup>	Mean*	3,18	2,50	2,98	2,28	2,00	2,97	2,63	2,98
	SD	0,44	0,57	0,68	0,93	0,88	0,41	0,46	0,65
20 <sup>3)</sup>	Mean*	3,07	2,34	2,73	1,87	1,57	2,80	2,26	2,91
	SD	0,54	0,51	0,61	0,88	0,68	0,36	0,42	0,79

School	Statistics	Self-development	Power	Creativity	Tools	Nature	Friends and free time	Others	Entertainment
21 <sup>2)</sup>	Mean*	3,34	2,60	2,85	2,10	1,88	2,79	2,68	2,86
	SD	0,53	0,64	0,74	0,97	0,96	0,54	0,47	0,82
22 <sup>1)</sup>	Mean*	3,30	2,49	3,14	2,06	1,86	2,88	2,54	3,30
	SD	0,44	0,68	0,68	0,85	0,77	0,54	0,43	0,63
23 <sup>1)</sup>	Mean*	3,27	2,61	2,99	2,32	2,12	2,89	2,67	3,22
	SD	0,67	0,74	0,76	0,93	0,82	0,75	0,51	0,87
24 <sup>1)</sup>	Mean*	2,98	3,01	2,83	1,94	2,09	3,04	2,47	3,04
	SD	0,49	0,54	0,58	0,73	0,72	0,48	0,36	0,75
25 <sup>2)</sup>	Mean*	3,12	2,64	2,97	2,40	2,47	2,85	2,78	2,95
	SD	0,59	0,78	0,74	1,06	0,95	0,63	0,72	0,97
Total	Mean*	<b>3,18</b>	<b>2,61</b>	<b>2,89</b>	<b>2,13</b>	<b>2,00</b>	<b>2,84</b>	<b>2,62</b>	<b>2,97</b>
	SD	<b>0,55</b>	<b>0,67</b>	<b>0,68</b>	<b>0,86</b>	<b>0,86</b>	<b>0,55</b>	<b>0,51</b>	<b>0,77</b>
<b>p value</b>		0,18	0,01**	0,04**	0,17	0,01**	0,004***	0,01**	0,25

\* Likert style responses ranging from “not important” to “very important” were ranked from 1 to 4 respectively.

\*\* Significant difference at the 0,05 level of confidence (2-tailed)

\*\*\* Significant difference at the 0,01 level of confidence (2-tailed)

Note: <sup>1)</sup> Big towns' schools (Tallinn, Tartu, Pärnu, Narva, Kohtla-Järve); <sup>2)</sup> Small towns' and countryside schools; <sup>3)</sup> Schools without service district

**Table 2.9. Correlations between students' interest and future career priorities based on Spearman rank correlation analysis**

<b>Job factors</b>  <b>Subjects</b>	<b>Self-development priority</b>	<b>Power priority</b>	<b>Creativity priority</b>	<b>Tools priority</b>	<b>Nature priority</b>	<b>Friends and free time priority</b>	<b>Others priority</b>	<b>Entertainment priority</b>
<b>Astronomy</b>	0,19**	0,02	0,24**	0,15**	0,19**	0,08*	0,17**	0,15**
<b>Optics</b>	0,25**	0,07	0,35**	0,15**	0,28**	0,14**	0,33**	0,17**
<b>Acoustics</b>	0,26**	0,08*	0,32**	0,19**	0,24**	0,11**	0,33**	0,11**
<b>Electricity</b>	0,07	0,08*	0,15**	<b>0,40**</b>	0,11**	0,05	0,10**	0,04
<b>Nuclear physics</b>	0,04	0,08*	0,07	0,34**	0,01	-0,01	-0,02	-0,01
<b>Botany</b>	0,29**	-0,03	0,30**	0,16**	<b>0,41**</b>	0,06	0,29**	0,10**
<b>Zoology</b>	0,22**	0,01	0,22**	0,09*	<b>0,45**</b>	0,07	0,25**	0,15**
<b>General biology</b>	<b>0,41**</b>	0,02	0,35**	0,02	0,21**	0,04	0,32**	0,19**
<b>Human study</b>	<b>0,40**</b>	0,06	0,33**	-0,05	0,21**	0,14**	0,45**	0,22**
<b>Chemistry</b>	0,24**	0,05	0,23**	0,23**	0,14**	0,04	0,15**	0,10*
<b>Earth science</b>	0,15**	0,01	0,18**	0,19**	0,31**	0,12**	0,23**	0,13**
<b>Technology</b>	0,06	0,16**	0,16**	<b>0,45**</b>	0,09*	0,11**	0,11**	0,04
<b>Science and scientists</b>	0,25**	0,05	0,28**	0,21**	0,19**	0,01	0,13**	0,13**
<b>Environment</b>	0,22**	0,00	0,24**	0,25**	0,34**	0,06	0,23**	0,06
<b>Unaccountable phenomena</b>	0,34**	0,09*	0,31**	0,00	0,26**	0,12**	0,28**	0,22**

\*\* Correlation is significant at the 0,01 level (2-tailed)

\* Correlation is significant at the 0,05 level (2-tailed)

**Table 2.10. Mean differences between schools towards the opinions of school sciences**

<b>School</b>	<b>Statistics</b>	F1. School science is a difficult subject	F2. School science is interesting	F3. School science is rather easy for me to learn	F4. School science has opened my eyes to new and exciting jobs	F5. I like school science better than most other subjects	F6. I think everybody should learn science at school	F7. The things that I learn in science at school will be helpful in my everyday life	F8. I think that the science I learn at school will improve my career chances
<b>1<sup>1)</sup></b>	<b>Mean*</b>	1,94	2,77	2,90	2,20	2,17	2,70	2,57	2,23
	<b>SD</b>	0,63	0,81	0,60	0,93	1,02	0,84	0,94	0,94
<b>2<sup>2)</sup></b>	<b>Mean*</b>	2,52	2,78	2,48	2,22	2,52	2,74	2,89	2,48
	<b>SD</b>	0,75	1,09	0,75	1,12	1,05	0,98	1,01	1,01
<b>3<sup>2)</sup></b>	<b>Mean*</b>	2,40	2,28	2,46	1,92	1,81	2,62	2,88	2,46
	<b>SD</b>	1,12	0,84	0,86	0,98	1,13	1,10	0,91	0,91
<b>4<sup>2)</sup></b>	<b>Mean*</b>	2,35	3,23	2,73	2,46	2,58	3,19	3,46	2,81
	<b>SD</b>	0,69	0,59	0,78	0,76	0,81	0,94	0,65	0,80
<b>5<sup>1)</sup></b>	<b>Mean*</b>	2,14	2,33	2,69	1,86	1,89	2,78	2,86	2,26
	<b>SD</b>	0,83	0,86	0,71	0,80	1,02	1,07	0,96	0,89
<b>6<sup>2)</sup></b>	<b>Mean*</b>	2,10	2,97	2,79	2,38	2,21	2,93	3,07	2,45
	<b>SD</b>	0,67	0,68	0,56	0,73	0,86	0,80	0,66	0,74
<b>7<sup>2)</sup></b>	<b>Mean*</b>	2,32	2,53	2,37	2,26	2,17	2,53	2,84	2,37
	<b>SD</b>	0,89	0,91	0,68	0,99	0,86	0,91	0,90	0,90
<b>8<sup>1)</sup></b>	<b>Mean*</b>	2,07	2,43	2,48	1,93	2,21	2,46	2,61	2,48
	<b>SD</b>	0,81	0,79	0,89	0,77	0,74	1,07	0,88	0,98
<b>9<sup>2)</sup></b>	<b>Mean*</b>	2,24	2,70	2,52	1,90	2,39	2,76	3,00	2,41
	<b>SD</b>	0,79	0,88	0,67	0,79	0,93	1,06	0,83	0,88
<b>10<sup>2)</sup></b>	<b>Mean*</b>	2,27	2,27	2,43	2,03	1,68	2,10	2,50	2,03
	<b>SD</b>	0,64	0,87	0,77	0,77	0,77	0,85	0,86	0,82
<b>11<sup>2)</sup></b>	<b>Mean*</b>	2,14	3,07	2,79	2,68	2,48	3,00	3,36	2,82
	<b>SD</b>	0,71	0,72	0,88	0,82	0,94	0,86	0,62	0,86
<b>12<sup>1)</sup></b>	<b>Mean*</b>	2,08	2,25	2,58	2,21	2,17	2,75	2,58	2,33
	<b>SD</b>	0,65	0,85	0,88	0,66	0,82	1,07	0,93	0,96

<b>13<sup>1)</sup></b>	<b>Mean*</b>	2,00	2,67	2,70	2,19	2,12	2,85	2,85	2,69
	<b>SD</b>	0,73	0,83	0,82	1,00	0,99	0,99	0,86	1,01
<b>14<sup>3)</sup></b>	<b>Mean*</b>	2,18	2,61	2,58	2,53	2,23	2,70	2,79	2,70
	<b>SD</b>	0,85	0,86	0,66	1,08	0,99	1,02	0,99	1,08
<b>15<sup>2)</sup></b>	<b>Mean*</b>	2,39	2,48	2,43	1,96	2,09	2,39	2,78	2,48
	<b>SD</b>	0,72	1,04	0,84	0,93	0,90	1,08	1,00	0,79
<b>16<sup>2)</sup></b>	<b>Mean*</b>	2,35	2,91	2,59	2,06	2,46	3,03	3,11	2,63
	<b>SD</b>	0,77	0,85	0,82	0,98	0,98	0,95	0,80	0,88
<b>17<sup>1)</sup></b>	<b>Mean*</b>	2,07	2,53	2,53	2,27	2,07	2,73	2,53	2,53
	<b>SD</b>	0,59	0,74	0,52	0,59	0,70	0,59	0,83	0,74
<b>18<sup>2)</sup></b>	<b>Mean*</b>	2,13	2,37	2,79	2,17	2,04	2,79	3,00	2,67
	<b>SD</b>	0,74	0,71	0,51	0,70	0,86	0,83	0,66	0,70
<b>19<sup>2)</sup></b>	<b>Mean*</b>	2,83	2,63	2,20	2,30	1,97	2,43	2,69	2,30
	<b>SD</b>	0,83	0,77	0,76	0,88	0,89	0,90	0,81	0,88
<b>20<sup>3)</sup></b>	<b>Mean*</b>	1,87	2,57	2,78	2,22	2,14	2,83	2,90	2,26
	<b>SD</b>	0,76	0,79	0,80	0,95	0,94	0,83	0,77	0,86
<b>21<sup>2)</sup></b>	<b>Mean*</b>	1,92	2,80	3,20	2,40	2,36	2,84	3,08	2,44
	<b>SD</b>	0,76	0,91	0,65	1,00	1,00	0,85	0,91	0,96
<b>22<sup>1)</sup></b>	<b>Mean*</b>	2,08	2,76	2,88	2,32	2,20	3,08	3,12	2,84
	<b>SD</b>	0,70	0,72	0,67	0,99	1,00	0,76	0,67	0,80
<b>23<sup>1)</sup></b>	<b>Mean*</b>	2,75	2,74	2,50	2,04	2,21	2,83	3,09	2,35
	<b>SD</b>	0,79	0,81	0,72	0,75	0,78	0,96	0,79	0,78
<b>24<sup>1)</sup></b>	<b>Mean*</b>	2,00	2,70	2,74	2,17	2,23	2,74	2,61	2,68
	<b>SD</b>	0,74	0,77	0,75	0,98	0,87	0,92	0,89	0,78
<b>25<sup>2)</sup></b>	<b>Mean*</b>	2,43	2,50	2,39	2,11	2,11	2,50	2,62	2,46
	<b>SD</b>	0,96	0,69	0,92	0,92	0,99	1,00	0,90	1,03
<b>Total</b>	<b>Mean*</b>	<b>2,23</b>	<b>2,64</b>	<b>2,62</b>	<b>2,19</b>	<b>2,18</b>	<b>2,73</b>	<b>2,88</b>	<b>2,48</b>
	<b>SD</b>	0,80	0,85	0,77	0,90	0,94	0,96	0,87	0,90
<b>p value</b>		<0,001***	<0,001***	0,001***	0,05**	0,05**	0,02**	<0,001***	0,11

School	Statistics	F9. School science has made me more critical and sceptical	F10. School science has increased my curiosity about things we cannot yet explain	F11. School science has increased my appreciation of nature	F12. School science has shown me the importance of science for our way of living	F13. School science has taught me how to take better care of my health	F14. I would like to become a scientist	F15. I would like to have as much science as possible at school	F16. I would like to get a job in technology
1 <sup>1)</sup>	Mean*	2,00	2,70	2,70	2,40	2,94	1,84	1,81	2,29
	SD	1,04	0,95	1,02	0,97	1,03	0,90	0,91	0,90
2 <sup>2)</sup>	Mean*	2,22	2,69	2,77	2,70	2,85	1,93	2,11	2,30
	SD	1,05	1,05	0,99	0,99	1,10	1,07	0,89	0,95
3 <sup>2)</sup>	Mean*	2,08	2,46	2,42	2,31	2,96	1,56	1,58	2,19
	SD	0,85	0,95	1,03	0,97	0,92	1,00	0,81	1,02
4 <sup>2)</sup>	Mean*	2,54	3,35	3,08	2,88	3,19	1,73	2,04	2,15
	SD	0,99	0,69	0,85	0,77	0,63	0,78	0,87	0,88
5 <sup>1)</sup>	Mean*	2,26	2,58	2,60	2,25	2,61	1,83	1,60	2,14
	SD	0,95	0,91	1,06	0,87	0,84	0,91	0,78	1,07
6 <sup>2)</sup>	Mean*	2,03	2,79	2,93	2,58	2,90	1,82	1,93	2,14
	SD	0,73	0,94	0,92	0,95	0,86	0,95	0,65	0,92
7 <sup>2)</sup>	Mean*	2,37	2,42	2,33	2,32	2,63	1,84	1,78	2,21
	SD	0,83	1,22	0,97	1,00	1,12	0,90	0,55	1,08
8 <sup>1)</sup>	Mean*	2,48	2,74	2,74	2,39	2,86	2,21	2,22	2,21
	SD	0,80	0,90	0,81	0,96	0,85	1,10	0,85	0,96
9 <sup>2)</sup>	Mean*	2,37	2,94	2,79	2,64	2,78	1,45	1,78	2,03
	SD	0,75	0,79	0,89	0,86	0,79	0,67	0,83	0,81
10 <sup>2)</sup>	Mean*	1,87	2,47	2,24	2,40	2,50	1,55	1,40	2,13
	SD	0,68	0,94	0,95	0,81	0,94	0,78	0,56	1,01
11 <sup>2)</sup>	Mean*	2,32	3,04	3,18	2,96	3,39	1,48	1,89	2,11
	SD	0,86	0,88	0,82	0,85	0,74	0,94	0,92	1,10
12 <sup>1)</sup>	Mean*	2,08	2,58	2,54	2,46	2,58	1,75	1,50	2,04
	SD	0,78	0,93	0,93	0,78	0,88	0,94	0,59	0,96



<b>13<sup>1)</sup></b>	<b>Mean*</b>	2,15	3,04	2,78	2,65	3,04	1,67	1,70	2,26
	<b>SD</b>	0,86	0,81	0,64	0,80	0,94	0,78	0,82	1,06
<b>14<sup>3)</sup></b>	<b>Mean*</b>	2,27	2,68	2,70	2,45	2,84	1,97	2,03	1,97
	<b>SD</b>	1,13	0,91	0,85	0,91	0,63	0,92	1,13	0,98
<b>15<sup>2)</sup></b>	<b>Mean*</b>	1,96	2,70	2,87	2,43	2,70	1,43	1,74	2,09
	<b>SD</b>	0,77	1,06	1,06	0,84	0,93	0,73	0,86	1,08
<b>16<sup>2)</sup></b>	<b>Mean*</b>	2,06	2,86	3,03	2,73	3,03	1,50	1,71	2,12
	<b>SD</b>	0,86	0,94	0,82	0,84	0,95	0,66	0,75	1,01
<b>17<sup>1)</sup></b>	<b>Mean*</b>	2,40	2,73	2,93	2,67	2,87	2,13	1,87	2,33
	<b>SD</b>	0,83	0,80	0,96	0,82	0,64	1,06	0,74	0,98
<b>18<sup>2)</sup></b>	<b>Mean*</b>	2,04	2,83	2,50	2,42	2,63	1,87	1,67	2,17
	<b>SD</b>	0,48	0,76	0,66	0,58	0,71	0,95	0,76	1,05
<b>19<sup>2)</sup></b>	<b>Mean*</b>	2,07	2,97	2,77	2,53	2,97	1,55	1,37	2,40
	<b>SD</b>	0,70	0,85	0,77	0,73	0,81	0,83	0,56	1,07
<b>20<sup>3)</sup></b>	<b>Mean*</b>	2,00	2,70	2,61	2,48	2,52	1,70	1,57	2,05
	<b>SD</b>	0,85	0,88	0,89	0,85	0,85	0,77	0,59	1,13
<b>21<sup>2)</sup></b>	<b>Mean*</b>	2,00	2,88	2,60	2,35	2,58	1,56	1,88	2,12
	<b>SD</b>	0,78	0,97	0,91	0,94	0,93	0,96	0,78	1,17
<b>22<sup>1)</sup></b>	<b>Mean*</b>	2,36	2,92	2,96	2,84	3,08	1,76	1,76	2,12
	<b>SD</b>	0,49	0,81	0,84	0,75	0,72	1,05	0,93	1,05
<b>23<sup>1)</sup></b>	<b>Mean*</b>	1,95	3,00	2,83	2,57	2,74	1,48	2,00	2,74
	<b>SD</b>	0,72	0,85	0,72	0,79	0,81	0,59	0,80	0,86
<b>24<sup>1)</sup></b>	<b>Mean*</b>	2,32	2,78	2,96	2,59	2,87	1,87	1,87	2,09
	<b>SD</b>	0,72	0,74	0,83	0,96	0,76	1,01	0,92	1,00
<b>25<sup>2)</sup></b>	<b>Mean*</b>	2,26	2,52	2,67	2,69	2,69	2,26	2,19	2,89
	<b>SD</b>	0,90	1,05	0,96	0,97	1,01	1,02	1,00	1,12
<b>Total</b>	<b>Mean*</b>	<b>2,18</b>	<b>2,78</b>	<b>2,74</b>	<b>2,55</b>	<b>2,84</b>	<b>1,74</b>	<b>1,80</b>	<b>2,21</b>
	<b>SD</b>	<b>0,84</b>	<b>0,92</b>	<b>0,91</b>	<b>0,87</b>	<b>0,88</b>	<b>0,91</b>	<b>0,83</b>	<b>1,01</b>
<b>p value</b>		0,19	0,10	<b>0,03**</b>	0,23	<b>0,01**</b>	<b>0,02**</b>	<b>0,001***</b>	0,38

**Table 2.11. Correlations between students' interest and opinions about school science based on Spearman rank correlation analysis**

Items	Astro-nomy	Light	Acous-tics	Electri-city	Nuclear physics	Botany	Zoology	Gen. biology	Human study	Chemi-stry	Earth	Techno-logy	Science	Environ-ment	Excep-tional
F1. School science is a difficult subject	0,02	0,04	0,02	-0,03	0,09*	-0,01	-0,03	-0,02	0,10*	-0,07	0,03	-0,02	-0,03	-0,05	0,06
F2. School science is interesting	0,17**	0,25**	0,20**	0,21**	0,15**	0,34**	0,27**	0,34**	0,25**	0,32**	0,25**	0,16**	0,28**	0,32**	0,19**
F3. School science is rather easy for me to learn	0,13**	0,07	0,08*	0,20**	0,15**	0,21**	0,17**	0,23**	0,09*	0,28**	0,13**	0,12**	0,24**	0,22**	0,08*
F4. School science has opened my eyes to new and exciting jobs	0,14**	0,23**	0,21**	0,21**	0,13**	0,34**	0,23**	0,22**	0,17**	0,24**	0,18**	0,13**	0,25**	0,29**	0,13**
F5. I like school science better than most other subjects	0,14**	0,22**	0,18**	0,20**	0,14**	<b>0,35**</b>	0,26**	0,24**	0,15**	0,25**	0,19**	0,13**	0,26**	0,31**	0,14**
F6. I think everybody should learn science at school	0,12**	0,24**	0,22**	0,13**	0,02	<b>0,36**</b>	0,24**	0,33**	0,29**	0,14**	0,14**	0,07	0,26**	0,28**	0,22**
F7. The things that I learn in science at school will be helpful in my everyday life	0,14**	0,25**	0,23**	0,15**	0,06	<b>0,35**</b>	0,30**	<b>0,35**</b>	0,32**	0,19**	0,19**	0,09*	0,23**	0,28**	0,20**
F8. I think that the science I learn at school will improve my career chances	0,15**	0,26**	0,24**	0,22**	0,12**	<b>0,39**</b>	0,25**	0,32**	0,27**	0,24**	0,25**	0,15**	0,29**	<b>0,35**</b>	0,15**

Items	Astro- nomy	Light	Acous- tics	Electri- city	Nuclear physics	Botany	Zoology	Gen. biology	Human study	Chemi- stry	Earth	Techno- logy	Science	Environ- ment	Excep- tional
F9. School science has made me more critical and skeptical	0,05	0,21**	0,23**	0,20**	0,12**	0,30**	0,20**	0,26**	0,24**	0,25**	0,17**	0,11**	0,24**	0,30**	0,16**
F10. School science has increased my curiosity about things we cannot yet explain	0,27**	0,29**	0,23**	0,19**	0,11**	0,30**	0,30**	0,35**	0,28**	0,24**	0,23**	0,11**	0,33**	0,26**	0,30**
F11. School science has increased my appreciation of nature	0,14**	0,26**	0,23**	0,14**	0,03	<b>0,42**</b>	0,33**	0,34**	0,32**	0,20**	0,23**	0,09*	0,28**	<b>0,37**</b>	0,23**
F12. School science has shown me the importance of science for our way of living	0,15**	0,29**	0,24**	0,21**	0,11**	<b>0,41**</b>	0,32**	0,30**	0,28**	0,26**	0,20**	0,14**	0,31**	<b>0,38**</b>	0,20**
F13. School science has taught me how to take better care of my health	0,13**	0,27**	0,23**	0,21**	0,10*	0,32**	0,22**	0,33**	0,33**	0,20**	0,16**	0,17**	0,23**	0,29**	0,18**
F14. I would like to become a scientist	0,29**	0,28**	0,18**	0,34**	0,35**	0,26**	0,17**	0,18**	-0,03	0,34**	0,21**	0,29**	<b>0,43**</b>	<b>0,38**</b>	0,17**
F15. I would like to have as much science as possible at school	0,20**	0,28**	0,20**	0,25**	0,20**	<b>0,35**</b>	0,27**	0,24**	0,11**	0,34**	0,26**	0,19**	<b>0,36**</b>	<b>0,37**</b>	0,17**
F16. I would like to get a job in technology	0,21**	0,13**	0,07	<b>0,40**</b>	<b>0,45**</b>	0,05	0,04	0,04	-0,15**	0,32**	0,11**	0,43**	0,32**	0,24**	-0,03

\*\* Correlation is significant at the 0,01 level (2-tailed) \*Correlation is significant at the 0,05 level (2-tailed)

**Table 2.12. Cross-Tabulation between F2 and F5 among Estonian grade nine students**

Gender			F5. I like school science better than most other subjects				Total
			disagree	lo disagree	lo agree	agree	
Girls	F2. School science is interesting	disagree	21	4	3	1	29
		lo disagree	46	35	11	0	92
		lo agree	27	67	60	9	163
		agree	1	9	22	18	50
	Total		95	115	96	28	334
Boys	F2. School science is interesting	disagree	29	3	3	1	36
		lo disagree	40	42	21	4	107
		lo agree	19	62	51	6	138
		agree	0	10	17	17	44
	Total		88	117	92	28	325

**Table 2.13. Groups' interest towards science subjects**

Subject	Interest	Loving school science with high interest		Loving other subject with high interest		Loving other subject with no interest		Loving school science with no interest	
		N	%	N	%	N	%	N	%
Astronomy	not interested	45	22,5%	53	27,2%	77	35,0%	16	36,4%
	interested	155	77,5%	142	72,8%	143	65,0%	28	63,6%
Optics	not interested	98	49,0%	108	55,4%	157	71,4%	30	68,2%
	interested	102	51,0%	87	44,6%	63	28,6%	14	31,8%
Acoustics	not interested	107	53,5%	117	60,0%	150	68,2%	31	70,5%
	interested	93	46,5%	78	40,0%	70	31,8%	13	29,5%
Electricity	not interested	79	39,5%	101	51,8%	129	58,6%	26	59,1%
	interested	121	60,5%	94	48,2%	91	41,4%	18	40,9%
Nuclear physics	not interested	84	42,0%	83	42,6%	116	52,7%	18	40,9%
	interested	116	58,0%	112	57,4%	104	47,3%	26	59,1%
General biology	not interested	55	27,5%	61	31,3%	117	53,2%	20	45,5%
	interested	145	72,5%	134	68,7%	103	46,8%	24	54,5%
Botany	not interested	125	62,5%	145	74,4%	195	88,6%	35	79,5%
	interested	75	37,5%	50	25,6%	25	11,4%	9	20,5%
Zoology	not interested	66	33,0%	92	47,2%	134	60,9%	22	50,0%
	interested	134	67,0%	103	52,8%	86	39,1%	22	50,0%

Subject	Interest	Loving school science with high interest		Loving other subject with high interest		Loving other subject with no interest		Loving school science with no interest	
		N	%	N	%	N	%	N	%
Human study	not interested	56	28,0%	61	31,3%	<b>104</b>	<b>47,3%</b>	20	45,5%
	interested	<b>144</b>	<b>72,0%</b>	134	68,7%	116	52,7%	24	54,5%
Chemistry	not interested	116	58,0%	140	71,8%	<b>189</b>	<b>85,9%</b>	36	81,8%
	interested	<b>84</b>	<b>42,0%</b>	55	28,2%	31	14,1%	8	18,2%
Earth science	not interested	86	43,0%	113	57,9%	<b>148</b>	<b>67,3%</b>	31	70,5%
	interested	<b>114</b>	<b>57,0%</b>	82	42,1%	72	32,7%	13	29,5%
Technology	not interested	96	48,0%	102	52,3%	<b>135</b>	<b>61,4%</b>	23	52,3%
	interested	<b>104</b>	<b>52,0%</b>	93	47,7%	85	38,6%	21	47,7%
Science & scientists	not interested	83	41,7%	115	59,6%	<b>155</b>	<b>70,8%</b>	24	54,5%
	interested	<b>116</b>	<b>58,3%</b>	78	40,4%	64	29,2%	20	45,5%
Environment	not interested	99	49,5%	122	62,6%	<b>171</b>	<b>77,7%</b>	27	61,4%
	interested	<b>101</b>	<b>50,5%</b>	73	37,4%	49	22,3%	17	38,6%
Exceptional phenomena	not interested	48	24,0%	61	31,3%	<b>97</b>	<b>44,3%</b>	18	40,9%
	interested	<b>152</b>	<b>76,0%</b>	134	68,7%	122	55,7%	26	59,1%

Table 2.14. Four groups students' opinions about school science

Items	Agree/ disagree	Loving school science with high interest		Loving other subject with high interest		Loving other subject with no interest		Loving school science with no interest	
		N	%	N	%	N	%	N	%
F1. School science is a difficult subject	disagree	<b>146</b>	<b>73,0%</b>	128	65,6%	126	57,5%	32	74,4%
	agree	54	27,0%	67	34,4%	<b>93</b>	<b>42,5%</b>	11	25,6%
F2. School science is interesting	disagree	-	-	-	-	220	100,0%	44	100,0%
	agree	200	100,0%	195	100,0%	-	-	-	-
F3. School science is rather easy for me to learn	disagree	39	19,5%	77	39,7%	<b>137</b>	<b>62,6%</b>	18	40,9%
	agree	<b>161</b>	<b>80,5%</b>	117	60,3%	82	37,4%	26	59,1%
F4. School science has opened my eyes to new and exciting jobs	disagree	86	43,9%	133	68,2%	<b>186</b>	<b>84,9%</b>	35	79,5%
	agree	<b>110</b>	<b>56,1%</b>	62	31,8%	33	15,1%	9	20,5%
F5. I like school science better than most other subjects	disagree	-	-	195	100,0%	220	100,0%	-	-
	agree	200	100,0%	-	-	-	-	44	100,0%

Items	Agree/ disagree	Loving school science with high interest		Loving other subject with high interest		Loving other subject with no interest		Loving school science with no interest	
		N	%	N	%	N	%	N	%
F6. I think everybody should learn science at school	disagree	34	17,1%	63	32,5%	<b>130</b>	<b>59,1%</b>	15	34,1%
	agree	<b>165</b>	<b>82,9%</b>	131	67,5%	90	40,9%	29	65,9%
F7. The things that I learn in science at school will be helpful in my everyday life	disagree	19	9,6%	43	22,4%	<b>109</b>	<b>49,8%</b>	15	34,1%
	agree	<b>178</b>	<b>90,4%</b>	149	77,6%	110	50,2%	29	65,9%
F8. I think that the science I learn at school will improve my career chances	disagree	56	28,4%	95	49,0%	<b>163</b>	<b>75,8%</b>	24	54,5%
	agree	<b>141</b>	<b>71,6%</b>	99	51,0%	52	24,2%	20	45,5%
F9. School science has made me more critical and sceptical	disagree	100	51,8%	140	72,2%	<b>174</b>	<b>81,3%</b>	25	56,8%
	agree	<b>93</b>	<b>48,2%</b>	54	27,8%	40	18,7%	19	43,2%
F10. School science has increased my curiosity about things we cannot yet explain	disagree	42	21,2%	51	26,3%	<b>123</b>	<b>56,9%</b>	22	50,0%
	agree	<b>156</b>	<b>78,8%</b>	143	73,7%	93	43,1%	22	50,0%
F11. School science has increased my appreciation of nature	disagree	37	18,7%	56	28,7%	<b>123</b>	<b>56,9%</b>	19	44,2%
	agree	<b>161</b>	<b>81,3%</b>	139	71,3%	93	43,1%	24	55,8%
F12. School science has shown me the importance of science for our way of living	disagree	55	28,1%	69	36,5%	<b>150</b>	<b>69,1%</b>	20	45,5%
	agree	<b>141</b>	<b>71,9%</b>	120	63,5%	67	30,9%	24	54,5%
F13. School science has taught me how to take better care of my health	disagree	38	19,3%	43	22,3%	<b>102</b>	<b>46,8%</b>	15	34,1%
	agree	<b>159</b>	<b>80,7%</b>	150	77,7%	116	53,2%	29	65,9%
F14. I would like to become a scientist	disagree	125	63,8%	166	85,6%	<b>193</b>	<b>88,1%</b>	35	79,5%
	agree	71	36,2%	28	14,4%	26	11,9%	9	20,5%
F15. I would like to have as much science as possible at school	disagree	126	63,3%	182	93,8%	<b>200</b>	<b>92,2%</b>	35	79,5%
	agree	<b>73</b>	<b>36,7%</b>	12	6,2%	17	7,8%	9	20,5%
F16. I would like to get a job in technology	disagree	105	53,0%	126	64,9%	<b>144</b>	<b>65,8%</b>	26	59,1%
	agree	<b>93</b>	<b>47,0%</b>	68	35,1%	75	34,2%	18	40,9%

**Table 2.15. Four groups students' opinions about their future career**

Factors	Importance	Loving school science with high interest		Loving other subject with high interest		Loving other subject with no interest		Loving school science with no interest	
		N	%	N	%	N	%	N	%
<b>Self-development priority</b>	not important	10	5,0%	9	4,6%	<b>28</b>	<b>12,7%</b>	3	6,8%
	important	<b>190</b>	<b>95,0%</b>	<b>186</b>	<b>95,4%</b>	192	87,3%	41	93,2%
<b>Power priority</b>	not important	82	41,0%	71	36,4%	77	35,0%	<b>15</b>	<b>34,1%</b>
	important	118	59,0%	124	63,6%	<b>143</b>	<b>65,0%</b>	29	65,9%
<b>Creativity priority</b>	not important	31	15,5%	36	18,5%	<b>63</b>	<b>28,6%</b>	11	25,0%
	important	<b>169</b>	<b>84,5%</b>	159	81,5%	157	71,4%	33	75,0%
<b>Tools priority</b>	not important	107	53,5%	112	57,4%	127	57,7%	<b>27</b>	<b>61,4%</b>
	important	<b>93</b>	<b>46,5%</b>	83	42,6%	<b>93</b>	<b>42,3%</b>	17	38,6%
<b>Nature priority</b>	not important	110	55,0%	135	69,2%	<b>174</b>	<b>79,1%</b>	28	63,6%
	important	<b>90</b>	<b>45,0%</b>	60	30,8%	46	20,9%	16	36,4%
<b>Friends and free time priority</b>	not important	<b>45</b>	<b>22,5%</b>	31	15,9%	38	17,3%	9	20,5%
	important	155	77,5%	164	84,1%	<b>182</b>	<b>82,7%</b>	35	79,5%
<b>Other people priority</b>	not important	49	24,5%	56	28,7%	<b>85</b>	<b>38,6%</b>	13	29,5%
	important	<b>151</b>	<b>75,5%</b>	139	71,3%	135	61,4%	31	70,5%
<b>Entertainment priority</b>	not important	32	16,0%	<b>35</b>	<b>17,9%</b>	39	17,7%	9	20,5%
	important	168	84,0%	160	82,1%	<b>181</b>	<b>82,3%</b>	35	79,5%