International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

The Development of Craft and Technology Education Curriculums and Students' Attitudes towards Technology in Finland, Estonia and Iceland

Ossi Autio[1], Mart Soobik[2], Gisli Thorsteinsson[3], Brynjar Olafsson[3]
[1] University of Helsinki
[2] University of Tallinn
[3] University of Iceland

To cite this article:

Autio, O., Soobik, M., Thorsteinsson, G., & Olafsson, B. (2015). The development of craft and technology education curriculums and students' attitudes towards technology in finland, estonia and ıceland. *International Journal of Contemporary Educational Research, 2*(1), 22-34.

International Journal of Contemporary Educational Research
Volume 2, Number 1, January 2015, Page 22-34 ISSN: 2148-3868

The Development of Craft and Technology Education Curriculums and Students' Attitudes towards Technology in Finland, Estonia and Iceland

Ossi Autio[1*], Mart Soobik[2], Gisli Thorsteinsson[3], Brynjar Olafsson[3]
[1] University of Helsinki
[2] University of Tallinn
[3] University of Iceland

Abstract

The research is based on a comparative study of craft and technology education curriculums and students' attitudes towards craft and technology in Finland, Estonia and Iceland. The study was undertaken in the Helsinki University, University of Tallinn and University of Iceland during years 2012-2013. In order to examine and compare the origins of craft education in Finland, Estonia and Iceland a literature review was completed. In addition, a quantitative survey was subsequently distributed to 658 school students in Finland, 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 craft and technology education in the three countries: these differences may be explained by differences in the national curriculums, the different pedagogical traditions and cultural differences in the field of technology. However, for deeper understanding, the qualitative findings need to be examined further with different research methods.

Key words: Technology education, Craft education Attitudes towards technology, National curriculum

Introduction

Compulsory education in Finland is intended for students from 7 to 15 years old. In addition, all 6 year olds are entitled to pre-school education for one year, prior to starting basic education. Primary school teachers teach students aged 7 to 13 years old (grades 1-6), while specialist teachers teach children aged 13 to 15 years old (grades 7-9). Secondary schools educate students aged 16 -19 years and these schools are divided into general education (upper secondary schools) and vocational education (vocational schools). Upper secondary schools prepare students mainly for higher education, while vocational schools instruct students for specialised vocational training (Framework Curriculum Guidelines, 2004).

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 of 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).

In Estonia, school attendance is mandatory for all children from age 7 until the pupil turns 17. In basic school, the allocated time for covering the curriculum is nine years. The stages of study in basic school are: 1st stage of study – grades 1 to 3; 2nd stage of study – grades 4 to 6; 3rd stage of study – grades 7 to 9. The standard period of study in upper secondary school is three years (Põhikooli- ja gümnaasiumiseadus, 2010). After graduating basic school, students can continue their studies in a vocational school. After obtaining secondary education in a vocational school or in an upper secondary school, students can move on to the higher education level, opting either for an institution of professional higher education or a university (Eesti Vabariigi haridusseadus, 1992).

* Corresponding Author: *Ossi Autio, ossi.autio@helsinki.fi*

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)

There are four levels of education in Iceland: playschool, compulsory school, upper secondary school and higher education (this is similar to the educational systems in other Nordic countries). Education in Iceland is mandatory for children aged 6–16 and is organised into a single, structured system; i.e., primary and lower secondary education are both part of the same school level and are generally housed within the same school. Upper secondary education (aged 16-20 years) is not compulsory, but anyone who has completed compulsory education has a right to study at this level. Upper secondary schools offer both general academic studies and vocational training. General academic studies are of four-years' duration, leading to a matriculation examination, while the length of vocational courses varies: they may last from one semester to ten semesters; the four-year courses are most prevalent (The Icelandic Ministry of Education, 2007).

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 in 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, Estonia and Iceland; however there are also some differences. In the following sections, the authors will attempt to highlight these differences in the curriculum level and later will try to ascertain whether there are any differences in practical level between the three countries, with regards to students' attitudes towards craft and technology.

Main part of the study was to recognise the origin of craft education in Finland, Estonia and Iceland to identify fundamental changes during the development of the curriculums. This was done by a literature review based on the different curriculums. The quantitative part of the study was, however, to find any differences in students' attitudes towards craft and technology in Finland, Estonia and Iceland. The research questions were:

1. What are the origins of craft education in Finland, Estonia and Iceland and how have the curriculums developed over the years?
2. Are there differences in students' attitudes towards craft and technology in Finland, Estonia and Iceland?

The origin of pedagogical craft and technology education

The Finnish educationalist Gygnaeus (1810-1888) founded public schools in Finland in 1866. At this time, Gygnaeus also introduced craft as a pedagogically-based compulsory subject, in an attempt to improve general education in Finland (Thorarinsson, 1891). In 1866, educational Sloyd (known as craft and technology education today) became a compulsory subject in Finland (Kantola, 1997).

Manual training in Finland was established in two ways: males in rural communities were required to take the programme and teaching centres had to offer related courses (Vaughn & Mays, 1924). With the implementation of this system of universal education for all citizens, Finland became the first nation to make handwork an integral part of a national scheme of elementary education (Bennett, 1926: Kananoja, 1989; Kantola, 1997).

Gygnaeus drew a sharp distinction between handicraft or manual arts as part of the general curriculum and handicraft as part of a technical or specialised education (Kananoja, 1989). Furthermore, he insisted that handicrafts should be taught by regular teachers, rather than specialised craftsmen (Bennett, 1937).

Unfortunately, Gygnaeus' ideas for teaching craft were not adopted. In the Committee Report (1912), the aims of teaching handiwork were based on the ideas of Mikael Soininen, who stated that craft education should be based on the general aims of handicraft training. These aims were in practice the same until the 1970s (Anttila, 1983).

Industrialisation in Finland occurred between the years 1920–1960 and, at the same time, the craft national curriculum began to focus on industrial skills, as such skills were required in society (Kananoja, 1989); little emphasis was placed on the development of students' personalities and the enjoyment of craft work. However, the policy of fulfilling the needs of an industrialised society did not last long. In the Committee Report (1970), it was claimed that craft education was outdated and, influenced by the Norwegian 'Forming' model, the education authorities decided to make craft part of the subject area for art. The Committee Report also emphasised the importance of sexual equality for the first time: it was considered that craft education could develop the important skills needed for everyday life in both sexes. At this time, the name of the subject was changed from craft education to technical craft or textile craft and it was recommended that the number of lessons taught should be considerably decreased. However, these plans never came to full fruition, as the result of a protest by the society of craft teachers. Thus, the impact of the Committee Report, in terms of how the subject was taught in schools, was of little significance.

Technology Education was first introduced in the Framework Curriculum Guidelines (1985), yet its impact on the subject of craft was insignificant. Handicraft skills were still considered of great importance; however, electronics and engineering were incorporated into the subject. The authorities wanted to further develop technology education, but, in practice, this was difficult. They also wanted to preserve the link to the heritage of Finnish craft and support student equality.

In the 1994 Framework Curriculum Guidelines, it was asserted that technology was an important aspect of the development of a modern Finnish society. Sustainability was also introduced into the curriculum. However, technology education was not established as a specific subject and the technological aspect of craft education was not particularly supported. The importance of developing technical literacy in students was emphasised, in order to enable students to adapt to new circumstances and take part in the development of new technologies within a modern Finnish society. It was deemed that students of both sexes should benefit from familiarity with modern technology.

Around 2001, a discussion took place between the authorities and the spokesmen of the craft industry, with regards to the importance of incorporating technology education as an active part of general education in Finland. Unfortunately, these assertions were not taken into account in the Framework Curriculum Guidelines of 2004, with technology merely mentioned in the craft curriculum. Compared to the previous curriculum, few changes were made. The importance of developing students' handicraft skills was underlined, as in the Committee Report of 1970, within the context of the complete process of handiwork. Nevertheless, technology was introduced as part of a specific cross-curricular theme, entitled *The Human Being and Technology*. In the next curriculum 2016, even the name for the subject is expected to be Handicraft. It means that there is a minor emphasis on technology. Instead, the development of students' personalities, the growth of self-esteem and gender issues will be more important.

The development of craft and technology curriculum in Estonia

According to the Schools Act in 1803 and 1804, an upper secondary school was to be established in each provincial town; among other subjects the study program included technology and technical drawing (Andresen, 2003). Schools functioned on the principles of "activity schools" (Arbeitschulen), which were common in the Western Europe and favored maximum application of work education principles at school, which did not mean only craft, but the principle, which should include the whole school and would guide the learner towards independent thinking and activity through work and through physical work, in particular (Põld, 1993).

In the independent Republic of Estonia (1919-1940) consistent work was started with the aim of developing the content and organization of education (Läänemets, 1995). The lessons plans of the seven-year school included the subject of handicraft, which was taught 2 lessons a week in every class (Haridusministeeriumi määrus tunnikava kohta, 1919). In 1940, the Republic of Estonia was incorporated in the Soviet Union. According to the study programs established in schools after WW II, Craft lessons focused on making study aids, including objects for other subjects, as schools lacked means and tools for the subject (ENSV Haridusministeeriumi Koolivalitsus). In the program of the 1954/1955 academic year, the objective of Craft was to develop students' personality, their skills, the ability to handle simpler tools and materials, using accomplishable techniques. In addition, socialist approach to work and collective working was developed in students (Keskkooli programmid 1954/55, 1954).

The directives of the 20th Congress of the Party in 1956 claimed that polytechnic education must be developed in general education schools, guaranteeing that students familiarize themselves with the most important contemporary industrial and agricultural sectors (Štšukin, 1956). At the beginning of the 1960s an innovation in the study plans was students' work for the public good, as well as practical training and practical production practice, at the beginning of the 1980s the trend was towards establishing inter-school production practice plants and the number of Craft lessons per week was increased to four (Rihvk, 1985). 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. Also creative building works were done within decorative wood carving and metal working art. The main aim was to prepare young people, who in the future would mostly become laborers and start working in a public economy sector.

On August 20, 1991 the Supreme Council of the Republic of Estonia passed the decision that Estonia no longer belongs to the Soviet Union and is an independent republic. In 1992 the Ministry of Education established the Craft programs for Grades 5 to 9 in general education schools (Eesti NSV Haridusministeerium, 1992). Classes were divided into two groups (boys and girls) and the program intended for a material-technological system in craft for grades 5 to 9, which meant that teaching various techniques is carried out through producing object of common need, whereas the goal orientation towards the usefulness of the objects for the society was essential. The program for boys had ten different parts: general technical training, woodwork, metal work, decorative wood carving, metal working art, electro-technical work, design and technical modelling, gardening and agriculture, and cording. Four different parts of it were expected to be taught (Eesti NSV Haridusministeerium 1992, pp. 4-5).

The 2002 curriculum established that the craft syllabus for basic schools has four different syllabi: handicraft for grades 1 to 3; handicraft, home economics, and craft and technology education for grades 4 to 9. The main content of craft and technology education was connecting national experience, innovation, and modern technology with students' purposeful creative practical work. **(**Põhikooli ja gümnaasiumi riiklik õppekava**,** 2002).

Later on, the regulation established by the government of the republic in 2011, states that the subjects of technology domain are craft, technology education, and handicraft and home economics. Craft is taught in grades 1 to 3 (girls and boys together). At the 2nd stage of study the students are divided into study groups based on their wishes and interests, selecting either handicraft and home economics or Technology studies. This allows students to study in greater detail the subject that they are interested in. The division into study groups is not gender-based, but in practice Technology education in grades 4 to 9 was mostly chosen by boys and handicraft / home economics in Grades 4 to 9 mostly by girls (Ainevaldkond "Tehnoloogia", 2011)

The teaching focuses largely on pupils' purposeful and creative innovation, where along with the joy of discovery they experience creating a selected object. Students perform interesting and imaginative creative tasks of applied nature, including the planning of a task or a product, designing and producing it, as well as self-evaluation and presentation of the work. Connections and applied outputs between the subject and spheres of life are pointed out, so that pupils get a complete understanding of the task or the product. It is important that students understand how technology works and they can take part in creating technology that corresponds to their abilities. Students' varying abilities and interests are taken into account and their initiative and motivation to learn is supported. The subject stresses the importance of invention and shapes students' professional behaviors and value judgments. The objective is to value ecological attitude and local traditions, as well as attain ethical beliefs. (Ainevaldkond "Tehnoloogia", 2011).

The development of craft and technology curriculum in Iceland

The originators of pedagogical craft education in Iceland introduced the ideology of Scandinavian Sloyd to Icelandic educators around 1900. Consequently, their work provided the basis for the establishment of school laws, in terms of general craft education and curriculum development. The first public school laws were established in Iceland's parliament in 1907 (Log um fraedslu barna, 1907); however, ideas for craft education were not included in this. The possible reasons for this were a lack of school buildings and facilities, a lack of interest on the part of the authorities and the importance of children working in the economy.

The first National Curriculum for the Education of Children was published in 1929 and this outlined seven years of school education for children living in urban areas and four years of education for children residing in rural areas. The craft industry was still not mentioned in the curriculum, although drawing was recommended as a subject (Eliasson, 1944). Despite this, craft was taught in several schools that had the necessary facilities.

Craft was first established as a subject in 1948. Instruction was gender-based, with craft for boys and textiles for girls (Fræðslumálastjórnin, 1948). The first integral national curriculum for compulsory education was published in 1960: this was gender-divided, but emphasised the general pedagogical values of the subject.

Based on the above law, a new national curriculum was established in 1976-1977 (The Icelandic Ministry of Education, 1977). In this curriculum, craft education was incorporated as a new subject area, entitled *Art and Handicraft*; this included art, textiles and craft. For the first time, all these subjects were compulsory for both boys and girls, with the curriculum being slightly revised in 1989.

In 1999, Craft was re-established as a technological subject, under the heading of *Design and Craft* (The Icelandic Ministry of Education, 1999): this new subject was based on a rationale of technological literacy, innovation and design (Thorsteinsson, 2002; Thorsteinsson & Denton, 2003). The curriculum was ambitious and made significant strides towards the education of technology. However, many teachers felt this was a step too far and felt uncomfortable utilising electronics in lessons. They lacked sufficient knowledge, skills and interest, with regards to the teaching of technology (Olafsson, Hilmarsson & Svavarsson, 2005).

When the national curriculum was revised in 2007, the education authority decided to seek suggestions from the Design and Craft Teachers' Association, in terms of the teaching of Design and Craft. Taking the teachers' views into account, it was decided to minimise the technological part of the Design and Craft curriculum and the original Sloyd values were once again included in the curriculum (Olafsson, Hilmarsson & Svavarsson, 2005).The curriculum moved away from the manufacturing process (i.e., mass production) and towards handicraft-based processes. Today, innovation and idea generation are still an important part of the curriculum (Olafsson & Thorsteinsson, 2010), as is encouraging students to organise their work. New aspects of the curriculum are outdoor education, green woodwork, sustainable design and health and safety. Teachers have gained increased freedom, in terms of following the school curriculum and managing their teaching, as there are no longer any aims listed each year. The main changes in the development of the three curriculums are presented in Table 1.

Table 1. The main changes in the national curriculums for Craft and Technology in Finland, Estonia and Iceland

Finland	Estonia	Iceland
1866 Statute of folk school -Craft compulsory school subject	1894 Russian law -Craft was officially a part of the curriculum for general education	The first public school laws in 1907 --Ideas for Craft education were not included.
1952 Committee Report -focus on industrial skills - using industrial machines deemed important	1954 Secondary school programs - focus on polytechnic education - develop students' ability to work with simpler tools and materials	The first National Curriculum for the Education of Children in 1929 -Craft was not mentioned. Despite this, craft was taught in schools that had the necessary facilities.
1970 Committee Report -pedagogical background for Craft education was introduced - large emphasis on gender equity	1961 Secondary school study plans - practical production and inter-school production practice plants -students' work for the public good	Craft was first established as a subject in 1948. Instruction was gender-based, with craft for boys and textiles for girls
1985 Framework Curriculum -concept of technology introduced -cultural heritage in Craft education made important	1992 Programs for general education -Craft separately for boys and girls -teaching various techniques -usefulness of the objects for the society was essential	In 1977 curriculum, Craft education was incorporated as a new subject area, entitled *Art and Handicraft*. -Both subjects were compulsory for both boys and girls.
2004 Framework Curriculum -students' personality development highlighted	2002 National curriculum for basic schools and upper secondary schools	In 1999 Craft was re-established as a technological subject, under the heading of *Design and Craft*

-enjoyment in doing craftwork and self-esteem deemed important	-Craft and Technology Education for grades 4 to 9 (mostly boys) -basic knowledge and practical skills in present-day engineering and technology	-The new subject was based on a rationale of technological literacy,
2016 Framework Curriculum -ideas on the name of the subject are exchanged? -additional lessons are requested for the subject in primary level?	2011 National curriculum for basic school -Technology education for grades 4 to 9 (study groups based on students' wishes and interests) -project works (girls and boys together)	In 2007 national curriculum was revised, the technological part was minimized and the original craft values were once again included in the curriculum. -innovation and idea generation still an important part of Craft education

Empirical research

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, Estonia and Iceland?* Dyrenfurth (1990) and Layton (1994) referred to attitudes in technology education using the concept of 'technological will'. According to these authors, technology is determined and guided by human emotions, motivation, values and personal qualities. Thus, the development of technology is dependent on the students' will to take part in lessons and on the impact of their technological decisions.

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 & de Vries (1986) and van de Velde (1992). Reliability measured by Cronbach alpha was 0.84. Totally 658 students took part in the survey. The age of the student-respondents 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 any differences between the respondents. This was done by conducting the one tailed t-test, with the same variance, on boys and girls. In the entire Finnish, Estonian and Icelandic groups, we employed the two tailed t-test, as we had no hypothesis based on the previous research.

Results

Several differences in students' attitudes towards craft and technology were found in the three countries. The average response in our Likert-style (1-5) questionnaire to all 14 items was among Finnish girls 3.37, Estonian girls 3.55 and Icelandic girls 3.67. Significant statistical difference was found between boys and girls (p=0.001), whereas the average response of boys was in Finland 3.78, Estonia 4.00 and in Iceland 3.87. Estonian boys had the most positive attitude towards technology, whereas the lowest attitude was found among Finnish 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 Table 2.

Table 2. Average (Mean) values for each statement, with regards to the measurement of students' attitudes towards craft and technology in Finland, Estonia and Iceland

Statement	Gender	Average Finland	Average Estonia	Average Iceland
1. Is interested in engineering and the phenomena related to it	girls	3.45	3.32	3.55
	boys	4.30	4.40	4.40
2. Spends a lot of time with engineering-related hobby activities	girls	<u>2.71</u>	<u>2.02</u>	<u>2.82</u>
	boys	3.06	3.44	3.58

3. Newspapers, magazines, and articles from the field of engineering are interesting	girls	2.35	2.87	2.82
	boys	2.83	3.50	3.00
4. Understanding engineering-related phenomena will be beneficial in the future	girls	3.45	3.59	3.59
	boys	3.95	4.43	3.95
5. Understanding engineering-related phenomena requires a special wit	girls	3.55	3.50	3.16
	boys	3.60	4.16	3.70
6. Both boys and girls may understand engineering-related phenomena	girls	4.62	4.42	4.82
	boys	4.29	4.22	4.60
7. The mankind has rather benefited than sustained damage from the development of engineering	girls	3.85	3.89	3.98
	boys	4.25	4.29	4.23
8. In the future would like to choose a specialty or a profession related to engineering	girls	2.40	2.40	2.55
	boys	3.25	3.39	3.25
9. Parents have a lot of engineering-related hobbies	girls	2.98	2.61	3.07
	boys	3.09	2.96	2.88
10. The atmosphere in the Technology Education / Craft lessons is pleasant and inspiring	girls	3.56	4.32	4.07
	boys	4.24	4.11	4.03
11. Technology Education / Craft lessons considerably contribute to the development of manual skills	girls	3.85	4.56	4.66
	boys	4.25	4.56	4.50
12. Technology Education / Craft lessons develop logical thinking	girls	3.60	4.12	3.89
	boys	3.84	4.24	3.93
13. Has been successful in Technology Education / Craft lessons	girls	3.49	3.99	4.55
	boys	3.80	3.93	4.25
14. Technology Education / Craft lessons will be beneficial in the future	girls	3.51	4.09	3.82
	boys	3.90	4.39	3.88
All 14 items	girls	3.37	3.55	3.67
	boys	3.78	4.00	3.87

The highest average values in the whole questionnaire were found in statement 7: 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. No significant statistical differences (p=0.21) 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 statement: Both boys and girls may understand engineering-related phenomena are shown in Figure 1.

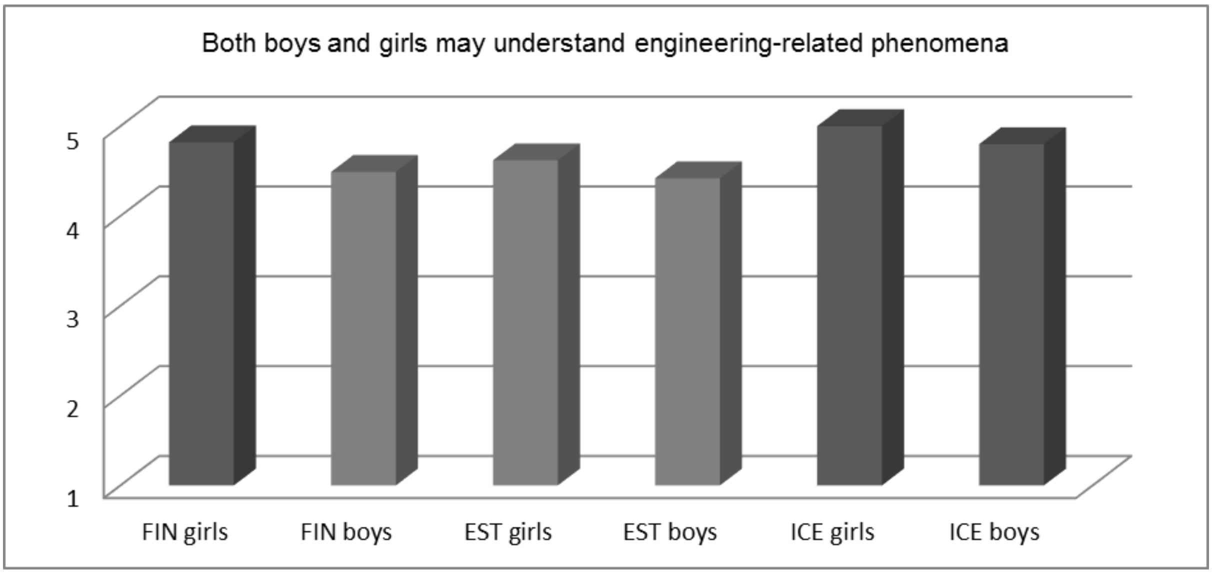

Figure 1: Shows the average values in statement: Both boys and girls may understand engineering-related phenomena

Another statement with high loadings was number 11: 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 (p=0.001) when compared with Finnish girls 3.85. 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 is obvious that several other school subjects have more motivational problems than technology education (Shernoff, Csikszentmiahlyi, Schneider & Shernoff, 2003). The averages for statement: Technology education / handicraft lessons considerably contribute to the development of manual skills are shown in Figure 2.

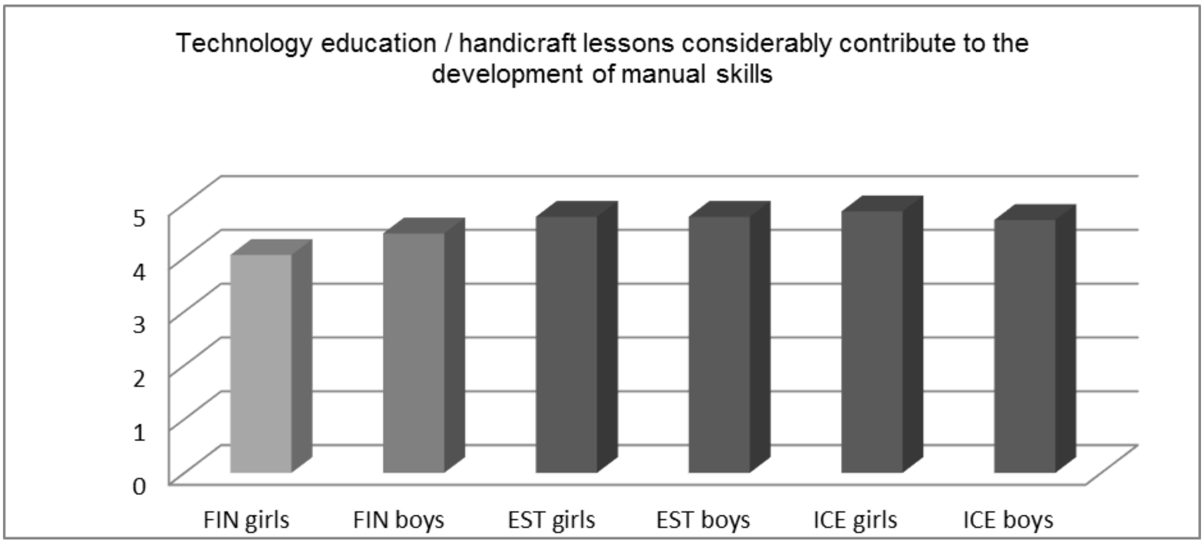

Figure 2: Shows the average values in statement: Technology education / handicraft lessons considerable contribute to the development of manual skills

The lowest value was found in statement 2: Spends a lot of time with engineering-related hobby activities. The average response among Estonian girls was 2.02 followed by Finnish girls 2.71 and Icelandic girls 2.82. Difference between boys and girls was statistically very significant ($p<0.001$) 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 3.

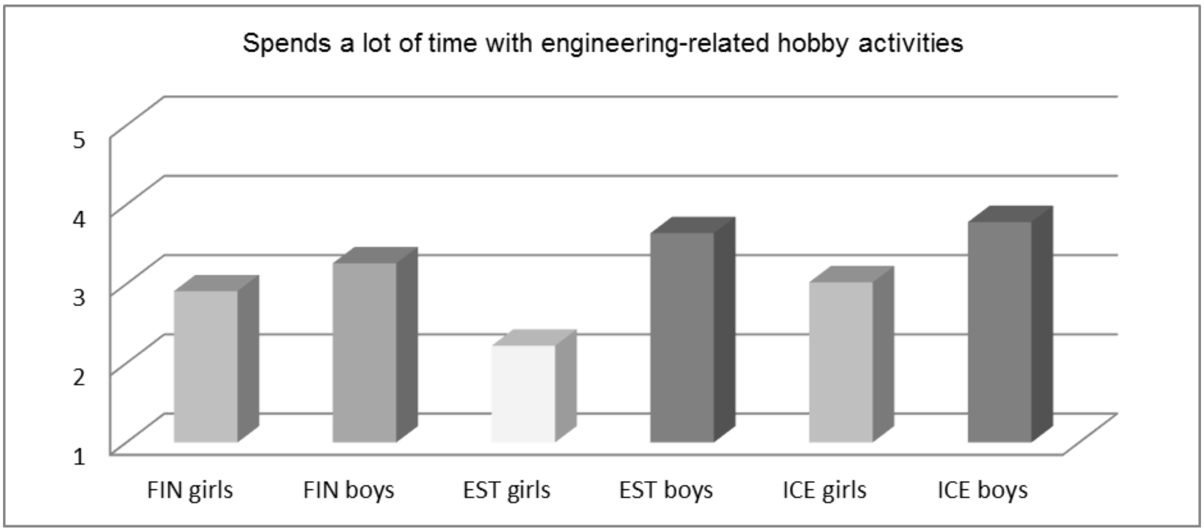

Figure 3: Shows the average value in statement: Spends a lot of time with engineering related hobby activities

Another statement with low values was number 3: In the future would like to choose a speciality or a profession related to engineering The lowest average responses were among Finnish and Estonian girls 2.40 followed by Icelandic girls 2.55. Again, statistically very significant difference ($p<0.001$) 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, it is absolutely the case that 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 4.

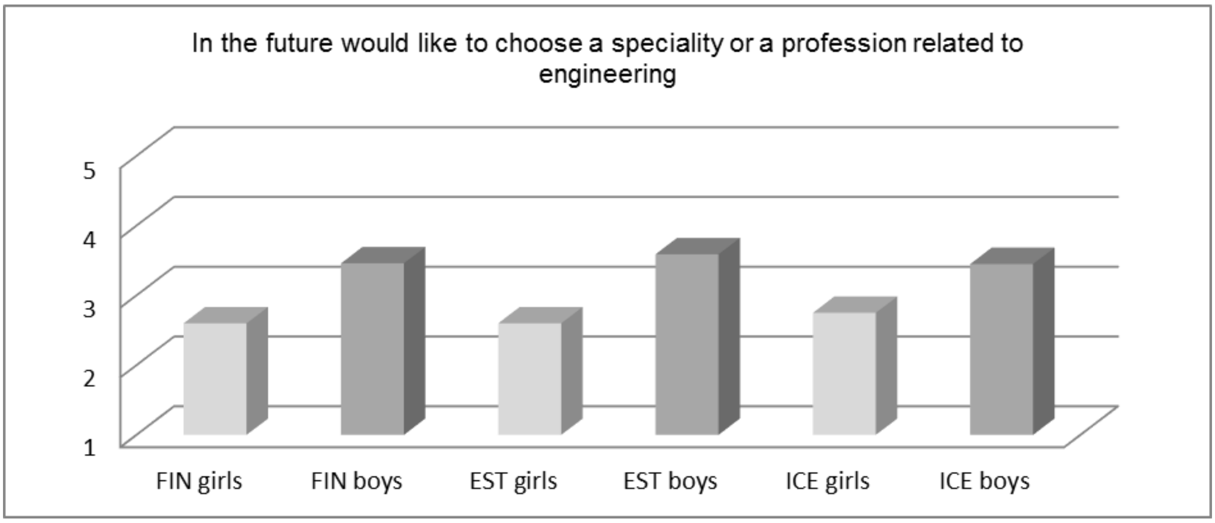

Figure 4*:* Shows the average values in statement: In the future would like to choose a speciality or a profession related to engineering

The highest correlation (0.76, $p<0.001$) to the average of other statements was found in statement 1: Is interested in engineering and the phenomena related to it. The statistical difference ($p<0.001$) between boys and girls was also the highest in this statement. Highest value was found among Estonian and Icelandic boys 4.40 followed by Finnish boys 4.30. Lowest value was scored 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 5.

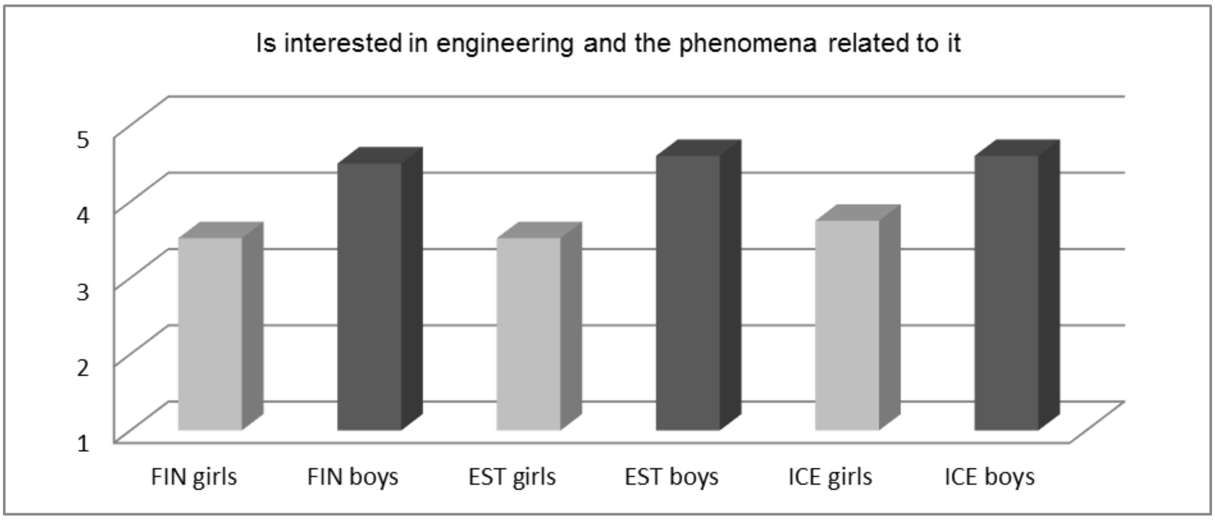

Figure 5: Shows the average value in statement: Is interested in engineering and the phenomena related to it

Conclusions and Discussion

Craft education in Finland, Estonia and Iceland originated over 140 years ago and was influenced by the Scandinavian sloyd 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 artifacts 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, as well as to cultivate communistic approach to work in the young generation. 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 (from initial ideas to the final products). This work is based on the idea generation of students and is thus expected to increase their self-esteem and ingenuity.

The literature review also highlighted that during the past twenty years the understanding of technology and its relationship to society has been emphasized. The technical development of society makes it necessary for all citizens to be prepared to use technical adaptations and to be able to exert an influence on the direction of technical development. Furthermore, students regardless of gender must have the opportunity to acquaint themselves with technology and to learn to understand and avail themselves of its uses.

Despite the origins of craft education in Finland, Estonia and Iceland being similar, nowadays the Estonian and Icelandic national curriculum place greater emphasis on technological aspects, design and innovation, whereas the Finnish national curriculum focused on the development of students' personalities and gender issues. What's more, in Finland there is just on subject - Craft education, but it is in practice further divided into technical work and textile work, whereas in Estonia and Iceland the curriculum allows more flexibility. In Iceland 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 three 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 both 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 the most negative attitude towards technology. Finnish girls seemed to be aware of the gender equity and their 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. This phenomenon seems to be true in Estonia and Iceland as well. Gender-based segregation and falling recruitment for scientific and technological studies are common phenomena in all the Nordic countries (Sjøberg, 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 few girls seemed to have technological hobbies or had interest in technological articles. What's more, in Finland the boys still want to choose technical craft studies and the girls' textiles (Autio, 1997; 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 responses to the statement: Is interested in engineering and the phenomena related to it. Finnish 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.

The Estonian boys' attitudes towards craft and technology were 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 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 in the results. 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 to whole population. In addition, the amount of students varied a little bit between countries. However, 658 students seemed to be enough as the results are consistent with previous studies (Autio, 1997; Autio, Thorsteinsson & Olafsson, 2012; Autio & Soobik, 2013). As the whole technological culture is different in these three countries, 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, attitude is a crucial part of the competence as it has a remarkable effect on technological knowledge and technological skills in real life situations.

The reasons behind the dissimilarities found between the three 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 in the young generation. On the other hand, the political situation has considerably changed in Estonia and the motivation for further development seems to be ambitious also in education, including the syllabi of craft and technology education. However, further research is needed before the authors can reach their final conclusions. We are continuing our efforts in several related projects.

References

Ainevaldkond "Tehnoloogia" [Subject field "Technology"]. (2011). RT I, 14.01.2011, 1. Retrieved from https://www.riigiteataja.ee/aktilisa/1200/9201/1009/VV1_lisa7.pdf.

Andresen, L. (2003). *Eesti kooli ajalugu. Algusest kuni 1940 aastani* [History of the Estonian school. From the beginning until 1940]. Estonia, Tallinn: AS BIT.

Anttila, P. (1983). *Työ ja työhön kasvatettavuus [Work and the education to work]*. Tutkimus koulun työkasvatuksesta ja siihen vaikuttavista tekijöistä. Helsingin yliopiston kasvatustieteen laitos. Tutkimuksia 100.

Arffman, I. & Brunell, V. (1983) *Sukupuolten psykologisista eroavaisuuksista ja niiden syistä [Psychological gender differences and the reasons for them]*. Jyväskylän yliopisto. Kasvatustieteiden tutkimuslaitoksen selosteita ja tiedotteita 283.

Autio, O. (1997). *Oppilaiden teknisten valmiuksien kehittyminen peruskoulussa [Student's development in technical abilities in Finnish comprehensive school*]. Research Reports No. 117. Helsinki: The University of Helsinki, Department of Teacher Education.

Autio, O. (2013) Oppilaiden teknologiset valmiudet – vertailu vuoteen 1993. [Students' technological abilities – a comparison to a year 1997] *Kasvatus 44 (4)*, 367-380.

Autio, O & Soobik, M. (2013). A Comparative Study of Craft and technology Education Curriculums and Students' Attitudes towards Craft and Technology in Finnish and Estonian Schools. *Techne series A, 20* (2), 17-33.

Autio, O., Thorsteinsson, G. & Olafsson, B. (2012). A Comparative Study of Finnish and Icelandic Craft Education Curriculums and Students' Attitudes towards Craft and Technology in Schools. *Procedia - Social and Behavioral Sciences 45 (2012), 114-124.*

Bennett, C. A. (1926) *History of Manual and Industrial Education up to 1870, Peoria*: The Manual Arts Press.

Bennett, C.A. (1937) *History of Manual and Industrial Education 1870 to 1917.* Peoria IL: The Manual Arts Press.

Bjerrum Nielsen, H. & Rudberg, M. (1989). *Historien om jenter og gutter. Kjonnsosialisering i ett utvecklingspsykoligisk perspektiv*. Oslo: Universitetslaget

Committee Report (1912). Helsinki: Kouluhallitus.

Committee Report (1970). Helsinki: Kouluhallitus.

Dyrenfruth, M. J. (1990). Technological Literacy: Characteristics and Competencies, Revealed and Detailed. In H. Szydlowski & R. Stryjski (Eds.) *Technology and School: Report of the PATT Conference* (pp. 26-50). Zielona Gora, Poland: Pedagogical University Press.

Eccles, J. (2007) Where are all the women? Gender differences in participation in physical science and engineering. In Ceci, S. & Williams, W. (Eds.) *Why Aren't more Women in Science.* American Psychological Association: Washington, DC.

Eesti Vabariigi haridusseadus [Education Law of the Republic of Estonia]. (1992). RT 1992, 12, 192. Retrieved from https://www.riigiteataja.ee/akt/968165?leiaKehtiv

Eesti NSV Haridusministeerium. Üldhariduskooli programmid. Töööpetus V- IX klassile [Programs for general education schools. Craft for Grades 5 to 9]. (1992). Eesti Vabariigi haridusministeerium.

Eliasson, H. (Ed.) (1944). Log og reglur um skola- og menningarmol a Islandi sem i gildi eru i marzlok 1944. Reykjavik: Fraedslumalastjornin.

ENSV Haridusministeeriumi Koolivalitsus [Educational authority of the Ministry of Education of the ESSR]. Rahvusarhiiv, f.R-14. Nr 4, s.12.

Haridusministeeriumi määrus tunnikava kohta [Regulation of the Ministry of Education on lesson plans]. (1919). Tallinn.

Fensham, P. (1992). Science and Technology. In Jackson, P. (Ed.) *Handbook of Research on Curriculum.* New York: MacMillan.

Framework Curriculum Guidelines (1985). Helsinki: Kouluhallitus.

Framework Curriculum Guidelines (1994). Helsinki: Opetushallitus.

Framework Curriculum Guidelines (2004). Helsinki: Opetushallitus.

Kananoja, T. (1999). Letters of Uno Cygnaeus and Otto Salomon the 22nd of June 1877- 1st of January 1887. In: T. Kananoja, J. Kantola & M. Isskainen (Eds.), *Development of Technology Education – Conference-98* (pp.32-57). Finland, Jyväskylä: University Printing House Jyväskylä.

Kananoja (1989). *Työ, taito ja teknologia. Yleissivistävän koulun toiminnallisuuteen ja työhön kasvattamisesta [Work, skill and technology. About education to work and functionality in comprehensive school]*. Turun yliopiston julkaisuja 72.

Kantola (1997). *Gygnaeuksen jäljillä käsityönopetuksesta teknologiseen kasvatukseen [In the footspeps of Uno Gygnaeus from handicraft to technology education]*. Jyväskylän yliopiston julkaisuja 133.

Kantola, J., Nikkanen, P., Kari, J. & Kananoja, T. (1999). *Through Education into the World of Work. Uno Cygnaeus, the Father of Technology Education.* Jyvaskyla University, Institute for Educational Research. Jyväskylä: Jyväskylä University Press, pp. 9 -17.

Keskkooli programmid 1954/55 õppeaastaks. Töööpetus. Praktilised tööd õppe-katseaias. Praktilised tööd õppetöökojas [Secondary school programs for the 1954/1955 academic year. Craft. Practical works in the test garden. Practical works in the workshop]. (1954).

Lauren, J. (1993). Osaavatko peruskoululaiset luonnontietoa. In Linnankylä, P. & Saari, H. (Eds.). *Oppiiko oppilas peruskoulussa? [Do students' learn in comprehensive school?]*. Jyväskylän yliopisto. Kasvatustieteen tutkimuslaitos.

Layton, D. (1994). A School Subject in the Making? The Search for Fundamentals. In D. Layton (Ed.) *Innovations in Science and Technology Education* (Vol.5). Paris: Unesco.

Log um fraedslu barna (nr. 59/1907).

Läänemets, U. (1995). *Hariduse sisu ja õppekavade arengust Eestis* [About the content of education and the development of curricula in Estonia]. Estonia, Tallinn: Jaan Tõnissoni Instituut.

Mammes, I. (2004). Promoting Girls' Interest in Technology through Technology Education: A Research Study. *International Journal of Technology and Design Education 14*, 89-100.

Olafsson, B., Hilmarsson, E. & Svavarsson, K. (2005). *Greinargerð vinnuhóps - endurskoðun aðalnámskrár grunnskóla í hönnun og smíði.* Unpublished Greinargerð.

Olafsson, B. & Thorsteinsson, G. (2010). Examining Design and Craft Education in Iceland: Curriculum Development and Present Situation. *FORMakadmisk*, 3(2), 39-50.

Põhikooli- ja gümnaasiumiseadus [Basic School and Upper Secondary School Act]. (2010). RT I 2010, 41, 240. Retrieved from https://www.riigiteataja.ee/akt/13332410?leiaKehtiv

Põhikooli ja gümnaasiumi riiklik õppekava [National curriculum for basic schools and upper secondary schools]. (2002). RT I 2002, 20, 116. Retrieved from http://www.riigiteataja.ee/ert/act.jsp?id=1008388

Põld, P. (1993). Töökasvatusest koolis [Work education in school]. In H. Muoni (Ed.), *Valitud tööd I* [Selected works I] (pp. 26-36). Estonia, Tartu: Tartu Ülikool, Eesti Akadeemiline Pedagoogika Selts.

Raat, J. & de Vries, M. (1986). *What do Girls and Boys think about Technology?* Eindhoven, University of Technology.

Rihvk, E. (1985). Üldkooli töööpetuse kolm aastakümmet [Three decades of Craft in general schools]. *Nõukogude Kool*, 7, 34-38.

Shernoff, D.J., Csikszentmiahlyi, M., Schneider, B. & Shernoff, E.S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly* 18, 207-231.

Silverman, S. & Pritchard, A. (1996). Building Their Future: Girls and Technology Education in Connecticut, *Journal of Technology Education* 7 (2), 41-54.

Sjøberg, S. (2002). Science and Technology Education: Current Challenges and Possible Solutions. In Jenkins, E. (ed.) *Innovations in Science and Technology Education Vol VIII*, Paris: UNESCO.

Štšukin, S. (1956). Polütehnilise õpetamise tähtis lüli [Important link in polytechnic education]. *Nõukogude Õpetaja*, nr 13, 3.

The Icelandic Ministry of Education (1977). The Icelandic National Curriculum.

The Icelandic Ministry of Education (1999). The Icelandic National Curriculum.

The Icelandic Ministry of Education (2007). The Icelandic National Curriculum.

Thorarinsson, J. (1891). Um kennslu í skólaiðnaði. *Tímarit um uppeldis- og menntamál*, 4(1), 3–20.

Thorsteinsson, G. (2002). Innovation and Practical Use of Knowledge. *Data International Research Conference 2002*, 171-177.

Thorsteinsson, G. & Denton, H. (2003). The Development of Innovation Education in Iceland: a Pathway to Modern Pedagogy and Potential Value in the UK. *The Journal of Design and Technology Education*, 8(3), 172-179.

Tooding, L. M. (2007). *Andmete analüüs ja tõlgendamine sotsiaalteadustes* [*Data analysis and interpretation in social sciences*]. Tartu, Estonia: Tartu Ülikooli Kirjastus.

van der Velde, J. (1992). Technology in Basic Education. In Kananoja, T. (Ed.) *Technology Education Conference*. Helsinki: The National Board of Education (151-170).

Vaughn, S. J. & Mays, A. B. (1924). *Content and Methods of the Industrial Arts*. New York & London: The Century Co.