TECHNOLOGY EDUCATION: 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 to explore briefly the integration between Science - and Craft education and some of the current practices in technology education in Finland. Finnish technology education can be characterized as a design approach that has evolved from the craft-oriented tradition. Additionally, it involves many elements of computer controlling and electronic principles, but still much of the learning is 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.

Keywords: technology education in Finland, craft education, science education

INTRODUCTION

The history of technology education is relatively short in every country. It is not based on old subjects like mathematics, geography or languages, which have a long tradition in history. It is obvious that technology education is still very much under-developed and although Finland has a good reputation in technology and is famous for many well known high tech products, there is still no special subject called Technology in the national framework curriculum. Technology education is taught decentralised amongst several subjects, such as Educational Handicraft, Physics, Chemistry, Biology and Home Economics.

In Finland technology education has evolved from craft oriented tradition and since the first day of craft education, students have made things using a variety of craft tools. In the beginning, work was based on copying and imitation, and was mainly geared towards the development of lower-level thinking skills. Although technology education nowadays involves many elements of computer controlling and electronic principles, many public and private institutions still claim that there is a growing need for employees, who are able to think critically and also to solve a range of problems (Grabinger, 1996). Moreover, several researchers maintain that various skills and competences (e.g. cognitive, metacognitive and problem solving skills) needed in the working life are seldom obtained at school (Resnick, 1986).

Several projects have been started to develop curriculum and technology education (Järvinen, Lindh & Sääskilahti, 2000; Lavonen, Autio & Meisalo, 2004). At 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 have had an effect on the formulation of the goals and contents of technology education in the national curriculum framework for compulsory school (2004).

1. Technology education in the Finnish curriculum

In the national framework curriculum of 2004, the goals and content for technology education were described for the first time. This was the first step towards the real strengthening of technology education in the Finnish educational system and it was largely due to Finnish industry and their interested groups.

The 2004 curriculum emphasized the meaning of technology from the view point 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 and moral value issues related to technology.

There is a high compatibility between the goals mentioned in our new curriculum and the nature of literacy in technology described in the publication, *Standards for Technological Literacy: Content for the Study of Technology* (Dugger and Gilberti, 2000). Although, technology education was introduced for the first time in the framework curriculum, a separate technology education subject has not, however, been established. Technology education has to be taught in all subjects as an integrated subject.

2. Technology education in practice

Although, Finland has moved from an agricultural society to a post-industrial society long ago, 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, in handicraft subject in grades 3-7. Computers are not used in technology education to a large extent, but usage is expected to increase in the near future. (Kankare, 1997; Alamäki, 1999).

Too often, the students reproduce artefacts on their own, according to the given models without any creativity. Students plan only occasionally and generate alternatives in small groups. Learning is focused on production skills, with the aim of teaching students how to replicate the demonstrated skills. Approaches that are now dominant in handicraft do not prepare students to meet the challenges of modern technology and technology oriented career. Thus, handicraft is a very practical school subject with no integration of science and technology aspects in 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.

Figure 1. "Too often, the students reproduce artefacts, according to given models without any creativity."

On the other hand, it is important to notice that students are highly motivated to work with their hands (Autio, 1997). Craft lessons are different from theoretical subjects such as physics or mathematics. Furthermore, some changes have been already occurred and can be expected to occur in craft education.

Finnish technology education has certain elements from two major trends. 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 and, therefore, we have developed

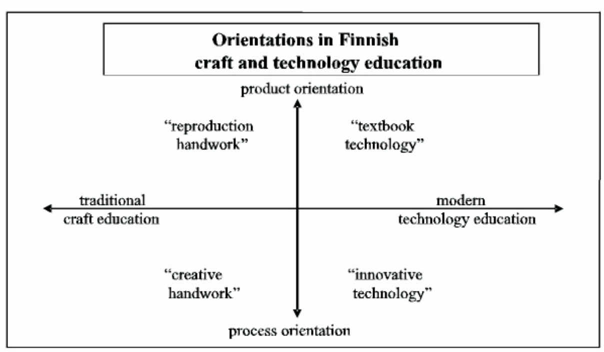

Figure 2. Current orientation in Finnish craft and technology education (Autio,1997).

"innovative technology" education programs for teacher education where learning in small groups is based on the creative process rather than just a product (Lavonen, Autio & Meisalo 2000). The current orientation in Finnish craft - and technology education is described in Figure 2.

2.1. Craft or creativity

The main problem with the current technology education approach is linking the learning of knowledge to the learning of different skills (e.g., designing and creative skills). Too often, the students reproduce model based products and the teaching of design has more to do with sketching and shaping than systematic creative problem-solving. It has been argued by several researchers that creative problem-solving activities are an integral part of technology education in contrast to recipe science or technology, or the reproduction of artefacts and teacher-dominated work.

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 this approach 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 the given date. This type of multi-staged process is a characteristic of effective and creative problem solving. The process is non-linear and follows no particular rules, because rational approach miss the entire point of creative problem solving (Fisher, 1990).

2.2. Textbooks or real technology

A common problem in Science 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 (cookbook science) or solve simple textbook problems, but 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).

According to the survey, organised by the Finnish Association of Teachers of Mathematics and Science in 1996, almost half of the schools for pupils in grade 7-9 have less laboratories, and about 40% of schools have less equipment for practical work. Moreover, there are only a few laboratory instruments in schools for grades 1-6. Therefore, these schools face considerable problems in carrying out practical student work, concretising science education and linking it to the environment.

The goals set for technology education have been realised in the new science textbooks. More applications of science 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 everyday 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. In grades 7-9, there are three Science subjects, Biology, Physics and Chemistry, as well as Geography and Home Economics, 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 realize the significance of individual and collective responsibility based on knowledge of the natural sciences and technology. (National Board of Education, 1994).

In many countries technology education has emerged out of craft and industrial arts education. Therefore it focuses more on physical technology, than biological, chemical and informational technologies. So the contents of technology usually concentrate more on productive activities than just text books. In particular, it is argued that creative problem solving is an integral part of technology education, in contrast to a pure text book method, 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 of innovative technology education.

Discussion

At present, both Science and Handicraft education are still quite far from the goals set for technology education. In schools, theoretical constructs in Physics and Chemistry 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 (Alamäki, 1999).

Moreover, the nature of tasks and working processes in craft education 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. Some people may think that technology education should be a design-process based with the emphasis on wood and metal work and the others feel that 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 for the children to understand that technology does not develop by itself, but is directed by human needs and wants. Technological development, control and mastery would be stopped 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.

Right now there is an obvious need for young technology teachers to act as agents for change. Moreover, it is obvious that more research and development efforts 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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