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TECHNOLOGY EDUCATION IN FINLAND – CRAFT, CREATIVITY, TEXTBOOKS OR TECHNOLOGY

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ABSTRACT: Changes in the economy, nature, production and society together with increasing scientific and technological knowledge make demands of transforming school teaching in the field of technology education. This article analyses current trends in Finnish technology education. The aim of the article is briefly to explore the integration between science - technology - and traditional craft education in Finland. Finnish technology education can be characterized as the design approach that has evolved from the craft oriented tradition. Additionally, it involves many elements of computer controlling and electronic principles. Thanks to Finnish industry and their interest groups there are some signs of strengthening in technology education. But still much of the learning is based on traditional craft education focused on production skills. Approaches that are now dominant in craft education do not prepare students to meet the challenges of modern technology and working life.

Key words: technology education, craft education, science education, creative problem solving

INTRODUCTION

During last twenty years there has been an active discussion about the role of technology education in Finnish compulsory education. Several development projects have been started aimed to develop the curriculum and technology education (Järvinen, Lindh & Sääskilahti, 2000; Lavonen, Autio & Meisalo, 2004; Parikka & Rasinen, 2009). Moreover, many public and private institutions claim that there is a growing need for employees, who are able to think critically and also to solve a range of technological problems (Grabinger, 1996). On the other hand, several researchers maintain that various cognitive, metacognitive and problem solving skills needed in the working life are seldom obtained at school (Resnick, 1986). The national discussion, the results obtained from the various development projects in the field of technology education and the international discussion about the role of technology education should have had an effect on the formulation of the goals and contents of technology education in the national curriculum framework for compulsory school.

In the beginning of 2000s, a discussion took place between the authorities and the spokesmen of the craft industry. Although, technology education was introduced for the first time in the framework curriculum, a separate technology education subject was not, however, been established. Nevertheless, technology was introduced as part of a specific cross-curricular theme, entitled 'The Human Being and Technology'. As a result of that, technology education should be taught in all subjects as an integrated subject. Officially, Finnish technology education was named handicraft which is in practice divided into two sections: technical - and textile craft. Hence, the main importance in the curriculum is still in the developing students' handicraft skills, within the context of the complete process of handiwork. In addition, the development of students' personalities and the growth of self-esteem were also emphasised.

However, the 2004 curriculum emphasized the meaning of technology from the point of view of everyday life, society, industry and environment, as well as human dependency on technology. The students should be familiar with new technology, including ICT (information & communication technology), how it is developed and what kind of influence it has. Students' technological skills should be developed through using and working with different tools and devices. Studying technology helps students to discuss and think about ethical, moral and value issues related to technology. There is a high compatibility with the goals mentioned in our new curriculum and the nature of literacy in technology described in the publication: International Technology Education Association (2007) Standards for Technological Literacy: Content for the Study of Technology.

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TECHNOLOGY EDUCATION IN PRACTICE

Although, we have moved long ago from an agricultural society to a post-industrial society, out–of–date technological processes, such as the making of wood and metal artefacts, are more common than processes, such as working with plastic, service and repair of technical equipment and construction of electronic equipment. Computers are not used in technology education to a large extent, but usage is expected to increase in the near future. Moreover, in many schools, the students reproduce artefacts on their own, according to given models without any creativity. Students only occasionally plan and generate alternatives in small groups. Learning is focused on production skills, with the aim of teaching students how to replicate demonstrated skills. Approaches that are now dominant in technology are based on old fashioned craft education and they do not prepare students to meet the challenges of modern technology and working life. Craft education is a very practical school subject with small integration of science and technology aspects in the teaching and learning. Its purpose is thought to be simply for practicing manual dexterity without reflective discussions. Often such thinking is based on views that require students to merely copy and reproduce similar products, such as wooden boxes and other wooden artefacts commonly used in households.

On the other hand, it is important to notice that students are highly motivated to work with their hands (Autio, 1997, Autio, 2013). 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 enrol in technology education are attracted to the types of projects they will be engaged in (Weber & Custer, 2005). It seems that several other school subjects have more motivational problems than technology education. Craft lessons are unlike subjects such as physics or mathematics considered more practical than theoretic.

The current orientation in Finnish craft - and technology education is described in Figure 1. It shows the main directions: traditional craft education - modern technology education and product orientation – process orientation, which includes typical sections in craft and technology education: reproductive handwork, creative handwork, textbook technology and innovative technology.

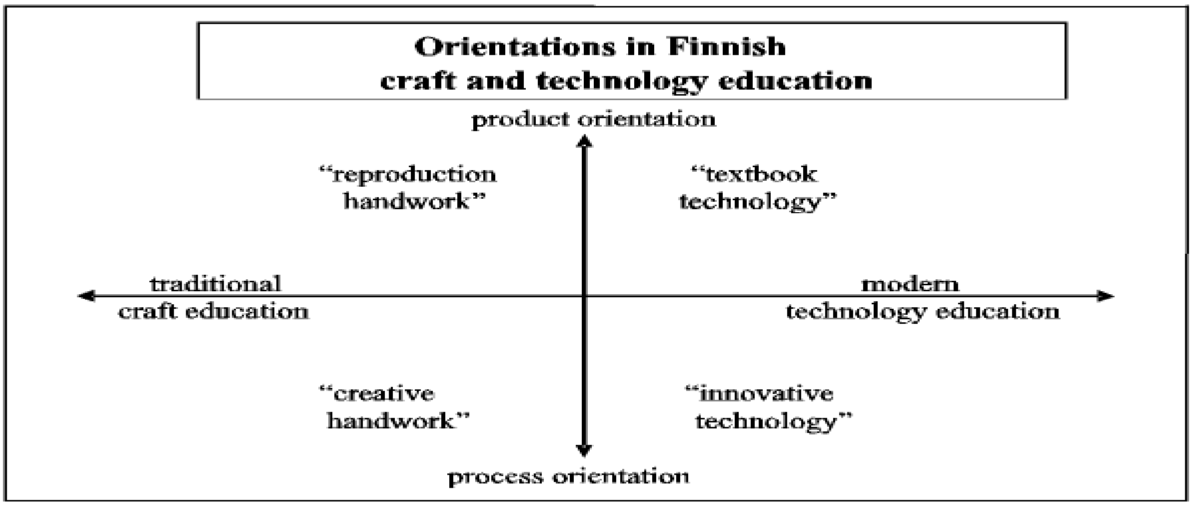

Figure 1. Current orientation in Finnish craft and technology education

In traditional craft education, children reproduce artefacts according to given models. It is adequate for teaching the basic skills, like learning to use a saw or soldering station. However, there must be time for learning creative problem solving and, from the design perspective, this is already happening in "creative handwork". In technology education, there is still the same problem as "textbook technology" overshadows practical innovations and creative problem solving. Therefore, we have developed "innovative technology" education programs for teacher education where learning in small groups is based on the creative process rather than just a product (Autio & Lavonen, 2005; Lavonen, Autio & Meisalo, 2004).

TRADITIONAL CRAFT AND CREATIVITY

The general aim of Finnish Craft and 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. Finnish handicraft traditions are also of importance throughout the whole curriculum (Framework Curriculum Guidelines, 2004).

However, the main problem with the traditional craft education approaches is linking the learning of knowledge to the learning of for example different designing skills. In reproductive handwork students reproduce artefacts according to given models and the teaching of design is based on simple sketching or direct shaping from the material. Instead, systematic creative problem-solving and planning models are seldom used. In the two dimensional model, planning is divided into three phases: initial planning, sketching and detailed planning. Each phase includes analysis, synthesis and assessment (Lawson, 1983). In more advanced, spiral process designers seem to backtrack at certain times and repeat a series of activities again and again, trying to resolve new problems with each repetition (Zeisel, 1995).

Moreover, knowledge and understanding of design should not emphasis only art related self-expression with artefact constructions. Designing should refer to technological design as well and the turning of making into thinking (Mitcham & Holbrook, 2006). According to Norman (1993), it is not guaranteed that if students' have expertise in artistic design they can automatically operate in technological design, for example in electronic circuits and mechanical movements. Competence in different Craft areas requires the development of different knowledge, skills and understanding. Therefore design and associated techniques are essentially independent (Lawson, 1983). That is clearly seen in traditional craft education, even if students' work with systematic planning models and uses their creativity, esthetical design usually overshadows technological issues.

It is not the main problem that in lower grades (1.-4.) most of the learning is focused on production skills, with the aim of teaching students how to replicate demonstrated skills and to achieve more knowledge of materials. We should be more concerned of whole-class teaching methodologies, with the teacher as expert and the student as the passive recipient of knowledge. Approaches that are now dominant in traditional craft education do not prepare students to meet the challenges of modern technology and working life. In spite of some progress, the legacy of behaviorist, teacher centered teaching methodologies; repeatedly appear as the dominant orthodoxy in technology education (Dakers, 2005). An important function of technology education should be the opportunity to transcend from routine activities and low-level thinking.

In creative handwork different ways to emphasize creative problem solving in small groups have been suggested (e.g., Grabinger, 1996; Dooley, 1997; Hill, 1999). A common feature of these approaches is to place students in the midst of a realistic, ill-defined, complex and meaningful problem, with no obvious or correct solution. Students work in teams, collaborate and act as professionals, confronting problems as they occur - with no absolute boundaries. Although they get insufficient information, the students must settle on the best possible solution by a given date. This type of multi-staged process is characteristic of effective and creative problem solving. The process is non-linear and follows no particular rules, because rational approaches miss the entire point of creative problem solving (Fisher, 1990).

TEXTBOOKS OR REAL TECHNOLOGY EDUCATION

A common problem in science and technology education in grades 5–9 is that many teachers teach the typical presentation-recitation way (chalk and talk), while students can also do, for example, routine practical work or solve simple textbook problems. This is a good example of "textbook technology". However, those activities do not encourage students to construct scientific concepts or meanings; neither does it help them to see phenomena and objects in the environment (Arons, 1997). In addition, many schools have poor laboratories and equipment for practical work. Therefore, these schools face considerable problems in carrying out practical student work, concretising science education and linking it to the environment. About five out of six schools have the proper ICT equipment for teaching Science. Moreover, it is a considerable problem that ICT is inadequately used by physics teachers.

The goals set for technology education have already been realised in the new science textbooks. More applications of science, for example, are described and there are even new chapters introducing technological themes, like the basics of electronics and the life cycle of products. It is obvious that teachers will, in future, based on the new textbooks, teach more technology in science

In grades 1–6, technological themes are also taught as part of Environmental and Natural Studies. This forms an entity containing aims and content from science and technology, environmental studies and civics. The different areas of Environmental and Natural Studies are: matter and energy; organisms and their environments; the globe and its areas; man and the environment. Besides technology education, in grades 7–9, there are three Science subjects, Biology, Physics and Chemistry, which contain technology education. The common aims of these subjects are to give a picture of man's living environment, and the interaction between man and the environment. Moreover, they help to realise the significance of individual and collective responsibility based on knowledge of the natural sciences and technology.

In Technology Education learning is based on practical work rather than in theoretical issues. Production emphasizes students' ability to expand the technological understanding and the ability to create new innovations by using different tools, machines and materials. According to Blomdahl and Rogala (2008) students will not just discover, create or develop useful technical products in technology education but will instead gain insight and knowledge about the origin and function of technology and its importance to people, nature and society. In practice, technology education can be used as a vehicle for teaching scientific knowledge in craft education as well as adding practical craft knowledge in science education (Ginns, Norton & McRobbie, 2005). From this point of view, contents (knowledge and concepts) and process (skills for construction and design) are equally important. In addition, one aim is to understand the need to manage in everyday life with mundane technologies in the continuously changing world (Michael, 2007; Stables, 2009).

DISCUSSION

Technology education as part of education in Finland has a long and rich history dating back to the 1800s when Uno Cygnaeus defined "sloyd" (handicraft). Since the first days of craft education over 150 years ago, students have made things using a variety of craft tools. In the beginning, work was based on copying and imitation, and was mainly geared toward the development of lower-level thinking skills. However, it might be assumed that technology education will be realised in the near future, because new goals and content for technology education have been set in the National Framework Curriculum of 2004. On the other hand, several goals set for the technology education were already presented in the general part of the National Framework Curriculum of 1994 and also in the goals of Science and Handicraft. At present, both Science and Handicraft education are quite far from the goals set for technology education. In school Physics and Chemistry, theoretical constructs easily overshadow practical applications of various physical phenomena, and connections between these two remain superficial. Likewise, in Technology, practical applications may overshadow the very basic physical phenomena and laws that lie behind the operation of any machine used. Furthermore, for example, if concepts and processes, like electric circuits and energy production, are met during Science or Handicraft lessons, they are seldom discussed in broad contexts such as environmental, ecological, and social perspectives.

Moreover, the nature of tasks and working processes in Handicraft give quite a narrow view of technological knowledge and processes: working with wood and metal is predominant. Furthermore, there is no consensus about how those new goals could be realised among teachers as well as among researchers or teacher educators. Others think that technology education should be design-process based with the emphasis on wood and metal work and others feel it should be a more theoretical "classroom-type" school subject.

In technology education, we should be more concerned about what children should learn rather than what kind of artefacts they make, because learning does not only take place upon completion of the product but also occurs through creative problem solving and reflection in every phase of the technological process. It is important that children understand that technology does not develop by itself, but is directed by human needs and wants. Technological development, control and mastery stop if technology is not taught from generation to generation. Every generation needs to understand how artefacts are made and what artistic and scientific knowledge is needed in technological production and utilisation.

In particular, it is argued that creative problem solving is an integral part of technology education, in contrast to an instruction-following method of technology education, reproducing artefacts, and teacher-dominated work (Sellwood, 1991; De Luca, 1993; Williams and Williams, 1997). Wu, Custer and Dyrenfurth (1996) have suggested even more forcefully that creative problem solving should be a core content area and method of teaching technology. These approaches particularly seem to fit technology-oriented modules in teacher education.

Right now there is an obvious need for young technology teachers to act as agents for change. Moreover, it is obvious as well that more research and development effort should be directed towards introducing creative problem-solving approaches in technology education (e.g., Lee, 1996; Gilbert & Boulter, 2000). Instruction and teaching models experienced during teacher education often serve as learning models for students.

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