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Entrepreneurship- and technology education in the context of the information society

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1. Introduction

In Finland, a national "Entrepreneurship decade 1995–2005" project was implemented. The purpose of this project was to emphasize the importance of local work and production to the survival of the locality, as well as to stimulate cooperation between schools and local enterprises. At the same time there was increasing discussion about the information society, its essential, and characteristics, and what kinds of changes it necessitates at all levels of education.

As a consequence of these, new subjects were introduced into comprehensive and upper secondary school curricula. These subjects were called: Entrepreneurship and active citizenship, Humanity and technology, and Technology and society. In addition, technological subjects were incorporated into handicraft education. When analyzing the goals and contents of these initiatives, it is easy to realize that their aim is to develop citizens' preparedness to act and survive in the information society.

In this article, we examine the basic concepts and purposes of entrepreneurial and technology education in the context of the information society. In addition, we offer some operational models for implementing entrepreneurial education in schools. These include, for instance, students' entrepreneurial activity, visits to local firms, entrepreneurs' visits to schools, and even small-scale business activities.

2. The information society is based on technical inventions

The concept of the information society was created by Professor Yoneji Masuda in 1972. In his book, Masuda[1)] presents the information society as a continuation of hunting, agricultural, and industrial societies. Nowadays it is easy to agree with this because in all fields of society, information and knowledge plays an increasingly central role and it exists in several forms. It has been argued that the change from an industrial society to an information society is as remarkable as the beginning of agriculture 10,000 years ago or the industrial revolution 200 years ago. In the following, we briefly present some critical events in history which have made the contemporary information society possible.

Throughout history, knowledge has had a central role in all societies. Knowledge has created a cultural heritage and determined how people understand their world view. Before writing skills, knowledge was local and communicated mainly by speaking. Writing was invented about five thousand years ago and the Chinese developed paper in the first millennium. When Johannes Gutenberg invented the printing machine in the 1450s, there was a significant increase in the amount of publishing, thus creating better possibilities for distributing information in printed form.

At the beginning of the 1800s the Germans established the Berlin Technical University and it started to carry out research and development projects for industry. This acted as a model for all other universities around the world seeking to launch more intensive cooperation between universities and industry. Based on this cooperation, inventions and related services were developed by using the results of scientific research to serve economic purposes. As a consequence of this, there have been new definitions of knowledge, such as research-based knowledge that distinguished fact from fiction.

From the 1800s onward there have been several inventions which have made the contemporary information society possible. The following list highlights some of these:

- The first phone was developed at the end of the 1800s when Alexander Graham Bell discovered how to change sound into electrical signals and vice versa. The telegraph and phone made "real-time telecommunication" possible.
- Inventions developed by Thomas Alva Edison enabled the building of the first power plant in the United States in 1882.
- Heinrich Rudolf Herz invented radio in 1886 when he realized that electromagnet waves move in the air and go through materials. This enabled the transfer of electronic and electromagnetic information.
- Paul Nopkow built a television already in 1884, before the invention of radio. However, the development of television really started in the early 1900s after the invention of the radio valve, camera tube, and cathode ray tube. Joining these with the idea of a radio made possible television broadcasting through the air. Regular television broadcasting started in many western countries in the 1930s and made audiovisual media culture possible.

After these inventions, the greatest step toward the information society was the development of the transistor in 1948. It started the technological revolution and made the development of the computer possible. Combining the idea of the phone and radio led to radiophones, which later developed into mobile phones. Nowadays, various pieces of equipment such as radio, television, camera, music player, and computer are joined together to create a device called the "smart phone". This enables multichannel communication. The development of the computer and information technology has brought about new possibilities to create "virtual realities" where the borderline between fact and fiction is disappearing. From all of this it is easy to argue that the development of western society and culture is based on technological inventions (for more detail, see Parikka[2)]).

3. The information society and education

In the contemporary information society, the values, ideals, wishes and dreams of youngsters have totally changed from earlier ones, for example, from the age of agriculture. Their activities and experiences of the environment have been technology-centered from the outset because they have been born into a society with computers, networks, mobile phones, etc.[3)]. Nowadays youngsters can get access to information easily and quickly through these devices and acquire the information needed. The development of information technology can also be seen in almost every workplace as utilization of different devices and applications. How to use them skillfully has become central to almost every job.

In 2001, Kurikka conducted a comprehensive questionnaire study (N = 3990) in Finland on attitudes of young adults (age 18 – 26) towards information technology and its use. Based on Kurikka's[4] findings, attitudes of young adults to the information society are very positive. The majority think that every student should learn to use computers already at school. The findings also indicated that 53 % of young adults considered information society skills 'very or quite important' when thinking about future employment opportunities. Young people think that computer technology is an inseparable part of working life. In addition, about every fourth young person was ready to fully accept the statement proposing that in the future there might not be any profession without computers.

Comprehensive school students today will still be fully occupied in working life at least in the 2050s. It is quite difficult to foresee what kinds of skills could be the most beneficial to them and whether there are some skills that would be harmful. It might be that at that time quite many people will do research and development work, or remote work through computer networks. On the other hand, there is already today a great shortage of professionals with diverse skills in the metal, construction and forestry sectors. It is probable that planning (design, management), flexibility, creativity, critical thinking, taking responsibility, versatile social skills and knowledge of different cultures will be expected in all professions in the future.

If we accept the above-mentioned facts and viewpoints, education should shift from teacher-centered teaching to student-centered activity emphasizing doing and experiences. This should be implemented already in basic level education. In education, activities emphasizing critical thinking, equality, research, creativity, and teamwork should be emphasized more than before at all levels of studies.

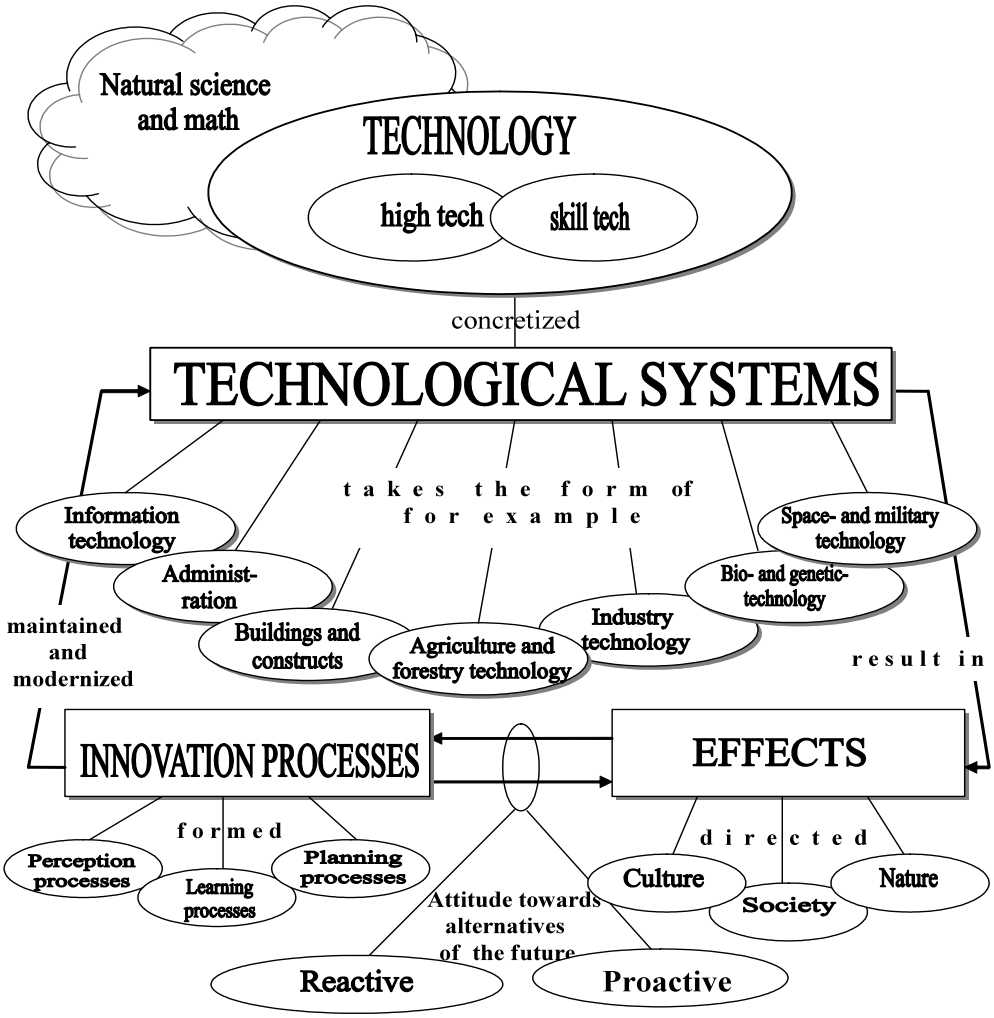
4. Technology education

Technology can be defined in general terms to include all humanity's artifacts and accomplishments. However, when defining development, research, and the related discussion of technology education in comprehensive schools, it should be defined by emphasizing the educational viewpoint. It means that the definition should include emphasis on the technology user's and developer's interest and understanding. Based on this, Parikka and Rasinen[5] and Rasinen[6] defined technology as follows: "Technology means understanding the structures and operational principles of technical equipment, machines, and devices, as well as their skillful and controlled use for developing new products and services".

In technology education, the tools for learning are machines and equipment (equipment technology) and use of tools (manufacturing technology). Knowledge of the quality of production materials connects these technologies to knowledge of technology. This definition is related to both material and mental aspects. Figure 1 illustrates these aspects in the form of a comprehensive conceptual schema. It divides technological know-how into high-tech (based on scientific knowledge) and skill-tech (based on everyday experiences). High-tech includes information technology, and automation that is based on computer systems. Skill-tech is related to technical skills where technical equipment is utilized in an innovative manner. It can be argued that the nature of technology is based on humanity's inventions and production; it is future oriented and innovative, practical, and based on

commercial needs. However, it is not usually environmental friendly and might even have a negative impact on nature. In technology education, the central educational objective is those technological skills that help students when they make ethical choices related to technical commodities, use technical commodities, and further develop technological solutions.[7)]

FIGURE 1. The concept of technology from the pedagogic viewpoint (adapted from Parikka[7)]).



5. Entrepreneurship education

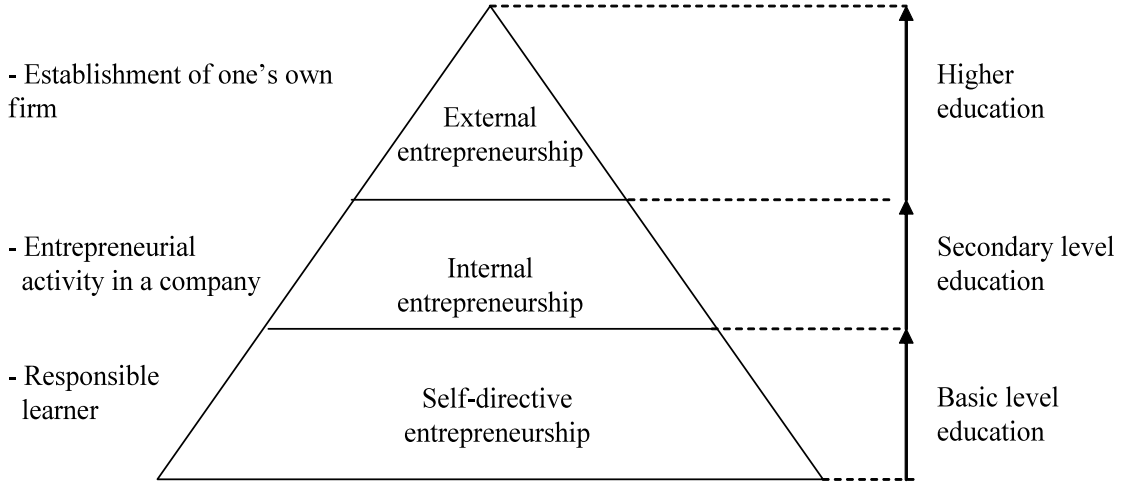
Dividing entrepreneurship into 'self-directive', 'internal', and 'external' entrepreneurship clarifies applications of school education. Self-directive entrepreneurship means the individual way to act generally in an entrepreneurial manner and taking responsibility for one's life. Internal entrepreneurship refers to entrepreneurial activities as a member of an organization or as a worker in a firm. External entrepreneurship is related to the establishment and management of one's own firm[8)].

The above division above can also be regarded as a framework for progress in entrepreneurial education. In early and basic education the focus is on one's own, self-directive entrepreneurship. In upper grades of comprehensive school, some elements of internal entrepreneurship can be added. In upper secondary and vocational education, some parts of external entrepreneurship can be included in the education[9)]. Even if the aim of entrepreneurship education in general education is clearly targeted

at self-directed and internal entrepreneurship, in the background there is a wish to have as many students as possible to become adults that are also external entrepreneurs. So the long-term aim is that students would grow to be citizens creating work for themselves.

Basic education can create a good basis for the development of students' entrepreneurial thinking. If this basis remains weak, it is difficult to compensate for these shortages later on in secondary or higher level education. It is clear that entrepreneurship education has to progress systematically through basic education. For instance, implementing some occasional visits to companies or theme days is not enough to bring sustainable results. Figure 2 illustrates one proposal for how entrepreneurship education can progress through the educational system. It includes three development levels, namely self-directive entrepreneurship in basic level education, internal entrepreneurship in secondary level education, and external entrepreneurship in higher level education.

FIGURE 2. Entrepreneurship education at different levels of the educational system



Education should be colored by diverse challenges for students to be creative, innovative and independent. There should be a drastic change in education methodology in order to activate teachers and students to move from carefulness and security to courage, risk taking, and independent decision making; from resignation and withdrawal to initiatives, convincing, challenges, and involvement; from solitary hard work to team work, openness, and networking; from avoiding possible hazards to seeking opportunities[10,11]. The recent development of society and industry has given birth to these changes above. They concern every citizen even if s/he is not planning an entrepreneurial career.

Facts and phenomena are learnt best in their original contexts. The most real learning environment for entrepreneurial education is everyday life (out-of-school), e.g. working life and industry, leisure and hobbies. Most of the contents and also methodological clues for entrepreneurial education are found there. This means that the organization of learning and the choice of problems handled should not be made only by the teacher. On the contrary, students should be encouraged and taught to observe and find them out by themselves. Working should lead learners to real entrepreneurial experiences; they should have opportunities to develop their creativity and design skills, make choices, take risks, cope with uncertainties and constraints, learn to commit themselves to the chosen aims, take

responsibilities and experience success as the result of their own entrepreneurial activity. In practice, entrepreneurial projects in school should bring some kind of added value to students, compared with those who are not interested in entrepreneurship. Table 1 below collects the approaches described above according to Parikka and Ojala[12]. The table can be used as some kind of a draft list when planning entrepreneurship and technological education for elementary schools in the context of the information society.

EMPHASIS	AIMS	PRACTICAL EXAMPLES
Changes in work image	Specialties of work and professions in the future	Future workshops, forecasting future professions and opportunities, thinking about alternatives for one's own paths to the future, planning future enterprises, and development of entrepreneurial ideas.
Reforming the concept of learning	Active observation and ideas, recognize one's own capabilities, take responsibility for one's own work, life-long learning	Individual learning (the teacher cannot learn on behalf of students), individual and team work, group and self-assessment practices.
Education for equal opportunities	Breaking down the myth about female and male jobs	What is the professional gender division, why are there differences between the salary of female and male jobs? Do some professions suit only for one sex?
Consumer education	Critical, responsible and considering consumer	Planning and following money consumption. Discussion of product safety, information security, and issues concerning usability, price, and quality.
Education for internationalization	Increasing understanding and interaction between different cultures and nations	Versatile opportunities for practice in everyday language and also speaking foreign languages.
Technology education	Acquainting oneself with technological systems and the possibilities to utilize them, understanding of sustainable development, innovativeness and awareness of price-quality ratio	Acquainting oneself with the production and marketing processes of industry, life cycle and value chain analysis of products. Mapping out and developing skill development programs of enterprises with local companies. Collaborative projects with 'godfather schools' utilizing the networks. Entrepreneurial training and practices.
Aesthetic education	Adopt the meaning of an aesthetic approach to life and as the guarantee for product sales	Preparing different enterprising ideas to the practical realization stage. Stress especially on the importance of aesthetic aspects in design and marketing.
Mathematical education	Understanding the importance of mathematical skills for entrepreneurship	Understanding and following entrepreneurial activities as a profitable activity. Monetary follow-up and assessment of the results should be attached to projects.

TABLE 1. Changes in entrepreneurial and technological education affected by the information society

6. Conclusion

As a summary, Table 2 combines some focal elements of the information society, entrepreneurship education, and technology education in the context of teaching and learning. These issues are not self-evident facts; instead, they are common viewpoints from different sources. The most important question is how well technology and entrepreneurship education can respond to the need for survival in the contemporary 'information' society. On the other hand, the question is whether technology and entrepreneurship education can offer enough knowledge to challenge and criticize the current information society and indicate better and alternative courses of action.

From Table 2 it is easy to observe that technology and entrepreneurship education are very close to each other. Technology is commonly seen as a target of business and also as a tool for business. Entrepreneurial activities are very insignificant without technology and, on the other hand, technology cannot progress without commerce. From the table, it can be argued that teachers of handicraft should act as teachers responsible for entrepreneurship education in basic level education.

	Information society	**Entrepreneurship education**	**Technology education**
Basis	Technical inventions, knowledge and skills, information networks, commercialism	Understanding of commercialism, entrepreneurship, economy, and production	Understanding of technological systems
Goals	Global society that is based on knowledge acquisition and usage	Understanding of entrepreneurship as potential career, active and participating citizen, entrepreneurial activity, establishment of a venture, guarantee competitiveness of a firm	Skills to survive in a technological world, equality and balance between nature and technological consumption (sustainable development)
Learning activity	Active citizen, life-long learning, competitiveness	Initiative and capability for taking risks, competitiveness, self motivated and responsible action, innovativeness, active creation of ideas and marketing together with local firms, practical training, establishment of small scale business	Active creation of ideas, critical thinking, problem solving, innovative thinking, product planning, team work, life-long learning
Evaluation of results		Evaluation of results of a real or practical project and propositions for its further development	Evaluation of results of one's own learning process, Evaluation of the quality of products and propositions for their further development

TABLE 2. Entrepreneurship and technology education in the context of teaching and learning in the information society

To conclude, there have been several research and development projects in the field of technology education. However, it would help to get a better and holistic understanding of the field if these results could be combined. This would help to identify the central findings and needs for further research directions. In the field of entrepreneurship education, the research is focused mainly on external entrepreneurship and education has been provided only at the higher level. Thus, there are several research opportunities related to 'self-directive' and 'internal' entrepreneurship in basic and second level education. For instance, it remains unclear how entrepreneurship and technology education is understood among students and teachers, and how it is implemented in basic level education in different countries. Furthermore, there is very limited knowledge of how entrepreneurship and technology education should be taught to achieve the best learning results. This research could significantly benefit by establishing an international research project where researchers from several countries could investigate how these issues are implemented in their home country. Thereafter, the results at national level can be combined to create a holistic view of the phenomenon.

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