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Technology Education in Finland, Slovenia, Estonia and Iceland: The Structure of Students' Attitudes towards Technology

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Abstract

The research is based on a comparative study of craft and technology education curriculums and students' attitudes towards craft and technology in Finland, Slovenia, Estonia and Iceland. The study was undertaken by the Helsinki University, University of Ljubljana, University of Tallinn and University of Iceland. A literature review was completed, in order to examine and compare the curriculums of technology education in Finland, Slovenia, Estonia and Iceland. In addition, a quantitative survey was subsequently distributed to 864 school students in Finland, Slovenia, Estonia and Iceland. It consisted of 14 questions, which aimed to ascertain students' attitudes towards craft and technology. The survey showed substantial differences in students' attitudes towards technology education in the four countries: these differences may be explained by differences in the national curriculums, the different pedagogical traditions and cultural differences in the field of technology. In addition, the study tried to examine the structure of students' attitudes towards technology. The factors can be interpreted as matching with the affective, cognitive and behavioral components. However, no far-reaching generalizations were allowed regarding the structure or properties of the attitudes towards technology as the questionnaire consisted of only 14 items.

Keywords: Technology education, Craft education Attitudes towards technology, National curriculum.

Introduction

The general aim of Finnish technology education is to increase students' self-esteem by developing their skills through enjoyable craft activities; it also aims to increase students' understanding about the various manufacturing processes and the use of different materials in craft. Furthermore, the subject aims to encourage students to make their own decisions in designing, allowing them to assess their ideas and products. Students' practical work is product orientated and based on experimentation, in accordance with the development of their personality. The role of the teacher is to guide students' work in a systematic manner. They must encourage pupils' independence, the growth of their creative skills through problem-based learning and the development of technical literacy. In addition, gender issues are important throughout the whole curriculum (Framework Curriculum Guidelines, 2004).

Slovenian primary school technological education is compulsory for pupils aged from 9 -13 years. D&T curriculum is based on standards and was last time reformed in 2011. Students are directed in carrying out activities such as design, preparation, technological processing, product testing, assessment, and product presentation as well as its price determination (economics) and evaluation (also environmental). Students discover and learn simple engineering and technological problems and to find ways to solve them by using simple tools. The general objectives stimulate students to develop their abilities at designing and finding new solutions where creative linking of science and technological knowledge with practice is encouraged. Teachers are recommended (by the curriculum) to implement experiential, problem and project based learning to gain students active work through data and information collection, exploration, experimentation, guided work and reflection. On the other hand, curriculum reform reduced amount of handicraft and practical work in the obligatory subject and introduced elective subjects (woodworking, plastic working, metalworking, electrical engineering, electronics in robotics, robotics in engineering, technical drawing and physics & engineering projects) which are implemented in the 7th-9th grade and are not compulsory to select. Execution of the elective subject is rather poor so the majority of the students only gain design and technology basic knowledge and the more contemporary themes are left out (Falkin, 2011).

Subjects taught in the domain of technology in Estonia enable students to acquire the mentality, ideals, and values inherent to the contemporary society. They learn to understand the options they have in solving tasks or creating new products; find and combine various environmentally sustainable techniques. In lessons, students study and analyse phenomena and situations, as well as use various sources of information, integrate creative thinking and manual activity. As a part of the study process, students generate ideas, plan, model, and prepare objects/products and learn how to present these. Students' initiative, entrepreneurial spirit, and creativity are supported and they learn to appreciate an economic and healthy life style. Learning takes place in a positive environment, where students' diligence and development are recognized in every way. Teaching develops their skills in working and cooperating, as well as their critical thinking and the ability to analyse and evaluate (Ainevaldkond “Tehnoloogia”, 2011).

The present national curriculum for the subject of craft and technology in Iceland places an emphasis on individual-based learning. It also gives teachers the freedom to run an independent curriculum at school, which is based on the national curriculum. As in Finland, the subject is product based and students learn via traditional craft activities. Students’ work is based on craft tradition rather than technology; however, innovation and idea generation are an important part of the Icelandic curriculum. There are also the aims of developing students’ manual skills, instructing them in the manufacturing processes and training them to organise their own work. The national curriculum also incorporates outdoor education, working with green wood and sustainable design (Olafsson & Thorsteinsson, 2010).

Thus, as seen above, there are many similarities between the national curriculums in Finland, Slovenia, Estonia and Iceland; however there are also some differences. In the following sections, the authors will try to ascertain whether there are any differences in practical level between the four countries, with regard to students’ attitudes towards craft and technology. First part of this study was to recognise the origin of craft and technology education in Finland, Slovenia, Estonia and Iceland. This was done by a literature review based on the different curriculums. The empirical part of the study was, however, to find any differences in students’ attitudes towards technology in Finland, Slovenia, Estonia and Iceland. In addition, the study tried to examine the structure of students’ attitudes towards technology. This was done by analysing the questionnaire data, utilizing Principal Axis Factoring method and correlation analysis. The aim was to determine the key factors in students’ attitudes. The research questions were:

1. What are the origins of craft education in Finland, Slovenia, Estonia and Iceland?
2. Are there differences in students’ attitudes towards craft and technology in Finland, Slovenia, Estonia and Iceland?
3. What are the key factors in students’ attitudes towards technology?

Methods

The aim of the quantitative aspect of the research was to answer the question: *Are there differences in students’ attitudes towards craft and technology in Finland, Slovenia, Estonia and Iceland?* In addition, the empirical part tried to find out: *What are the key factors in students’ attitudes towards technology?*

The research on students’ attitudes toward technology has a long history. PATT (Pupils Attitudes Towards Technology) is the first instrument specifically made for this purpose. This instrument was first conducted in the Netherlands and since 1984 researchers have been using it in several different formats and a number of different instruments have been made for measuring an attitude in the field of technology (Garmiere & Pearson, 2006).

According to Ankiewicz, van Rensburg and Myburgh (2001) attitude is a broad concept with several different definitions and interpretations. The most common definition for attitudes is: Attitudes are psychological tendencies that are expressed by evaluating a particular entity with some degree of favor (Eagle & Chaiken, 1993). According to de Klerk Wolters (1989) the attitude towards technology is “a certain feeling with reference to technology, based on a certain concept of technology, and that carries with it an intention to behavior in favor of or against technology”. Dyrenfurth (1990) and Layton (1994) state that technology is determined and guided by human emotions, motivation, values and personal qualities. Furthermore, they are using the concept ‘technological will’ - students’ will to take part in lessons and technological decisions.

It is suggested that the dimensionality of attitudes consists of one to three dimensions. The traditional approach is that attitudes have an integrated nature, consisting of affective, cognitive and behavioral components; these three components can be related to one another to some extend (Ankiewicz, & al., 2001). The affective component refers to feelings and emotions concerning an attitudinal object and associates episodes linked with emotional reactions. The behavioral component includes person's readiness for action, such as choosing to take a technology course, to read about technological issues or to adopt a technology related hobby. The cognitive component includes ideas or options that express the relationship between situational and attitudinal objects (Ankiewicz & al., 2001). Whether or not the attitude towards technology contains the cognitive dimension is often discussed and according to Ardies, De Mayer and van Keulen (2012) technological knowledge may have a certain correlation with the attitude towards technology.

In order to evaluate students' attitudes towards craft and technology in Finland, Estonia and Iceland, a questionnaire was devised, consisting of 14 statements. For each Likert-type item, there were five options, from 'Strongly Disagree' (= 1) to 'Strongly Agree' (= 5). The questionnaire also featured some questions about students' backgrounds, in addition to questions that attempted to gauge students' motivation and success, in terms of craft and technology education classes. The questionnaire was based on the PATT standards (Pupils Attitudes Towards Technology), which were designed and validated by Raat and de Vries (1986) and van der Velde (1992). Totally 864 students took part in the survey (see Appendix A for the survey items). The age of the students was 11-13 years.

According to Autio (1997), de Klerk Wolters (1989), Fensham (1992) and Lauren (1993) we could assume that there would be differences in individuals' attitudes towards technology. Therefore, we tried to find out whether there were statistical differences between the respondents. This was done by conducting one tailed t-test, with the same variance, on boys and girls. In the entire Finnish, Slovenian, Estonian and Icelandic groups, we employed two tailed t-test, as we had no hypothesis based on the previous research. To determine the structure of students' attitudes, the questionnaire data was analyzed with the SPSS program, utilizing Principal Axis Factoring as the extraction method and Varimax with Kaiser Normalization as the rotation method. The exact number of factors was determined by means of Cattell's Scree-test. In addition, the comprehensibility criteria were also used, and the number of factors was limited to three, as the meaning of the factors was then readily comprehensible. The internal consistency of each factor was determined by Cronbach alpha coefficient. The Cronbach alpha coefficients of the factors varied between 0.78 and 0.86. It seems that each factor measures one quality and a meaningful interpretation of the factors is possible.

Results

Are there differences in students' attitudes towards craft and technology in Finland, Slovenia, Estonia and Iceland?

Several differences in students' attitudes towards technology were found in the four countries. The average response in our Likert-style (1-5) questionnaire to all 14 items was among Finnish girls 3.25, Slovenian girls 3.17, Estonian girls 3.55 and Icelandic girls 3.67. Significant statistical difference was found between boys and girls, whereas the average response of boys was in Finland 3.75, Slovenia 3.73, Estonia 4.00 and Iceland 3.87. Estonian boys had the most positive attitude towards technology, whereas the lowest attitude was found among Slovenian girls. The difference between boys and girls was definitely the smallest in Iceland. The averages for all 14 items in each country are presented in *Figure 1.*

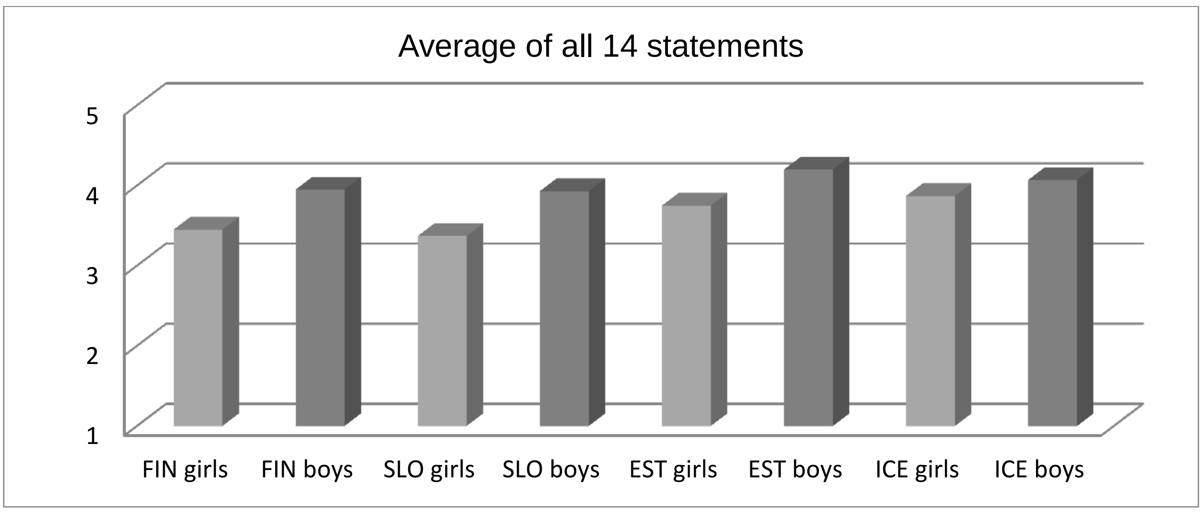

Figure 1. The average values of all 14 statements

The highest average values in the whole questionnaire were found in the statement: *Both boys and girls may understand engineering-related phenomena.* The highest average responses were among Icelandic girls 4.82, Finnish girls 4.62 and Icelandic boys 4.60. Any significant statistical differences were found between boys and girls. This is a clear sign that gender issues in technology education are adopted by both boys and girls. The averages for the statement: Both boys and girls may understand engineering-related phenomena are shown in *Figure 2*.

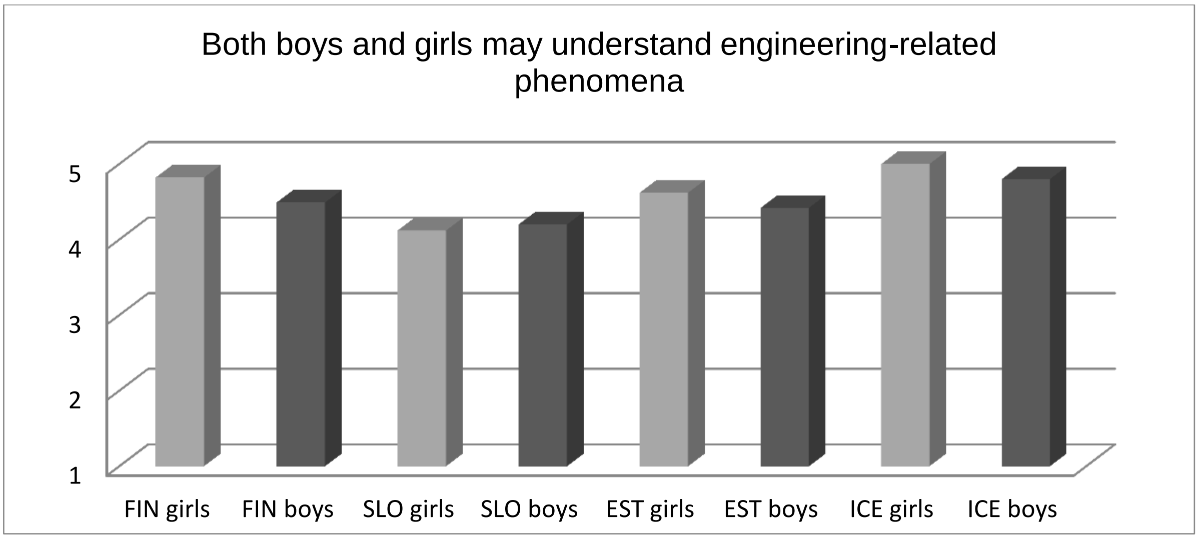

Figure 2. The average values in statement: Both boys and girls may understand engineering-related phenomena

Another statement with high loadings was: *Technology education / craft lessons considerably contribute to the development of manual skills*. The highest average responses were among Icelandic girls 4.66, Estonian boys and girls 4.56 and Icelandic boys 4.50. Interestingly there was a significant statistical difference when compared with Finnish girls 3.75 and Slovenian girls 3.87. In general, it seems that it is not surprising that both boys and girls are attracted to craft and technology education because they enjoy working with their hands and like the independence and chance for creativity provided by these classes (Silverman & Pritchard, 1996). It seems that several other school subjects have more motivational problems than technology education. The averages for the statement: Technology education / craft lessons considerably contribute to the development of manual skills are shown in *Figure 3*.

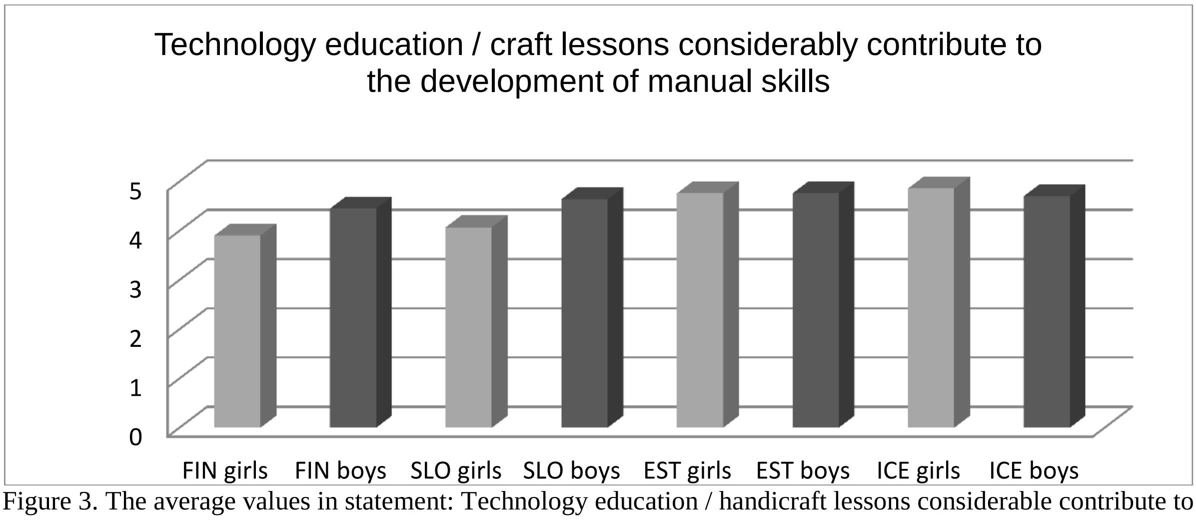

Figure 3. The average values in statement: Technology education / handicraft lessons considerable contribute to the development of manual skills

The lowest value was found in statement: *Spends a lot of time with engineering-related hobby activities.* The average response among Estonian girls was 2.02 followed by Slovenian girls 2.16. Difference between boys and girls was statistically very significant whereas Icelandic boys scored 3.58 and Estonian boys 3.44. The averages for statement: Spends a lot of time with engineering-related hobby activities are presented in *Figure 4*.

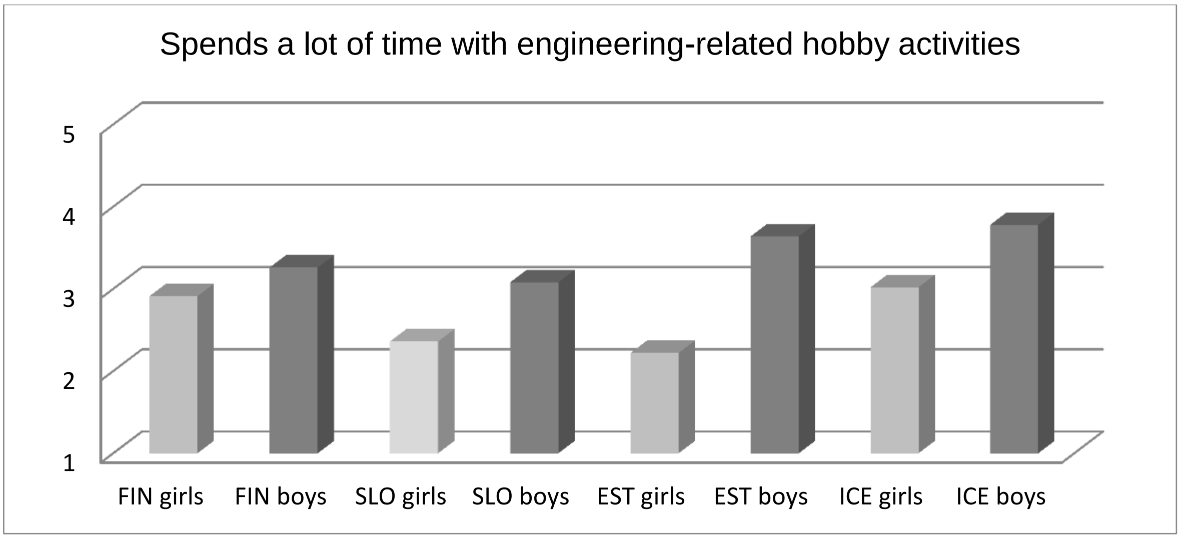

Figure 4. The average value in statement: Spends a lot of time with engineering related hobby activities

Another statement with low values was: *In the future would like to choose a speciality or a profession related to engineering.* The lowest average response was among Slovenian girls 1.82, followed by Finnish and Estonian girls 2.40. Again, statistically very significant difference was found whereas Estonian boys scored 3.39 followed by and Icelandic and Finnish boys 3.25. This is consistent with Eccles (2007) who states that males will receive more support for developing a strong interest in physical science and engineering from their parents, teachers and peers than females. In addition, all young people will see more examples of males engaged in these occupations than females. The averages for statement: In the future would like to choose a speciality or a profession related to engineering are presented in *Figure 5*.

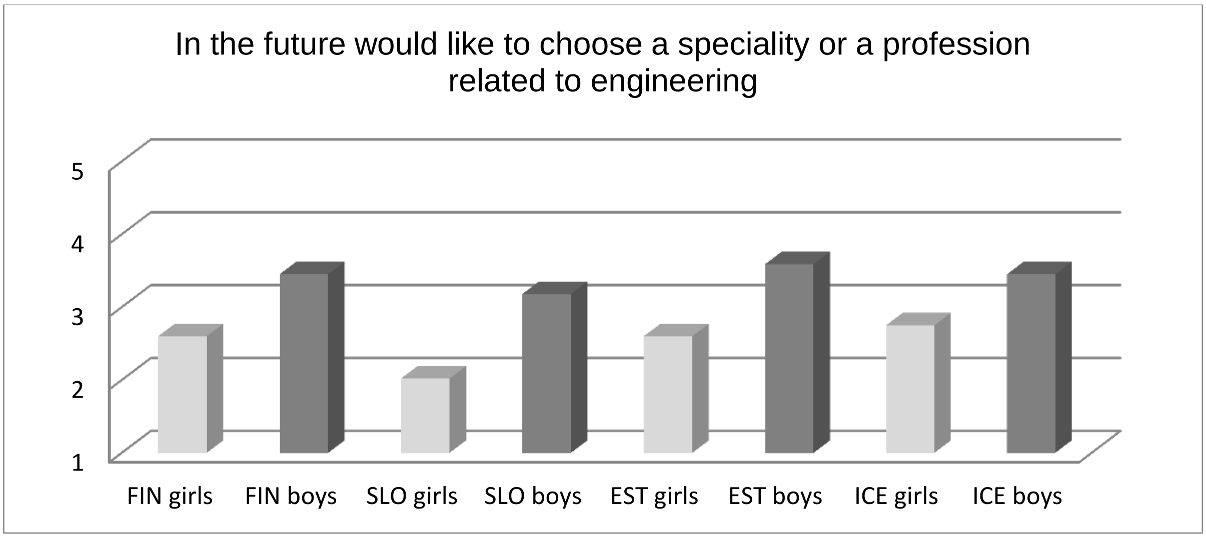

Figure 5. The average values in statement: In the future would like to choose a speciality or a profession related to engineering

The highest correlation (0.76, $p<0.001$***) to the average of other statements was found in statement*: Is interested in engineering and the phenomena related to it*. In the factor analysis, this statement explained 57.7 % of the total variance. The statistical difference between boys and girls was also the highest in this statement. The highest value was found among Estonian and Icelandic boys 4.40 followed by Finnish boys 4.30. The lowest value was scored by Slovenian girls 2.99, followed by Estonian girls 3.32. The difference between boys and girls interest areas can be seen in practice, at least in Finland, where boys still want to choose technical craft studies and the girls' textiles (Autio, 1997; Autio, 2013). The averages for statement: In the future would like to choose a speciality or a profession related to engineering are presented in *Figure 6*.

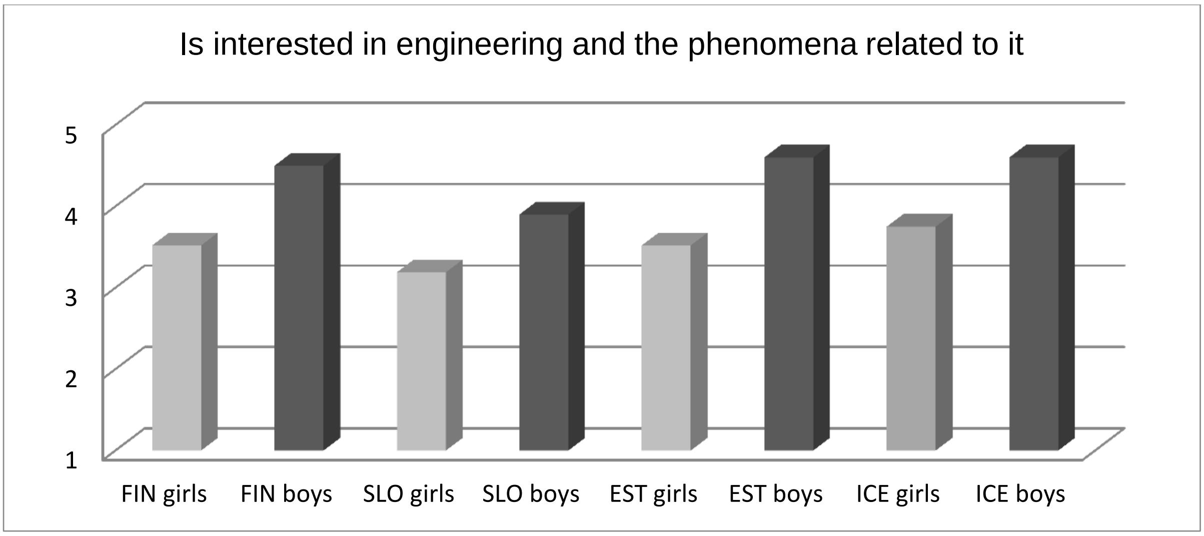

Figure 6. The average value in statement: Is interested in engineering and the phenomena related to it

What are the key factors in students' attitudes towards technology?

The second part of the empirical research tried to find out: *What are the key factors in students' attitudes towards technology?* The questionnaire data was analyzed with the SPSS program, utilizing Principal Axis Factoring as the extraction method and Varimax with Kaiser Normalization as the rotation method. This method was used to determine how students experienced the key factors in their creative problem-solving processes. The exact number of factors was determined by means of Cattell's Scree-test. The comprehensibility criteria were also used, and the number of factors was limited to four, since the meaning of the factors was then readily comprehensible (Dunteman, 1989). To determine the internal consistency of each factor, a Cronbach alpha coefficient, based on the average inter-item correlation, was determined for each factor. The Cronbach alpha coefficients of the factors varied between 0.83 and 0.88.

Each factor, therefore, measures one quality and, thus, a meaningful interpretation of the factors is possible. On the other hand, no far-reaching generalizations were allowed regarding the structure or properties of the attitudes towards technology. The factor analysis simply made it easier for us to describe how these students experienced attitudes towards technology. Each of three factors indicates the students' perspectives regarding attitudes towards technology. Variables (items) that described the highest loading on each factor with means and standard deviations (SD) of each item are presented in *Table 1*. The factors were labeled on the basis of the researchers' discussion on variables (items) loading on a factor.

After the questionnaire data was analyzed and three factors were found. They explained 50.8 % of the common variance, with the eigenvalues of 3.73, 1.86 and 1.58, and percentages of total variance of 26.2%, 13.3% and 11.3% respectively. The communality, indicates that three factors can be used satisfactorily as predictors. Moreover, the extent to which each item plays a role in the interpretation of the factors was high. The eigenvalues indicate that Factor 1 covers most of the variance, and the other two each contribute about the same amount to the explanation of the variances. The factors can be interpreted as matching with the affective, cognitive and behavioral components presented by Ankiewicz & al. (2001). However, no far- reaching generalizations can be done as the questionnaire consists of only 14 items. The factor analysis simply made it easier to describe how the students experienced attitudes towards technology.

Factor 1, *Behavioral component*, explained 26.2% of the total variance and included five items. Three items were clearly connected with person's readiness for action: I 8: In the future would like to choose a specialty or a profession related to engineering, I 3: Newspapers, magazines, and articles on the field of engineering are interesting and I 2: Spends a lot of time with engineering-related hobby activities. Item I 1: Is interested in engineering and the phenomena related to it. On the other hand, this item also had high loadings on the affective component.

Factor 2, *Affective component,* consisted of four items and explained 13.3% of the variance indicating affective component. All four items: I 11: Technology Education lessons considerably contribute to the development of manual skills, I 14: Technology Education lessons will be beneficial in the future, I 12: Technology Education lessons develop logical thinking and I 10: The atmosphere in the Technology Education lessons is pleasant and inspiring. These items clearly referred to feelings and emotions concerning an attitudinal object and associated episodes linked with emotional reactions.

Table 1. Means and standard deviations (SD) and Varimax, with Kaiser Normalization Rotated factor loadings for Principal Axis Factoring, calculated from the items measuring students' attitudes towards technology

	Mean	SD	Factor loading
F1: Behavioral component			
Cronbach=0.86, Eigenvalue=3,732, explain: 26,2%			
I 8: In the future would like to choose a specialty or a profession related to engineering	2.91	1.01	.794
I 1: Is interested in engineering and the phenomena related to it	3.85	.92	.779
I 3: Newspapers, magazines, and articles from the field of engineering are interesting	2.92	1.12	.728
I 2: Spends a lot of time with engineering-related hobby activities	2.81	1,18	.648
I 4: Understanding engineering-related phenomena will be beneficial in the future	3.78	.95	.591
F2: Affective component			
Cronbach=0.83, Eigenvalue=1,860, explain: 13,3%			
I 11: Technology Education lessons considerably contribute to the development of manual skills	4.08	.93	.768
I 14: Technology Education lessons will be beneficial in the future	3.96	1.04	.725
I 12: Technology Education lessons develop logical thinking	3.85	.92	.701
I 10: The atmosphere in the Technology Education lessons is pleasant and inspiring	4.11	.98	.678
F3: Cognitive component			
Cronbach=0.78, Eigenvalue=1,581, explain: 11,3%			
I 6: Both boys and girls may understand engineering-related phenomena	4.30	.92	.653
I 5: Understanding engineering-related phenomena requires a special wit	3.61	.99	.-636
I 7: The mankind has rather benefited than sustained damage from the development of engineering	4.08	1.02	.601
I 9: Parents have a lot of engineering-related hobbies	2.91	1.17	.578

Factor 3, *Cognitive component,* consisted of four items: I 6: Both boys and girls may understand engineering-related phenomena, I 5: Understanding engineering-related phenomena requires a special wit, I 7: The mankind has rather benefited than sustained damage from the development of engineering and I 9: Parents have a lot of engineering-related hobbies. These items explained 11.3% of the variance. The cognitive component – an attitude towards a concept in this case technology; includes ideas or options that express the relationship between situational and attitudinal objects. However, the loadings in cognitive component were significantly lower than in other two factors and for example I 5: Understanding engineering-related phenomena requires a special wit item had a negative loading of -.636. The remaining item I 13: Has been successful in Technology Education lessons was not present in any of three factors. We can assume that this item explained quite the same features as the items on the affective component.

Mean values were clearly higher on affective and cognitive area than on the behavioral component. Students seemed to be aware of the concept technology and gender equity as they highly agree with the statement: I 6: Both boys and girls may understand engineering-related phenomena. However, much less students are willing to challenge stereotypes about non-traditional careers especially for women, as it could be conducted from responses to the statement I 8: In the future would like to choose a speciality or a profession related to engineering. Anyway, the attitudes towards technology seemed to be quite positive in general. Both boys and girls are attracted to technology education because they enjoy working with their hands and like the independence and creativity provided by these classes (Silverman & Pritchard, 1996). We can assume that students who typically enroll in technology education are attracted to the types of projects they will be engaged in (Weber & Custer, 2005).

Next step when analyzing the structure of the attitudes was correlation analysis. It is a method of statistical evaluation used to study the strength of a relationship between two, numerically measured, items. Correlation analysis is useful when a researcher wants to establish if there are possible connections between variables. It is often misunderstood that correlation analysis determines cause and effect. However, this is not true because other variables that are not present in the research may have impacted on the results. If correlation is found between two items, it means that when there is a systematic change in one variable, there is also a systematic change in the other. The items from the attitude questionnaire were classified according to the Eccles (2009) Expectancy Value Model of Motivated Behavioral Choice. Theory is often used as a conceptual framework for understanding how youth come to choose and pursue a given career (Eccles, 2008). In Figure 6 the structure of students' attitudes towards technology is presented as interpreted from the correlation analysis.

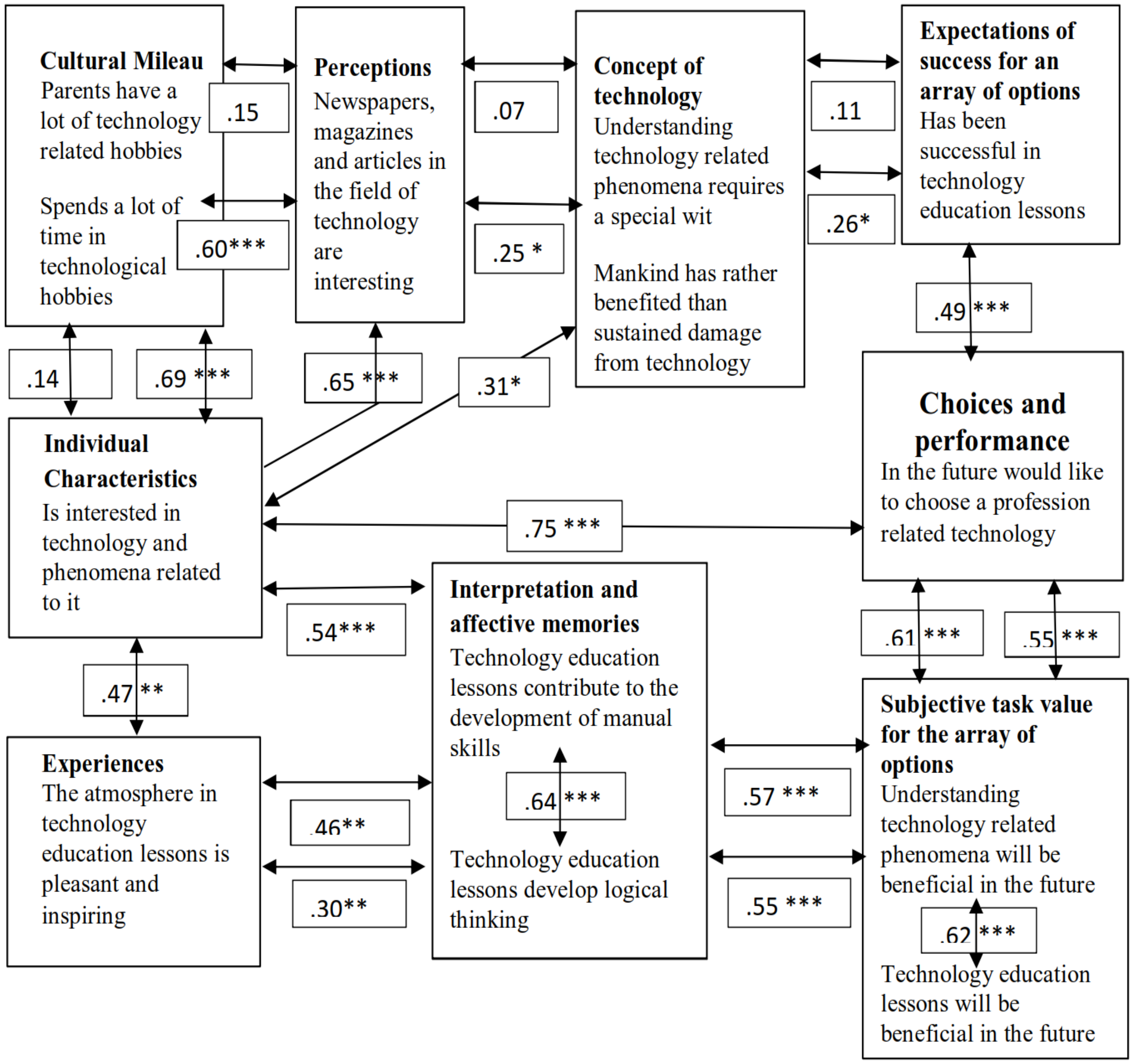

Figure 6. The structure of students' attitudes towards technology is presented as interpreted with the correlation analysis

The paths between the interest in technology and willingness to choose a profession are quite complicated. From the figure, we can conclude that the highest correlation is direct between I 1: Is interested in engineering and the phenomena related to it and I 8: In the future would like to choose a specialty or a profession related to engineering (.75***). In addition we can draw a conclusion that the correlations between the items of the cognitive component (I 5: Understanding engineering-related phenomena requires a special wit, I 7: The mankind has rather benefited than sustained damage from the development of engineering) are lower than the correlations in general. Whether or not the attitude towards technology contains the cognitive dimension is often discussed and based on our finding the issue needs to be further researched.

Discussion

Craft education in Finland, Slovenia, Estonia and Iceland originated over 140 years ago and was influenced by the Scandinavian pedagogy. In the beginning, the subjects largely focused on students copying artefacts, using a variety of handicraft tools: the purpose of this was to improve their' manual skills, rather than their thinking skills. At that time various types of tools were made in craft lessons, e.g. surfaced pointers, tin dustpans, which were needed either at school or in the household. In 1960's, especially in Estonia, an important aim was to guarantee that students familiarize themselves with the most important contemporary industrial and agricultural sectors and ensuring a tight connection between teaching and public work. Also in Finland one of the main aims was to prepare young people, who in the future would mostly become laborers and start working in a public economy sector. However, to day the focus is much more on developing students' thinking skills, which enables them to work through various handicraft processes. This work is based on the idea generation of students and is thus expected to increase their self-esteem and ingenuity.

Despite the origins of craft education in Finland, Slovenia, Estonia and Iceland being similar, now a days Slovenian, Estonian and Icelandic national curriculum place greater emphasis on technological aspects, whereas the Finnish national curriculum focused on the development of students' personalities and gender issues. What is more, in Finland there is just on subject - Craft education, but it is in practice further divided into technologically based technical work and artistically oriented textile work. In Slovenia, there is also just one subject for both boys and girls. The problem seems to be, especially for older girls, that students are not allowed to choose subjects based on their interest area. Hence, a justifiable question of other point of view in equality arouses: are all students in Finland and Slovenia without any regard to sex given an opportunity to choose study groups based on their wishes and interests, which allows them to study in greater detail the subject that they are really interested in? Gender-based segregation and falling recruitment for scientific and technological studies are common phenomena in all the Nordic countries (Sjöberg, 2002). However, it is a paradox that the inequity is noticeable in Finland where for decades gender equality has been a prime educational goal.

In addition, only a few girls seemed to have technological hobbies or had interest in technological articles. What is more, in Finland the boys still want to choose technical craft studies and the girls' textiles (Autio, 2013). A practical solution to get both sexes to choose both subjects has not been found although it is obvious that boys and girls have different interest areas as seen in response to the statement: Is interested in engineering and the phenomena related to it. Finnish, Slovenian and Estonian craft and technology education curriculum could benefit from Icelandic system with two different subjects: art based textile education and innovation based technology education, compulsory for both boys and girls.

In Estonia and Iceland, the curriculum allows more flexibility. In Iceland two different subjects: art based textile education and innovation based technology education, compulsory for both sexes, seem to be relatively good setup for gender equity as the difference in attitudes was the smallest in Iceland. In Estonia technologically based 'technology' and 'handicraft / home economics' gives students an opportunity to choose study groups based on their wishes and interests, and allows students to study in greater detail the subject that they are interested in.

In the quantitative part of the research, several differences in students' attitudes towards craft and technology were found in the four countries. Definitely, the smallest difference between boys and girls was found in Iceland. This finding corroborates with comparable results from Autio & Soobik (2013) and Autio, Thorsteinsson and Olafsson (2012) which shows that Icelandic girls performed better attitudes than Slovenia, Estonian and Finnish girls. This is an interesting finding as the Finnish curriculum has put large emphasis on gender equity since 1970, but still Finnish girls had more negative attitudes towards technology. Finnish girls seemed to be aware of the gender equity and they highly agree with the statement: both boys and girls may understand engineering-related phenomena. However, only a few girls are willing to challenge stereotypes about non-traditional careers for women, as it could be conducted from responses to the statement: in the future would like to choose a speciality or a profession related to engineering.

The critical side of the study is that the study group consisted only from 11-13 year-old students and in Estonia only 11-year-olds. This concentration only in the younger students may have had a small effect on the results in Estonia. Although students' attitudes are assumed to be rather stable during the school years Arffman & Brunell, 1983; Bjerrum Nielsen & Rudberg, 1989); Autio, Thorsteinsson and Olafsson (2012) found that there was significant statistical difference between 11 and 13-year-old Finnish girls in attitudes towards technology. Furthermore, no statistical difference was found between younger and older Finnish and Icelandic boys or between Icelandic younger and older girls. Another critical point of the quantitative part was the use of a relatively small sample of students compared with the whole population. In addition, the amount of students varied a little bit between countries. However, 864 students seemed to be enough as the results are consistent with previous studies (Autio & Soobik, 2013; Autio, Thorsteinsson & Olafsson, 2012).

Conclusions

As the whole technological culture is different in Finland, Slovenia, Estonia and Iceland, we must notice that, the questionnaire measures only students' attitude, not their absolute technological will which is shaped and guided by the whole society, human emotions, motivation, values and personal qualities. The concept attitude is just a single one part of a larger concept, which is 'technological competence'. However, the attitude is a crucial part of the competence as it has a remarkable effect on technological knowledge and technological skills in real life situations.

As a support for this point of view, in the factor analysis, factors matching the affective, cognitive and behavioral components were found. However, no far- reaching generalizations were allowed regarding the structure or properties of the attitudes. The factor analysis simply made it easier for us to describe how students experienced attitudes towards technology. On the other hand, mean values were clearly higher on affective and cognitive area than on the behavioral component. Students seemed to be aware of the concept technology and gender equity, but were not willing to challenge stereotypes about non-traditional careers. In correlation analysis, the correlations between the items of the cognitive component were lower than the correlations in general. It is often discussed whether or not the attitude towards technology contains the cognitive dimension. At least the weight of it in attitudes needs to be further researched.

The Estonian boys' attitudes towards technology were the most positive. It indicates that the Estonian curriculum that includes two different craft subjects: the technologically based 'technology' and 'handicraft / home economics' is still a relatively motivated setup especially for boys, because they can concentrate in greater detail to the subject that they are really interested in. In addition, the innovation and technology part: technology in everyday life, design and technical drawing, materials and processing with exchanged study groups works fine for both boys and girls. On the other hand, motivation in technology education can be significantly improved by developing special programs (Mammes, 2004), where teachers are aware of the differing interests of both genders and consider ways of making the environment and the subject attractive to all (Silverman & Pritchard, 1996).

The reasons behind the dissimilarities found between the four countries may be due to differences in the curriculums and in different pedagogical traditions. Besides, in Estonia there was still some influence from Tsarist Russia with a tight connection between teaching and public work, as well as to cultivate ideological approach to work on the young generation. On the other hand, the political situation has considerably changed in Estonia as well as in Slovenia and the motivation for further development seems to be ambitious also in education, including the syllabi of technology education. However, further research is needed before the authors can reach their final conclusions.

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Appendix A. Items of Survey of Student Attitudes towards Technology

Items	(1) Strongly Disagree	(2)	(3)	(4)	(5) Strongly Agree
1. Is interested in technology and the phenomena related to it.					
2. Spends a lot of time with technology-related hobbies.					
3. Newspapers, magazines, and articles from the field of technology are interesting.					
4. Understanding technology-related phenomena will be beneficial in the future.					
5. Understanding technology-related phenomena requires a special wit.					
6. Both boys and girls may understand technology-related phenomena.					
7. The mankind has rather benefited than sustained damage from the development of technology.					
8. In the future would like to choose a specialty or a profession related to technology.					
9. Parents have a lot of technology-related hobbies.					
10. The atmosphere in the Technology Education is pleasant and inspiring.					
11. Technology Education lessons considerably contribute to the development of manual skills.					
12. Technology Education lessons develop logical thinking.					
13. Has been successful in Technology Education lessons.					
14. Technology Education lessons will be beneficial in the future.					