Ossi Autio[1], Janez Jamsek[2], Mart Soobik[3], Gisli Thorsteinsson and Brynjar Olafsson[4]

Craft and Technology Education Curriculums and Students' Attitudes towards Craft and Technology in Finland, Slovenia, Estonia and 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, Slovenia, Estonia and Iceland. The study was undertaken by the Helsinki University, University of Ljubljana, University of Tallinn and University of Iceland during years 2012-2015. A literature review was completed, in order to examine and compare the curriculums of craft and technology education in Finland, 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 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 quantitative findings need to be examined further with different research methods.

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

1. *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

[1] University of Helsinki. E-mail: <ossi.autio@helsinki.fi>.
[2] University of Ljubljana. E-mail: <janez.jamsek@uni-lj.si>.
[3] University of Tallinn. E-mail: <mart@tehnoloogia.ee>.
[4] University of Iceland. E-mail: <brynjar@hi.is>.

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).

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. An important innovation in curricular reform since 1999 are technological activity days. They are distributed throughout the nine-year education in an average 4 days per year. These days allow student consolidation and integration of the knowledge obtained from the subject and cross curricular. Students work inclusion is more active and motivational, and therefore encourages students' curiosity and creativity. The same reform also 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).

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 (Andersen, 2003; Põhikooli- ja Gumnaasiumiseadus, 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 Haridussseadu, 1992).

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 National Curriculum, 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, 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 regards to students' attitudes towards craft and technology.

Main part of the 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 craft and technology in Finland, Slovenia, Estonia and Iceland. 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?

2. *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, Slovenia, Estonia and Iceland?

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. Whether or not the attitude towards technology contains the cognitive dimension is often discussed and according to Ardies, De Mayer & van Keulen (2012) technological knowledge may have a certain correlation with the attitude 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).

In order to evaluate students' attitudes towards craft and technology in Finland, Slovenia, 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 der Velde (1992). Totally 864 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 statistical 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, Slovenian, Estonian and Icelandic groups, we employed the two tailed t-test, as we had no hypothesis based on the previous research.

3. *Results*

Several differences in students' attitudes towards craft and 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.

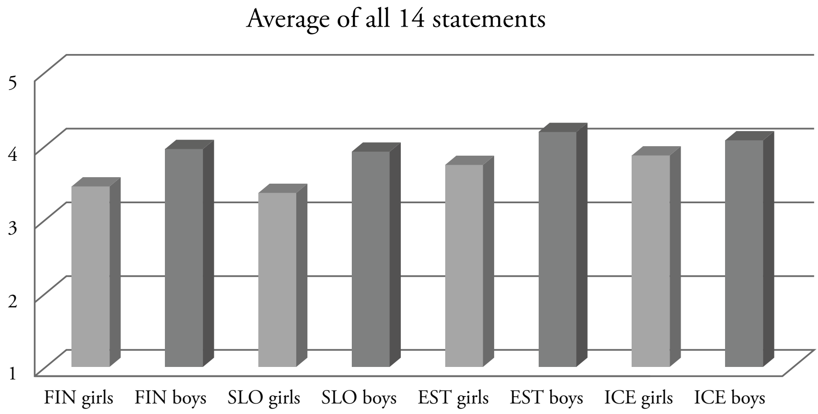

Figure 1 – *Shows the average values of all 14 statements*

The highest average values in the whole questionnaire were found in 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 statement: Both boys and girls may understand engineering-related phenomena are shown in Figure 2.

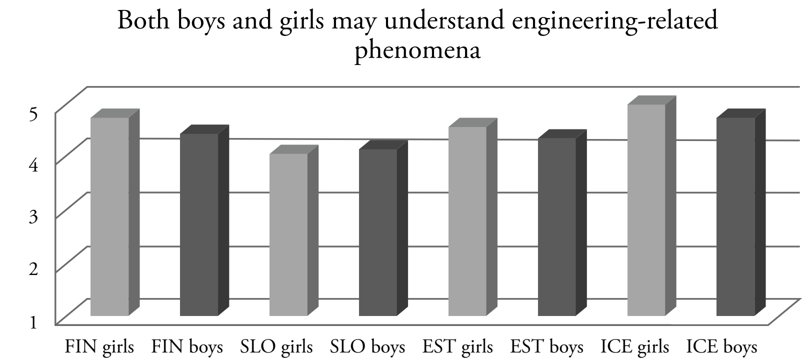

Figure 2 – *Shows the average values in statement: Both boys and girls may understand engineering-related phenomena*

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 statement: Technology education/craft lessons considerably contribute to the development of manual skills are shown in Figure 3.

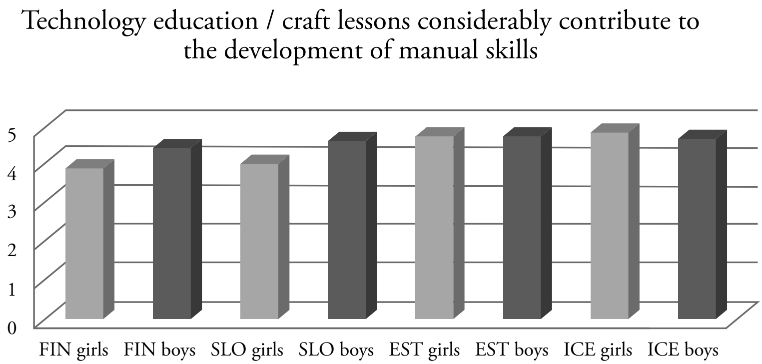

Figure 3 – *Shows the average values in statement: Technology education/handicraft lessons considerable contribute to the development of manual skills*

The lowest value was found in statement: 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.

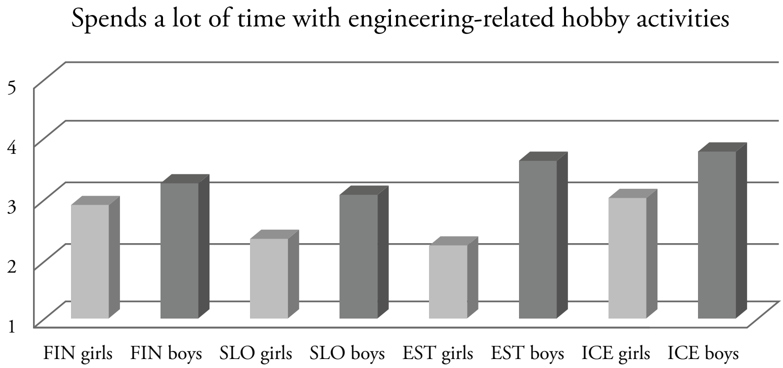

Figure 4 – *Shows the average value in statement: Spends a lot of time with engineering related hobby activities*

Another statement with low values was: In the future would like to choose a speciality or a profession related to engineering. The lowest average responses 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.

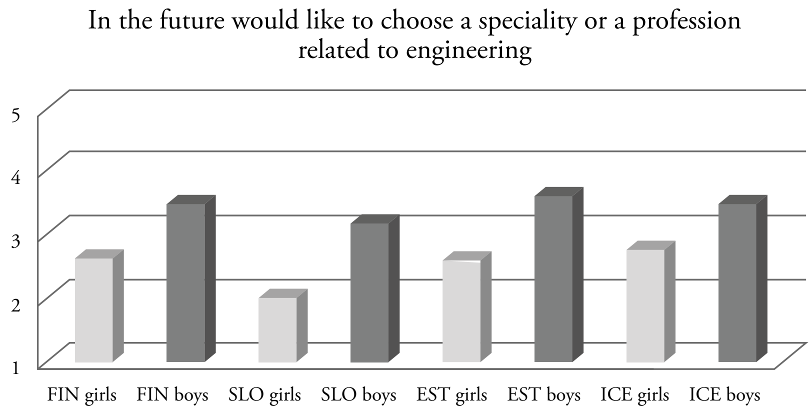

Figure 5 – *Shows the average values in statement: In the future would like to choose a speciality or a profession related to engineering*

The highest correlation (0.76, p<0.001***) to the average of other statements was found in statement: 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. Highest value was found among Estonian and Icelandic boys 4.40 followed by Finnish boys 4.30. Lowest value was scored by Slovenian girls 2.99, followed by Finnish and 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: Is interested in engineering and the phenomena related to it are presented in Figure 6.

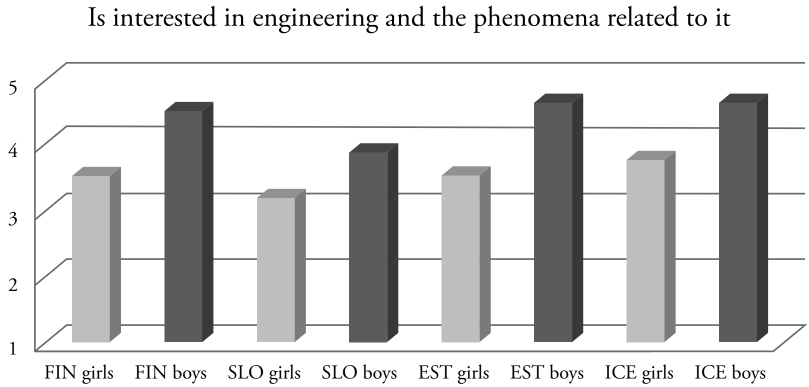

Figure 6 – *Shows the average value in statement: Is interested in engineering and the phenomena related to it*

4. *Conclusions and Discussion*

Craft education in Finland, Slovenia, 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 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 to ensure 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, today 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.

Despite the origins of craft education in Finland, Slovenia, Estonia and Iceland being similar, nowadays the Slovenian, Estonian and Icelandic national curriculum place greater emphasis on technological aspects, design and innovation, whereas the Finnish national curriculum focuses on the development of students' personalities and gender issues. What's more, in Finland there is just one 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. Problem seems to be, especially for older girls, that students are not allowed to choose subjects based on their interest area. 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' give 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 Slovenian, 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 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 also in Slovenia and based on these findings 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. 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, 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.

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, where teachers are aware of the differing interests of both genders and consider ways of making the environment and the subject attractive to all.

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 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 to 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, 1997; Autio & Soobik, 2013; Autio, Thorsteinsson & Olafsson, 2012). As the whole technological culture is different in these four 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 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 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.

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