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Introduction

Equality and non-discrimination must be actively promoted as part of education, guidance and school culture while also dismantling practices that prevent equality. All pupils must be provided with equal opportunities to acquire the knowledge and skills required in society and working life. (Ministry of Education and Culture, 2010.) Traditionally craft as a school subject in Finland has been divided into technical work and textile work, and pupils have to choose which content area to study after grade 4. Boys have mainly chosen to study technical and girls textile craft. National Framework Curricula (1994 and 2004) and the Committee on Alleviation of Segregation (2010) advocate that the introduction to craft encompasses technical and textile craft contents and should be implemented with the same content for all pupils (Ministry of Education and Culture, 2010). However, this division has been maintained in schools and is still a reality for many pupils.

Several studies conducted by the European Union (e.g., Eurostat 2004, Implementation of "education & training 2010" work programme) demonstrate that women and girls continue to be dramatically underrepresented in education, fields, and jobs related to technology. The UPDATE - Understanding and Providing a Developmental Approach to Technology Education - project revealed that there is a great demand for new learning materials and pedagogical practices in technology education. Therefore, giving pupils an equal opportunity to study technology is not enough. In order to promote girls' interest and encourage them to study technology, new improved technology education practices need to be created. This study seeks to obtain information on what would better motivate pupils, particularly girls, to study technology at grades 5-6 in Finland.

Technology education and gender stereotypes

Traditionally technology has been a field dominated by males and it is seen as a topic closely connected to the male gender stereotype. This demonstrates that, in terms of gender, technology is extremely value laden (Dakers, Dow & McNamee, 2009, 382). Preschool aged children have already started to develop gender role stereotypes and it seems that the process of females turning away from the field of technology starts at that time. By the age of two or three, children begin to show preferences for toys which are earmarked for their own gender. At the beginning of primary school, children's gender stereotypes adhere to the cultural standards concerning toys, activities and vocational roles. Boys' toys are often electronic and girls' based on developing social skills (Turja, Endepohls-Ulpe & Chatoney, 2009, 353; Weber & Custer 2005, 55-56).

In Finnish primary schools technology is mainly taught during craft, particularly technical craft lessons. Craft as a subject has been divided into technical craft and textile craft. Boys have traditionally chosen to study technical and girls textile craft. The National Curriculum of 1970 emphasised that there should no longer be a division between girls and boys, but both should study the same contents from grades 1-3, and afterwards choose one of the subject areas for grades 4-7. In the 1994 and 2004 Framework Curricula for Comprehensive Schools, craft, which included technical craft and textile craft, formed an entity which was directed at all pupils, regardless of gender. However, in addition to having common craft education for boys and girls, the documents allowed municipalities and schools to write their own curricula and therefore nothing actually changed in practice. (Rasinen, Ikonen & Rissanen, 2006, 450–452.) In most schools, pupils still choose between technical craft and textile craft after grade 4. (age 10), even though the 2004 National Framework Curriculum states that craft is one subject (same contents) for all pupils. Because of the long tradition of gender-based division, the contents of textile and technical craft have been put together in such a way that they maintain traditional gender stereotypes. As a result of the division of textile and technical craft, those girls who choose to study textile craft, which is easily connected to female gender stereotype, deny themselves exposure to technology-related contents that are part and parcel of technical education.

Basic concepts of motivation

"To be motivated means to be moved to do something" (Ryan & Deci, 2000, 54). Motivation can be divided into various kinds of motives, which function as a basis when conceptualizing and analysing it. Students' perceptions regarding their work on a particular learning task and achievement goals play a large role in determining their motivation and the strength of the individual motives. (Shachar & Fischer, 2004, 73; Kosonen, 2010.) People have not only different amounts, but also different kinds of motivation. They vary in their level and orientation. The most basic distinction is between intrinsic and extrinsic motivation. Intrinsic motivation refers to doing something because it is inherently interesting or enjoyable while extrinsic motivation refers to doing something because it leads to a distinct outcome or a reward. (Ryan & Deci, 2000, 55.) One aspect of intrinsic motivation is the optimal state of mind, the flow experience. It is an optimal experience when we feel a sense of exhilaration and happiness, a deep sense of enjoyment. This happens when a person's energy – or attention – is invested in realistic goals, and when skills match the opportunities for action. (Csikszentmihalyi 1990, 3–6, 39–40.)

In this study we mainly used Kosonen's (1996) theory of motivation, which has certain similarities with the theories described above. In her motivation theory she describes how a person is always in a state of motivation that is affected by the person's goals, motivational orientation or direction, earlier experiences, knowledge and skills, emotions, social interaction and attitude. Although Kosonen's theory was originally created for studying pupils' motivation towards music, it can be applied with small modifications to suit technology education. The motivation categories in this study are 1) motives based on emotional experience, 2) motives based on the contents of technology, 3) motives based on accomplishment and achievement, 4) motives based on social interaction, 5) reluctance, and 6) working process.

Aims and methods of the study

The main aim of the study was to find out if there is a difference between girls' and boys' motives for pursuing technology education. A questionnaire study was carried out and the data were collected during spring 2009. Pupils were chosen from schools in larger municipalities and some from schools in smaller municipalities, and from various parts of Finland. Pupils (N=300) in the fifth and sixth grade (aged 11-12 years), answered the questionnaire: 150 girls and 150 boys. The structured questionnaire consisted of questions concerning background information: age, gender, if pupils have studied (technical craft or textile craft or both) at school and a series of statements (1-32). For each statement, which concerned different technological activities related to various types of motives, pupils were asked to mark their degree of agreement or disagreement on a Likert scale of 1-4 (1= I fully agree, 2= I partly agree, 3= I partly disagree, 4= I fully disagree). In the questionnaire, the statements, based on Kosonen's (1996) theory of motivation, were categorised but mixed.

Gender-related differences in motives for technology education

In this data 47,7 % of pupils (29 girls and 114 boys) have studied technical craft, 32,7 % (92 girls and 6 boys) textile craft, and 18,3 % (28 and 27 boys) have studied both. When pupils were asked about craft artefacts or use of tools and working in craft lessons, the answers were in general very positive. Of all pupils over 86% agreed with the statements: “I like the crafts that we do at school” and “I find it important that my artefact is well made and looks nice”. In addition, over 74% of pupils agreed with the statement “When working in a craft lesson, the work carries me away”. When pupils were asked about what kind of projects they would like to do, 82% agreed with the statement “I would like to make a useful artefact for my home” and “The best for me is if I can create my own idea and realize it.” Most of the pupils (79%) agreed with the statement “I like building and constructing things”.

In order to examine motivation consisting of various motives, factor analysis was performed for the motive statements (1–32). The data used in the analyses included 281 answers. The first step, Principal Component Analysis (PCA), was performed to find out if there was some redundancy in the variables and how many factors could be found. In this study, redundancy can be assumed because the questionnaire was based on a theory of motivation and therefore has categorised variables. The following tests indicated that factor analysis is a suitable procedure for this data: Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = .819 (Meritorious) and Bartlett’s Test of Sphericity Sig. =.000. Factor analysis was performed with 31 statements and, after Maximum Likelihood extraction, six variables whose communalities were <.300 were discounted. A seven-factor solution was reported based on a reasonable amount of variables in each factor and how well the factors matched the theory. The factors are presented in Table 1. The seven-factor solution accounts for 44,2% of total variance.

Table 1

Factors, their reliability and how the factor accounts for the total variance.

Factor	Cronbach’s Alpha	% of Variance
F1 I like to do crafts	.74	9,3 %
F2 Contents and usefulness	.70	14 %
F3 Working alone	.60	5,2 %
F4 Environmental aspect	.83	4,4 %
F5 Solving problems independently	.59	5,3 %
F6 To learn new things	.57	3 %
F7 Encouragement of teacher	.48	3 %

Etrxaction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization. a. *Rotation converged in 25 iterations*.

In this study, factor analysis was performed to create factors of motivation and consequently to compare girls’ and boys’ motivation using a t-test. Detailed results of the factor analysis will not be presented in this article. Based on the t-test results, the greatest statistically significant differences between girls (N=144) and boys (N=137) appeared to be related to factors, F4, F5, F7 and F2. Table 2 presents all the factors, means and greatest mean differences with a p-value of < .01 (**) and <.001 (***).

Table 2

Factors and t-test results

(Note: 1= I fully agree, 2= I partly agree, 3= I partly disagree, 4= I fully disagree)

Factor	Girls' mean	Boys' mean	Mean difference
F1 I like to do crafts	1.81	1.91	.10
F2 Contents and usefulness	2.02	2.28	.26 **
F3 Working alone	1.82	1.94	.12
F4 Environmental aspects	2.12	2.63	.51 ***
F5 Solving problems independently	2.55	2.16	.38 ***
F6 To learn new things	1.99	1.95	.04
F7 Encouragement of the teacher	1.64	1.92	.28 ***

** $p < .01$

*** $p < .001$

This analysis shows that the statistically greatest difference appeared to be in F4=Environmental aspects of technology. This factor consists of two statements: "I'm interested in inventing solutions for keeping the environment clean" and "I would like to learn how to preserve nature". Although it cannot be said how much these contents are related to technology education in pupils' responses, these results indicate that girls are interested to learn about environmental issues and these contents could motivate girls in technology education. The weakest but statistically significant ($p<.01$**) difference was with factor F2=Contents and usefulness. This factor consists of three statements: "I would like to make a useful artefact for my home", "I like to make decorative artefacts" and " I want to learn about the risks in using the internet". In relation to the theory of motivation categories, the statements in F4 and F2 are linked to motivation category 2, namely motives of the contents of technology education. This shows that in addition to environmental contents girls are more interested than boys in making useful and decorative artefacts.

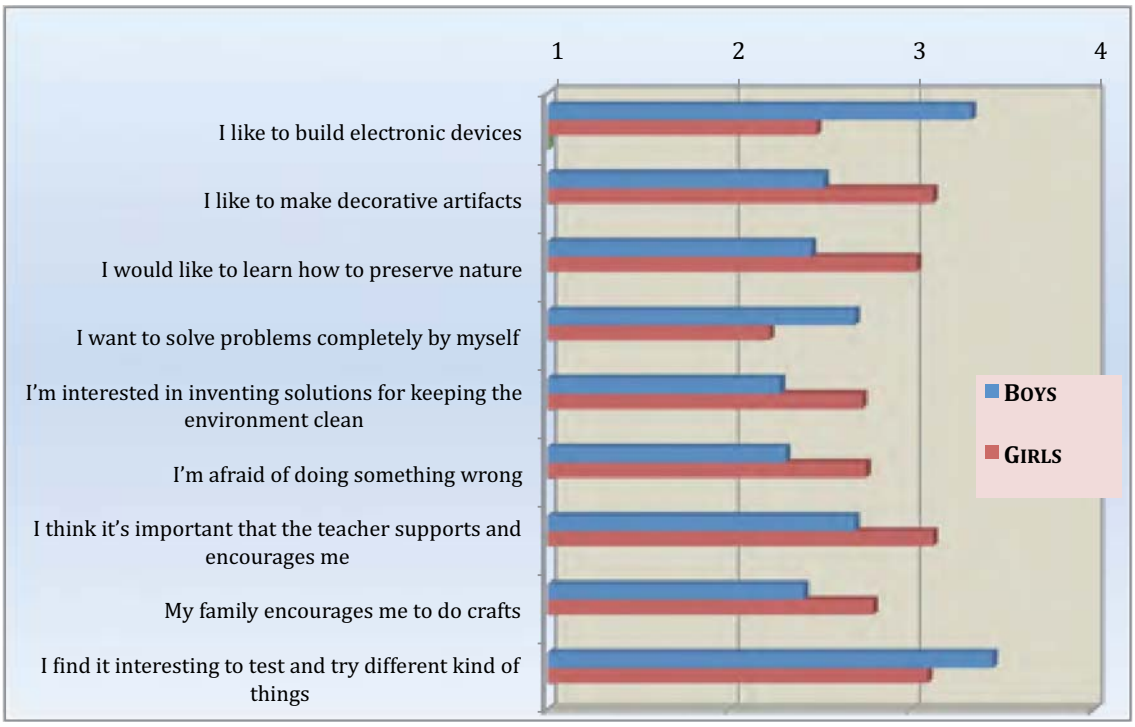
There was also a highly significant difference between factors F5=Solving problems independently and F7=Encouragement of the teacher. F5 consists of three statements: "I want to solve problems completely by myself", "I think that we are doing too easy projects during the craft lessons" and "I find it interesting to test and try different kinds of things". F7 consists of two statements: "I think it's important that the teacher supports and encourages me" and "I think it's good that the teacher tells us exactly what to do next". With reference to the theory of motivation, the statements in F5 and F7 are linked to the motivation categories 6, working process, and 4, motives based on social interaction. Based on these results it can be claimed that boys seem to have a better mastery of working in craft lessons than girls and are more self-confident. Boys are more willing to solve problems independently, test and try different kinds of things and they do not need much help or encouragement from the teacher when constructing projects. This clearly demonstrates girls' need to receive encouragement and appreciation for their technical competence, particularly from their teacher.

A t-test was also used to compare girls' and boys' answers to each of the statements (1-32) separately. Table 3 presents the statements and greatest mean differences, between boys and girls, with a p-value of < .001 (***)

Table 3

The statements that showed the greatest difference between girls and boys.

(1 = I fully disagree, 2 = I partly disagree, 3 = I partly agree, 4 = I fully agree)



*** P < .001

These findings also show that the greatest differences between girls' and boys' motives appeared to be linked to the motivation category 2, motives of the contents of technology education. Compared to girls, boys preferred to build electronic devices. One explanation for this might be that electronic devices or projects that have electronic parts are done mainly during technical craft lessons and most of the girls included in this study have studied textile craft at school. Therefore girls do not know much or anything about building electronic devices, which might affect this outcome. The second greatest difference appeared to concern the aesthetic aspect of the projects done in craft lessons. Girls cared more than boys that their artefact should be decorative. The findings also show that girls were clearly more interested in learning how they could preserve nature and find solutions for keeping the environment clean.

In the questionnaire pupils were asked about the craft process and working in craft lessons. Motivation categories 6, working process, and 4, motives based on social interaction, can also be found in this analysis. Compared to girls, boys wanted more to solve problems independently and found it interesting to test and try out various kinds of things. Social interaction seemed to matter to girls more because they found it more important to receive support and encouragement from the teacher and from family members. Girls' replies also showed that they were more afraid of doing something wrong while working.

Conclusion

The findings in this study show that in general pupils liked the crafts that they do at school. They were also of the opinion that they are carried away by working during craft lessons. This is an excellent

result, but it does not give a realistic view of the state of technology education. In this data 18 % of pupils have not chosen either textile or technical craft, but have studied both. Based on our experience it is probable that this percentage is generally slightly higher in Finland. However, it is not enough to give pupils an equal chance to study technology i.e. not to ask them to choose between textile and technical craft. In order to raise girls' interest in technological studies, aspects and topics that interest girls should be utilized in craft and technology education.

It is apparent from the findings in this study that the greatest differences between girls' and boys' motives appeared to be linked to motivation category 2, motives of the contents of technology education. Girls might often associate technical craft, the products made and the working methods used in technical work classes with the rough and masculine, rather than with the aesthetic or feminine. Therefore, as pupils' perceptions or attitude regarding their work on a particular learning task play a large role in determining their motivation, it is necessary to modify the contents of technology education to suit girls better. In order to promote girls' interest in technology education and offer them experiences where they feel technology as inherently interesting or enjoyable, teachers should pay attention to providing girls with opportunities for creating useful and aesthetic products. Teachers should also introduce environmental aspects related to technology education and encourage girls in technological studies. In short, one result of addressing these aspects of technology education might be that girls regard it as a school subject or occupational field offering them more potential in the future.

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