The Touch of Technology – Gender equity and factors in students' motivation

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Abstract

The aim of this paper was to study how the comprehensive school students´ attitudes in technology education are based and what are those factors which affect the forming of them. The study was carried out as a qualitative case study and the collecting of the material was performed with the help of individual theme interviews. The study group consisted of six 15-16 year old students, which represented six totally different cases in motivation towards technology education. In the choice of the test person main weight was given to the sex and to negative and positive attitude towards technology. The artifact to be made in the school lessons and the freedom of choice had the most significant effect on the attitude. Friends, physical abilities, school curriculum and the society values proved to be less significant factors in the forming process of the attitudes towards technology in this study.

Introduction

Although Finland has a good reputation in technology, there is still no special subject called Technology on the national framework curriculum. Technology education is taught decentralised amongst several subjects, such as physics, chemistry, biology, home economics and educational handicraft. Educational handicraft is in practice further divided into technical craft and textile craft. In Finland technology education has evolved from craft oriented tradition and since the first days of craft education, students have made things from different materials using a variety of craft tools. In the agricultural times, work was based on copying and imitation, and was mainly geared toward the artefact and the product itself, but nowadays much more technological contents are included.

However, the main problem in Finland is that most of the technological contents are taught in technical craft lessons, and according to old traditions, boys select technical craft and girls are taken part just in textile craft lessons. Although in the curriculum it is claimed that technical craft and textile craft should be compulsory for boys and girls in grades 3 – 6, they have to select one of the craft subjects for several practical reasons like timetabling and the number of teachers employed. What's more, even if they could choose shared craft education which contains both craft areas, about 70 % of girls would still choose only textile craft and about 80 % of boys would choose technical craft (Autio 1997). Based on this segregation, it is clear that boys have more experience in the field of science and technology. This gender-based segregation and falling recruitment for scientific and technological studies is a common phenomenon in all the Nordic countries

(Sjøberg, 2002). However, it is a paradox that the break is noticeable in Finland where gender equity has been a prime educational aim for decades.

Interest, learning and motivation

In everyday language interest has many different meanings. However, the scientific concept of interest is hardly the same as its common language everyday counterparts. In common language interest is quite often used as a counterpart to attitude or in some situations motivation. Hence, in this study as a technical term interest has been treated as a general affective variable, a general arousal experience.

According to Piaget (1971) every action involves an energetic or affective aspect and a structural or cognitive aspect. Further Piaget argues that interest is the affective side of assimilation and accommodation. On the other hand, Izard (1991) emphasizes that interest is the most frequently experienced positive emotion which also motivates the development of skills, competencies, and intelligence. At the experimental level Izard described interest excitement as the feeling of being engaged, caught up, fascinated, or curious.

Krapp & al. (1992) distinguished two major points of view from which interest has been approached. One is interest as a characteristic of person and the other is interest as a psychological state aroused by specific characteristics of learning environment. Traditionally, the former approach has been termed with term individual interest or topic interest and the latter has been called situational interest. According to Hidi (1990), individual interest develops slowly and tends to have long-lasting effects on a person's knowledge and values, whereas situational interest is an emotional state that is evoked suddenly by something in the immediate environment and that may have only a short term effect on an individual's knowledge and values. However, individual and situational interests are not dichotomous phenomena. Both types of interest concern person / environment interaction, and they are supposed to interact and influence each others development.

Schiefele (1991) drew a conceptual distinction between a latent and an actualized individual interest. A latent individual interest is a relatively enduring preference for a certain topic, subject areas, tasks, contexts, or activities. Moreover, Schiefele suggested that interest is a content-specific concept as well as directive force, and that it consists of feeling-related and value-related valences. Feeling-related valences are feelings that are associated with a topic or an object, for instance the feelings of enjoyment and involvement. Value-related valences refer to the attribution of personal significance to an object.

Unlike individual interests, which are always specific to individuals, situational interests are assumed to be spontaneous, fleeting, and shared among individuals. Situational interest may be evoked suddenly by such aspects of situation as novelty, intensity, or complexity. If these aspects are seen as characteristics of an environment, then they contribute to the interestingness of the situation. Deci (1992) emphasized that a situation or an object must also offer an optimal challenge in order to be interesting.

Unlike the terms attitude, interest, and motivation the terms “intrinsic motivation” and “extrinsic motivation” are not used in everyday language. The main idea of intrinsic motivation is that even without extrinsic sources of motivation the organism would be active. Originally Deci (1975) split the motivation into intrinsic and extrinsic motivation. Extrinsically motivated behavior is instrumental in nature. Such actions are performed for the sake of some expected outcome or extrinsic reward or in order to comply with a demand. Intrinsically motivated behaviors on the other hand are engaged in, as Deci expressed it, for their own sake and not because they lead to an extrinsic reward. Later Deci and Ryan (1985) identified four types of extrinsic motivation: external, introjected, identified, and integrated forms of regulation. Moreover, Harter and Jackson (1992) demonstrated that intrinsic-extrinsic motivation must be conceptualized both as a trait and a non trait in order to fully understand children’s motivational orientation to school subjects.

Gottfried (1990) used the term academic intrinsic motivation in broad sense to depict a special kind of intrinsic motivation for school learning. Academic intrinsic motivation involves the enjoyment of school learning characterized by a mastery orientation; curiosity, persistence, taskendogeny, and the learning of challenging, difficult and novel tasks.

Empirical research

The study was carried out as a qualitative case study and the collecting of the material was performed with the help of individual theme interviews. The study group consisted of six 15-16 year old students, which represented six totally different cases in motivation towards technology education. In the choice of the test person main weight was given to the sex and to negative and positive attitude towards technology. Three boys and three girls took part in the study. Both groups included one student, who was interested in textile work, one who was interested in technical work and one who was interested in either area of Finnish technology education.

The test persons were named with characteristic expressions:
A boy in textile craft – “individual rationalist”
A girl in textile craft – “aesthetic textile artist”
A boy in technical craft – “relaxed carpenter”
A girl in technical craft – “rebellious”
A boy in either textile or technical craft – “academic theoretician”
A girl in either textile or technical craft - “outsider”

Results

The factors behind the attitude of each test person are described in tables. They express those factors which have had most effect (bold – underlined text) and those which have had less meaning in the test person’s motivation (bold or normal text). The significance of the factors is based on the test person’s direct comments or non direct expressions which have been documented during the interviews.

A Boy in textile craft – "individual rationalist"

The first test person – "the individual rationalist" reacts neutrally to technology education in general and sees craftsmanship as public utility which facilitates the life. He is moderately gifted himself and he sees the crafts important socially examined but not appreciated enough. He thinks that perhaps the young people are not interested in the handworks therefore. At home technology is not a special hobby for him and the working has been restricted to drawing in which he was interested much as a child.

According to the research person, many matters affect in attitudes towards technology education but he cannot analyze them in more detail. However especially the significance of the product to be made and the satisfaction from the process is important to him. Relaxed and comfortable working atmosphere is also an important matter. Furthermore, the class environment is significance to the convenience and the classroom should be light and wide enough. A good teacher can wake positive thoughts and feelings on the pupils and according to him the teacher also generally has big significance in the basing of the attitude. Instead the friends do not have much effect on his choices because as a strong character he wants to make independent decisions.

Table 1. Factors behind the attitudes towards technology of "the individual rationalist"

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- Talent	**- Classroom environment**	**- Teacher**	**- Internal feedback**
- Character	**- Home environment**	**- Classroom atmosphere**	**- Product /artifact**
- Physical abilities	- Values in society	**- Teacher - Student interaction**	**- Process**
		- Mother and sister	**- Evaluation**
			- Freedom of choice

A Girl in textile craft – "aesthetic textile artist"

The second test person – "aesthetic textile artist" reacts very positively to technology education and has studied textile work especially profoundly. Already in nursery school she reacted positively to the handwork and now on the secondary school level handwork has become a real hobby to her. She sees herself as a skilful worker which also motivates her further.

None of her friends have any interest in handworks but her grandparents have had big significance because the influence has been positive already since childhood. At home she is encouraged to the handwork and she sees the handworks even as his possible profession of the future. In her opinion, in the handworks the most important factor is an opportunity to the independent choices in regard to working and the product. The classroom has to be large enough so that there will be room for all the pupils. Also materials and tools have a big significance to his motivation. In her opinion, the good teacher must not talk too much but the interaction is important. If it is easy to approach the teacher, a discussion will be more easily created between a teacher and the pupil.

Table 2. Factors behind the attitudes towards technology of “the aesthetic textile artist”

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Talent**	- **Materials**	- **Teacher**	- **Product /artifact**
- **Needs**	- **Machines and tools**	- **Teacher - Student**	- **Internal feedback**
- **Character**	- **Classroom**	**interaction**	- **Freedom of choice**
- **Hobbies**	**environment**	- **Grand mothers**	- **Process**
- **Career plans**	- **Home environment**	- **Family**	- Evaluation
	- **Group size**	- **Classroom atmosphere**	
	- **Nursery school**	- Change of teacher	

A boy in technical craft – “relaxed carpenter”

For the first time “the relaxed carpenter” became familiar with technology education in the comprehensive school. So the school has served as his first factor which affects an attitude. The test person reacted positively to technology education and already on a lower level of the comprehensive school technology education became his favorite school subject. In his opinion, technical handwork is a comfortable counterbalance to the academic subjects. While working with his hands he can relax and the attention can be paid out of unpleasant matters. From his opinion, evaluation and good numbers are not important in technology education and so it is easier to get an internal satisfaction from the working as well.

The test person is a gifted hand worker and so his interest and his own needs are important to his motivation. The whole school curriculum and -environment have affected an attitude to its part and according to him there must be enough materials and tools must be in good order in the classroom of technology education. The teacher - pupil interaction has also been significant. In the teacher's company, one has not needed to stress and the help has dared to ask even to stupid questions. However, the final product has motivated him most. The freedom of choice in the planning has increased motivation whenever the product has been personal and come into his own use.

Table 3. Factors behind the attitudes towards technology of “the relaxed carpenter”

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Interest**	- **Group size**	- **Teacher**	- **Product /artifact**
- **Needs**	- **Materials**	- **Classroom atmosphere**	- **School curriculum**
- **Character**	- **Machines and tools**	- **Teacher - Student**	- **Freedom of choice**
- **Hobbies**	- **Classroom**	**interaction**	- **Internal feedback**
- Talent	**environment**	- **Parents**	- **Process**

A girl in technical craft – "rebellious"

"The rebellious" considers the technology education important because it is an important counterbalance to the theoretical subjects. Her first role model was her grand father and she has been interested in technology education all the way from the child. She works willingly with the bigger machines and with hard materials and does not like to fiddle with small details.

In technology education the atmosphere of the technical work lessons is usually relaxed and the group is smaller than in other subjects. The effect of the curriculum of the school has also been important because the school has offered enough alternatives. The wood-, metal-, and electrical work have belonged to the curriculum. In the doing of the electricity guitar for instance several different skills and materials have been joined. She remembers it as her most agreeable project all. The impressive and valuable product that has been made for her self motivates her greatly but it increases the interest also in other products.

Table 4. Factors behind the attitudes towards technology of "the rebellious"

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Needs**	- **Classroom environment**	- **Classroom atmosphere**	- **Product /artifact**
- **Interest**	- **Machines and tools**	- **Parents**	- **Freedom of choice**
- **Physical abilities**	- **Home environment**	- **Grand father**	- **Internal feedback**
	- **Materials**	- **Change of teacher**	- **School curriculum**
	- **Group size**	- Teacher	- **Evaluation**

A Boy in either textile or technical craft – "academic theoretician"

According to "the academic theoretician", technology education is not an anyhow significant matter in his life. He indeed considers it only as the hobby of a small minority of people. At home the academic values are also appreciated to a considerably higher one. The test person's thoughts in regard to technology education follow those values and attitudes which are very much from home. He does not either place a value on the crafts or on the vocational education in the field of technology. In his opinion, the high school is absolutely better and the more respected study place.

During his first school years he, however, liked craft education. In that case the product and the freedom of choice were some of the most significant sources of the motivation. When proceeding to more difficult and more challenging work, the skills and the talent were not enough any more and general interest also gradually ended.

Table 5. Factors behind the attitude towards technology of “the academic theoretician”

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Character**	- **Home environment**	- **Parents**	- **Product /artifact**
- **Needs**	- **Classroom**	- **Friends**	- **Freedom of choice**
- **Interest**	**environment**		- School curriculum
- **Talent**	- **Machines and tools**		- Evaluation
	- Group size		
	- Values in society		

A girl in either textile or technical craft - “outsider”

As the “outsider” has very limited experience in technology education she reacts very negative to this subject and the handworks have been the very unpleasant matter of the whole school days to her. She does not believe she has enough nerves and ability to concentrate on precise and detailed working. In this case the interest and the needs of the individual have a strong effect on the motivation.

The best memories from the handwork are connected with the situations in which the product was finished and there was an advantage from it. Also the optional projects with much freedom have stayed in the mind. The tools and classrooms have been in good order at school so she does not believe that these have affected his negative attitude. The teachers have also been nice. Perhaps the most significant effect on his motivation has been that she has lived abroad a large part of her school years and she has never been able to become acquainted with the studying of the handwork.

Table 6. Factors behind the attitudes towards technology of “the outsider”

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Character**	- **Living abroad**	- **Teacher - Student**	- **Product /artifact**
- **Interest**	- **Classroom**	**interaction**	- **Freedom of choice**
- **Needs**	**environment**	- **Grand mother**	- **Evaluation**
- Physical abilities	- **Nursery school**	- **Classroom atmosphere**	- **Process**
	- Materials	- Teacher	
	- Machines and tools		
	- Values in society		

In this study, the artifact to be made and the freedom of choice had the most significant effect on the attitudes towards technology. However, the whole school environment affected an attitude to its part and according to test people in the classroom of technology education there must be enough materials, tools must be in good order and there must be enough space for everybody. The teacher - pupil interaction had also been significant.

From non direct expressions, we can conduct that students own needs and interest were definitely more significant than the talent and physical abilities which are traditionally valued quite high in the technology education. Among other smaller details the society values, friends, and school curriculum had some effect on the attitudes, but proved to be less significant factors in the forming process of the attitudes towards technology.

Table 7. Factors behind the attitudes towards technology of all test people

PERSONALITY	ENVIRONMENT	SOCIAL RELATIONS	SUBJECT CONTENTS
- **Needs**	- **Classroom**	- **Teacher**	- **Product /artifact**
- **Interest**	**environment**	- **Teacher - Student**	- **Freedom of choice**
- **Character**	- **Home environment**	**interaction**	- **Internal feedback**
- **Talent**	- **Machines and tools**	- **Parents**	- **Process**
- Hobbies	- **Materials**	- **Classroom atmosphere**	- **Evaluation**
- Physical abilities	- **Group size**	- Change of teacher	- School curriculum
- Career plans	- Nursery school	- Friends	
	- Values in society	- Sisters / brothers	
	- Moving abroad	- Grand parents	

Discussion

According to this study, the attitude towards technology was relatively positive with most of the students. Many researchers share the same opinion and it is not surprising that both boys and girls are attracted to technology education because they enjoy working with their hands and like the independence and chance for creativity provided by these classes (Silverman & Pritchard 1996). Students who typically enroll in technology education are attracted to the types of projects they will be engaged in (Weber & Custer 2005).

It seems that several other subjects have more motivational problems than technology education. Additional studies, based on momentary time sampling methods suggest that these negative perceptions are not limited to one or two of the hardest class subjects but are pervasive across entire school curriculum (Shernoff & al., 2003). We can assume that all subjects could use more practical methods, which give the students more independence and the change for their own creativity.

Some students do not either place a value on the crafts or on the vocational education in the field of technology. From their opinion, the high school is absolutely better and the more respected study place than the vocational education. Usually, these thoughts in regard to technology education follow those values and attitudes which are very much from home. On the other hand interest in technology can be improved significantly by developing special programs (Mammes, 2004) where teachers need to be aware of the differing interests of the both sexes and consider ways of making the environment and the subject attractive to them (Silverman & Pritchard, 1996).

The artifact to be made seemed to have more value than the process. Also in the factor analysis of Autio (1997) a practical advantage received from the product was emphasized higher than the process, which for its part would refer to the emphasizing of the external motivation. Even though Ryan & Deci (2000) suppose that extrinsic motivation is possible to change intrinsic if the project is interesting enough. This phenomenon seemed to be true also in this study. Most of the students valued the product first, but later on the internal feedback turned out to be one of the key elements of the attitude.

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