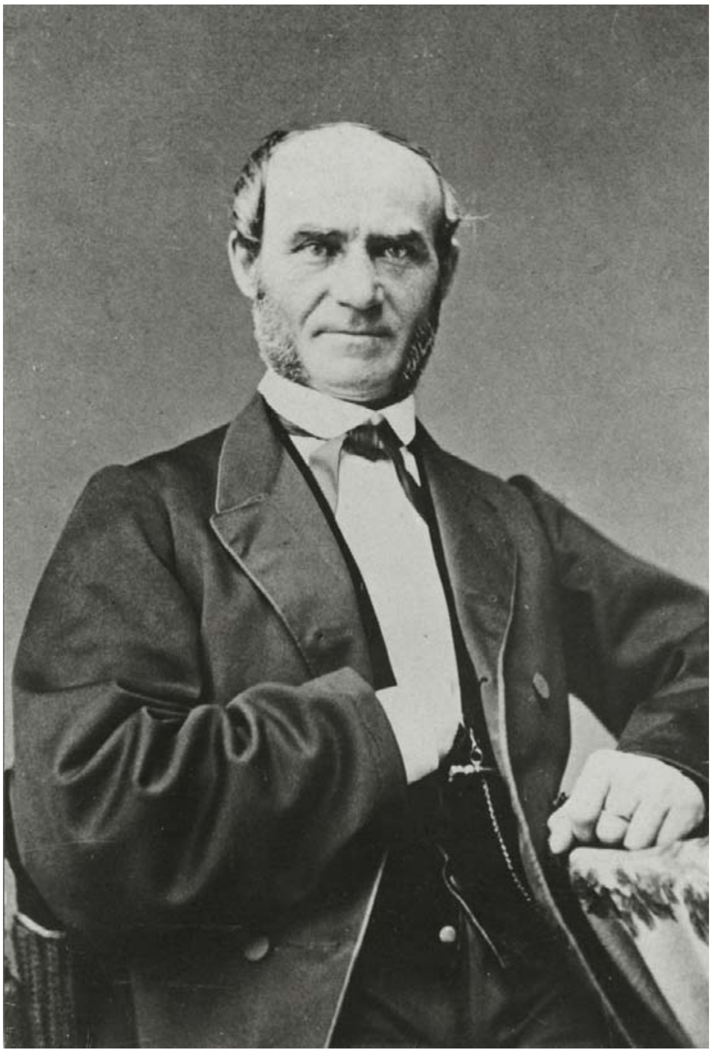
Aki Rasinen & Timo Rissanen (eds.)

In the Spirit of Uno Cygnaeus – Pedagogical Questions of Today and Tomorrow



UNIVERSITY OF JYVÄSKYLÄ
DEPARTMENT OF TEACHER EDUCATION

Aki Rasinen & Timo Rissanen (eds.)

In the Spirit of Uno Cygnaeus – Pedagogical Questions of Today and Tomorrow

200th Anniversary of the Birthday of Uno Cygnaeus
Symposium 12th - 13th October, 2010

Department of Teacher Education, University of Jyväskylä, Finland

Jyväskylä 2010

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PREFACE

The 200th anniversary of Uno Cygnaeus's birth took place on the 12th October, 2010. He was the founder of Finnish teacher education, which was started at Jyväskylä Teacher Training College (*Seminar*) in 1863. The influence of Cygnaeus's work on the Finnish general education is remarkable. He emphasized a balanced education and an intrinsic part of this was craft education which was accepted as a compulsory subject in the Finnish folk schools. Uno Cygnaeus and Otto Salomon, his colleague from Sweden, cooperated to spread the idea of crafts (*slöjd* in Swedish and later *sloyd* in English) and craft education internationally. Cygneaus regarded it as important that craft education was not merely the study of techniques or pre-vocational training but an effective means to achieve the balance of the head, heart and hand.

The Department of Teacher Education celebrated Cygnaeus on his birthday when staff members, students and international guests congregated for a two-day symposium to review Cygnaeus's national and international importance in the field of education. The presentations of the symposium are collected in this book.

The publication in hand discusses the work of Uno Cygnaeus and its influence on education, particularly craft and technology education in various countries. How craft and technology education has developed varies from country to country and the emphasis areas differ between national educational systems. Generally speaking, the development is towards design and technology education in the international context.

The book views craft and technology education from many perspectives. Some articles examine the history of craft and technology education, whereas others introduce possible alternatives for the present practice and further development of the subject area. There are also presentations about methodology, learning at pre-school, general education schools or universities, and gender and critical considerations. The papers are written on the one hand by experienced professors and on the other hand by persons who are still in the beginning of their researcher career. Most of the authors are not native English speakers and, therefore, the reader is kindly asked to take this into consideration.

We hope that the articles will show the reader the historical background and the present situation in various countries and also offer ideas for further development of craft and technology education worldwide.

We would like to express our gratitude to the Department of Teacher Education for financing the printing of this book.

Jyväskylä 12th October, 2010

Aki Rasinen Timo Rissanen

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CYGNAEUS AND HIS REPUTATION

Uno Cygnaeus is, and was, an institution and a national monument. In his lifetime, he was practically identified with progressive elementary school education in Finland. The man and the institution were indistinguishable. Soon after his death, he also began to be regarded as a kind of ideal Finn, a man who brought enlightenment and liberty to the nation and even an important figure in the history of humankind.

In the late nineteenth century, Cygnaeus was called “the father of the Finnish elementary school”. This appellation was based on his exceptionally significant and elemental life's work, which influenced the culture and identity of the nation, and which, it was thought, would bear fruit for centuries to come.

In this article, I shall address the question of the canonization of a great man: how and why Uno Cygnaeus came to be called “the father of the Finnish elementary school”; what kind of father he was depicted to be; and what kind of political, social and cultural contexts this fatherhood was associated with at any given time. I shall concentrate on the last quarter of the nineteenth century and examine the process of canonization in public writings, newspaper articles, literature, speeches, talks and lectures.

The nineteenth century was characterized by nationalist ideals. Populations became peoples and nations, and for this change, or progress, they needed an historical and human foundation. The smaller the population, the sparer its social structure and the less history it possessed as a state, the more important it became for it to nominate monumental public figures and to create national monuments. Great men provided the foundation for change and pointed the way to the future. They were the exemplars of the people, and the aspirations of the nation were projected through them. The objectives and achievements of the people thus became inscribed in the names of individuals.

In Finland, the nationalist ideal, publicity and education joined forces in a young society with a faith in progress. An educative press, educative public functions, educative literature and science were all harnessed to the nationalist mission. Through them the people were led to civilization and prosperity; Cygnaeus exploited the public sphere assiduously and skilfully, writing hundreds of essays and newspaper articles about the school system and the development of education. It is probably no wonder that, given the situation in the nineteenth century, enlighteners and educators of the people were made into heroes of the nation. In good times, an educator could bring about reforms and disseminate his ideas, and in unfavourable circumstances he was honoured as a defender of the people, a hero who helped them surmount their difficulties. Cygnaeus presents an excellent example of this. He carried out his life's work in favourable circumstances, and for his achievements he was given the title "the father of the Finnish elementary school", and he was honoured as a great man. And when the situation deteriorated, he became even more important: he was called a hero of patriotic endeavour and a champion of culture and the future. By the 1890s, only a few decades after the radical reforms he proposed, Cygnaeus had come to be regarded as the greatest and most notable hero of the age.

The canonization process happened quickly. In the early 1870s, immediately after the first progressive elementary schools based on Cygnaeus' model had been established, he was considered to be one of the noble patriots of Finland. At the end of that decade, when the oldest schools were ten years old, he was generally given the title "the father of the Finnish elementary school". The appellation given to him in a newspaper article about the elementary school of the time was "the Inspector General of Finnish Elementary Schools, the father of our country's school system". The words "Finnish" and "our" in the title referred to the whole nation, "elementary school" to the substantial work Cygnaeus had done for the benefit of the people, while "father" indicated that he was the creator and patron of popular education. One can appreciate the high merit expressed by the title when one realizes that at that time a debate in the public sphere in Finland was examining the most important reforms of the age and placing them in order of importance: first came elementary education, followed by the consolidation of the activities of the Diet, the recognition of Finnish as an official language, the introduction of the country's own currency, the establishment of a national army and economic reforms.

In 1880, Cygnaeus reached the grand old age of 70. The year was epochal − in many senses. The process of canonization really got under way. The greatest hero of the nation was considered to be the reformist Tsar Alexander II (who ruled the country as the Grand Duke of Finland), but immediately after him came Cygnaeus. That was no mean achievement: if it was Alexander who had made the reforms possible, it was Cygnaeus who had implemented the most important of them.

It is no wonder that in Finland 1880 became a year of national celebration commemorating Cygnaeus, the elementary school system and popular education, and that it finally established Cygnaeus as "the father of the Finnish elementary school", so that really his name could no longer be mentioned without that title being appended to it. He had become an institution, the common property of the nation.

The major celebrations naturally took place on Cygnaeus' birthday in October, but in actual fact the hero of the day was continually rushed from one place to another, from one gala to the next, like a mobile symbol of the nation. Wherever the railways reached, there festivities were arranged, and there in all likelihood Cygnaeus appeared as the guest of honour, although admittedly –

and fortunately for him − the rail network was still sparse. Even so, he was transported to the most inaccessible places. As a figure of national stature, he attended the inauguration ceremonies of all kinds of institutions and buildings, and − as one might expect − his presence was considered to be more important that the actual purpose of the function. He tended, so to speak, to steal the show. Here are a few examples:

In March he laid the foundation stone for a new church in Tampere, and he also participated in an evening gala for children in an elementary school as well as attending the unveiling of a portrait of the Tsar. When Cygnaeus sailed in, one of his most devoted disciples was just making a speech. The speaker changed his speech and greeted the new arrival with lavish praise. It became clear to everyone present that the person who had arrived was Dr. Cygnaeus, the Inspector General of Finnish Elementary Schools, their gentle protector, the tender father of the whole system of elementary education. In May, a new teacher seminary was officially opened in Karelia. The opening ceremony turned into a patriotic eulogy and sanctification not only of Karelian culture as represented in the Finnish national epic, the Kalevala, and of the ancient past of Finland and Karelia, but also of Uno Cygnaeus. Not just was Cygnaeus' favourite quotation "Be thou faithful unto death, and I will give thee a crown of life" embroidered across the rostrum, but he was also the natural choice to make the main speech on the occasion, and − as was related in the press − the venerable elder moved the audience with his exceptionally eloquent, weighty, and highly printable, speech. At the ensuing dinner, toasts were proposed to the Tsar, the senators and to Cygnaeus. But only in his case was a speech made in connection with the toast. It dealt with the old man who was so beloved of the Finnish people and with his great achievements in Finnish education. It probably came as a disappointment to the speaker that Cygnaeus, exhausted by the journey, was unable to be present.

In 1880 the first biographical texts about Cygnaeus were published. The two most important of them appeared simultaneously in a Swedish encyclopaedia and in a Swedish journal when a meeting of 300 Nordic teachers was held in Stockholm. This really marked the inception of writings dealing with Cygnaeus and his achievements. The encomiastic journal article was spread over several pages, and it was noticed in the Finnish press. In some readers it evoked jealousy, but not even the most envious critics dared to deny the major achievements of Cygnaeus. Even they admitted that it was to his eternal credit that elementary education flourished in such a gratifying way in Finland. The press paid greater attention to the high esteem in which Cygnaeus was held by Nordic educationists. Their regard for him was indeed extremely high, which could be clearly seen and heard at one particular occasion held in connection the meeting. Cygnaeus himself was unable to travel to Stockholm, but he sent his greeting to the meeting. When this greeting was read out at a celebratory dinner, the participants broke out into cries of applause, raised their glasses in his honour and wished a long life to "Cygnaeus, the grand old man of education, the father of the Finnish elementary school".

The actual birthday celebrations were naturally held on 12 October. They turned out to be a particularly important event, as the students, the *spes patriae*¸ the most ardent and active group in promoting the nationalist ideal and enlightenment made Cygnaeus one of their own. They came to salute him, singing in Finnish and Swedish the most sacred and politically charged anthems of the nation, *Our Land* and *The Song of Finland*. The attendance of the students was important for two reasons. First, it was a demonstration that the disagreement between Cygnaeus and the academic world had been forgotten and that pedagogy was beginning to be appreciated in university circles. Secondly, it was the students who created and built the cult of the Finnish great man, deciding who those great men should be and making their birthdays into national festivals. If the students had not recognized Cygnaeus, he would soon − I dare to maintain − have fallen into complete oblivion.

Cygnaeus' birthday celebrations swelled to such proportions that contemporaries immediately realized that he had stepped permanently into the ranks of great men. The press also noted this. The fact that that Inspector General Cygnaeus had reached the age of 70 was reported in just about every single paper − in some it was given greater coverage, in others just a mention, but even the shortest reports included the most important fact: that he was the father of Finnish elementary education.

Cygnaeus' birthday was celebrated in different localities. In the celebrations, educationists, teachers and pupils admired the portrait of the father of the elementary school, sang and prayed and listened to stories about Cygnaeus, the noble old man, and his work as father of the elementary school. The female students of the teacher seminary in Jyväskylä, wrote a congratulatory poem in his honour, in which the addressee was described as the vigorous and beloved light of the backwoods of Finland, the hope of the people, the illuminator of the future. His memory was to be cherished. The poem also made reference to a future event − the inevitable erection of memorial stature to the great man, which "dear and wonderful already existed in the heart of the people".

Thus Cygnaeus' birthday was made into a festive day in the young nation, and on 12 October the event was celebrated in schools and particularly in teacher seminaries. On that day, the local people were also invited to take part in the celebrations, which were reported in the press, and an essential part of which was a speech in which − as might be expected − the significance of the day as Cygnaeus' Day and the Day of Finnish Civilization was emphasized. In some places, Cygnaeus was not merely referred to as the father of the Finnish elementary school; he was also described as a gentle and tender father of the Finnish people, as a distinguished servant of the country highly esteemed by the nation, and as a beloved elder.

A major event in the process of canonization is the death of the person to be canonized. Uno Cygnaeus fell ill and passed away on 2 January 1888. The first obituaries, in which his life was reported to the reading public, appeared in the papers the following morning.

The obituaries demonstrated how great was the loss. One paper stated at the beginning of its obituary that the demise of the father of the Finnish elementary school was grieved not only by the Finnish elementary school and but by the whole of the Finnish people, for whom Cygnaeus had blazed the path to enlightenment.

The obituaries of Cygnaeus, which were extensive, exhaustive and profound, can be divided into two main categories: those that concentrate on events in his life and those that emphasize the significance of his life's work. However, whichever category they belong to, they all naturally contain certain common features, such as the view that the mission of raising Finland into a strong and happy nation formed the main thread of Cygnaeus' life. The obituaries are lavish in their glowing praise of Cygnaeus: he is not only the father, founder, creator and bulwark of the Finnish elementary school but also a great man in the true sense of the word and a successor of the great men of history. He is a lofty exemplar of patriotic toil and the blessings it brings, a venerable silver-locked elder, a devoted toiler, the fatherland's most honest and faithful worker, a champion against the power of darkness, and *the* figure of the year if not indeed of the decade. He is even labelled a phenomenon in the history of Finnish education the like of which there had never been in terms of importance and influence. He is described as having carried out his life's work to the very end patriotically, with unshakable conviction, indefatigable devotion and exceptional enthusiasm and to have sacrificed himself, his organizational ability and all his powers in the service of education and popular enlightenment. Cygnaeus was not just a person who had combined and realized lofty educational ideas, the organizer of the school system and a visionary: he had come to represent something almost beyond compare.

Of the details concerning Cygnaeus' life, there are brief mentions of his date and place of birth, his education and his early career, and more rarely of his family relations. More attention − especially in the obituaries of the first category – is devoted to the different periods in his life: his time as a preacher and teacher in a Lutheran parish in Alaska is described, and almost always his return on Christmas morning to St. Petersburg from his long journey is mentioned. Much is written about his time in St. Petersburg as a minister and a teacher, and particular attention is paid to the fact that it was in the company of Petersburg educationists that he became acquainted with the ideas of Pestalozzi, Fröbel and Diesterweg.

During his time in St. Petersburg, Cygnaeus drafted a proposal for reforming Finnish elementary education at the behest of the Tsar. This is justly claimed to be the turning point in his life and an action that marked the future of the Finnish elementary school system. All the obituaries clearly describe the fundamental idea behind the report: a common school for all classes that was to be based on Christian home upbringing and for which a teacher seminary open to members of both sexes should be established. The idea of an elementary school for all irrespective of their social background which would educate everyone into a knowledgeable and able citizen was downright radical in a society in which popular education was administered by the church and aimed at maintaining prevailing social class distinctions. Similarly, all the obituaries mention those demands of the report that were considered most radical and which aroused the greatest resistance: the severance of education from the church, the education of girls, education by development, practical education (handicrafts) and physical education. It should be noted here that the inclusion of handicrafts in the curriculum was praised in the press, for the very reason that it raised the esteem for craft trades.

After the report was published, Cygnaeus was sent abroad to learn about the school systems of different countries. The outcome of his investigatory journeys was a new concrete proposal that Cygnaeus had to defend until it was ratified as a decree on elementary education in 1866.

The obituaries estimated the relationship between Cygnaeus and European educationists, particularly Pestalozzi. All the writers were aware of the central significance of Pestalozzi's ideas, but according to some Cygnaeus' own ideas and particularly his implementation of the school system were original, while others considered that he had been too strongly influenced by Pestalozzi, Fröbel and Diesterweg.

The obituaries also briefly mention later periods in Cygnaeus' life, his work as a school inspector and later the Inspector General of Elementary Schools, as the director of Jyväskylä Teacher Seminary and the honours paid to him.

The obituaries of the second main category deal exhaustively with the foundations of the elementary school ideal. Rather than Cygnaeus himself, the main protagonist is actually the Finnish people, whose saviour Cygnaeus had set himself up to be in his victorious struggle against the darkness of ignorance. These writings see Cygnaeus as having sacrificed his talents for the benefit of the Finnish people, and they emphasize the societal importance and the patriotic character of the elementary school and its connections with the awakening of a nationalist sentiment and with reforms that had promoted national independence.

In addition to the obituaries, mention must be made of a poem of over a hundred verses by Zacharias Topelius entitled *Uno Cygnaeus*, which was evidently intended to honour the departed and to make his name known to schoolchildren. In it, Cygnaeus was a man upon whom God had bestowed a gift that enabled Finland to open its windows to the world. Cygnaeus was also a man who had had faithful companions and who had laid the foundation stone for a school for the people, which created a bridge to the future, to the light of understanding, to Christianity and to the service of the fatherland.

Cygnaeus' funeral took on such proportions and it was arranged at short notice in such a manner as was generally accorded only to statesmen. But what else was to be expected of the funeral of a national hero? Over a thousand people took part in the cortège, the service and the ceremonies. The funeral procession was divided into sections so that the first unit that made its way to the Old Church in Helsinki was composed of the board of governors and teachers of Helsinki Elementary School and a large group of teachers who had arrived from the countryside. The second section comprised the representatives of the Finnish Students' Association and the student nations of Helsinki University bearing their flags draped in mourning. The third was made up of those who had received their master's degrees in 1886 and the fourth of the representatives of the teacher seminaries. After these came the relatives of the departed and other members of the public.

The funeral oration described the time in the long life's work of the departed when he had devoted himself to the education of the people and on which his fame was based. Dozens of wreaths were laid on and around the coffin, and, as was the custom, each person who laid a wreath made a speech. From these speeches there emerges a picture of a man who was great in his own right and whose importance for the fatherland and for both the Swedish-speaking and the Finnish-speaking sections of the population was huge. He is ranked among the most noble sons of Finland and depicted as a faithful toiler, a loving and paternal teacher, a friend of the fatherland, the protector of the elementary school, a great, gentle, resourceful and admonishing elder, and as a man who took paternal pleasure in the success of his pupils, and finally he is praised as the supreme temporal guardian of teachers.

Before the great man was carved in stone and cast in bronze, Cygnaeus was recorded in history. Gustaf Lönnbeck, his son-in-law and former subordinate, published two biographies of him in 1890, each of them in both Swedish and Finnish. One was an extensive scholarly study of Cygnaeus' life, character, work and principles. It was reissued in a revised and illustrated edition to mark the centenary of Cygnaeus' birth in 1910. The second short biography was a popular reader about 30 pages in length.

Both works served an important function in the canonization of Cygnaeus. The scholarly study really only calls him "the father of the Finnish elementary school" in its title. Otherwise, in the fashion of biographical works, it goes through the subject's life and mentions preceding generations, drawing attention to historical heroes and those who took up the cause of popular education. In the spirit of the times, the peasant roots of Cygnaeus are also emphasized − after all he had improved the educational level of the common people. Otherwise, the description of the vicissitudes of his life is characterized by inevitability: the way in which his growing up and experience prepared him for his great mission. Here a very interesting fact emerges: namely, that Cygnaeus depicted his life in his own writings and notes. This should not be understood to mean that he made himself out to be a great man, but rather that he frequently and honestly used his own experiences to justify his demands for change. The book also contains a long and interesting chapter dealing with Cygnaeus as an educationist, a person and a citizen. It is as honest as Cygnaeus himself: it presents both his greatness – his idealism, vigour and humanity; – and his weaknesses – his severity, his exaggerated self-esteem and his inability to make compromises.

In the reader intended for popular consumption, Cygnaeus is not described as "the father of the Finnish elementary school" in the title, but he is all the more clearly depicted as such in the contents of the book itself. In fact, the author mentions in the introduction that the intention behind the work is to make the rank and file of the people aware of the development of elementary education in Finland and of the life, activities and ideals of the founder of the elementary school system. The booklet is constructed in such a way as to specifically create a picture of Cygnaeus as a mythical saviour; indeed its structure becomes understandable by comparison with the Bible. It has six chapters, two of which seem in effect to predict the coming of Cygnaeus, while three chapters portray him in an almost messianic light and the Finns as the chosen people. The last chapter completes the messianic theme with the revealing title: "The work lives on, the master is dead". In the 1890s and the early years of the twentieth century, a period in which the Tsar tried to impose a policy of Russification on Finland, the work with its patriotic zeal was considered to be an extremely important tool for educating the youth of the country.

Civilized nations usually remember their great men with memorials. Although in principle there already existed a memorial to Cygnaeus (in the public debate, the elementary school itself was regarded as an ever-lasting monument to him), it was thought that he deserved a memorial. First a sepulchral monument was to be erected in his honour and then a statue. In the late 1880s, the country's elementary school teachers and inspectors already acquired the designs for the monuments, and they began to collect funds to realize out. The press followed the collection of funds and the progress of the works closely. The sepulchral monument (designed by Gustaf Nyström) was erected in Helsinki in 1892 and the statue (by Ville Wallgren) in Jyväskylä in 1900.

Around the collection of funds and the monuments there grew up a veritable Cygnaeus cult, which was further nourished by other ways of commemorating the father of the elementary school, and the societal aspect of which was proclaimed at the unveiling ceremonies of the monuments. Cygnaeus became the exemplar of the Finnish national struggle.

The statue project had both opponents and supporters, who once again exploited the public sphere to state their cases. There was a heated debate in the press over the value of the expensive statue. However, no writer, whatever side he was on, questioned the importance of Cygnaeus. For both camps, he deserved to be remembered as the father of the Finnish elementary school and as a warm-hearted and noble person. But the opponents of the project considered that all available funds should be used for education itself, the real task of civilizing the people and of thereby saving the Finnish nation. On the other hand, the defenders were of the opinion that the statue was just what was needed to save the people. They did not regard the enlightenment of the people and the statue as mutually exclusive. According to them, great civilized nations had used monumental art as a tool to further progress by arousing and nourishing a sentiment of nationhood. They emphasized the fact that public art represented the cultural capital of the people and humankind generally and that it made people aware of their responsibilities towards their fatherland. Therefore, the Finns, too, should follow the example of the great civilized nations. The supporters of the project believed that the Finns were a civilized people: if the Finns were incapable of erecting a statue and thereby disseminating culture, it was evidence of an insufficiency of resources and thus of the historical bankruptcy of the Finnish people.

Funds were collected by means of lists of donations and evening entertainments for which entrance fees were charged. These were aptly called Cygnaeus galas. In the spirit of popular enlightenment and the life of civilized society, the programme included music, speeches about Cygnaeus and the elementary school, lectures and plays, solo, communal and choral singing and poetry readings. There were also visits to the grave of the great man in which the proceedings resembled those of the Cygnaeus galas. There was usually a speech about Cygnaeus' life's work and elementary education, and *Our Land* or some other patriotic anthem was sung.

The unveiling of the memorials turned into great patriotic popular events with speeches about the past and references to the future of the human race. The programme included speeches, the laying of wreaths and patriotic songs and anthems. At the unveiling of the sepulchral monument, Cygnaeus was described as the only man of his time who was able to carry out the great task of the moment. However, the patriotism and celebration of Cygnaeus reached a climax in the speeches that were made at the unveiling ceremony of the statue in Jyväskylä.

In these speeches, Cygnaeus' work and the statue as a symbol of his life's work were measured against the yardstick of the nation, and even that of humankind as a whole. They portrayed the father of the Finnish elementary school as one of those whom God had blessed with the genius, ability and gifts to carry out a mighty task and whose work was to bear fruit for centuries to come. According to the speakers, a people that did not remember its great men deserved to be forgotten in the annals of history.

The speakers thought that it was thanks to Cygnaeus that the Finnish people was a civilized nation, and the statue now stood as a mark of its pride. They believed that the statue did not represent a single person but rather a period in the progress of a whole people and important step in human endeavour. It signified power and the ideals that had radiated from the invisible springs of enlightenment to guide the people on its arduous journey through the ages. Cygnaeus was one of those whom every Finnish citizen who was aware of history held dear. For the speakers, Cygnaeus and the statue represented the development of Finland. Although Finland was a remote and barren country with an inclement climate, its duty was to forge ahead in the service of enlightenment as far as nature permitted.

The speakers also recalled the fact that Cygnaeus was one of the chosen few who had achieved fame beyond the frontiers of the country. The statue would permit the present and future generations to understand what this noble person had achieved not only for his fatherland but for the whole of humankind. By his work and his ardent patriotism, Uno Cygnaeus had inscribed his name in history for all time. The statue was a reminder of the past and an encouragement to people to learn from it.

PRIMARY SOURCES

Newspapers

Finland, Finlands Almänna Tidning, Folkwännen, Helsingfors, Helsingfors Dagblad, Hufvudstadsbladet, Keski-Suomi, Laatokka, Lappeenrannan Uutiset, Lounas, Maamme, Morgonbladet, Oulun Wiikko-Sanomia, Pohjalainen, Päijänne, Päivälehti, Rauman Lehti, Sawo-Karjala, Suomalainen, Suomen Wirallinen Lehti, Tampereen Sanomat, Uleåborgs Tidning, Uusi Suometar, Uusimaa, Vaasan Lehti, Wiipurin Uutiset.

Literature

G.F. Lönnbeck, Uno Cygnaeus, ”Finska folkskolans fader” (1890)
G.F. Lönnbeck, Uno Cygnaeus, ”Suomen kansakoulun isä” (1890)
G. F. Lönnbeck, Finlands folkskola och Uno Cygnaeus. En framställning för folket (1890)
G.F. Lönnbeck, Suomen kansankoulu ja Uno Cygnaeus. Yhteiselle kansalle (1890)
G.F. Lönnbeck, Uno Cygnaeus, ”Finska folkskolans fader”. Jubileumsupplaga med illustrationer (1910)
G.F. Lönnbeck, Uno Cygnaeus, ”Suomen kansakoulun isä”. Kuvitettu elämäkerta satavuotispäivän muistoksi (1910)
Nordisk Familjebok 3 (1880), 701—702
Z. Topelius, Uno Cygnaeus, till folskolebarn den 12. Oktober. – Sägner (1888)

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UNO CYGNAEUS: THE FINNISH VISIONARY WHO CHANGED EDUCATION FOREVER

Uno Cygnaeus was one of the most influential educators in history. He is recognized as being the "Father of the Finnish Folk School." This basic general education system was for all boys and girls, a pioneering effort for which Cygnaeus and Finland are still recognized today. Cygnaeus also advocated the separation of schools from the supervision of the church—that became the responsibility of the Finnish public school system. Through Cygnaeus' leadership and writing, education in Finland and other countries has benefiting significantly.

Cygnaeus was a strong advocate and leader for preparing teachers to teach folk school and handicrafts (sloyd) education. He was the founder of a teacher preparation institution titled, "Jyvaskyla Seminary." In some of his writings related to this seminary, Cygnaeus uses the words "lecturer in arts and technology." This is one of the earliest, or possibly the earliest use, of the word "technology" historically related to education. As a result, some people view him as the "Father of Technology Education".

The concept that work is a "moral responsibility," and it should be perceived as an "honor of man" to accomplish, came from Cygnaeus. Central to his thinking and writings was that education for work should acquaint every child with real work so that every citizen of the future would have a general appreciation and respect for work and not just training for a specific vocation.

What is the origin and background of Uno Cygnaeus?

Uno Cygnaeus was born in 1810 in Hameenlinna, Finland. His father was instrumental in promoting and creating an interest in different folk processes, artifacts, and handicrafts for Uno during his childhood. His father taught woodwork skills, and he taught his son to turn wood on a lathe, make handicrafts, and gain a love and respect for working with your hands. It is evident that these childhood experiences influenced Cygnaeus' thinking and philosophy very much in his later life.

Cygnaeus attended the university in Turku and continued later to study at the University of Helsinki where he majored in natural sciences (biology and zoology) and theology. He received his master's degree in 1836. In 1837, he became an ordained priest and served as an assistant pastor and prison chaplain in Viipuri, Finland for two years. He also taught in a private (non-church related) school in Viipuri.

After his work in Viipuri, Cygnaeus moved to another part of the Russian empire and became the first pastor of the Sitka, Alaska Lutheran Church where he served for approximately five years. Then in 1845, he moved to St. Petersburg, Russia where he served as assistant clergyman of St. Catherine's Church in St. Petersburg. A few years later, he was promoted to the position of administrator of a parochial school of St. Mary in St. Petersburg. His experience in Alaska, along with his educational background in Russia and Finland, gave him excellent preparation for his leadership role later in life. Cygnaeus then served for over a decade as director of the Finnish School in St. Petersburg until the mid 1850s.

In 1855, the Russian senate was commissioned to research the educational systems in other countries in middle Europe. Uno Cygnaeus was given a grant in 1858 from the Russian senate to accomplish this task. As a result of his investigations; travels to Sweden, Denmark, Germany, Austria, and Switzerland; and drawing from the best of educational thinking of people like Frobel, Pestalozzi, and Diesterweg, Cygnaeus prepared a report to the Russian senate in 1860. Due to the creation of the informative report, he was asked to write a proposal that same year for establishing a general educational system in Finland. In this report, he proposed the now famous "Finnish Folk School" as a basic school for all children. The report was the fundamental basis for a law passed in 1866 to establish folk schools throughout Finland for all pupils and to develop universities to prepare teachers to teach in these schools. In 1861, Cygnaeus was nominated to the National Board of Education in Finland as the first "Chief Inspector of Schools." He held this position until 1887 (one year prior to his death in 1888). Cygnaeus was concurrently responsible for the Finnish Folk Schools and the teacher professional preparation institutions or "seminars."

The concept of the Finnish Folk School was cutting-edge and inventive in the total spectrum of education. It laid the foundation for much of what we do (and try to do) worldwide today in the study of technology.

Cygnaeus' influence on the study of technology

In its most basic meaning, technology is the modification of the natural world to meet certain human needs and wants. Technology helps us to extend our abilities by improving our health; growing and processing food and fiber; harnessing and using energy; communicating more effectively; processing data and information faster and more efficiently; moving people and things farther and quicker; producing products; building structures and environs; and other activities.

As it was mentioned earlier, Uno Cygnaeus actually used the term "technology" as early as 1861 in Finland in reference to working skills for technology at that time. Cygnaeus strongly believed in having a quality general education for all children (both boys and girls). He stressed the significance of schooling as the major factor in developing one's personality as well as mental (cognitive), physical (psychomotor) capabilities, and values and ethics (affective). Cygnaeus believed that learning should not just include studying books, but children should also learn to use their hands with some level of dexterity. He used the mandatory handicraft (sloyd) education for all pupils to accomplish this.

If Cygnaeus were alive today, he would most likely be a strong supporter of the study of technology by all students from kindergarten through high school. The first priority of a study of technology is to provide technological literacy to all students. This study includes all students who traditionally have not been served by technology programs. Most certainly, Cygnaeus would view the study of technology today as mandatory (not as an elective).

Technology must be a required subject for every student at every level of education. Incorporating a study of technology into a country's school systems will require establishing unified content through standards, developing curriculum, creating assessments, preparing and updating teachers, and providing and maintaining exemplary laboratory environments. This effort will reap rewards for citizens in every community, and society as a whole.

As has been stated earlier, technology education is the school subject specifically designed to help students develop technological literacy. Technology education is not the same as educational technology which is sometimes referred to as instructional technology (IT) or information and communication technology (ICT). Educational technology involves the study of computers and the use of technological developments in the digital setting, such as hardware, software, audiovisual equipment, and mass media, as tools to enhance and optimize the teaching and learning process and environment in all school subjects. Many times educational technology is referred to in literature as "teaching *with* technology" and not "teaching *about* technology".

Philosophies of Cygnaeus and Salomon

One of the best insights into Cygnaeus and his beliefs and philosophy comes from "Letters of Uno Cygnaeus and Otto Salomon," compiled by Dr. Tapani Kananoja who held the position of Chief Inspector at the Finnish National Board of General Education for 20 years (the same office that Uno Cygnaeus was appointed to over a hundred years earlier). Kananoja provides some very interesting personal and philosophical perceptions of Cygnaeus and his colleague, Otto Salomon from Sweden.

In his paper, Kananoja states that ”The relation between the Cygnaeus and Salomon seems problematic sometimes. Cygnaeus seems to have been the teacher, Salomon the apprentice, not always so obedient. The latter [Salomon] respected the former [Cygnaeus] and voluntarily adopted a lot. The scheme of work by Salomon seems not to have changed, however; it is vocational, bound to techniques, up to the end, even if Salomon frequently expressed his ideas to be the same as the ideas of Cygnaeus [who was a champion of general education]” (Kananoja, 1999).

A tension between general education and vocational education still exists today in most countries. This is especially true in the United States (U. S.) where industrial arts education and now technology education have philosophically been general education and yet about one half of the 50 states have technology education under the vocational education (now referred to as career and technical education—CTE) umbrella administratively controlled at the state department of education level.

In 2000, *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) was developed by the Technology for All Americans Project at the International Technology Education Association. This effort for developing what every child in Grades K–12 should know and be able to do in order to be technologically literate was funded in the U. S. by the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). The standards underwent a rigorous review and subsequent revision by the National Research Council, with input and advice from the National Academy of Engineering. The development of *STL* created a stronger relationship with general education or core education, especially science and mathematics. An important part of *STL* is that it gives substantial attention to the concept of engineering design.

In the recent past, there has been a movement in the US to include the study of technology in the integration of science, technology, engineering, and mathematics (STEM) into a transdisciplinary subject in schools. This effort further separates the relationship between the study of technology and vocational/CTE education in the United States.

Summary

Uno Cygnaeus is a recognized educator in the worldwide history of education. Most people view him as the “Father of the Finnish Folk School” while many view him as the “Father of the Finnish Public School System.” Others refer to him as the “Father of Technology Education”. His work and the work of many others since him have propelled Finland to be rated at the top of recent worldwide educational studies.

Clearly, Uno Cygnaeus was a visionary and pioneer in his philosophy and accomplishments in education. We have all benefited from his ideas and work, and we will continue to do so in the future. One cannot help but wonder that if Uno Cygnaeus were to return to our world today for just a short while, would he be pleased or discouraged with what he sees in education?

REFERENCES

Bennet, C.A. (1937). *History of manual and industrial education 1870 to 1917*. Peoria, IL: The Manual Arts Press.

Bybee, R. (2000). Achieving technological literacy: A national imperative. *The Technology Teacher*, *60*(1), 23–28.

Dugger, W.E., Jr., Bame, A.E., Pinder, C.A., & Miller, D.C. (1985). *Standards for technology education programs*. Reston, VA: International Technology Education Association.

Encyclopedia Britannica. (2010). *Uno Cygnaeus*. Retrieved June 27, 2010, from http://www.britannica.com/EBchecked/topic/148261/Uno-Cygnaeus.

International Technology Education Association. (1996/2005). *Technology for all Americans: A rationale and structure for the study of technology*. Reston, VA: Author.

International Technology Education Association. (2000/2002). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

International Technology Education Association. (2003). *Advancing excellence in technological literacy: Student assessment, professional development, and program standards*. Reston, VA: Author.

International Technology Education Association. (2009). *The overlooked STEM imperatives: Technology and engineering*. Reston, VA: Author.

Jyväskylä University Museum. (2010). *Uno Cygnaeus*. Retrieved June 27, 2010, from http://www.jyu.fi/tdk/museo/unoe.html.

Kananoja, T. (1999). *International relations of Uno Cygnaeus and development of handicrafts education in the Nordic countries*.

Kananoja, T. (1999). *Letters of Uno Cygnaeus and Otto Salomon, the 22nd of June 1877 – 1st of January 1887*. (Unpublished paper).

Kananoja, T. (2004). *Uno Cygnaeus and Russia*. (Unpublished paper).

Kananoja, T., Kantola, J., & Issakainen, M. (toim.) (1999). *Development of technology education conference -98*. Jyväskylän yliopisto opettajankoulutuslaitos. Opetuksen perusteita ja käytänteitä 33.

Kantola, J. (1999). Jyväskylä university in the context of technological education; Technological footsteps. Julkaisussa Kananoja, T., Kantola, J., & Issakainen, M. (toim.) *Development of Technology Education*. Jyväskylän yliopisto opettajankoulutuslaitos. Opetuksen perusteita ja käytänteitä *33*, 58–67.

Kantola, J. (2002). Developing handicrafts education into technology education at Jyväskylä university. Julkaisussa Kantola, J., & Kananoja, T. (toim.). *Looking at the Future: Technical Work in the Context of Technology Education*. Jyväskylän yliopisto. Opettajankoulutuslaitos. Tutkimuksia *76*, 85–97.

Kantola, J., Nikkanen, P., Kari, J., & Kananoja, T. (1999). *Through education into the world of work. Uno Cygnaeus, The father of technology education*. Institute for Educational Research, University of Jyväskylä.

Olson, D.W. (1963). *Industrial arts and technology*. Englewood Cliffs, NJ: Prentice Hall.

Phillips, K. (1985). A progression of technology in industrial arts education. *Technology Education: A Perspective of Implementation*. Reston, VA: The American Industrial Arts Association.

Reincke, H.J. (1995). Slöjd. Die schwedische Arbeitserziehung in der internationalen Reformpedagogik. Europäische Hochschulschriften XI, 613. Frankfurt am Main: Peter Lang.

Reincke, H.J. (2005). Finnish educational handicrafts. (Unpublished paper).

Salomon, O. (1877-1877). Letters to Uno Cygnaeus.

Wikimedia Commons. (2010). *Uno Cygnaeus*. Retrieved June 27, 2010, from http://commons.wikimedia.org/wiki/Category:Uno_Cygnaeus.

Contents

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THE CONCEPT-CONTEXT APPROACH IN TECHNOLOGY EDUCATION

Cygnaeus and concept learning, can that go together?

Cygnaeus' merits for technology education are well known (Kantola, Nikkanen, Kari, and Kananoja 1999). He was a great promoter of craft education for all. He recognized the educational importance of having experiences with materials and processes and making devices with a practical or aesthetical value. His influence went way beyond the Finnish borders (Kananoja 2005 and Kananoja 2009). Still today, we are aware of the need to have a practical dimension in technology education. Without that, no justice is done to the nature of technology. Even though a lot of people working in technology do not process materials themselves anymore, the personal experience with materials and processes is necessary for designers in order to develop products that can be made according to the properties of the materials. Besides that, the satisfaction that pupils get when they have made an artifact with their own hands that they can show proudly to parents and grandparents is an important motivating factor in technology education.

But as the development of technology went on, we became aware that there should be more to technology education than craft skills. Even Cygnaeus would probably agree with that, because we get the impression that for him the experiences with materials and processes served a higher purpose than only acquiring craft skills. Cygnaeus had studied natural science and theology, both subjects that no doubt had made him aware of the value of higher order thinking and concept learning. In both disciplines, concepts play an important role. That this holds for natural science is probably clear to all who are involved in technology education. Natural science is almost by definition focused on developing concepts that help us understand the natural phenomena around us. But it holds no less for theology, in which concepts like 'trinity', 'person', 'nature' are crucial for understanding claims about the relationship between God, the Father, the Son and the Holy Spirit and for understanding what it means to claim that Jesus Christ is God and man at the same time.

So the learning of concepts can not be something that would be in conflict with Cygnaeus' interests and thinking. So when today we reflect on how concept learning can get a proper place in technology education, we are not necessarily going against Cygnaeus. Much depends, however, on how we want to realize concept learning. If we do it in a very abstract way, we do move away from his ideals for education. In that respect he would probably disagree with a lot of science education practice. Although technology education is far away from that, the proper connection between learning theoretical concepts and the practical nature of technology education is still problematic. Here we can certainly learn from some new developments in science education, where there is now a trend towards a more concrete approach. In this paper I want to focus on one approach in particular, in which concept learning is combined with practical activities in concrete contexts.

The concept-context approach

One of the difficulties science educators encountered was the application of concepts to concrete situations. The experience is that, with difficulties, pupils can learn concepts through an abstract approach, but then they have great difficulties to apply them to practical situations. It appeared that they begin to work with two perceptions of the world: a school image and a street image, as one can call them. In the school image, they manipulate with formulas and numbers, but there is no connection with what they experience in daily life.

Therefore, a trend emerged to use practical situations, or contexts, to teach science concepts. The idea was that if pupils had learnt the concept in a context, they would be able to transfer the concept to other contexts. This, however, appeared not to be the case. Now the concept was so much attached to the context in which it had been learnt, that pupils had difficulties to get to a more generic, abstract level and apply the same concept to a different situation. So a next step was taken. Nowadays, science educators believe that the best way to learn concepts is to let students go through a variety of contexts, confront them with the presence of a concept in all these contexts, in each of which it has a particular meaning, and then gradually let them develop a more generic understanding of that concept. This approach is called the concept-context approach, and it was initiated in biology education in the Netherlands (Bulte, Westbroek, De Jong and Pilot 2006; Pilot and Bulte 2006), and has been adopted widely since then.

Concepts in technology

So far, so good for science education. But how about technology education? Here the situation is different in that we often do not even know what exactly our set of concepts is. We have been focused more on craft skills, and later in design skills, and the interest in getting to know what our equivalents of science concepts are is of a more recent time. Sure, we have some ideas. The use for the concept of 'systems' has been popular for some time already. Materials, energy and information are also concepts that certainly pervade the whole domain of technology. Particularly in former Eastern Germany some individuals have made interesting efforts to describe a coherent set of basic concepts in technology (Blandow 1995; Wolfgramm 1994). The philosophy of technology also can serve as a resource of inspiration for listing concepts in technology (De Vries 2005). More recently, the Standards for Technological Literacy in the USA (International Technology Education Association 2000) contain numerous concepts that play a role in technology. But apart from those, we only find scattered bits and pieces and there is no fixed set of technological concepts that the whole community of technology educators agrees on. Recently, an effort has been made to make a start with finding such a set. By means of a Delphi study, Rossouw, Hacker and De Vries (in press) were able to come up with a list of concepts (and possible sub-concepts) that had been generated by a group of experts in technology education, engineering education and the philosophy and history of technology. This list is presented in Table 1.

TABLE 1 Concepts in technology

Concept	Possible sub-concepts
Designing ('design as a verb')	Optimizing Trade-offs Specifications Inventing
Systems	Artefacts ('designs as a noun') Function Structure
Modeling	Abstraction Idealization
Resource	Materials Energy Information
Values	Sustainability Innovation Risk/failure Social interaction

The list of possible sub-concepts is by no means exhaustive. Also it should be remarked that for modeling no sub-concepts were generated in the Delphi study; these were added later by a panel of experts reflecting on the outcomes of the Delphi study.

Contexts in technology education

In the same Delphi study the experts were also asked to generate contexts they esteemed suitable for teaching the concepts, or at least a variety of concepts. The outcomes of that part of the study are presented in Table 2.

TABLE 2 Contexts in technology

Context	Possible practices
Shelter ('construction')	Building a hut in a tree
Artifacts with practical purposes ('production'/'manufacturing')	Using furniture at home
Mobility ('transportation')	Riding from home to school and vice versa
Communication	Using your mobile phone
Health ('biomedical technologies')	Going to the dentist
Food	Preparing a meal at home
Water	Using showers and toilets
Energy	Using energy at school
Safety	Safety regulations at school

Some remarks about the content of this Table need to be made. The contexts can all be understood in terms of basic human and social needs. In fact, some were originally phrased in more 'classical' terms (such as 'manufacturing' or 'construction', and these terms were added in the Table for clarity). The right column of the Table contains 'practices'. This term was used by the philosopher Alasdair MacIntyre to express his conviction that in ethics virtues can only be learnt in specific contexts. One can not just become a 'good man' ('good' in the ethical sense of the word), but a 'good engineer', or a 'good salesman'. He used the term 'practices' to indicate that each profession has its own set of activities that determine the nature of that profession. By doing those activities one learns how to behave ethically responsible. This idea of 'practices' was borrowed from this ethical theory by people developing the concept-context approach in education. When teaching a concept in a context, we have to find authentic practices that are recognizable for pupils and that ideally they themselves are involved in. This is closely related to what activity theory says (Van Aalsvoort 2004). It also brings us very close to Cygnaeus' ideas about education being practical and relevant for daily life.

Combining concepts and contexts in technology education

The next question is how to combine concepts with contexts. In principle one could draw a matrix with the concepts in the rows and the contexts in the columns and then identify activities in each of the cells that enable the learning of the particular concept in the particular context. The outcome of this would look like Table 3.

TABLE 3 Concepts and contexts

	A. Designing	B. Modelling	C. Systems	D. Resources	E. Values
1. Shelter	A1	B1	C1	D1	E1
2. Artefacts	A2	B2	C2	D2	E2
3. Mobility	A3	B3	C3	D3	E3
4. Communication	A4	B4	C4	D4	E4
5. Health	A5	B5	C5	D5	E5
6. Food	A6	B6	C6	D6	E6
7. Water	A7	B7	C7	D7	E7
8. Energy	A8	B8	C8	D8	E8
9. Safety	A9	B9	C9	D9	E9

In doing this, we have to look careful into the following issue: each of the concepts will get a specific meaning for each context in which it is applied (in other words: cognition is situated; see Hennessy 1993). Let us take the concept of systems again. This has a different meaning in the context of shelter and in the context of mobility, just to take two of the contexts. Architects will not often consider a house as a system in the sense that there is an input, a process and an output. But in transportation this is probably the first meaning of that concept. Formally the concepts are the same for all the contexts, but the practical meaning is different. Learning will occur through this practical and specific meaning and it is only by seeing the same concept in different contexts that the students will start to develop the more generic insight into this concept. So for each of the combinations of concepts and contexts one has to identify the specific meaning the concepts get in that specific context.

Filling each of the cells in the matrix would create a large a number of possible activities. Some structure needs to be added to that in order to get a decent curriculum. Two options seem to present themselves here. The first option can be called the thematic approach. In this approach one takes the contexts as a starting point. The curriculum will be structured according to the contexts and in each of the contexts the pupils learn a variety of concepts. That enables them to learn the connections between the concepts so that they will be able to draw a concept map, in which the whole set of concepts is presented in a coherent way.

The second possible approach is to work row-wise and take the concepts as a starting point for structuring the curriculum. This can be called a disciplinary approach. The headings in the curriculum structure will then be the concepts and each of the concepts is taught in a variety of contexts. This will enable pupils to see the connection between the use of the concept in one contexts and in the other and thus they will learn to transfer the concept from one context to another (for this, the term 're-contextualization' rather than 'transfer' is a suitable term).

For each of these options examples can be found in existing materials. Probably the most explicit example of a disciplinary approach is the book *The Man-Made World*, which was the outcome of the Engineering Concepts Curriculum Project at the Polytechnic Institute of Brooklyn. Here the chapter titles clearly represent a disciplinary approach: Decision Making, Optimization, Modeling, Systems, Patterns of Change, Feedback, Stability, Machines and Systems. A typical example of a thematic approach is the textbook *Technology Education: Learning by Design*, by Michael Hacker and David Burghardt. Here we see as chapter titles: Materials, manufacturing and construction, Communication and information Technology, Energy, power and transportation, Biological and chemical technology.

Combinations of a thematic and a disciplinary approach are also possible. In the Netherlands, I was involved in the development of course material for technology education in lower secondary education (Mes, Smeets and De Vries 1994). The title of the resulting books is: *Techno-logisch*, a name that hardly needs translation for an international audience. This course was written for two years of education. In the first year a disciplinary approach was used, with chapter titles like: materials, energy, information, transmissions, systems. For the second year we used a thematic approach with titles such as: construction, communication, transportation, production. The concepts that had been taught in the first year by using a variety of practical situations to illustrate them, re-appeared in the second year. Unfortunately, no research was ever done to find out if this combination of approaches worked, but for many years the course material was the market leader in the country. That, at least, gives the impression that the material was well received by teachers and pupils. The same combination was used by John Williams in his two coursebooks *Introducing Design and Technology* and *Design and Technology in Context*.

Towards a concept-context curriculum in technology education

The result of the Delphi study in terms of concepts was a list of basic concepts, but we do not have the exact content for those concepts yet.
Let us take, for instance the sub/concept of optimising. What is the content of that? We can say that the concept of optimising contains the following notions:

- there is an already *existing situation* (optimising assumes that we do not start from scratch);
- we can apply *variations* to that situation
- we can *compare* the new situation(s) and the previous one(s) in terms of *better/worse*;
- there is a points at which we have reached a '*best*' situation, at least for the time being (the 'optimum') at which we *terminate* the process of varying.

This can be done for all concepts and sub-concepts. Sometimes there are different options, such as in the case of systems:

- either we can conceptualise it as a coherent set of parts working together or
- we can conceptualise it as a transformation of input through a process to an output.

Both options are used in practice and they are compatible. As for the list of sub-concepts, it is useful to go back to the full list of concepts that were mentioned in the Delphi study to get a more extensive Table 1. For instance, it is definitely worthwhile to add 'heuristics' to the sub-concepts under designing (as a verb), because there is literature that suggests that it is important to engineering.

In a similar way we need to look further into the contexts. They, too, have not yet been operationalized in any way. To enable learning that is meaning for students and that allows for developing real responsibility and commitment, we need to search for practices of actions that are authentic for students. In Table 2 I have already given one example for each of the contexts. For instance, the broad context of mobility needs to be transformed into practices of actions that students are normally involved in and for which the concepts can have a value for better understanding and acting. An example of such a practice is: participating in traffic (e.g. biking from home to school and vice versa, or taking the bus to make those trips). For all the contexts such meaningful practices of actions need to be identified.

A question that needs to be addressed is this: do all practices need to be authentic? For instance, it may well be that imaginary situations of building shelter on the moon, which is certainly not an authentic context, as no student will ever be involved in that, still has significant advantage that justify its use in spite of the fact that it is not authentic.

Another step that is necessary is to define what progress is made through the curriculum in terms of concept learning. Different forms of progress can be identified:

- from more concrete to more abstract
- from simple to more complex (e.g., more sub-concepts)
- from qualitative to quantitative
- from little to more (cumulative progress)

The students will always start with some intuitive notion of the concept. These can be called 'pre-concepts' and they may sometimes contain misconceptions. In fact, we would have to know these before starting teaching because we have to address those in order to prevent that a proper notion will develop independent from the intuitive and perhaps incorrect notion (this is sometimes called 'street image' versus 'school image'). Students may, for instance, be able to make complex calculations in electrical circuits and yet believe that the current after a bulb is smaller than before. As for the proper concepts, the pre-concepts are probably also specific for each of the contexts and this, too, has to be taken into account.

Closing remarks

It is clear that there is still a long way to before we have realized a full curriculum that could really be called a concept-context curriculum for technology education. So far we have mostly focused on themes that could be of interest for pupils and we have developed all sorts of projects in those contexts. But no serious effort has yet been made to combine concepts and contexts in a systematic way and do that while taking into account the recent insights into concept learning. In my view it is a very promising approach and I hope one day Cygnaeus will again be honored with a presentation on the concept-context approach, but then a presentation presenting a full-blown concept-context curriculum for technology education.

REFERENCES

Aalsvoort, J. van. 2004. Activity theory as a tool to address the problem of chemistry's lack of relevance in secondary school chemical education. International Journal of Science Education, 26(13), 1635-1651.

Blandow, D. 1995. Elements of technology education (inaugural lecture). Eindhoven: Eindhoven University of Technology.

Bulte, A.M.W., Westbroek, H.B., De Jong, O & Pilot, A. 2006. A research approach to designing chemistry education using authentic practices as contexts. International Journal of Science Education, 28(9), 1063-1086.

Hacker, M. and Burghardt, D. 2004 Technology Education: Learning by Design. Upper Saddle River, NJ: Pearson Prentice Hall.

Hennessy, S. 1993. Situated cognition and cognitive apprenticeship: implications for classroom learning, Studies in Science Education 22, 1–41

International Technology Education Association 2000. Standards for Technological Literacy. Content for the Study of Technology. Reston, VA: ITEA.

Kananoja, T. 2005. Technology education in Finland. In Vries, M.J. de & Mottier, I. (Eds.) International Handbook for Technology Education : Reviewing the past twenty years. Rotterdam/Taipei : Sense Publishers, 437-448.

Kananoja, T. 2009. Technology education in general education in Finland. In Jones, A. & Vries, M.J. de (Eds.), International Handbook of Research and Development in Technology Education. Rotterdam/Taipei : Sense Publishers, 41-50.

Kantola, J., Nikkanen, P., Kari, J. & Kananoja, T. 1999. Through Education into the World of Work. Uno Cygnaeus, the Father of Technology Education. Jyväskylä: University of Jyväskylä.

Mes, P., Smeets, J. & Vries, M.J. de. 1994. Technologisch mhv. Techniek voor mavo/havo/vwo. (Technological. Technology education for lower secondary education, 2 volumes) Houten: Educaboek

Pilot, A. & Bulte, A.M.W. 2006. The use of "contexts" as a challenge for the chemistry curriculum: its successes and the need for further development and understanding. International Journal of Science Education, 28(9), 1087-1112.

Rossouw, A., Hacker, M. & Vries, M.J. de. (in press). Concepts and Contexts in Engineering and Technology Education: An International and Interdisciplinary Delphi Study. International Journal of Technology and Design Education.

Truxall, D. & Piel, E.J. (1971). The Man-Made World. New York: McGraw-Hill Book Company.

Vries, M.J. de. 2005. Teaching About Technology. An Introduction to the Philosophy of Technology for Non-Philosophers. Dordrecht: Springer.

Williams, J. 1994. Introducing Design and Technology. Melbourne: MacMillan Education.

Williams, J. 1994. Design and Technology in Context. Melbourne: MacMillan Education.

Wolffgramm, H. 1994. Allgemeine Techniklehre: Elemente, Strukturen und Gesetzmäßigkeiten; Einführung in die Denk- und Arbeitweisen einer allgemeinen Techniklehre, Band 1. Allgemeine Technologie. Hildesheim: Verlag Franzbecker.

Contents

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THE STATUS OF TECHNOLOGY EDUCATION IN THE UNITED STATES, 2010

Introduction

This paper is a report on the current status of technology education in the United States (U.S.). The main points that are discussed are: the recent decade of creating and implementing nationally-developed educational content standards including *Standards for Technological Literacy* (ITEA/ITEEA, 2000, 2002, 2007) in the U.S.; ITEA/Gallup Polls, Engineering by Design, the creation of a technology and engineering assessment as part of the National Assessment of Educational Progress (NAEP) for 2014; a movement towards incorporating technology and engineering education as part of STEM in grades PK-12; technology vs. technical; and positioning the study of technology within education in the U.S.

Evolution of educational standards in the United States

Nationally-developed educational standards in the United States have been produced that provide a better understanding of what every student should know and be able to do in order to become literate. The development and use of these educational standards have been instrumental in influencing the direction and progress of education at the national, state, and local levels. These nationally-developed standards began being released in the late 1980s and continued through the beginning of the 21st century. Educational standards evolved from and were a result of some discontent for the quality of public education in the U. S. The discontent began with a report from the National Commission on Excellence in Education formed by the U. S. Department of Education in the " A Nation at Risk" in 1983. In the late 1980s and 1990s, virtually every area of study in schools created national content standards for what all students should know and be able to do in their subject matter. There were two sets of nationally-developed standards in science and all the other subject areas completed one set of standards. Other school subject areas that were prominent in the national standards movement in the 1980's and 1990's were history, English/language arts, art, physical education, mathematics, and others. The mathematics standards were the first to be produced in 1989 by the National Council of Teachers of Mathematics (NCTM). After the NCTM standards were released, the American Association for the Advancement of Science (AAAS) created a set of standards for science titled, Project 2061 *Benchmarks for Science Literacy* (*BSL*). The second set of nationally-developed standards in science were produced by the National Research Council in its document, *National Science Education Standards* (*NSES*) (1996). Many other subject areas developed national standards in the 1990's and early 2000's. The International Technology Education Association received funding from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) to develop *Standards for Technological Literacy (STL)* from 1994 to 2005. Many states and local school districts used these nationally developed standards as a basis for developing their own state and local ones.

Standards for technological literacy: Content for the study of technology

ITEA, through its Technology for All Americans Project (TfAAP), produced a significant publication titled *Technology for All Americans; A Rationale and Structure for the Study of Technology (R&S)* from 1994 to 1996 (and completed a comprehensive revision of this document in 2006)(ITEA, 2006). The R & S document provided the research necessary to identify the content to be later used in the creation of STL standards.

Standards for technological literacy were developed by the International Technology Education Association (ITEA) from 1996 to 2000. These include *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) (2000/2002/2007), which established the content in a standards format for what every student should know and be able to do in order to be technologically literate.

The vision of *Standards for Technological Literacy* is that all students can and should become technologically literate. So what is technological literacy? ITEA defines it as one's ability to use, manage, evaluate, and understand technology. Technological Literacy can be viewed as furthering the study of technology, innovation, design, and engineering. Technological literacy is more of a capacity to understand the broader technological world rather than an ability to work with specific pieces of it (NAE & NRC, 2002, p. 22).

The standards and benchmarks in *STL* and the standards and guidelines in *AETL* were created with the following goals:

- They offer a common set of expectations of what students should learn in the study of technology.
- They are developmentally appropriate for all students in Grades K–12.

- They provide a basis for developing meaningful, relevant, and articulated curricula at the local, state, and provincial levels.
- They promote content connections with other fields of study in Grades K–12.
- They encourage active and experiential (hands-on) learning.

Some of the characteristics of *STL* are:

- There are five categories under which 20 standards are located:

The Nature of Technology (three standards)
Technology and Society (four standards)
Design (three standards)
Abilities for a Technological World (three standards)
The Designed World (seven standards)

- Under the 20 standards, there are approximately 290 benchmarks that provide further elaboration and detail to each of the standards.
- The benchmarks in *STL* are organized by grade cluster (K–2, 3–5, 6–8, and 9–12).

In addition to STL, *Advancing Excellence in Technological Literacy* (*AETL*) was developed by ITEA from 2000 to 2003. AETL has three major sets of standards within its organization that address: (1) student assessment standards, (2) professional development of teachers of technology standards, and (3) technology program standards.

TfAAP/ITEA next created four Addenda for STL and AETL from 2003 to 2005. These provide assistance for developing and implementing standards-based technology programs, student assessment, professional development, and curriculum. They feature practical suggestions and processes, multiple forms and worksheets, and concrete examples for implementing exemplary technology education programs and curriculum in grades K-12.

Anyone who wishes to read or preview the documents of STL, AETL, and the Addenda can view them in their entirety by going to the ITEA Webpage at www.iteea.org. As with any set of educational content standards, they should be continually updated and revised. There is currently some interest in doing this with STL to make it more inclusive of engineering as well as science and mathematics.

ITEA/Gallup polls

In 2001 and 2004, the International Technology Education Association (ITEA), in conjunction with the Gallup Organization of Princeton, New Jersey, conducted polls on "How Americans Think About Technology". In the 2001 survey, 1,000 telephone interviews were conducted of a national, general population sample of adult men and women, ages 18 and over. In the 2004 survey, the sample size was 800. The results from these two surveys are:

- In both polls, a majority of Americans (62% in 2004, 59% in 2001) responded that science and technology is basically one and the same thing.
- When asked in the 2001 poll how important it was for high school students to understand the relationship between science and technology, 98% stated that it was very or somewhat important.
- Most Americans (68% in 2004, 67% in 2001) view technology narrowly as being computers, electronics, and the Internet. This was the result of an open-ended question that was provided to the respondents in which they had to verbally tell the telephone interviewer what they thought technology was.
- There was near total consensus in both polls (98% in 2004, 97% in 2001) of the public sampled that schools should include the study of technology in their curriculum. The URL for the ITEA Gallup Poll is: <www.iteaconnect.org/TAA/PDFs/GallupPoll2004.pdf>.

As it has been documented in the ITEA Gallup Poll, there is mass confusion about what science and technology are in the United States. If this finding is true, then what is the best thinking of our time as to what science and technology are? This is presented in the next four paragraphs:

Science, which deals with and seeks the understanding of the natural world (NRC, 1996, p. 24), is the underpinning of technology. Rodger Bybee, Past-president of the Biological Sciences Curriculum Study (BSCS), explains more about science and technology.

> A lack of technological literacy is compounded by one prevalent misconception. When asked to define technology, most individuals reply with an archaic and most erroneous idea that technology is applied science. Although this definition of technology has a long standing in this country, it is well past time to establish a new understanding about technology. It is the interest of science, science education, and society to help students and all citizens develop a greater understanding and appreciation for some of the fundamental concepts and processes of technology and engineering. (2000, pp. 23–24)

Science is very concerned with what is (exists) in the natural world. Many of the courses in schools, colleges, and universities reflect this natural world inquiry. These courses deal with biology, chemistry, astronomy, geology, etc. Some of the processes that are used in science to seek out the meaning of the natural world are "inquiry," "discovering what is," "exploring," and using "the scientific methods."

Technology, on the other hand, is the modification of the natural world to meet human wants and needs (ITEA, 2000, p. 7). This definition is comparable with the definition provided in the *National Science Education Standards* which states, "The goal of technology is to make modifications in the world to meet human needs" (NRC, 1996, p. 24). Similar to these definitions, the American Association for the Advancement of Science (AAAS) *Benchmarks for Science Literacy* presents the following: "In the broadest sense, technology extends our abilities to change the world; to cut, shape, or put together materials; to move things from one place to the other; to reach further with our hands, voices, and senses" (1993, p. 41). In the National Academy of Engineering (NAE) and the National Research Council (NRC) publication, *Technically Speaking*, *Why All Americans Need to Know More About Technology,* technology is described as "…the process by which humans modify nature to meet their needs and wants" (2002, p. 2). All of these nationally recognized definitions of technology in the United States are very similar and reinforce each other. Technology is very concerned with what can and should be designed, made, and developed from the natural world materials and substances to satisfy human needs and wants. Some processes used in technology to alter and change the natural world are "invention," "innovation," "practical problem solving," and "design."

Engineering by design

The International Technology Education Association's Center to Advance the Teaching of Technology and Science (ITEA-CATTS) has developed the only standards-based national model for Grades K-12 that delivers technological literacy. The model, Engineering by Design™ (EbD), is built on *Standards for Technological Literacy* (ITEA); *Principles and Standards for School Mathematics* (NCTM); and *Project 2061, Benchmarks for Science Literacy* (AAAS).

Built on the constructivist model, students participating in the program learn concepts and principles in an authentic, problem-based environment. A network of teachers (EbD™ Network) has been selected to collaborate and conduct action research in order to better understand the complexities of student learning and to help all students succeed and be prepared for the global society in which they will grow up.

We live in a technological world. Living in the twenty-first century requires much more from every individual than a basic ability to read, write, and perform simple mathematics. Technology affects every aspect of our lives, from enabling citizens to perform routine tasks to requiring that they be able to make responsible, informed decisions that affect individuals, our society, and the environment.

The mission of Engineering by Design is that citizens of today must have a basic understanding of how technology affects their world and how they exist both within and around technology. Technological literacy is fundamentally important to all students. Technological processes have become so complex that communities and schools should collaborate to provide a quality technology program that prepares students for a changing technological world that is progressively more dependent on an informed, technologically literate citizenry.

The vision of Engineering by Design is that ITEA model technology programs are committed to providing technological study in facilities that are safe and facilitate creativity, enabling all students to meet local, state, and national technological literacy standards. Students are prepared to engage in additional technological study in the high school years and beyond. Students will be prepared with knowledge and abilities to help them become informed, successful citizens who are able to make sense of the world in which they live. The technology program also enables students to take advantage of the technological resources in their own community.

The National Assessment of Educational Progress for technological literacy

For the first time ever, technological literacy will be part of the National Assessment of Educational Progress (NAEP), also known as The Nation's Report Card™. The first step toward this unprecedented assessment was announced in 2008 by the National Assessment Governing Board, which awarded WestEd a contract to develop a NAEP Technology and Engineering Literacy Framework. Under this new contract, awarded after a competitive bidding process, WestEd – a national education research and development organization based in San Francisco – has recommend the framework and test specifications for the 2014 NAEP Technology and Engineering Literacy Assessment. Ultimately, this task will lead to ways to define and measure student's knowledge and skills in understanding important technological tools. Governing Board members decided the 8th grade level for implementation of this assessment.

The NAEP Technology and Engineering Literacy Assessment is the country's first nationwide assessment of student achievement in this area. The work comes at a time when there are no nationwide requirements or an accepted common definition for technological literacy. Few states have adopted separate tests in this area, even as more business representatives and policymakers voice concern about American student's abilities to compete in a global marketplace and keep up with quickly evolving technology.

Several groups assisted WestEd in this 18-month project, including the Council of Chief State School Officers, the International Technology and Engineering Educators Association, the International Society for Technology in Education, Partnership for 21st Century Skills, and the State Educational Technology Directors Association. With this assistance, WestEd convened two committees in 2008-10 that included technology experts, engineers, teachers, scientists, business representatives, state and local policymakers, and employers from across the country. The committees advised WestEd on the content and design of the assessment and made recommendations to the Board on the framework and specifications for the 2012 NAEP Technology and Engineering Literacy Assessment. In addition, hundreds of experts in various fields and the general public participated in hearings or provide reviews of the framework document as it is developed. Ultimately, the collaboration reflected the perspectives of a diverse array of individuals and groups. The Governing Board reviewed and approved the Technology and Engineering Literacy Framework in March, 2010.

Technology and engineering education

As demonstrated in the NAEP assessment, a new movement in education in the U.S. is the integration of the subjects of science, technology, engineering, and mathematics known as STEM. The "E" in STEM represents engineering while the "T" in STEM stands for technology. It is relevant to know that technology education (the study of technology) started about a century and one half ago through involvement with engineering in some major colleges in the U.S. Technology education has taught engineering drawing and engineering design for decades in the U.S. At least two states (Virginia and New York) created high school curricular that teaches engineering at grades 11-12 (ages 16-17).

If one accepts the similar definitions that "technology is the process by which humans modify nature to satisfy their wants and needs" (NAE, 2002) or "technology is the modification of the natural world to meet human needs and wants" (ITEA, 2000, 2002, 2007), then engineering must be determined to be a part of technology. The Accreditation Board for Engineering and Technology (ABET) defines engineering as: "the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind" (ABET, 2007).

In developing STL, the engineering profession was very involved. Dr. William Wulf, President of the National Academy of Engineering (NAE), served as a very active and influential member of ITEA's Technology for All Americans Project's Advisory Board. Dr. Wulf wrote the foreword in the STL document. The NAE provided a formal letter of support to STL when it was released in 2000. Additionally, the NAE and the NRC gave recommendations for members of a Technological Literacy Standards Review Committee that reviewed STL in its development. There was also a NAE Focus Group that guided STL throughout all of its eight drafts to ensure that the content was accurate and appropriate for K-12 schools in the U.S. This Focus Group was composed of some of the top engineers in America. In the last time period of developing STL (1999-2000), the NAE provided assistance in organizing a special panel of 17 engineers and others who gave detailed input into the content and organization of STL. Finally, a number of engineers were included in the review and validation of STL through public hearings, electronic document review, and by mail. In summary, the engineering profession was extensively involved in the process and product of STL.

There is a growing need for engineers in the U.S. (Clayton, 2005). Industry and business have more positions available for engineers than there are graduates emerging from universities. The increase of the number of graduates in engineering in China and India adds to concern about the production of engineers in the U.S. The need for engineers, as viewed by some people, provides an opportunity for expanding engineering education down into the public school curriculum in grades K-12 as a recruiting tool. As it has already been stated, technology education already teaches many basic engineering concepts in such programs as ITEA's Engineering by Design (EbD) and Project Lead the Way.

As with most things in life, there are at least two sides to every story. The inclusion of the study of engineering in grades K-12 schooling in the U.S. may create opportunities as well as cause problems. The concepts and content of engineering could be appropriate for only a few rather that be appealing and beneficial to all students. Additionally, change happens very slowly in education, so the acceptance of engineering as a subject matter along with other subjects such as the study of technology in the STEM integration process could be a major uncertainty. Another problem is the lack of coherence between technology education and engineering in schools (grades K-12).

In summary, there are opportunities as well as problems related to the "T' and "E" in STEM as being deliverers of needed and acceptable content alongside their partners of "S" and "M" in an integrated approach to education for all students in the future.

Technology vs. Technical

Technology education is still considered as part of general education in many states in the U.S. If one truly believes that a study of technology is so important that all students should be required to learn about and be able to do technology, then technology education should be a required subject for every student. This requirement includes those students going to college after high school graduation as well as those students going into career and technical education (previously called vocational education in the U. S.) jobs after graduation. Currently, in most states, this basic, core, or required education only includes language (reading and writing English), mathematics, science, and social studies (history). Technology education is an elective and is not a required subject matter in the majority of states.

There is confusion today in the U.S. between the terms "technology" and "technical". Many citizens believe that they are the same. Because of this confusion, technology education is often considered as being vocational education. This problem is further compounded when many technology educators say that they teach “tech Ed”. In this misunderstanding of words, does “tech” mean technology or technical?

Although technical education is being offered in some public high schools today, technical skills in the U.S. are mostly being taught at the community college level (2 years beyond high school graduation). Also, there are numerous privately owned technical training institutions that offer associate degrees or certificates in technical education.

Positioning the study of technology within education in the U.S.

Education in the U.S. is the responsibility of each state. Education is not a national responsibility although in the past decade “No Child Left Behind’ legislation has resulted in the federal (national) level assuming more responsibility for education. Each state has its own set of guidelines of what the study of technology includes within a given state. These guidelines include the level of support provided by the state to local (county, city, parish, etc.) school districts. In some cases, the level of support is 50% or more which makes education in that state primarily state controlled while in other states the level of funding from the state to local school districts is less than 50% making education a local responsibility. These state guidelines also include the responsibility of who develops standards as well as who maintains the philosophy for teaching and learning.

An effort has just begun in the U.S. to establish new national revised standards in science, mathematics and reading for the whole country. This is referred to as “Common Core State Standards” and it is supported by the National Governor’s Association and The Council of Chief State School Officers http://www.corestandards.org. Other new national subject matter standards will be developed and validated in the future. As was stated earlier in this paper, the first nationally developed standards were created in the 1980’s and 1990’s. They were designed to provide unified content for subject matter areas such as STL identified content for what should be taught and learned to be technologically literate in grades K-12 in America’s schools.

As was previously stated, the general public (ITEA/Gallup Poll, 2001 & 2004) as well as the U.S. Department of Education view technology from a narrow perspective, which includes information and computer technology (ICT), computers, media, or education technology. Technology education is not understood well by the general public and many people think that it prepares students to be only computer literate. ICT primarily deals with using technology or teaching “with” technology and it is not concerned with invention, innovation, design, or making that is included in a broader understanding of technology.

Technology education does not have the same status as mathematics and science in the U.S. schools today. Moreover, curriculum development for programs and courses in technology is no longer being developed at many of the local, state, or national levels of education in the U.S.

The number of teacher preparation colleges and universities continue to decline in numbers in the U.S with the average number of graduates being produced each year from 2004 to 2009 being 306 graduates (Moye, 2009). The latest research about the status of technology education in the U.S. shows that the number of technology teachers is declining and in 2008-09 there were approximately 28,310 technology teachers at the secondary school level in the U.S (Moye, 2009). There is no current accurate data on the number of students taking technology courses in America's schools today.

Summary

This paper presents a report on the current condition of technology education in the U.S. While many positive accomplishments have been made in the past, much more needs to be done in the future if the mission and goals of our profession are to be met. In many respects, the American public believes that the study of technology is needed in our schools now and in the future (ITEA/Gallup Poll, 2004). Unfortunately, what people believe and what happens as a result of this belief is not always the same. As a result, the study of technology in the U.S. faces an uncertain future.

REFERENCES

Accreditation Board for Engineering and Technology (2007-08). *Engineering Accreditation Criteria*, Baltimore, MD: Author.

AAAS. (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

Bybee, R. (2000). Achieving technological literacy: A national imperative. *The Technology Teacher*, *60*(1): 23–28.

Clayton, M. (2005). Does the US face and engineering gap? *The Christian Science Monitor*, December, 20, 2005.

ITEA. (2010). *Engineering by design*. Reston, VA: Author.

ITEA. (1996/2005). *Technology for all: A rationale and structure for the study of technology.* Reston, VA: Author.

ITEA. (2000/2002/2007). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

ITEA. (2003). *Advancing excellence in technological literacy: Student assessment, professional development, and program standards*. Reston, VA: Author.

Moye, J. J. (2009). *Technology education teacher supply and demand in the United States.* Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.

National Academy of Engineering (NAE), & National Research Council (NRC). (2002). *Technically speaking: Why all Americans need to know more about technology*. (G. Pearson & T. Young, Eds.). Washington, DC: National Academy Press.

National Commission on Excellence in Education. (1983). *A nation at risk*. Washington, DC: US Department of Education.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

National Research Council. (1996). *The national science education standards*. Washington, DC: National Academy Press.

Rose, L.C., & Dugger, W.E. (2001). ITEA/Gallup poll reveals what Americans think about technology. *The Technology Teacher*, *61*(6).

Rose, L.C., Gallup, A.M., Dugger, W.E., & Starkweather, K.N. (2004). The second installment of the ITEA/Gallup poll and what it reveals as to how Americans think about technology. *The Technology Teacher*, *64*(1).

Other URL's of Interest:

STL, AETL, Addenda, and Video about the ITEA Standards Publications—International Technology and Engineering Educators Association (ITEEA) (New name effective March, 2010): Webpage URL: www.iteea.org

NSES—National Research Council (NRC): www.nap.edu

BSL—American Association for the Advancement of Science (AAAS): www.aaas.org

Mathematics Standards --National Council of Teachers of Mathematics (NCTM): www.nctm.org

Accreditation Board for Engineering and Technology (ABET): www.abet.org

National Assessment of Educational Progress (NAEP): www.naeptech.org

Contents

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FINNISH TECHNOLOGICAL EDUCATION; HANDICRAFTS AND TECHNOLOGY EDUCATION FROM 1866 UP TO NOW

Finnish Education system

From about 1100's up to 1805 Finland was a part of Sweden. In 1805 – 1917 the country was under the Russian regime. Finland had an autonomous status, own Parliament and Government but Russian authorities to guard the Russian interests. Some of the Emperors, Czars, especially Alexander the 2nd, were, however, very positive for the small poor neighbouring country, understood the needs and actively organised our national development.

In 1866 Finland had the possibility to launch the national education system. In 1917 Finland became an independent country. Both the Swedish and the Russian systems left their marks on the culture, language, administration and people.

In the 1930s and especially from 1945 on, one of the duties of general education was to organise 'Education for Work'. At that time there was not enough vocational education institutes in the country and the folk school and especially its upper classes, Civic School (grades 7 – 9), were given also vocational aims.

In Finland every Primary School teacher gets the competence to teach handicrafts, up to now either Technical Work or Textile Work. Some teachers do today the basic course in the both two areas. For Junior Secondary schools the subject teacher education happens in Technical Work (Rauma Department under Turku University) and Textile Work (Helsinki and Joensuu Universities). In Vaasa (Åbo Akademi University) there are the same two institutions for the Swedish language schools.

In the following text I am talking also about myself – maybe too much… Sorry! However, I was the later colleague of early Uno Cygnaeus in handicrafts education and our experiences had some similarity… He was anyway the Chief for the whole school (1861 – 1888), I only for one subject (1971 – 91).

National Board of General Education

National Board of General Education was a government office under the Ministry of Education for 125 years (up to 1991). During that time the Chief

Inspectors supervised the schools and were responsible for writing the curricula, and so they also had to follow the global development in different subjects.

The first Chief Inspector was Uno Cygnaeus, the only one at that time. He was originally a priest who had worked for some years in St. Petersburg as the organiser and teacher of the Finnish school and then as a priest in Alaska in the Russian-American Company of Commerce. After returning to Finland Cygnaeus had the task to plan the Finnish Folk School. Because of that he made a large study tour (1858 – 59) to Europe in order to find out the contemporary education reforms. Most important findings he made in Germany and in Switzerland.

Actually the first school in the country to realize handicrafts education was Jyvaskyla Normal School, a demonstration folk school in the connection of the teacher training seminary. From that time on there has been same kind of demonstration schools in the connection of every teacher education department. These schools have their own legislation, higher salaries and smaller classes than the municipal schools. The becoming teachers do their teaching exercise in those schools. The lecturers and professors of the department work together with the demonstration school personnel and supervise the teaching practice.

Cygnaeus wrote the texts for the laws and decrees, organised teacher training, was responsible for founding the folk schools in the country, supervising them, etc. He organised teachers' in-service training courses and conferences in the summertime, where teachers and inspectors shared their experiences and were guided. Cygnaeus really worked hard but had also the opportunity to influence the whole folk school and all the teachers, and he was respected. His photo was hanging in every classroom like that of the President of the country. Later on Cygnaeus became the principal of Jyväskylä Seminary (1861 – 68).

As the handicrafts education pioneer Cygnaeus brought handicrafts to general education school as a subject for every pupil (Folk School Decree 1866). Also he launched as the first one two subject terms in general education; 'Slöjd' (Sloyd) (Allingbjerg 1983, 28), and Technology (Cygnaeus 1861). The previous word was Swedish, actually ancient Islandic in origin. Swedish was the language of administration and civilized Finnish people at that time. The latter concept Cygnaeus used like a prophecy, 'technology and art' ('Zeichnen und Technologie'), just close to the later British subject title Design and Technology. He proposed a job in Jyvaskyla teacher training seminary be 'Lecturer of Art and Technology' (Cygnaeus 1861).

There are quite many texts about Cygnaeus. E.g. professor Nurmi travelled the same tours in Europe and in Alaska in the 1990's than Cygnaeus did and wrote the life story of Cygnaeus (Nurmi 1987). Repeating the texts here is now not necessary.

See on Cygnaeus also at www.jyu.fi/tdk/museo/kasityo/kasityo.html

Comprehensive school system

In 1971 the Comprehensive School system was founded in Finland by amalgamating the parallel schools, on the other hand Folk School and Civic School and on the other hand the academic school. The curricula were re-written and large In-Service Training programs were organised for all teachers.

In my time as the Chief Inspector (1971 – 91) we had one colleague for each subject and quite many in general management, totally maybe about 50 – 60 supervisors. Today the number of Chief Inspectors has gone down.

After 1971 the duties of the chief inspectors began to change. Supervising and travelling from school to school diminished. Instead of inspecting tours the chief inspectors became more and more responsible for in-service training, writing the national curriculum and its guidelines, advisory services and material conditions of the schools. In 1971 also handicrafts education had new demands. The rapid changes and technological development of the society, production and environment gave new challenges. Teachers did not always necessarily realize or internalize them. General education also lost the vocational aims. Many redneck wood- and metalwork teachers blamed the chief inspector to be guilty for losing the subject status…

At the amalgamation of the school systems all the educators had to change their programs and behaviour. Chief inspectors organised in-service training for the regional advisors, who trained the municipal advisors, who trained the teachers. That system worked for about 10 years.

In 1971 the subject title 'boys' handicrafts' was replaced with 'technical handicrafts', just like 'girls' handicrafts' became 'textile handicrafts'. And in 1975 the subject title 'technical handicrafts' was changed in the upper comprehensive school to be 'technical work', like 'textile handicrafts' became 'textile work'.

The background of Technical Work was one of the problematic starting points in 1971 in my new work as the inspector, because the subject was supposed to be general education but, however, the close history of the subject was vocational. In the Comprehensive School handicrafts lost its status and most of the weekly civic school periods. That was, however, the government decision, not of the inspector…

My personal history…

I was actually involved with handicrafts (and technology) education in all three industrial development stages of the country, Pre Industrial, Industrial and Post Industrial. I saw these stages also at home – e.g. from horse and carriage to tractors and harvesters... Some of my father's competencies were those of farmer's, layman lawyer's and architect's and of skilful craftsman's and constructor's.

I worked as a Primary school teacher for 7 years, as Junior Secondary school woodwork teacher for 4 years and as the national supervisor, Chief Inspector, of 'Technical Work education' for 20 years at the National Board of General Education (under the Ministry of Education).

When I started my work as a folk school teacher in 1958 – 60; 1962 – 67, the pupils' handicraft projects were supposed to be copying the old models and working along the ready made drawings. Pupils' creativity was a totally unknown concept for the teachers. That was Pre industrial...

In 1966 – 67 I got training to become Junior Secondary School Woodwork teacher. In 1967 – 71 I worked as a woodwork teacher in Raisio, close to Turku.

In 1969 – 70 I already had the opportunity to work for the government. My temporary predecessor in the National Board invited me to found a group in our school to think the basics of the becoming technical work curriculum. Our group of three teachers gave to the Chief Inspector papers, which I had written when I was at the same time doing the teaching practice for the academic secondary school. It was a deal to do so. The temporary inspector wanted to check his draft curriculum, which he had translated mostly from Swedish. I had already in 1969 a study tour as a teacher to Sweden and Norway. In 1970 I also had a one month temporary inspector's supervision tour to the North of the country in order to see the situation in the schools. At that time I was already B. Ed, which was not very usual for a woodwork teacher.

In 1971 I had my Masters and became the Chief Inspector at The National Board of General Education. As the teacher I had thought the curriculum to be too vocational… I was maybe a rebellion… As well I was very much afraid of the big woodwork machinery because of my pupils' safety… I was very interested also of the handicraft practice in other countries and familiarized with the Nordic education, the Middle European ideas (Kerschensteiner, Gaudig, etc.), the British innovations (e.g. Georg Harrison), later on the American authorities (Delmar W. Olson), etc.

My work was administrative, curriculum writing, lecturing, In-service training, guiding the purchases of the schools and founding pilot projects for innovations. I actually never had time to practice or learn all the new subject things myself because of having a lot of other things to take care of… As well later on I understood and approved the new curriculum ideas of Control Technology, microchips, etc., adopted them in the curriculum and organised in-service training but never did them practically myself or had them as my hobby, etc. Pupils' creativity and new technology became anyway quite central in the subject development in my time.

There was plenty of interesting and important work to do for the subject development in the National Board from 1971 on. The office was responsible among other things for furnishing the schools, purchases of equipment, tools, furniture, textbooks and even handicraft materials. Workshop designs, catalogues, recommendations and orders for municipalities were written. Standards for workshop sizes, tools and machinery, criteria for purchases of materials and prices were created. 'Young persons' safety at work' was a new legislation in 1972. It caused also a lot of work. Pupils' safety became some kind of monopoly for technical work teachers, because my subject took care of it and technical work had the most dangerous circumstances in the school, the woodwork machinery. Later on some technical work teachers had the opportunity to have new jobs as municipal Work Safety Officials giving general advice for safety in the schools.

The new comprehensive school curriculum also had a need for textbooks. Already before I was nominated in the National Board I wrote with the wife a book on Art education and then two books on Textile Work education with her and the textile teacher of my school and had a Technical work book series in the pipeline with other colleagues. – All these books are just history now…

During the 20 years in administration I was on leave of absence a couple of times and was invited to work as the technical work teacher trainer for short periods as the lecturer and Associate Professor in Rauma Teacher education department under the University of Turku. Totally I was there about 2.5 years. Then I also worked in Zambia, Africa, as an invited Training Specialist for 1.5 years.

After these 20 years I retired from the government office and was invited again to be the Associate Professor for Didactics in Technical Work teacher training program in Rauma (1994 – 95) and then Associate Professor in Technology education in Oulu University (1995 – 98). In Oulu a new job was founded for me in 1995. A technology education specialisation program was started in Primary teachers' training program and I had worked there as a Docent (visiting professor) already from 1993 on.

When I came to work at the National Board I met a colleague, Sven Gladh, who told that he had written his Master's thesis on Uno Cygnaeus and it was published by the School History Society in 1968. I was naturally interested and got that book in my hands possibly from the writer himself. Later on Gladh became a regional school inspector in the South. In the same publication there was another article by Juhani Jussila on Cygnaeus. Jussila was later on the professor of education in Rovaniemi University. – I have translated both articles for the participants here. (I will try to check the language and have them published later on.) As well there are copies for all on the abstract of the life story of U.C. and two articles of mine…

On Cygnaeus I have been lecturing for the first time in Sweden at Nääs in 1990, where I was invited by e.g. Jochen Reincke. It was a German-Nordic conference on Otto Salomon. I compared Otto and Uno with each other. Later on I have written a paper about the pedagogy of Otto Salomon for a teacher trainers' conference in Helsinki University in 1995 (Kananoja 1995) and about the letters between Uno and Otto in a Conference in Jyväskylä University in 1999 (Kananoja 1999).

I haven't always been polite to the memory of Otto Salomon but tried to find out the truth. As much as I know now, Uno discovered and developed most of the things for handicrafts education on German ideas and Otto adopted these. Salomon was very skilful in disseminating ideas around the world in his training courses at Nääs. He has been called 'the father of handicrafts'. Actually it would be better be to call him as 'the father of Swedish Sloyd'.

In 1996 a nongovernmental organisation, Finnish Association for research in Technology Education, FATE was founded. The association was considered necessary in order to try to secure the future of the subject. Work of the association has mostly been organising international conferences and writing the home pages in the Internet for information and guidance for becoming researchers and teachers. These pages can be read at www.teknologiakasvatus.fi I have been the chairman of the association from the beginning on – but recently trying to retire more or less...

Technical Handicraft and/or Technical Work education was indeed an innovative subject in my time in 1971 – 91. I had the first modern research project on equal opportunities in handicrafts education from 1969 on. Because of that I organised writing of textbooks for both textile work and technical work with some friends. Later on I organised also 'technical or invention competitions for pupils' with the help of the teachers' association, used the term problem solving education in handicrafts as the first one in the country, brought design and computers in handicrafts, proper applications of creativity in handicrafts and began development aid project (for Zambia) in the school. As well the new contents and concepts like equal opportunities, safety at work, electronics in handicrafts, technology, control technology and entrepreneurship came in the curriculum, in the comprehensive school and to the National Board from me. Some of them were naturally the international mainstream of the subject. Teacher trainers and teachers adopted those things step by step. In the beginning there were sometimes difficulties. It is anyway natural when a certificated and experienced teacher has to change the working habits and technology quite many times in his older days and at the same time he loses a lot of weekly periods and in-service training is not always satisfactory.

Research on technical work (technology) education

The first national piece of research on new technical work education was my licentiate thesis (Kananoja 1975), which project I began in 1969. The effort was to try to find out, which kind of handicrafts organisation would be most productive in pupils' attitudes, dexterity, technical ability and creativity. One of the experimental models in the project was integration of technical work, textile work and art education according to the long term vision of the curriculum, which I was testing. The results were not promising for integration. The three subject teachers' associations agreed. With my research I anyway waked up my textile work colleague to study her Masters and start the research…

My research project was a unique effort. Later on I found an Austrian project, which had some ideas of the same kind (Zankl – Ziefuss about 1975-80). When I found that project I tried to make a replica of it with my students but failed because the culture in the University was different than before; the students did not anymore have the German language skills.

In my doctorate I changed my theme and wrote about developing technical work to technology education (Kananoja 1989). I also compared the curricula and textbooks in Finland, Soviet Union, GDR and FRG with each other. That piece of research was practically the last one in Finland on education in GDR, because the state did not exist after that any more… My doctorate was maybe also a little bit unexpected for the traditional handicrafts people with its emphasis on technology education. – It took 9 years before other efforts for doctorate were made in the area. Today, after 21 years from the first one, we have ten doctors on the development of Technical Work education. It is quite many in the country with a small population…

During my time as 'The Responsible One' I also opened the subject development doors for education science, to the foreign countries and international research. My teachers did not always like that but I had to do it because nobody else did. I also had the need to know what was happening in other countries. I never claimed that I had 'invented technology education' but told where to find it as the new stage of handicrafts education… – I also ordered my follower in the office to participate technology education conferences abroad, e.g. in Edinburgh in Scotland in 1990 and that started his personal internationalization development, which he unfortunately later on turned to business only... – When I left the office I also left most of my precious papers in my book self for my follower but unfortunately lost them – as well as the friend...

Sweden had been the first Nordic country realizing the Comprehensive school system, and it was important to see what was happening there. Soon I found out, however, that the Nordic idea of the discipline was not a satisfactory solution for future development for us. E.g. the Swedish curriculum had 'teknik' separately from handicrafts and it was a very engineering type of reproductive subject. According to the Nordic ideas technical handicrafts education should also be integrated with textile work and art and/or let to stay only on the traditional basic crafts ideas or Aesthetics. Integration would mean diminishing number of weekly periods. Limiting handicrafts curriculum on basic techniques only would also limit the approaches of 'education for work', prevocational, modern technical or technological ideas and contents. – In the other Nordic Countries technology was not included in handicrafts education. In Finland we already had 'motors and electricity' in technical work in the Civic school, and so it was easy and purposeful to adopt also electronics, computers and control technology like in the UK, US, Germany, etc.

I succeeded to keep up the status of the subject in the National Board and in the national curriculum. I also succeeded to avoid integration during my time as the Chief Inspector. Teachers and teacher associations of all three subjects agreed – at that time... The dreadful future vision was that integration would reduce the number of periods from the subjects and so lower the status of practical education. Nobody teaching the subjects naturally wanted that.

In about 20 years the Finnish comprehensive school system proved to be successful. So the government could begin to cut the administration costs. Instead of the National Board of General education and the National Board of Vocational education a new office, 'The National Board of Education' was founded in 1991. The new Board had a new working culture, did not anymore have representatives for every subject, e.g. none for technical work.

Discussion on technology education was not continued in the new office after 1991. Also nobody took any more care of organised and national development work of technology education in the context of technical work education.

In 2004 technology was written in the Finnish curriculum as 'thematic entities'. Little by little these have mostly been taken over by Science. Some new problems were also created in the same curriculum, when technical work and textile work were integrated and the title became again (historic) 'handicrafts' or 'crafts'.

The subject title in school as a brake or provider for development should also now provide discussion about the subject titles. Technology as a growing societal and economic power and cultural factor should be supported by versatile education, not least because of the dangers technology has brought in the environment but also as a new aspect of general education.

Situation now (2010)

The efforts to change the title 'handicrafts education' to be 'technology education' are not fully succeeded in Finland so far. In technical work the younger teachers have, however, been eager to work on electronics, computers and control technology. Misunderstandings, e.g. that technology education should teach industrial assembly line work in school (!) or that technology education should mean only modern technology or Computers or Physics Education, have been general, in some cases also intentional.

Technology as a 'thematic entity' should now according to the curriculum (2004) be handled in every grade and in every subject. That is problematic, because Technical Work education brought the idea of Technology Education idea as a practical approach in the Finnish curriculum discussion according to the models from the leading industrial countries of the world. The idea was to replace the old handicrafts education with a new term like it was done in the UK, US, etc. In Finland the mandate of technology education has now been transferred more or less on the responsibility of Maths and Science educators. These subjects also have very active, innovative and powerful subject associations… However, the aims of theses subjects are not doing technology, creativity, inventions, design, etc. like the modern handicraft and technology education aims are. One can only hope that the mathematical-scientific subjects will limit on their main tasks. Technology can anyway bring more colour and applications for those subjects if done properly.

- Today it seems that the lower comprehensive school pupils (grades 1 – 6) will be losing 50 % of the periods of technical work and the higher comprehensive pupils will lose majority of their 3 periods for the compulsory subject (grade 7) and a lot of the options (grades 8 – 9). – The technical work teachers' association has focused on the junior secondary teachers and has not taken care of primary teachers or whole curriculum development. As well there was no one anymore at the National Board after 1991 to take care of the resources for technical work education.

- Entrepreneurial education was also launched in technical work guidance at first time in curricular texts in 1976 in Finland. Later on an EU project was working on that collaboration (Santakallio 1997). Also Jyvaskyla University published a report on it (Parikka 1997). Nothing else has, unfortunately, been done for that collaboration after these efforts in our subject. Today there is a new interest for it born within Commercial education…
- There have been some regional efforts to keep up technology education. Jyvaskyla University teacher education department has done a lot in a project for technology education. Near to Oulu, in Ylivieska city there is a training centre called 'TEKNOKAS' organising in-service training in technology education.

Finland has made good results in the OECD international education research, PISA. I am happy for having been the member in education administration at that time when the basis for the good results was created. Actually the reasons for the good results might be many:

1 Finland is quite a small country and to make total reforms is more easy, cheap and quick than in many other countries.
2 From the beginning on (1866) we have had many modern efforts in education and policies including the early ideas of 'Education for All' and 'Equal opportunities'.
3 The Finnish School was never under the total power of the church.
4 The Finnish national human character usually tries 'to do better than before'.
5 The foreign education models have been selected and followed carefully, not blindly.
6 The Comprehensive school system may have started at the right time.
7 All the teachers have done Masters in Education from the 1980s on. So they know how to apply research. If they do not apply it, they know that they should not resist doing it…
8 Finland is more or less outside the international mainstreams and problems caused by globalisation. There are opportunities to develop education systematically in peace. The schools still are more national and homogenous than multinational.

Possible future development of technological education in Finland

Curricula are reformed at about 5 – 8 years intervals. Writing will take 1 – 2 years. The last curriculum was published in 2004.

For the future there are ideas to amalgamate the both sub areas of handicrafts in schools and naturally also in teacher education. Especially in teacher education the total integration will be difficult because of the traditional school subject images, aims and contents the sub areas have and even of the length of the studies.

Just now, in 2010, the new Period Allocation Proposal has been published and the new curriculum will soon be in the pipeline. The new proposal means a catastrophe for technical work education. In the previous curriculum the number of periods at the 7th grade for obligatory technical and textile work were 3. During that the pupils got practical experiences for making the options for grades 8. – 9. There was also a short 'change period' from technical work or textile work to the other one in order to give practical information what the options would consist of in the other subject area. The new period allocation proposes only 1 obligatory period for the 7th grade in integrated handicrafts, which will be ½ of a weekly period for technical work per year! During that it is really not possible to familiarize anymore with the subject for the options. – That problem is mostly caused by the equal opportunities –interested pressure groups. Now there are reasons to start a fight for equal opportunities for boys…

The equal opportunities movement is a problem for teacher education departments also. At the moment we only have two institutions to certificate technical work teachers. For textile work teachers we have three institutions. Also the figures for intakes are problematic at the moment compared with the needs for new teachers in the both handicrafts areas….

At the moment all the government institutions are forced to cut expenses. Also in handicraft teacher education there might be some cuts because of the integration of the two handicraft subjects. How to manage the essential skill education in two subjects in the same number of years is one of the problems... – That problem exists, unfortunately, because there was actually no reasonable central development in technical work from 1991 on. As well the Rauma department never was active for the future … Helsinki and Vaasa textile work – like Rauma – have been dedicated for emancipation for the old Nordic Sloyd…

We talk about technology education, and most of the practical technology learning projects seem to count only on computers and control technology. They are also fun to do in school work. Teachers and kids love making nice, whirling, colourful and noisy electronic gadgets on the former woodwork benches in the machine shop. No Problem! They are motivating and important! But do they lead to some new important skills? – Technology education as such also needs careful new visionary thinking and not only forgetting all the Good Old Contents. The older skills are still needed, e.g. how to construct or renovate a house, how to warm the home today, how to take care of the sewerage in modern ecology, how to develop the energy technology, etc. Many of these things belong of course to vocational education. However, the seeds are sown in general education schools. The role of prevocational education seems also to have disappeared. It is unfortunately not discussed and paid the appropriate attention to anymore.

Finally… It is natural that the retired people will disappear and their life long work is history at some stage. So, I am both happy but also a little bit disappointed with my career as the subject innovator, the chief inspector, the starter of the academic handicrafts…

Happy? Quite many of my ideas became true… What I proposed or wrote or represented was not always fully realized in my subject area. Quite much of it happened, however, with positive results. I had plenty of freedom and opportunities to realize The Important Ideas. Some of the Good Friends and colleagues are still here… It has been fine and funny so see how also the ideas are still living, however… As well I am happy for the continuity of research in the subject.

Disappointed? Thinking Research and Development, it has been a little bit problematic to find out some of the wheels being re-invented. There should still be many new and original ideas to find out and to do in the world – also in practical education…! In those 'wheels' I also include some business- or career-oriented former friends who were amazingly ready to forget the support they got...

As well the unnecessary pressures in the competition of the subject development and for the subject mandates were something I never imagined to have to experience.

Most problematic stress sources I sometimes got from some ignorant teachers and Sloyd colleagues who did not follow the global development and were not aware of the national development needs. Sometimes they also tried to get rid of the Chief Inspector …

Usually the development of education systems is slow – for some people slower than for the other ones... However, for the Innovator it is not always nice to have to flee – just like a political refugee – from some institutions in order to let the people mature and discover the development ideas later on themselves…

REFERENCES

Allingbjerg, C. 1983. Slöjd I Danmark 1883-1983. Aarhuus: Dansk skoleslöjds forlag.
Cygnaeus, U. 1861. Letter the 14th of June 1861 to the director of the Seminary of Wettingen, Switzerland.
Kananoja, T. 1987. The influence of different kinds of organisation and contents of teaching technical and textile work on pupils' dexterity, creativity and attitudes. Turku University 1975; 1980. Litentiate thesis. English summary. In: Coenen - van den Bergh, R. (Ed.) Report PATT-conference 1987. vol. 2. Contributions, 286 – 318.
Kananoja, T. 1989. Work. Skill and technology: About activity education and education for work in general education. Doctoral Thesis. English summary. Annales Universitatis Turkuensis Ser. C 72, 365 – 393.
Kananoja, T. 1990. Uno Cygnaeus – Vater der Finnischen Volksschule und seine Ideen zur Slöjd-Pedagogik. In: Oberliesen, R. u.a. (Hrsg.) Sonnenberg Internationale Berichte zur Geschichte von Arbeit und Technik im Unterricht. Braunschweig: Sonnenberg, 125 – 140.
Kananoja, T. (Chairman & secretary). 1991. Memo on Technology education. The National Board of General Education.
Kananoja, T. 1992. PATT: Finland – Zambia. In: Bame, A.B., Dugger W.E.Jr. (Ed.) ITEA-PATT International Conference October 15-18, 1992, Reston, Virginia, 295-311.
Kananoja, T. 1995. Otto Salomonin periaatteet käsityönopetuksen kehittämisen lähtökohtina – taito- vai taidekäsityö? Teoksessa Tella, S. (Toim.) Juuret ja arvot. Ainedidaktiikan symposiumi Helsingissä 3.2.1995. 329 – 344.
Kananoja, T. 1998. Testament in Oulu.
Nurmi, V. 1987. Uno Cygnaeus. Suomalainen koulumies ja kasvattaja. Helsinki: Valtion painatuskeskus ja Kouluhallitus (In Finnish).
Nurmi, V. 1987. Uno Cygnaeus. A Fnnish educator and educationist. Summary. Helsinki: National Board of General Education.
Parikka, M. 1987. (Ed.) Kasvu yrittäjyyteen (Growth into Entrepreneurship.) Department of teacher education. The Principles and Practice of Teaching 27. (in Finnish)
Santakallio E. 1977. Perspectives on the development of entrepreneurship and technological education in Finland. Series B Educational materials and reviews 9. University of Oulu. Publications of the department of teacher education Kajaani.

Fate publications (See also: www.teknologiakasvatus.fi**)**

Kananoja, T. (ed.) 1997. Seminars on technology education. Oulun yliopiston kasvatustieteiden tiedekunnan opetusmonisteita ja selosteita 69/1997

(Papers of Alamäki, Dugger, Dugger and Eldon, Hulshbosch, Kananoja, Lindh, Luukkonen, de Vries, Welty). (In English)

Kananoja, T., Tiusanen, T., Sahlberg, P. (ed.) 1992. Technology Education Conference: From Nordic to Global Models. Heinola 11.-17.10.1991. National Board of Education, Heinola Course Centre and FINISTE. (Papers of Arvidsson, Barbafiera, Blandow, Broge, Dugger, Dyrenfurth, Ehrnborg, Ferreyra (Unesco), Frazer, Harvey, Kananoja and Tiusanen, Kolehmainen, Novakova, Panotis (Unesco), Reincke, Rihvk and Varik, Sahlberg, Schneidewind, Sjögren, Szũsz, van der Velde, Ziefuss.) (In English)

Kananoja, T., Kari, J., Parikka, M. (ed.) 1997. Teknologiakasvatuksen tulevaisuuden näköaloja. Jyväskylän yliopisto. Opettajankoulutuslaitos. Opetuksen perusteita ja käytäntöjä 30/1997. (Papers of Järvinen, Kananoja, Kari and Nöjd, Kolehmainen, Lindh, Parikka, Santakallio, Suomala). (In Finnish)

Kananoja, T., Kari, J., Parikka, M. (ed.) 1997. Kananoja, T., Kari, J., Parikka, M. (ed.) Teknologiakasvatuksen käytäntöjä. Oulun yliopiston kasvatustieteiden tiedekunnan opetusmonisteita ja selosteita 74/1997. (Papers of Alamäki, Hamm, Kananoja, Myllymäki and Rukajärvi-Saarela, Raiskio and Kurjanen and Saari, Rissanen). (In Finnish)

Kananoja, T., Kantola, J., Issakainen, M. (ed.) 1998. Development of technology education –conference –98. Jyväskylän yliopisto. Opettajankoulutuslaitos. Opetuksen perusteita ja käytänteitä 33/1998. (Papers of Alamäki, Apaolaza, Autio, Benson, Ginestíe and Brandt-Pomares, Broge, Brush, Hansen, Herrera, Hill and Lutherdt, Hämynen, Järvinen and Twyford, Kananoja, Kantola, Kiss and Bohdaneczky and Bun, Lizano, Luukkonen, Parikka and Rasinen, Pikkarainen, Pulkkinen, Reincke, Santakallio, Sarjala, Saxton, Thorsteinsson, de Vries, Yokoyama). (In English)

Kananoja, Kantola, Liuha, Rasinen. Translation of the ’Standards for technological literacy’.2000. Original publisher International Technology Education Association, ITEA. (The translation in Finnish is in the Internet under the title ’Teknologisen perussivistyksen standardit’ at the home page of FATE (www.teknologiakasvatus.fi.->Tekstejä) (In Finnish)

Kananoja, T., & al. 2000. Technological education in general education schools in Finland. FACTE. Helsinki: Edita. (In English)

Kananoja T., & al. 2000. Technology education in general education schools in other countries. FACTE. Helsinki: Edita. (In English)

Kantola, J., Nikkanen, P., Kari, J., Kananoja, T. (Ed.) 1999. Kasvatus työn kautta työhön. Teknologiakasvatuksen isä Uno Cygnaeus. Koulutuksen tutkimuslaitos. (In Finnish)

Kantola, J., Nikkanen, P., Kari, J., Kananoja, T. (ed.) 1999. Through education into the world of work. Uno Cygnaeus, the Father of Technology Education. Institute for Educational Research. University of Jyväskylä. (Previous publication in English)

Kantola, J., Kananoja, T. 2002. (ed.) Looking at the future: technical work in the context of technology education. University of Jyväskylä. Department of Teacher Education. Research 76. (In English)

Kantola, J., Kananoja, T. 76/2002. (ed.) (Papers of Davies, Dugger, Järvinen, Kananoja, Kantola, Lehtonen, Lindfors, Lindh, Liuha, Migounov and Petryakov, Parikka, Peltonen, Rasinen, Soobik). (In English)

TEKA. Papers from Helsinki and Lahti conferences. 2003. See: www.teknologiakasvatus.fi Papers are at FATE home pages as 'Papers from Helsinki and Lahti conferences' (Alajääski, Autio, Hast, Hirvonen, Kananoja, Kantola and Rasinen, Kemppinen and Ketamo, Lehtonen, Parikka, Raulamo). (In English)

TEKA. Papers from Turku conference. 29.10. – 01.11.2004. See: www.teknologiakasvatus.fi Papers are at FATE home pages as 'Turku conference papers' (Dakers and Dow, Dugger, Kananoja, Kantola and Nikkanen, Komarov, Lvov, Middleton, Migunov and Petryakov, Parikka and Ojala, Pavlova, Rasinen, Soobik, de Vries). (In English)

Doctoral dissertations of technical work education

Alamäki A. 1999. How to Educate Students for a Technological Future: Technology Education in Early Childhood and Primary Education. Doctoral Dissertation. Annales Universitatis Turkuensis B 233. Turku University. ISBN 951-29-1553-7

Järvinen, E.-M. 2001. Education about and through technology. In search of more appropriate pedagogical approaches to technology education. Doctoral Dissertation. Faculty of Education. University of Oulu. Acta Universitatis Ouluensis. Scientiae Rerum Socialium. E 50. Oulu.ISBN 951-42-6486-X

Kananoja, T. 1989. Work, skill and technology: About activity education and education for work in general education. Doctoral dissertation. Annales Universitatis Turkuensis C 72. (In Finnish) ISBN 951-880-232-7. (In Finnish)

Kananoja, T. 1989. Work skill and technology. About activity education and education for work in general education. Doctoral dissertation. English abstract. Institute of Education. University of Turku. B 29. Turku.

Kankare, P. 1997. Realization context of technological literacy in comprehensive school technical work education. Doctoral dissertation. Annales Universitatis Turkuensis 139. (In Finnish) ISBN 951-29-1090-X

Kantola, J. 1997. In the footsteps of Cygnaeus from handicrafts education to technology education. Doctoral dissertation. Jyväskylä studies in education, psychology and social research 133. (In Finnish) ISBN 951-39-0015-5

Metsärinne, M. 2003. Sloyd vision Teaching and Learning. Case and action research on the 9th Class. Doctoral Dissertation. Annales Universitatis Turkuensis. C 198. (In Finnish) Turku. ISBN 951-29-2348-3

Parikka, M. 1998. Technology Competence. Challenges for reforming technology education in comprehensive and upper secondary schools. Doctoral dissertation. Jyväskylä studies in education, psychology and social research 141. (In Finnish) ISBN 951-39-0265-X

Rasinen, A. 2000. Developing Technology Education. In Search of Curriculum Elements for Finnish General Education Schools. Doctoral dissertation. Jyväskylä studies in education, psychology and social research 171. Jyväskylä. ISBN 951-39-0840-2

Suomala, J. 1999. Students' problem Solving in the LEGO/logo Learning Environment. Doctoral Dissertation. Jyväskylä Studies in Education, Psychology and Social Research 152. Jyväskylä.

Contents

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INTERNATIONAL COOPERATION IN INDUSTRIAL TECHNOLOGY EDUCATION

Abstract

The Aichi University of Education has been making a remarkable contribution to the development of industrial technology education for developing countries by many activities. In this background, there are advantages of being located in one of the most active industrial areas in Japan and the Technology Education Department is playing a positive role.

The activities mentioned above are as follows. The training course of industrial technology education was implemented with the cooperation of JICA from 1999. The International cooperation symposiums were hosted by the university with the JICA training courses in 2003 and 2008. International Forum on "Making Things and Education" project was done at the World Exposition 2005 in Aichi. International Cooperative Initiative Project in the Ministry of Education, Culture, Sports, Science and Technology has done with the theme of "Model Creation of Core Curriculum Sharing System to Support the Industrial Technology Education in Developing Countries" which lasted for three years from 2007 to 2009.

In addition to these matters, the industrial technology educations in the United States of America and Finland were discussed. The former is the advanced country which leads the world in high-technology industry. The later, on the other hand, is the country with traditional technology which has created the industrial technology education in school education firstly in the world.

Introduction

Looking at the history of the Aichi University of Education, it was first established in 1873 as the Aichi Prefecture Training School, changing to the Aichi Teachers' College in 1949, then to the Aichi University of Education in 1966 and finally to the National University Corporation Aichi University of Education in 2004. Throughout its history, the university has made continuing contributions to the educational community of the region by turning out a large number of capable teachers. Against this background, the University has a mission to make its physical resources such as libraries, facilities and equipment as well as its human resources available beyond Aichi Prefecture all over Japan and throughout the world. As part of these efforts, the Technology Education Department takes a leadership role in various programs for participants in Japan and abroad.

Below, we'll introduce the efforts of the Technology Education Department during the past ten years or so, especially those concerning international cooperation, namely JICA (Japan International Cooperation Agency) training, International cooperation symposiums, International forums and International cooperation initiatives.

JICA Training

Background and objectives

For the development of an industrial-technology society based on manufacturing/production, it is essential to enhance the industrial technology education that forms its foundation. In recent years, our industrial technology education has gained momentum as Japan's industrial-technology society was energized with the advance of sophisticated technologies and informatization. Likewise, in developing countries, the enhancement of the industrial technology education in particular, will promote not only the country's industrial technology, but also economic activities in general, which will lead to richer and more stable lifestyles for the people. This training is implemented through an industry-government-academia cooperation led by the Ministry of Education, Culture, Sports, Science and Technology. JICA and the Aichi University of Education which is renowned in the field of industrial technology education, work together in carrying out training aimed at the promotion and reinforcement of an industrial-technology society centered on industrial technology education, maximizing the features of the Tokai Area that has one of the best industrial and commercial zones in Japan. Namely, the training is focused on Japan's methods and systems concerning the promotion and enrichment of the industrial technology education, aiming to contribute to human resource development in the relevant fields of the participants' countries.

The Year of Establishment and Development

In 1998, an application was made with the Ministry of Education, Culture, Sports, Science and Technology (the Education Ministry at the time) to set up a group training course: "Industrial Technology Education" as an international cooperation program of JICA. Later, the program was approved by the Foreign

Ministry and JICA. It was then started under the jurisdiction of the Chubu International Center and has been implemented 12 times in succession up to 2010.

The course created in 1999 was improved with regard to content and methodology with the first phase completed in fiscal 2003. In 2004, the curriculum, etc. was improved with the commencement of "Industrial Technology Education II," and the second phase was completed in fiscal 2008. In 2009, the course name was again changed to "Industrial Technology Education" and the second session of the third phase was implemented from June 8 to July 16 of this year.

International Cooperation Symposium

The First International Symposium on Educational Cooperation for Industrial Technology Education (held in July 2003)

With the remarkable progress of industrial technology in the 20th century, the great advances in informatization and internationalization have greatly changed our life. In this environment, we should ensure that a rich and stable life is possible for everyone in every country on the globe in the 21st century. In order to accomplish this, it is essential to develop and establish an industrial-technology society in each country. Therefore, it is important to enrich industrial technology education as the basis for an industrial-technology society.

With this aspiration, the Aichi University of Education implemented the "Industrial Technology Education" course, JICA group training, during the period from 1999 to 2003. In 2003, the fifth year of the training, the university held an International Symposium on Educational Cooperation to cap the efforts made through the industrial technology education training course during these years. The major purpose included the presentation of various challenges concerning "Making Things and Human Resource development" that were the very basis of the industrial technology education of each country, in order to achieve mutual understanding and sharing, and to help with problem solving in industrial technology education in each country by introducing actual efforts and results to solve these challenges in each country from various perspectives.

The symposium was operated by the Executive Committee of the International Relations Committee of the International Symposium on Educational Cooperation for Industrial Technology Education consisting of the expert members of the International Relations Committee of the Japan Society of Technology Education which is the supporting organization, and the academic staff in charge of the technological education courses of the Aichi University of Education. Two days of the symposium included keynote speeches (the Ministry of Education, Culture, Sports, Science and Technology and ITEA), Panel Discussion I, International Information Exchange, Panel Discussion II and Commemorative Lectures (by PTC and JICA).

Participants of the Symposium were 180 in total including 40 participants from 20 foreign countries in Africa, Asia, Europe, the Middle East and North and South America.

The Second International Symposium on Educational Cooperation for Industrial Technology Education (held in July 2008)

The First Symposium was held to cap the achievements of JICA training during the five years from 1999 to 2003. After the Symposium, the training was implemented for five more consecutive years, and in 2008, the 10 year of the training, the Second International Symposium on Educational Cooperation was held to cap the achievements of the course during these 10 years. The objective of the symposium held under the title of “Human Resource Development for Making Things” was to contribute to the solution of industrial technology education problems in the participants’ own country through the opportunity to present, understand and share various problems and introduce actual efforts to solve problems in their countries and the results of these efforts.

This symposium was held for three days from July 4 to 6 of 2008 also under the leadership of the industrial technology course of the Aichi University of Education with cooperation of a number of supporting and co-hosting organizations.

International Forums

Holding of an international forum in "Making Things and Education" Project at The World Exposition 2005 in Aichi

Japan World Exposition 2005 (Aichi Expo, also called “Ai-chikyuhaku” which means “Love the Earth Expo”) was held at Seto and Nagakute on the eastern hills of Nagoya for 185 days from March 25 (Fri.) to September 25 (Sunday), 2005. The World Exposition was held in Japan 35 years since the Osaka Expo of 1970 with participation from about 121 countries and four organizations, and attracted about 22 million visitors, greatly exceeding expectations of 18 million.

The Aichi Expo was organized under the theme of “Nature’s Wisdom” with the aim of creating a new culture and civilization. Considering that Aichi Prefecture is one of the best manufacturing regions in Japan and the Aichi University of Education is involved in education and education research, the university planned "Making Things and Education" events and staged them as citizens’ projects under the titles of “Dialogue with Nature,” “Gain Hands on Experience of Modern Techniques” and “Exchanges with People of the World.”

Concrete content

The Aichi University of Education staged the "Making Things and Education" events as Aichi Expo project with cooperation of the institutions concerned, organizations, companies, interested persons outside of the university, university officials/faculties, etc. for seven days from July 25 (Mon) to 31 (Sun), 2005. The project included making-thing workshops using forest thinned wood, metal that melts at low temperature and LED; a making-things contest using CAD software/forest thinned wood, and; a making-things international forum with participants from around the world, particularly Asia. The successful events offered numerous suggestions for the future “Making Things and Education.”

International Cooperative Initiative

The Aichi University of Education was chosen for the International Cooperative Initiative of the Office for Planning of International Policies, International Affairs Division, Minister's Secretariat of the Ministry of Education, Culture, Sports, Science and Technology, for three years from 2007 to 2009 (http://www.scp.mext.go.jp/). The theme was Model Creation of Core Curriculum Sharing System to Support the Industrial Technology Education in Developing Countries. The following is its description in detail.

The First Year (Fiscal 2007)

Overview

Core curriculums were developed in accordance with the requests of individual countries by compiling and organizing the accumulated textbooks, materials, etc., of the “Industrial Technology Education” group training course for JICA, the “Education Curriculum Development” courses set-up especially for each country, and the “School Education Improvement” and “Industrial Education” courses. A field survey was carried out in Malaysia to check the effectiveness of the individual curriculums in the developing countries. Contents were added and expanded and core curriculum reorganized as needed.

A model system was built so that Japan could provide core curriculums to support the industrial technology education of individual countries. Curriculums are mainly aimed at about 40 countries that have sent trainees but can be offered to other countries as well.

The Second Year (Fiscal 2008)

Overview

In the first year, courseware, core curriculums, etc. for "Technical Education" and "Industrial Education" as well as textbooks for teacher training were developed according to the needs of individual countries. In the second year, core curriculums were developed as an example of courseware for specialized technical education that is in the greatest demand in the field of industrial technology education. Example textbooks were also developed. To check whether these deliverables were useful in developing countries, a field survey was conducted in Kenya and the Philippines alongside with a questionnaire survey for many other countries. Then there were the review of the core curriculum and the educational grades, the addition and expansion of the contents and the development of deliverables that were applicable according to the developmental stage of the industrial technology of the country.

The Third Year (Fiscal 2009)

Overview

In the previous year, core curriculums were developed for industrial technology basics that are the basis of specialized technical education in the greatest demand among industrial technology education, and a textbook "Industrial Technology Basis" was compiled. Industrial technology has both aspects of knowledge and skill. As the textbook "Industrial Technology Basis" had been created to cover theoretical aspects, this year there were the development of core curriculums, the compilation of its content contents and creation of an evaluation sheet to cover the skill aspects. The effectiveness in developing countries were also checked through verification efforts including PR activities and a workshop at the Colombo Plan Staff College that was actively involved in industrial technology education. At the same time, verification was also carried out through a questionnaire survey of a large number of countries. The result was reflected in the core curriculum and contents to complete deliverables applicable according to the developmental stage of the industrial technology of each country.

Future Challenges and Outlook

Learning from the United States

In the United States, just like in Japan, contents and methods of school education have been actively explored in response to the progress of science and technology, the development of information/global society, environmental and other issues. As technology education is deeply involved, efforts to respond to the new era are even more assiduous in this field.

Looking at the history of technology education in the United States, Industrial Arts Education was conducted as general education already in the early 1900s, which served as a reference for Japan after the Second World War. Later in the 1960s, the Sputnik Shock in the United States led to the transformation of educational content based on several new proposals. Industrial Arts Education was changed to Technology Education in 1985 and the new name has been used in many schools. ITEA (International Technology Education Association), a leading organization in industrial technology in the United States, changed its name to ITEEA (International Technology and Engineering Educators Association) in March 2010. ITEA actively enhanced its relationship with academic societies involved in engineering including ASEE (the American Society for Engineering Education) as well as that with NASA (the National Aeronautics and Space Administration) and NSF (National Science Foundation). This way, industrial technology has evolved keeping a close linkage with various organizations/institutions in an effort to stay at the forefront of emerging technology. Although it is not relevant to directly compare the historical development and current state of the industrial technology in the United States with that of Japan, there are the commonalities and differences as shown in the terms used in industrial technology. At least it can be said that both have been trying to develop the industrial technology for the next generation. In the global community in the future, it is necessary that all countries share this idea and lay a foundation for the appreciation of industrial technology.

Learning from Finland

The discussion has been carried out regarding the countries that have introduced technology education or undertaken its improvement/reform, including the United States of America, which is actively promoting technology education. Finland which was the first country to incorporate the technology education into the school education in the Middle of 19th Century. Finland was occupied by Sweden for about 500 years and by Russia for about 100 years, attaining independence in the early 20th Century. Now the country is famous for computer-related high-tech industries represented by NOKIA, although traditional lumber and paper industries have also been strong, taking advantage of the country's rich forest resources. Its national territory is a little smaller than Japan (about 340 thousand square kilometers) with a population of about 5.30 million, less than the population of Aichi Prefecture (about 7.40 million). The country is now attracting attention for its efforts toward school education. Let us look at the current situation of the country that has a long history of technology education, as well as the country's idea of technology education.

Looking at the education system in general, as is the case in Japan, six years of elementary school education and three years of lower secondary school education are compulsory as basic education. After completing the compulsory education, students may advance to an academic high school or a vocational high school, and then to a university or a technical college. Since 2004, subjects to be taken in each grade of elementary/lower secondary schools in Finland are not rigidly defined but may be significantly changed by schools.

Subjects involved in technology education include Technical Work and Textile Work that teach craftwork. Male students mainly take the former while female students prefer the latter but there is no significant difference in the number of students between classes. Technical Work starts from elementary school and the subject is mandatory for every elementary school teacher candidate. Therefore, each university provides a Technical Work preparatory course for students who took Textile Work in their basic education so that they can further proceed to basic and advance courses for this subject. This way, many universities are trying to expand technical work education. It is very difficult to be admitted to a teacher training department. For example, only 276 among 4,307 candidates (6%) were accepted to the Jyväskylä University in 2008.

Third graders (elementary school) of the Teacher Training School attached to the Jyväskylä University do practical work in Technical Work class using both hand tools and electric power tools. They build a log house, cutting the wood themselves and installing a light bulb inside. Seventh graders (1st graders of lower secondary school) of the Teacher Training School make a sensor using a phototransistor. They create substrates and containers and do wiring according to a blueprint. Some students (eighth graders) make Finnish baseball bats based on actual models. The theme for these students was "something related to sports". Other students make archery bows, snow boards, etc. sometimes laminating timber for this purpose. They use various woodworking machines including good-quality circular saws as well as hand and automatic feed planers.

As can be seen from these examples, technology education in Finland is focused on making things. Themes are not necessarily cutting edge technology but often more universal. Technology education in Finland is known for its teaching that respects students' personal ideas and actions, which we found in many places. This may be a characteristic common across education in Finland.

Conclusion

Japan's population pyramid has changed into a wine-glass shape, with an especially smaller population of youth. The estimated future total population of Japan has been in decline since peaking in 2005. Japan will show a super-aging society with people aged 65 or over accounting for about 33% of the population. The birthrate is also continuing to decline, posing a problem of a decline in younger workers as well as a decrease in population. This will lead to a decline in people involved in industrial technology as well increasing concern of the weakening of Japan as a major power based on making things.

For these reasons, although Japan is a pioneer with regard to science and industrial technology, it is facing difficult challenges in modern society, which does not allow unambiguous discussion of the industrial technology of today and in the future. In this shrinking world, industrial technology needs to flourish in every country. Challenges concerning industrial technology and industrial technology education faced by individual countries may be solved within the country, but it is necessary to improve communication by further reducing the distance between nations

This need will further increase the importance of international cooperation concerning industrial technology.

REFERENCES

Hidetoshi Miyakawa: *Emerging Trends and Challenges in TVET in Japan*, Emerging Trends and Challenges in TVET in Asia and the Pacific Region, Colombo Plan Staff College for Technician Education (CPSC), Philippines, pp.83-96, December 2008

Final Report of ISITE2003: *Beyond Tomorrow: International Cooperation in Industrial Technology Education*-International Training, Aichi University of Education, March 2004.

Hidetoshi Miyakawa, et al: *International Symposium on Educational Cooperation for Industrial Technology Education*, The Journal of Japan Society of Technology Education, Vol.46, No.3, pp.165-177, 2004.

Hidetoshi Miyakawa, et al: *Performance and Accomplishment of "Making Things and Education" Project at The World Exposition 2005 in Aichi, Japan*, The Journal of Japan Society of Technology Education, Vol.48, No.1, pp.45-50, 2006.

Hidetoshi Miyakawa: *Technology Education of Secondary Education in the U.S.A.*, The Journal of Japan Society of Technology Education, Vol.44, No.2, pp.109-119, 2002.

Final Report of ISITE2008: *Cross Border: International Cooperation in Industrial Technology Education,* Aichi University of Education, March 2009.

Hidetoshi Miyakawa: *International Comparative Study on Technology Education: A Discussion on the industrial technology in Finland*, The 52nd National Convention of Japan Society of Technology Education, Niigata University, August 2009

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SEARCHING NEW VALUES FOR CRAFT EDUCATION: CAN DESIGN BASED LEARNING BE A SOLUTION

Introduction

The craft education – previously textile and technical work - has been an independent and obligatory school subject already when the Finnish school system was established in 1866. The craft education has had the official and equal position within other school subjects for a relatively long time. Moreover, from the very beginning craft education has been separated from art education, which is not very common in other countries. To compare with other countries, thus far the craft education has been able to keep a quite steady position in Finland (Garber, 2002). The holistic craft processes emphasized in National Curriculum for Basic Education 2004 highlight the iterative nature of design process; ideation, testing and making as well as reflective and evaluative aspects related to craft design (Fnbe 2004, 242). Designing is essentially included into craft processes and craft can be seen as the way to materialize the design thinking. In this article, I would like to put emphasis on the essence of craft education as design oriented activity. I would like to argue that craft education, as a form of design based learning, have a lot of potential to offer for integrated and inclusive curriculum, especially in elementary level of education.

The previous and becoming National Core Curriculum for Basic Education both emphasizes the integrated projects and thematic entities (Fnbe 2004). The craft education is in a state of change – the proposed new National Core Curriculum 2020 – is again putting the craft education as well as other art school subjects to very vague position. The upcoming National Core Curriculum 2020 stresses the importance of art and craft subjects – however the reality appears to be quite different – the study hours are proposed to reduce, especially in the grade seven. In Finland the debate related to the role of art and craft education goes always back to the discussion 1) what is the main role of craft education 2) how we can improve gender related issues to craft education and 3) how craft education can be integrated better within other school subjects. Thus, in this article I will describe some important aspects of integrating curricula of the craft education, and discuss its potential for reduction marginalization of the art and craft in schools. I also consider that the inclusion of design activities in curricula provides new possibilities to value craft education especially in elementary school. This bears relevance to the question of how craft should be taught at school and what are the main emphasizes of the content of craft education.

The designing and producing of new ideas in concrete end products is the essence of craft education. Designing is a complex process, including extensive visual or artistic and technical skills, as well as intensive domain specific knowledge (Goel, 1995; Popovic, 2004; Seitamaa-Hakkarainen & Hakkarainen, 2001). I have noted that the composition (i.e. visual design) and the construction (i.e. technical design) are essentially integrated aspects in design process (Seitamaa-Hakkarainen & Hakkarainen 2001). Without domain specific knowledge, we are not able to design and produce new material artifacts – either art-based or technological innovations. The cyclical design process begins with the identification of a problem, and it might engage exploring and the ranking of design priorities that might appear to be in competition within each other (Seitamaa-Hakkarainen, 2000, 170). Design activities develop the ability to enhance and transform ideas through visualization; it involves testing the practicality of multiple solutions through sketching and prototypes (Seitamaa-Hakkarainen & Hakkarainen 2001). The mediation of the different material artifacts, materials and tools play crucial role in design activities. Through design projects, students learn to view the same information from many viewpoints, and to represent various solutions and alternative forms of presentation. This entails evaluation of the solutions as well as reflection of the design process itself. Thus, in design based learning those unique qualities of holistic craft process highly relates to the solving complex problems. Design projects should be centered in the problems of our daily lives and the places in which we live. However, the challenge for the present craft education is that the origins of the design problem too often come only from the student's personal context.

The central idea of the present paper is to describe pedagogical practices that allow one to acknowledge nature of design learning and role of material artifacts in design process. In the following, I will first introduce the reform of the craft education related to development of National Core Curriculum for Basic Education and the debate around that. Secondly, I will highlight the value of design activity and design based pedagogy by emphasizing the importance of learning by collaborative design (LCD). Thirdly, I will shortly describe two design based elementary level school projects and underline the relevance of design constraints and the different role representations in designing. Finally, I will discuss the implications of design based curriculum and possible future for craft education in Finland.

The ongoing debate around craft education

The debates about the position of craft education – especially during the reforms of the National Core Curriculum for Basic Education - have been very vivid (Collanus, Guttorm, Jokela & Kärnä-Behm, 2006; Kaukinen, 2006). These discussions usually have dealt with 1) the importance or value of craft education in the modern (innovative) society, 2) the question of gender and equality (i.e. textile and technical work) and 3) the position of the craft education related to art, design and technology. The value of craft production has decreased from 1866 – from the time when Uno Cygnaeus introduced craft education in the school curriculum for basic education - it is not necessary to learn to make artifacts needed in daily life, like it was in beginning of 20th century. Already in 1970 the National Core Curriculum for Basic Education wanted to modernize handicraft education. This was done by separating handicraft as textile work and technical work as well as emphasizing the theoretical basis related to the consumer education and the textile (i.e. material) science (Pöllänen & Kröger, 2000). The curriculum also underlined the various materials, techniques and tools used in craft education. Later, the goals of craft education have been changed; the values have move towards creativity and problem solving, technical and aesthetic skills, independent working skills and promotion of self-expression. Also the understanding of technological phenomena of daily life and cultural heritage is emphasized.

The second topic – the gender issue and related equality – has been a very fundamental issue related to reforms of the National Curriculum. Already in 1985 the National Core Curriculum for Basic Education tried to deal with the gender issue; the students were able to choose between technical and textile work and in grade 7 they all studied both subjects a certain period of time. The idea was that students will learn to know both subjects and they were able to select other one as a voluntary subject. This was not enough – the girls most often selected the textile work and the boys choose the technical work. In 1994 the National Curriculum reform, the textile and technical work was connected under the label “Craft education, textile and technical work”. Then both subjects i.e. textile and technical work were studied in grade 3 and then students were able to select either textile or technical work. Either of these changes were not enough – again the majority of the girls selected textile work and boys selected technical work. Thus, the National Core Curriculum for Basic Education 2004 changed the name as craft education, without extra definitions at the end of the name. The National Core Curriculum 2004 defined craft education as unit of school subject and that compulsory craft consist of textile and technical work. However, how that was practically organized at school level, have been very wide-ranging and the question of the gender issue is still problematic.

The present National Curriculum for Basic Education 2004 does not give detailed guidelines how the craft education should be taught or detailed content to be covered, materials and techniques to be used. The National Curriculum does not underline any specific content, it aims the holistic craft education by emphasizing designing, making and evaluation processes (Fnbe 2004, 242). In general the National Core Curriculum defines the basic study hours for each subject as well as provides general frame and objectives for each school subjects' content. The main control and implementation of the curriculum has moved toward municipals and local schools already in previous reforms. Municipals and schools write their local curriculum in the given frame. In the school curriculum the teachers define more detailed aims and contents for the subjects they teach, following the national and local curriculum. Thus, the teachers are better involved to participate and design their own curriculum, which provides higher engagement for development of their teaching and pedagogy. In general, the National Core Curriculum highly valued the teachers' pedagogical knowledge and skills; it provides teachers with flexible possibilities to implement subject content.

As stated earlier, in the National Core Curriculum for Basic Education 2004 the craft education was combined obligatory school subject for all students uniting the technical and the textile work. The combination of two previously independent subjects has been considered to reduce the number of study hours and requiring too many craft skills to be learnt (Pöllänen, 2009). The teaching of craft should attempt towards a holistic craft process from the first grade (Pöllänen, 2009). In the grade one and two craft education is taught by the class room teacher. From grade 3 to 5, depending on the school size, the craft education is taught either by the classroom teacher or subject teacher, especially in big urban schools. The general problem is that not all classroom teachers have sufficient qualifications for teaching craft education. From the seventh to the ninth grade the craft education is taught by the subject teacher; usually the technical teacher in technical work and textile teacher in textile work. Also, from the fifth to the ninth grade, student may have possibility to concentrate on textile or technical work. However, the students must be offered content from the non-chosen craft subject (Pöllänen, 2009). According to Pöllänen (2009) the broad formulation of the objectives and contents of craft education may be a risk of teachers trying to include too many contents (or technique) to be covered in short period of time.

The third important debate is focused on the one hand, defining craft as art oriented (visual art) activity and, on the other hand craft is seen to be closely connected to technology education. There is enveloping assumption that craft is a subdiscipline of art or technology. Collanus, Guttorm, Jokela and Kärnä-Behm (2006) argued that the aesthetic skills and promotion of self-expressive aspects of craft education should be emphasized and better integrated to art education. Accordingly, they argue that craft could be seen as art. Pöllänen (2009) calls those tasks as "craft as self-expression". In the design activity, the visual aspects are crucial, and moreover, the starting point for the design task can easily deal with purely aesthetic and expressive aspects of the design. Although design most often results in a beautiful or interesting end product, the goal is not always only aesthetic. On the other hand, many researchers have emphasized that the modern society does not need traditional craft education and it should move towards technology education and learning technological phenomena related to students' everyday life (Kantola, 1997). I have argued that the composition (i.e., visual design) and the construction (i.e. technical design) are essentially integrated aspects in all art, craft, design and technology processes (Seitamaa-Hakkarainen, 2000; Lahti, Seitamaa-Hakkarainen and Hakkarainen, 2004). Without domain specific knowledge of those design aspects we are not able to design and produce new material artifacts or innovations. By referring the composition and the construction, I propose those interconnected spaces very generally; only the design context, design problems and design constraints guide the way how these aspects are relevant for problem solving and how they are dealt with. Thus, I would like to put emphasis on that craft education is design oriented activity and the nature of the design problems define also the emphasis of the design elements in that process. However, I have noted that the challenge for craft education in Finland, is that the origins of the design problem too often narrowed to student's personal needs and the repertoire of different kind of design problems have neglected. The important notion of the design problem is that its origins and priorities should also reside outside the personal context.

In the following, I will focus on the nature of complex and authentic design problems, the collaborative aspects of design learning, and underline the pedagogical approach *Learning by Collaborative Designing* (LCD -model, Seitamaa-Hakkarainen et al., 2001; Seitamaa-Hakkarainen, Viilo, & Hakkarainen, 2008). By highlighting the some of the components related to design based learning, I will briefly describe elementary students' collaborative lamp designing project and architectural design project as examples of integrative and design based pedagogy. In these cases the leadership was provided by a professional designer together with class teacher.

Collaborative designing and role of material artifacts

In recent years, the use of collaborative learning settings in the areas of Design and Technology education has increased (Murphy & Hennessy, 2001). Collaboration refers to the situation where students actively communicate and work together in order to create a shared view of their design ideas, make joint design decisions, construct and modify their design solutions as well as evaluate their outcomes through discourse (Hennessy & Murphy, 1999). Fostering learning through collaboration requires teacher or tutor to design, enact and evaluate a certain kind of teaching and learning settings, paying attention to the nature of the design task, its context and supportive pedagogy

(Hennessy & Murphy, 1999; Viilo, Seitamaa-Hakkarainen, & Hakkarainen, in press). The basic requirement for collaborative construction of the design object is that students' solve the authentic and challenging design tasks. The successful collaboration is based on open-ended and authentic design tasks that allow students to confront the multidisciplinary or user-center characters of design practice (Murphy & Hennessy, 2001; Seitamaa-Hakkarainen et al., 2010) From the socio-cultural approach, facilitating collaborative designing process means taking into account the object-oriented activity and the mediating artifacts. The object is a design task or problem that the participants are working with and that is developing and changing. Students' sketches, from the first general visualizations to construction details, play a special role in the design process. Through this externalization ideas become visible and improvable, enabling their collaborative advancement. Furthermore, concrete materials and tools, and testing with models and prototypes support the development of ideas by adding the material aspect to the conceptual ideas.

As stated earlier, designing has been characterized as problem solving oriented towards the construction of an artifact for specific purposes (Cross, 2004; Hennessy & Murphy 1999; Seitamaa-Hakkarainen & Hakkarainen, 2001). Designing is a complex process, including intensive visual or artistic and technical skills, as well as extensive domain specific knowledge (Goel, 1995; Popovic, 2004; Seitamaa-Hakkarainen & Hakkarainen, 2001). As an inherently interdisciplinary activity, design addresses the social, economic, cultural, cognitive, physical, and technological dimensions of a design situation. The complexity of the design process emerges from its cyclical and iterative nature; it is not a linear process, and thus the possible solutions arise from a complex interaction between parallel refinement of the design challenge and the design ideas (Lawson, 2006; Puntambekar & Kolodner, 2005; Visser, 2009). Designing cannot be reduced to mere play with ideas; in order to understand and improve the ideas in question, they have to be given a material form by means of practical exploration, prototyping, and making. Due to the complexity, designing involves the integration of several skills and competencies and therefore has the potential for enhancing both content knowledge and reasoning capabilities (Puntambekar & Kolodner, 2005). The design and making of the product highlight the inter-relationship of conceptual and procedural knowledge.

The role of materials and artifacts in the design process is crucial (Keller & Keller, 1996; Murphy & Hennessy, 2001; Seitamaa-Hakkarainen & Hakkarainen, 2001). Designers are "working with things"; they express their ideas in "things themselves" rather than merely words (Baird, 2004, p. 148-149); designed artifacts literally carry, bear, and embody knowledge. Learning to work with such *knowledge* (Baird, 2004) is an essential aspect of appropriating design practices. Consequently, in design settings material artifacts and tools have a central role in mediating the learning processes. The physical context is one of the central substance in craft education where interaction with tools, concrete objects and materials offers a potentially supportive environment for problem solving and designing (Hennessy & Murphy, 1999). Students think with different materials during the design activity, they formulate thoughts with the help of tools and machines, which mediate the meaning (Johansson, 2006). In the design process, the interaction with two- and three-dimensional models (sketches, prototypes) allows students direct possibilities to explore and evaluate a proposed solution's form and function directly (Hennessy & Murphy, 1999). The various representations (graphical and physical) provide different kinds of prompts to test the design ideas (Henderson, 1999). With or without new technologies students develop knowledge and skills to model, design and construct ideas into physical artefacts as interactive process. In design activity students are concerned with the usefulness, adequacy, improvability, and developmental potential of ideas (Bereiter and Scardamalia 2003). It is essential to provide students with experiences in solving complex design tasks, tasks that engage them in iterative improvement of their ideas and the artefacts embodying them.

The Learning by Collaborative Designing model (LCD model) emphasizes collaborative interaction within and between peers or teams; between students and teacher and/or external domain experts of the design field (see Seitamaa-Hakkarainen, Lahti & Hakkarainen, 2005; Kangas, Seitamaa-Hakkarainen & Hakkarainen, 2007; Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010). The model depicts designing as a spiral and cyclical process, and highlights the role of physical artifacts, material objects and abstract models as essential parts of the process. The model consists of the following phases: 1) creating the design context, 2) defining the design task and related design constraints, 3) creating conceptual and visual (physical) design ideas, 4) evaluating design ideas and constraints, 5) experimenting and testing design ideas by sketching, modeling and prototyping, 6) evaluating functions of prototypes and 7) elaboration of design ideas and redesigning. However, these phases should not be understood as a prescription for rigidly specified design stages (cf. Kolodner, 2002; Kolodner et al., 2003). The model merely illustrates the relations between elements of the collaborative design process (see Figure 1).

In collaborative design learning settings, the design context and the design task are defined through joint analysis; all participants have to learn to understand the external and internal constraints related to the problem or solution. In this phase, the teacher or external domain experts have an important task to help students to define the diverse cultural, social, psychological, functional and emotional aspects essential to the design of the product. During the outlining of the design constraints and sometimes conflicting issues that have an effect on the design process and its requirements need to be taken into consideration. By acquiring deepening knowledge, sharing that knowledge socially, producing varying design ideas and evaluating those ideas, the design process progresses forward cyclically.

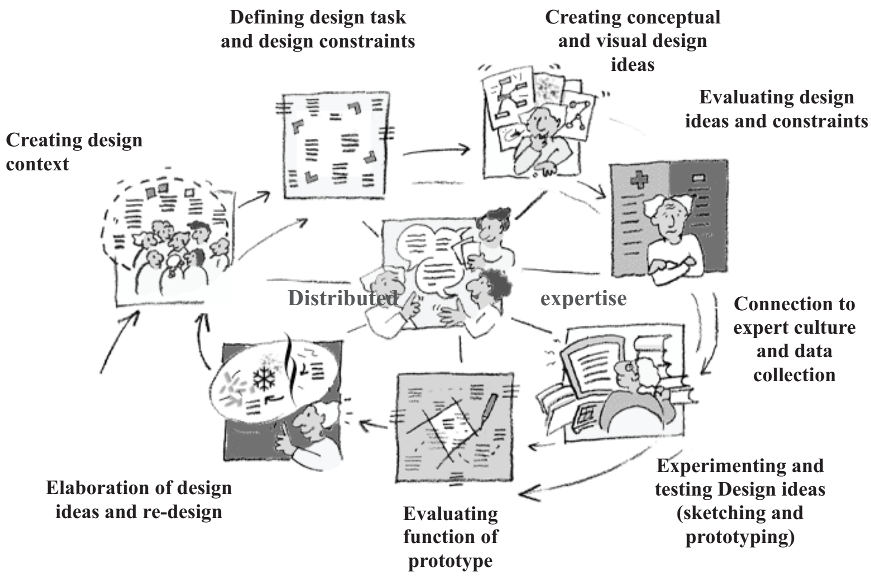


FIGURE 1 Learning by Collaborative Designing (LCD) model.

Thus, constant cycles of idea generation, and testing of design ideas by visual modelling or prototyping, characterize the process. Moreover, the critical role of the teacher or the external domain experts underscores the value of the physical context (i.e., diversity of concrete objects or material artifacts, interaction with tools) and social interaction in order to make design tasks shareable. The LCD model is explicated in detail in our previous article "Learning by collaborative designing: technology-enhanced knowledge practices" (Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010). In the next section, I will introduce the context for integrative design based learning setting and describe the implementation of elementary level students' collaborative design project i.e. "Artifact project" and "Architecture Project". The special consideration is to bring to light the analysis of the design constraints and the role of external representation of design ideas.

Context for integrative design-based learning settings

"The Artefact Project" and "Architecture Projects" were designed together with the class teacher and took place in her classroom in Laajasalo Elementary School, Helsinki, Finland. The projects based on the following ideas: 1) the collaboration with researcher and teacher, 2) collaboration with design expert, 3) integration of many school subjects solving a real-world problem, and 4) working over an long period of time. The Artifact project started with 31 participating elementary students at the beginning of their second term of fourth grade and continued across 13 months until the end of their fifth grade. This project was followed with the Architecture project, which lasted approximately five months in spring 2005. Both projects highlight the authentic design problem and the variety of conceptual and material aspects in designing. The aim of the projects was to break the boundaries of traditional schoolwork by supporting students' collaboration by working with the help of various experts. Moreover, the emphasis of the project was also the integration of various school subjects. Thus, both projects integrated many school subjects, i.e. history, mother tongue, physics, chemistry, biology and geography, visual arts, technology and craft education. The technical infrastructure of the projects was provided by Knowledge Forum (KF). KF learning environment was developed at the University of Toronto and it was based on knowledge building pedagogy (Bereiter, & Scardamalia, 2003; Scardamalia & Bereiter, 2006).

In the first longitudinal school project "Artefact project: Past, Present and Future" students were asked to analyse artefacts within a cultural context, to study physical phenomena (such as electricity) related to artefacts, and to design future artefacts. In the first phase - The Past - an exploration of historical artefacts was conducted by looking into the evolution of artefacts as cultural entities. The actual historical investigation of artefacts and arrangement of the historical exhibition were carried out during the subsequent twelve weeks. Each student team was asked to choose one item for deeper investigation. The item had to 1) be used daily, 2) have a long history, 3) be originally made by hand and 4) be used by hand. Students chose items which most of them had used and which they found interesting: a clock, a spoon, money, a lock and a key, a jewel, a ball, and a lamp. According to students' ideas the historical aspects of the artifacts were researched by visiting the Finnish National Museum, gathering offline and online reading materials, and interviewing grandparents. In the second phase of the Artefact Project – The Present – the physical subject domains from the curriculum were integrated to the project. The teacher lead the students investigate and ask research questions from the phenomena related to the chosen artefacts, such as movement of a ball, functioning of a lamp, light, and characteristic of metals. When the students examined light as a physical phenomenon, they planned, conducted, and reported their own experiments concerning light. While studying electricity, metals and magnetism, expert-designed science experiments with pre-given tool kits were conducted in the classroom. In addition, the teacher arranged visits to a blacksmith's shop and the Clock Museum. The blacksmith demonstrated how he works with iron. The field trip to the Clock Museum brought new information about present-day clocks and their mechanisms (Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010)

The third phase of the project – The Future – took ten weeks. First, the design process was rehearsed by designing a lamp. The leadership for this phase was provided by professional designer together with the teacher. Beyond conceptual design relying on writing, the students supported their design through drawing by hand or with computer (Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010; Kangas, Seitamaa-Hakkarainen & Hakkarainen, submitted). The investigation of the lamp design led the students towards the last stage of the project focused on projecting, in terms of design, how their chosen artefacts would look in the year 2020.

In total, the Artefact project took 139 lessons (in Finland one lesson lasts 45 minutes) during three terms. In the first phase of the project, the students worked in the "home teams" (about 4 students per group), which investigated the chosen artefacts and produced knowledge to the team views of KF. The teams were heterogeneous, consisting of boys and girls, as well as less and more advanced students. The composition of the home teams changed when the investigations concerning the present of artefacts began. During the second phase of the project, all students worked with the same topics and created Knowledge Forum views collectively shared by the whole class. In the last phase, the students returned to their original home teams (formed in the beginning of the project) and all students worked in the same views. In the last phase, notes were mainly written in teams rather than individually; i.e., all team members participated in creating the content of their note (Kangas, Seitamaa-Hakkarainen & Hakkarainen, 2007; Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010).

The Architecture Project "Architecture Project: City Plan, Home and Users -- Children as Architects" lasted approximately 19 weeks and it took approximately 45 lessons, about 2-3 hours a week. The expert, a professional interior designer who represented expertise in architectural design, was present in the classroom during the design process. During the Architecture Project, the students worked in "home teams" (four to five students in a team) to produce knowledge for each teams' views of KF as well as for shared views of the whole class. Before starting the actual Architectural design phase the students were studied how living conditions (i.e. housing) have changed in different historical phases. They studied living conditions in different geographical areas (for example in Savannas) and how different animals and insects habitat (biology). Figure 2 present main activities during the Architecture project as well as number of notes produced to KF database in each month.

As stated previously, the LCD -model emphasize the importance of design context and design constraints related to design. It also concerns the creation of design ideas and redesigning those ideas. During this stage the material (such as sketches and scaled models) and conceptual artefacts (i.e., explanations and justifications) play crucial role which mediate the design thinking and support design process. Critical analysis and evaluation of design ideas preceded the creation of detailed design ideas and the process become cyclical in nature. In the following, I will describe how these design activities became visible during the projects.

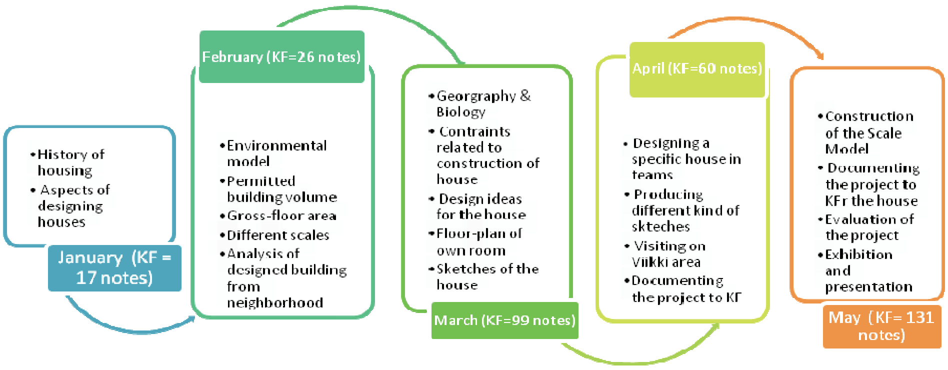
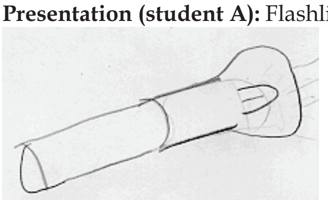
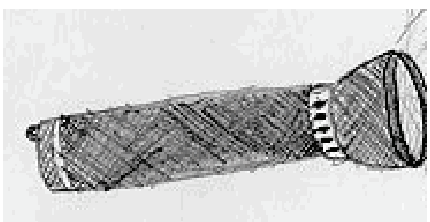


FIGURE 2 Design activities, KF notes in each month.

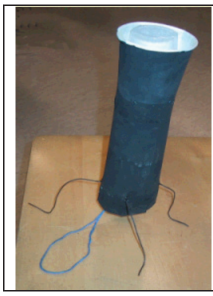
The role of design constraints and diversity of design representations

In the Lamp designing phase the designer described his own design process and drew students' attention to the essential points of lamp designing and following that the students first task was to pick a well or badly designed lamp from one's own environment and present an analysis of that particular lamp to the whole class and KF database. For example two students presented the following analysis and the picture of the flashlight in Knowledge Forum:

Presentation (student A): Flashlight	**Presentation (student B):** Flashlight
 My lamp lights up relatively small part of the darkness, but you can point it where you like. The light is quite bright, but bad quality. It didn't cost very much. A flashlight can be carried easily anywhere. I think it's handmade. Good: -covered with wood -can be carried easily -rather affordable -exclusive Bad: -bad quality of light -lights up a small spot (#1811)	The bad thing about flashlights is the fact that the batteries will come to an end at some point. Good things are: -you can direct it where ever you want to -lights up short or long distances -can be carried with you (#1827) 

Their analysis considered the certain design constraints related to the functionality of the flashlights: can be carried easily, the light can be focussed, quality of the light, durability of the batteries and the affordance of the flashlight. After the analysis of existing flashlights both students started to design collaboratively and stated their aim to improve the flashlight in following way: *"New flashlight. The lamp could be improved by adding 2 batteries, so the power would not end so quickly. Still it would be easy to carry. It would be easy to point it anywhere. Main measurements: 16cm x 3cm. Carrying tape at the end* (#1833*)"*. However, they needed expert support and the designer commented on the students' notes by writing annotations: *Is there any other options than adding batteries, to prevent the power from ending? What shape of lamp would be the easiest to use? Do we need other than pointing light from a flashlight?* (#1903). From this note, the actual designing continued, and the student proposed new design ideas "*Design ideas: An accumulator would be one option, but it would enlarge the lamp a lot, and it would not fit inside the pocket anymore. It would be nice, if it was small and oval, and not slippery in the hand. The light should be bright, because there would be an uneven dome on top of it. Carrying would be easier with the carrying tape. There would also be a dimmer, when you twisted the end of the lamp, the light would dim, and when you twisted other way round it would brighten. Circa 70 watts.* (#1918).

It was crucial for their designing to understand the important constraints and specific feature of flashlight i.e. functionality of the particular type of the lamp in order to improve their preliminary design. The designing continued and they produced variety of conceptual and visual design ideas (for example inserting folding legs for the lamp, in order to keep it standing in vertical direction) leading to a final presentation and evaluation of the new lamp.

	**Conclusions:** We designed "The Calamar" on the basis of the flashlight. We wanted the lamp to have soles. The goals were attained. There were no problems. The lamp is a bit too large, but still it fits in a backpack for instance. The carrying tape is not needed, otherwise it's all right. "The Calamar" is a good lamp for expeditions or usage at home. Main measurements: 16 x 3. (#2047)

In the Architecture Project the design task was very complicated, an authentic and real problem: to design apartment buildings for various user groups at a building site planned by the City of Helsinki. The quantity of external design information was needed at the beginning of the design process: The students were given an aerial map of the local area as well as basic information regarding city planning, such as City Plan, permitted building volume, and gross-floor area and so on. Thus, the architectural design process started with all students performing a joint analysis of the design context: the students were oriented toward city planning and they reflected on how to investigate and study the building or construction processes. Figure 3 represents one team's note of the issues by listing their consideration related to architectural designing.

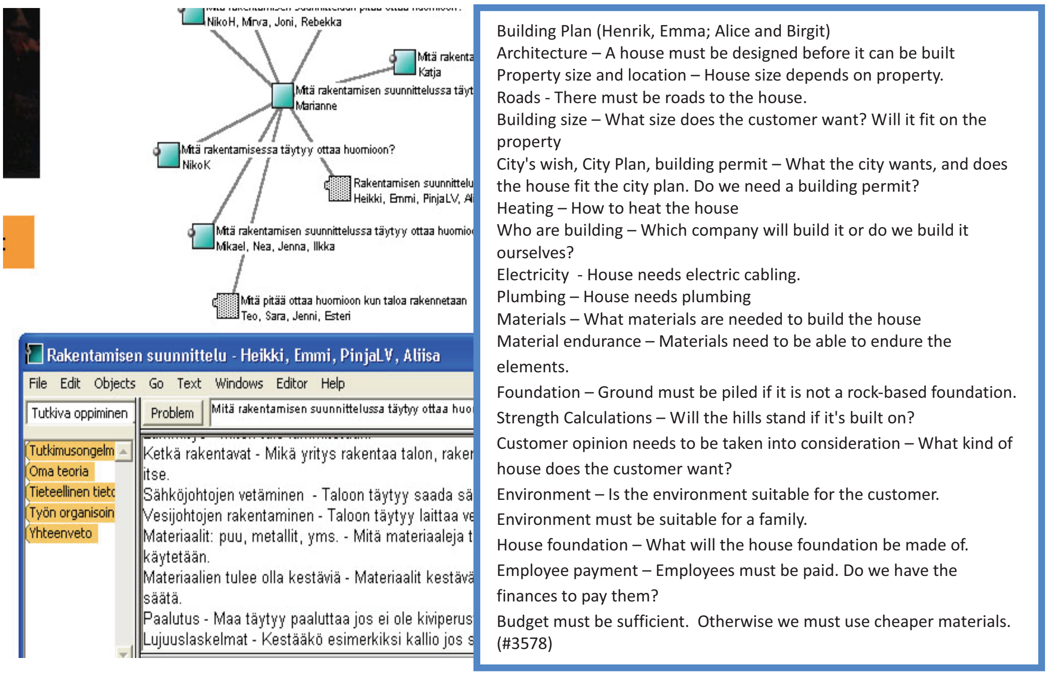


FIGURE 3 Students' team open KF:note considering issues related to architectural designing

The student team reflected on what issues need to be taken into consideration in the construction design: soil, map, the size and location of the building site, pile work, traffic, water plumbing and electric wiring, strength calculation, and budget. Various aspects of designing houses or apartment and associated design constraints were also discussed in the classroom. This way they were able to portray a holistic view of all aspects related to architectural design and their design context. Correspondingly like in Lamp designing, the analysis of design constraints was facilitated by the teacher and architect by designing special tasks for students i.e., analysis of neighborhood apartment buildings. Thus, in order to anchoring students' own experiences of architecture, students were engaged in design-oriented knowledge practices in terms of investigating the building design of their own neighborhoods. Accordingly, students were asked to select a well or badly designed apartment building or duplex from their neighborhood, justify their selection (why was the house interesting to them), and make their assessment concerning characteristic of design. Working towards that end, all students drew pictures as well as constructed written explanations justifying their design evaluations.

During massing and composition students needed to consider together within team different kinds of specific design constraints related to building site: traffic, effects of sun, permitted building volume etc. All of them were real and important aspects related to the real-life architectural design context and requirements for permitted buildings. When reflecting on the effects of sun, wind, traffic, sounds, and accessibility, it was decided that each team would adopt a special design challenge regarding its own house. Student produced several design challenges for their specific house, for example as the one team aimed:

> *We wanted to improve the basement so they would be more protected. The basements can not be such that you can push your hand through the wall and see other peoples basements because then it would be easy to steal others belongings.*
>
> *If the house has a road nearby it would be prudent to include good soundproofing into the house so all the noise during the night doesn't seep in. The door to the house could be put facing away from the road and all the noise can not be allowed to read all the way upstairs.*
>
> *If the house has a clubroom everyone should be able to use it and it should be everyone's responsibility.(#3788)*

Working together with professional interior architect and peer collaboration helped students to develop sophisticated solutions to architectural problems. The expert familiarized the students with different kinds of scale models that architects are working with. Central concepts, such as massing, maximum permitted building volume, and the height of eave (i.e., height of roofs) became familiar. During the architectural design student constructed variety of design representations. The design process started, by creating a shared Environmental Model of the building site according to the City Plan (1:500). The building site was divided into seven parts (i.e., the participants were formed seven corresponding design teams) and each team of students was asked to design its own particular apartment building. The city plan model, calculation of gross floor volume, scale drawings and scale models were constructed and loaded to KF's as pictures and texts. The efforts of the LCD model were organized toward developing conceptual design ideas embodying and explicating those, and giving the ideas a material form as prototypes or different kinds of scale drawings and models. While working with calculations needed for construction, students were constantly transforming numbers from one scale to another. During construction designing, the participants created several sketches and drawings of floor plans and facades. The purpose of these sketching activities was to understand the difference between a sketch and a final drawing. Thus, constant cycles of idea generation, and testing of design ideas by visual modelling and prototyping, characterized their architectural design process.

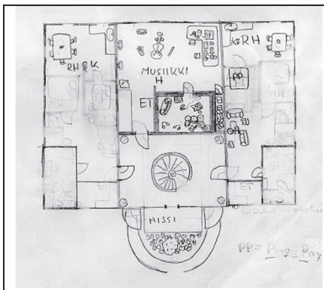
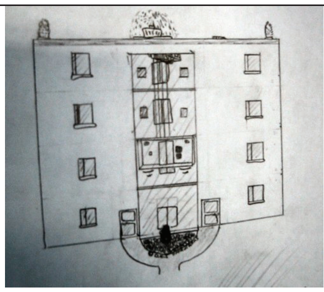
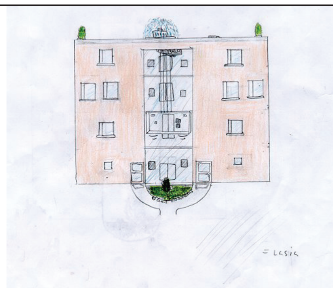
		
Floor plan of the Sound House (1st floor)	Facade sketch of Sound House	Final facade of Sound House

FIGURE 4 Different kind of sketches of Sound house

Students were guided to think of measures from the perspectives of a person using the building, moving from one room or area to another, and living within an apartment. Space needed for movements, external doors, stairs, and elevators had to be taken into consideration before starting to work with floor plans. With the help of the cardboard figure it was easy to explore how you can move and dwell in different parts of the house and how much space was needed for this or that part of a room. The cardboard figures were concretely located in the apartments while the participants were working with their interior designs. The last stage of the project was to construct a scale model of one apartment regarding each apartment building. The functionality and size of an apartment was accessed according to the users' needs.

These kind of architectural knowledge practices (calculating areas, transforming different scales in different drawings, drawing floor plans and façades) were very challenging activities as stated by the one student:

> "*The hardest part in this project was probably the calculations, drawing some of the according to scale and because everyone in our group did their own floors blueprint. It was very hard because we had to constantly measure as to make sure everyone had the same scale. We began our work with the facade. When we had finished the facade, we realized that the windows location did not fit inside the rooms. Some of the windows went straight through the walls. We had to erase the windows and copy them again in the right places. Then we thought while making the miniature model that the room location was odd. The bathroom was the biggest room in the house; the bedroom barely fit a bed. So we decided to change the order of the rooms. We also had to change the placement of the windows. By the sixth layout the bathroom and bedroom filled one side of the house.*" (#5639)

Discussion

The holistic craft process is emphasized in National Curriculum for Basic Education. The holistic craft process includes the ideation, testing and making, evaluation as well as reflection. As Pöllänen (2009) has pointed out the concept of holistic craft process is difficult concept, especially to concretize and apply by the teachers. The value of craft education in the modern innovative society is to be found in the knowledge creation and creativity (Bereiter, 2002). The craft education is very closely related to art, design and technology; the character of the design context and task can emphasize the different aspects of designing – from purely technological problem to design of functional or user-centered objects toward more art related self-expression (see also Pöllänen 2009). The challenge for the craft education in Finland is that the origins of the design problem too often come only from the student's personal context. The projects described aimed at improving quality of elementary-level education by engaging very young students in design practices. Further, the purpose of the projects was to examine how collaborative designing may be used to facilitate learning in the process of developing and elaborating shared design artefacts. The project showed that with the expert support very young students are able to solve multifaceted, complex design tasks. An engagement in such activities involves working with ill-defined problems; these arise in authentic situations often ones never before encountered; thus addressing them fosters the development of competencies for knowledge creation (Bereiter, 2002).

The craft process can be seen as the way to materialize the design thinking. Designing is not only limited to the ideation phase but also includes analysis of design context and design constraint. The careful analysis of design context or design situation and the understanding of the design constraints is very important part of the designing. In the project cases presented earlier, the student teams learnt, with the help of the expert, to reflect on what issues need to be taken into consideration when designing certain object or environment. Expert-like working familiarized them with specific functionalities of the flashlights, planning regulations, and requirements of building site that designers and architects are working with.

The craft education provides a rich environment for collaborative learning (Hennessy & Murphy, 1999; Murphy & Hennessy, 2001; Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010). The experiences of collaborative designing in educational setting appear to promote both participants' creativity as well as the practices entailing collective elaboration of design ideas (Fisher et al., 2005). Design provides direct experience for students with materials and technologies. In designing their local environment and products, very young students learn how to exercise creativity within challenging constraints, communicate visually, and work in teams. Design activities develop the ability to enhance and transform ideas through the visualization. Through design projects, students learn to view the same information from many viewpoints, and to represent various solutions and alternative forms of presentation. Students use many visual skills, drawing design documents, building models, and constructing computer visualizations. The mediation of the different material artifacts, materials and tools is the heart of designing.

In this article, I have put emphasis on the design based learning, which I argued to offer enormous potentials for integrated and inclusive curriculum, especially in elementary level education. Design based learning relates to the solving of authentic problems in our daily lives. Design based learning and teaching challenges the teachers to provide more authentic learning context and to create activities that goes beyond the traditional curriculum. The design based learning also provides a very promising learning environment for expert-student partnerships. The Finnish National Curriculum for Basic Education 2004 provides a lot of possibilities to apply integrated curriculum and conduct design based learning projects. The curriculum introduces several thematic entities such, that should be covered and teach in integrative way. Students access to integrative authentic learning environment enable students 1) intervene creatively to model, adapt and develop ideas as an interactive process, 2) become creative problem solvers and designers and 3) participate in tomorrow's rapidly changing technologies in some level. All thematic entities are very easily connected with craft and art education. The teachers should take this opportunity and build-up school collaborative community. Design based pedagogy provide new value for craft education and will help to prevent it to fall in marginalization of the school subjects.

REFERENCES

Baird, D. 2004). *Thing knowledge: A philosophy of scientific instruments.* Berkeley, CA: University of California Press.

Bereiter, C. (2002). *Education and mind in the knowledge age.* Mahwah, NJ: Erlbaum.

Bereiter, C. & Scardamalia, M. (2003) Learning to work creatively with knowledge, in E. De Corte, J. L.Verschaffel, N. Entwistle & Van Merrienboer [Eds] *Powerful Learning Environments: Unravelling Basic Components and Dimensions.* New York: Macmillan, pp. 55–68

Collanus, M., Guttorm, H., Jokela, P., & Kärnä-Behm, J. (2006) Ylös kapiokirstun pohjalta. Puheenvuoroja käsityöstä ja sen tulevaisuudesta. Teoksessa L. Kaukinen & M. Collanus (Toim.). Tekstejä ja kangastuksia. Puheenvuoroja käsityöstä ja sen tulevaisuudesta. Artefakta 17 Akatiimi, 149-157.

Cross, N. (2004). Expertise in design: An overview. *Design Studies, 25*(5), 427–441.

Fnbe (2004) The Finnish National Board of Education, *Perusopetuksen opetussuunnitelman perusteet* (online). Available from URL:www.oph.fi/ops/perusopetus/pops_web.pdf

Fisher, G., Giaccardi, E., Eden, H., Sugimoto, M., & Ye, Y. (2005). Beyond binary choices: Integrating individual and social creativity. *International Journal of Human-Computer Studies, 63*, 482–512.

Garber, E. (2002) Craft education in Finland: definitions, rationales and the future, *International Journal of Art & Design Education*, Vol. 21, No. 2, pp. 132–45

Goel, V. (1995) *Sketches of Thought.* Cambridge, MA: MIT Press.

Henderson, K. (1999). *On line and on paper: Visual representations, visual culture, and computer graphics in design engineering.* Cambridge, MA: MIT Press.

Hennessy, S., & Murphy, P. (1999). The potential for collaborative problem solving in design and technology. *International Journal of Technology and Design Education, 9*(1), 1–36.

Johansson, M. (2006). The work in the classroom for sloyd. *Journal of Research in Teacher Education, 2-3*, 153–171.

Kantola, J. (1997) Cygnaeuksen jäljillä käsityönopetuksesta teknologiseen kasvatukseen. Jyväskylä studies in education, psychology and social research; 133. Jyväskylän yliopisto

Kangas, K., Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2007). The Artifact Project. History, science and design inquiry in technology enhanced learning at elementary level. *Research and Practice in Technology Enhanced Learning 2*(3), 213–237.

Kangas K., Seitamaa-Hakkarainen P. & Hakkarainen K. (submitted). Reproducing the Figured World of Designing: Infusing Expertise in Elementary Students' Collaborative Design Process. *The Journal of Learning Sciences.*

Kaukinen, L. (2006) Käsityöoppiaineen arvo ja merkitys sekä opettajankoulutuksen järjestäminen. Teoksessa R. Jakku-Sihvonen (Toim.) Taide- ja taitoaineiden opetuksen merkityksiä. Yliopistopaino, 76-90.

Keller, C. & Keller, J. (1996). *Cognition and tool use. The blacksmith at work.* Cambridge University Press.

Kolodner, J. (2002) Facilitating the learning of design practices: Lesson learned from an inquiry in science education. *Journal of Industrial Teacher Education. 39*(3), 1–31.

Kolodner, J. L., Camp, P. J., Crismond, D., Fasse, B., Gray, J., Holbrook, J., Puntambekar, S., & Ryan, M. (2003). Problem-based learning meets case-based reasoning in the middle-school science classroom: Putting learning by design into practice. *Journal of the Learning Sciences, 12*(4), 495–547.

Lahti, H., Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2004). Collaboration patterns in computer-supported collaborative designing. *Design Studies, 25*(4), 351–371.

Lawson, B. (2006). *How Designers Think. The design process demystified.* New York: Elsevier.

Murphy, P. & Hennessy, S. (2001). Realising the potential – and lost opportunities – for peer collaboration in a D&T setting. *International Journal of Technology and Design Education, 11*, 203–237

Popovic, V. (2004) Expertise development in product design - strategic and domain-specific knowledge connections. *Design Studies, 25*(5), 527–545.

Puntambekar, S. & Kolodner, J. (2005). Toward implementing distributed scaffolding: Helping students learn science from design. *Journal of Research in Science Teaching 42*(2), 185–217.

Pöllänen, S. & Kröger, T. (2000) Käsityön erilaiset merkitykset opetuksen perustana, in J. Enkenberg, P. Väisänen & E. Savolainen [Eds]*Opettajatiedon kipinöitä. Kirjoituksia pedagogiikasta.* Savonlinnan opettajankoulutuslaitos, pp. 233–53

Pöllänen S. (2009) Contextualising Craft: Pedagogical Models for Craft Education. *International Journal of Art & Design Education, XXx* 249-260

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.) *The Cambridge handbook of the learning sciences* (pp. 97–115). Cambridge, MA: Cambridge University Press.

Seitamaa-Hakkarainen, P. (2000) *The Weaving-Design Process as a Dual-Space Search*, Helsinki: University of Helsinki, Department of Home Economics and Craft Science, Research Report 6.

Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2001). Visualization and sketching in the design process. *The Design Journal 3*(1), pp. 3–14.

Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2001). Composition and construction in experts' and novices' weaving design. Design Studies, 22/1, pp. 47-66.

Seitamaa-Hakkarainen, P, Lahti, H. & Hakkarainen, K. (2005). Three Design Experiments for Computer Supported Collaborative Design. *Art, Design and Communication in Higher Education Vol.4/2*, 101–119.

Seitamaa-Hakkarainen, P., Viilo, M., & Hakkarainen, K. (2010). Learning by collaborative designing: technology-enhanced knowledge practices. *International Journal of Technology and Design Education,* Vol. 20 Issue 2, p109-136,

Viilo M., Seitamaa-Hakkarainen, P. & Hakkarainen K. (in press). Supporting the technology-enhanced collaborative inquiry and design project – A teacher's reflections on practices. Teachers and teaching, theory and practice.

Visser, W. (2009) Design: one, but in different forums. *Design Studies, 30*(3), 187–223.

Contents

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THE NEW NATIONAL CURRICULUM FOR THE ESTONIAN SCHOOL. TECHNOLOGICAL SUBJECTS. TECHNOLOGY EDUCATION.

Introduction

The present article discusses about the new national curriculum for the Estonian school, especially from the point of view of technology education. It is worth noting that for the first time in the history of the Estonian curriculum the updated curriculum includes the field of technology and technology education. The article touches upon the structure of the subject domain of technology education and its distribution. It also focuses on the content and study results of technology education as well as the organisational aspects of the subject. At the end of the article the system of necessary means for applying technology education are elicited.

Pre-curriculum development

In Estonia the previous curricula were adopted in 1996 and updated in 2002. Until the present day teaching in Estonian general education schools has been based on the national curriculum adopted in 2002. Since 2001 curriculum development has been carried out in the University of Tartu and in the National Examinations and Qualifications Centre. Under the direction of the latter the results of the curriculum development since 2006 were made public on November 26, 2006.

The preparation of the curricula was preceded by the preparation and approval of the corresponding terms of reference by the Council of the National Curriculum for Basic Schools and Upper Secondary Schools in 2008. The terms of reference included the priorities of developing the curriculum with the aim of solving the problems that the present curriculum has, i.e. the obscurity of study results and the related study load that students have; the general part and the coherence of syllabi; the integration of different subjects; the lack of applied materials, etc. The terms of reference elicit the priorities of the curriculum development. The high-priority courses of the curriculum development progress are the following:

1. Developing the system of learning objectives and study results in order to guarantee better coherence of different parts of the curriculum (incl. different parts of the general part, recurring topics, subjects) and to achieve the objectives across subjects.
2. Developing the subject domains in order to increase the coherence of the general part and the recurring topics, as well as the vertical and horizontal coherence of subject syllabi, and to promote the development of joint objectives, approaches, and assessment principles.
3. Optimising the volume and complexity of the learning content and study results, taking into account the developmental peculiarities of children and the available time resources.
4. Preparing materials for explaining, aiding, and instructing the application of the curriculum (henceforth instructions) (Estonian … 2008, 4).

In addition to many important viewpoints, the article 1.2.3 of the terms of reference, which specifically treats the field of technology and natural sciences, is worth mentioning.

The process of preparing the curriculum contributes to putting into practice the following developmental goals of the Estonian general education system: ... Increasing competence in exact sciences and natural sciences and in the field of engineering/technology, and raising interest in continuing studies in the given fields – integrating the learning content of natural science subjects and improving the correspondence of the study results to the goal promote the formation of a consistent world view and help to achieve necessary general education competences; increasing the amount of practical work in natural science subjects and the importance of sciences and natural sciences; describing the use of the fields of study in upper secondary school. The goal will be reached: 1) by increasing the financial resources of the curriculum development compared to other subject domains; 2) by financing the work in groups smaller than a class, which would enable better application of practical works, outdoor education, etc.; 3) through greater national support for providing technical means for teaching compared to other fields of study; 4) through greater national support for developing methodological materials and financing the primary and in-service training of teachers compared to other fields of study“ (Estonian … 2008, 3).

These terms of reference are promising and give hope that teaching technology and natural science subjects, which to this day have receded to the background, will gain more attention, also in respect to material resources. The Estonian economy is improving regardless of the depression in the recent years and we hope that the state is able to put the terms of reference in practice also in reality.

For the purpose of making substantive decisions regarding the curriculum, a council of expert was established, which included different educational theorists and institutions. The preparation of curricula was coordinated by the Curriculum Division of the General Education Department of the Ministry of Education and Research. The draft syllabi were prepared by the subject working groups formed at the National Examinations and Qualifications Centre and the University of Tartu, which comprised the corresponding specialists (including the representatives of institutions of higher education and the teachers from general education schools).

Preparing the syllabus for technology education was carried out by the author of the present article in cooperation with his fellow teacher. This was a period of constant hard work. The underlying principle in technology education was to make a syllabus that be as close to Estonian culture as possible, taking into account our cultural background and traditions. At the same time the syllabus also had to be innovative and based on the best experiences of other advanced countries. Preparing the syllabus we also went back in time and thought about the wise things Mr Uno Cygnaeus, an acknowledged Finnish head of education once said about the issue in his letters. Reading the correspondence between Uno Cygnaeus and Otto Salomon, presented by Tapani Kananoja, one sees the skilfulness of Mr Cygnaeus in apprehending the essence of handicraft in basic school, which is still applicable and important in today’s school life. Basic education has to stimulate the general developmental objective of a child as an individual. In his letters Cygnaeus continually stresses that basic education must foster the development of children's mental attitude and the perception of beauty as well as their basic skills (Kananoja 1999, 36, 37). The very same letter also touched upon a very important event for Estonians, but unfortunately it was treated only very briefly. Namely, on November 11, 1882 Uno Cygnaeus writes to Otto Salomon that he has heard Mr Salomon had had more success with handicraft in Estonia ... than Cygnaeus in Finland (Kananoja 1999, 46)!

The developer and researcher of the Estonian school, Peeter Põld (1878-1930), leans in his pedagogical principles of the time largely on German educational theorists and philosophers. He follows the example of the vocational education theorist G. Kerschensteiner; among the classics he is fascinated by J. Pestalozzi, F. Fröbel, J. Herbart, A. Diesterweg; among Americans he turns his attention to J. Dewey. In respect to handicraft, modelling, and drawing P. Põld leans on J. Wetekamp. Uno Cygnaeus (1810-1888), one of the leading founders of the Finnish school, especially in craft, rested his conviction largely on the same classics-authorities as Peeter Põld. Although in Finland, pursuant to the School Act, Craft as a compulsory subject was included in the school curriculum already in 1866, which is factually the earliest date in the world (Parikka et al 2000, 7), Põld published his first extensive article on craft – „Work Education“ – in Estonia in 1910 (Põld 1993, 26-36).

Proceeding from P. Põld's creation it has to be noted that he was in favour of applying the principles of work education at school as much as possible. This does not refer simply to craft, but more broadly to the principle that the school as a whole must follow and which endeavours to guide a learner towards independent thinking and activity through work and especially through physical work. This beautiful trend wishes to replace the current school of books or knowledge, where ready-to-use knowledge is transferred to the learners by the teacher, with the so called works school, where learners come to understand the truth through doing things by themselves and teachers are only in the role of a helper or an adviser. He was, however, among the first people to look for scientific solutions to pedagogical questions and problems in Estonia, thereat proceeding first of all from Estonian traditions and the unique conditions. Both M. Tuulik and A. Elango claim that P. Põld's pedagogical truths have survived through time, remained viable, because these have justified themselves and they have a fixed value (Tuulik 1996, 114 & Elango 1997, 16). We have to agree with them, because even today we can lean on the ideas of the pedagogical theorist P. Põld in educating-teaching. His thoughts about spiritual values and ethics are one of the „pillars" of teaching each subject, including technology education.

On the other hand materials from several acknowledged foreign experts of technology education have been read and experienced and their approaches have been altered to meet the needs of the Estonian school life. First off all we can point out several researchers and developers of the technological field in Finland, who we have close cooperation with (Esa-Mati Järvinen, Tapani Kananoja, Aki Rasinen, Timo Tiusanen, etc.). We actively carry out joint summer conferences and trainings aimed at the subject teachers both in Estonia and in Finland. From my point of view I can note that my ideas in technology education have largely been influenced by the American source material „Standard for Technological Literacy" (Standard … 2000), which was given to me by William E. Dugger. The American publication was translated into Estonian in 2007. Another sources for learning how to prepare the content of the subject are books and articles written by the promoters of technology education in other countries (the Netherlands, Australia, Great Britain, incl. Scotland, etc.).

It is nice to point out that in Estonia we have reached such a period with developing the curriculum for basic schools, where a new subject – technology education – has been added to the list of compulsory subjects. It is the first time in the Estonian history.

Coming back to the syllabus of technology education we can point out that occasionally, due to the visions of the leading figures of the curriculum development, the preliminary syllabus underwent significant changes and also the integration of subjects and the public opinion were to be taken into account. The prepared materials of the curriculum were uploaded and made available on the Internet and thus everyone could study and comment these (Õppekava … 2010). Finally, after several versions the consigned syllabus was prepared, which was accepted by several interest groups.

Updated national curriculum for basic schools

At the beginning of 2010 the Government of the Republic of Estonia approved the updated national curriculum. The curriculum is divided into two different documents – the national curriculum for upper secondary schools and the national curriculum for basic schools. In upper secondary school the volume of study common to all pupils was reduced from 72 courses to 63 courses (Gümnaasiumi … 2010). The curriculum introduced conditions for offering different fields of study and choices to pupils. The new national curriculum for upper secondary schools does not include technology education as a compulsory subject, but each school may choose a suitable technical subject among the elective courses: „Applied biology“, „Geo-informatics“, „Regularities in chemical processes“, „Chemistry of elements“, „Chemistry of life“, „Physics and engineering“, „Another kind of physics“, „Natural sciences, technology and society“, „Mechatronics and robotics“, „3D-modelling“, „Technical drawing“, „Using a computer in research“, „Bases of programming and creating applications“ (Gümnaasiumi … 2010).

Following, we will predominantly focus on the national curriculum for basic schools (Põhikooli … 2010), which was approved by the government of the republic on January 28, 2010. The curriculum divides basic school into three stages of study by grades:

1) 1st stage of study – grades 1–3;
2) 2nd stage of study – grades 4–6;
3) 3rd stage of study – grades 7–9.

The curriculum elicits the **schooling and educational** objectives, which state that:

(1) Basic school bears the task of both schooling and educating students. School contributes to helping raise students to become creative, versatile individuals, who are able to successfully realise themselves in different roles: in the family, at work, and in the public life.

(2) In basic school the main endeavour of schooling and educating is to guarantee students perceptual, moral, physical, and social development fit for their age and the formation of their integral word view.

(3) The task of basic school is to create a safe, positive and developing learning environment fit for the children's age, which would support their desire to learn, their self-reflection and critical thinking, the development of knowledge and volitional qualities, creative self-expression and the formation of the social and cultural identity.

(4) Basic school guarantees the formation of the essential values. Students learn to understand the values behind their actions and feel

responsibility for the results. In basic school the basis is created for learning to understand oneself as a self-conscious individual, a member of the family, nation, and the society. Students learn to be self-conscious and they are broad-minded and open about the versatility of the world and the people.

(5) Basic school helps students to get a clear idea of their interests, inclination, and abilities and guarantees them the readiness to continue studies on the next educational level and for lifelong learning. Basic school graduates have acquired an understanding of their future roles in the family, work life, society, and the country.

(6) Acquiring and developing knowledge, values, and practical skills takes place during the whole process of schooling and educating at school, in the cooperation between home and school, and as a result of the interaction between students and their environment.

(7) Estonian school aims at retaining and developing the Estonian nation, language, and culture, thus special attention in basic school is paid to teaching the Estonian language (Põhikooli … 2010).

Compared to upper secondary school the educative function of basic school is more important. Basic school guarantees all students perceptual, moral, and social development fit for their age and the formation of their integral world view – it has to provide students with an integral set of skills to enable them to cope in life. In upper secondary school the main objective of schooling and educating is to enable students to find a field of activity that meets their interests and abilities, one that would be their path for further education (Estonian … 2010).

The curriculum for basic school includes the following important aspects:

- fundamental values of basic education;
- schooling and educational objectives (incl. competences and the subject domains);
- concept of learning and the learning environment;
- characteristics of different stages of study;
- organisation of studies (compulsory subjects and recurring topics and the volume of compulsory lessons by stages of study);
- assessment and finishing a class and graduating basic school;
- school curriculum.

In order to establish better links between closely related subjects (by both the goals and content), the latter have been categorised by subject domains. This makes it easier to focus on their common goals. The new curriculum pursues tighter connections between the subjects and with the general part (e.g. the goals, general competences, recurring topics).

In the national curriculum for basic schools the following compulsory subject domains and subject syllabi have been included:

1) language and literature: Estonian language, literature (in Estonian language schools), Russian language, literature (in Russian language schools);
2) foreign languages: A-foreign language, B-foreign language and Estonian as the second language;
3) mathematics: mathematics;
4) natural science subjects: nature studies, biology, geography, physics, chemistry;
5) social science subjects: citizenship studies, history, social studies;
6) arts: music, art;
7) technology: craft, handicraft and home economics, technology education;
8) physical education: physical education (Põhikooli ..., 2010).

Next, the article will focus on the field of technology and we will look in more detail into technology education, leaving craft (taught in the 1st stage of studies) and handicraft and home economics in the background.

Subject domain "Technology"

The structure of different subject domains in the curriculum is similar. First the domain-specific competences are expounded, the formation of which are supported by the objectives of subjects, the content of learning, and study results, recurring topics, extracurricular activities.

> *Technological competence in the subject domain signifies the ability to cope in the world of technology and to understand, use, and assess technology; to creatively and innovatively apply and develop technology; to understand the modern developmental trends of technology as well as the connections between technology and natural sciences; to analyse the possibilities and potential threats of applying technology; to follow the requirements of protecting intellectual property; to solve problems, integrating mental work with manual activities; to choose and safely use different materials and tools; to purposefully put ideas into practice; to cope with housework and to eat healthy (Ainevaldkond … 2010).*

In the learning activity ideas are generated, objects and products are designed, modelled, and prepared and students learn to present their handiwork. Through tasks and common discussion students learn to notice the functionality of the designs and its connections with artistic creation and the cultural background. Students' self-initiative, enterprising spirit, and creativity are supported and they learn to appreciate sustainable and healthy lifestyle. Students acquire knowledge on healthy nutrition and home economics. Working in the training kitchen students accustom themselves to value the basic facts about healthy nutrition. They learn in a positive environment, where their studiousness and development is acknowledged in every way (Ainevaldkond … 2010). In technology education students acquire a diverse training, which creates possibilities to analyse, adapt, and develop the practical and mental activity on a quantitatively new level and to help students in the future choice of profession. The teaching process pays great attention to students' purposeful creative innovation , where along with the joy of discovery they are able to experience the creation of the selected product. Students carry out interesting and imaginative creative applied tasks, including planning, designing, and preparing a task or an object and the self-assessment and presentation of the work. From the students' point of view the objective of learning technology education is to acquire the basic knowledge and skills to cope in the modern technical world.

Technology education combines several subject domains and integrates with all the subjects in basic school. The content of learning stresses connections and applied outputs between subjects and spheres of life and situations, between parts and the whole. This helps students to get a complete understanding of a task or product. Compact knowledge or skills in different subject domains deepen students' awareness of the world around them and enable them to cope well in their future work life. Above all, technology education bears the task of applying the theoretical knowledge acquired in other subjects in the everyday life.

Integration may also take place between students' prior knowledge and experiences and the information that they acquire during the study process. One of the purposes of integration is to combine information, knowledge, skills, etc. into an organised whole. At that the organised structure is applied in the study materials and in the knowledge the students have just acquired, integrating these with the existing knowledge and skills. Students acquire the skill to analyse and see the connections between different subject domains. They have an understanding of the connection between different phenomena and what they have learned, which is proper for their age, and they are able to apply their knowledge in solving practical tasks. The teaching stresses the skills of solving problems and thinking critically and the ability to understand the wholeness of things. In order to apply integration in lessons a newly prepared collection has been published in Estonia, where I have elicited examples on how to use the topics of technology education in the subject. The collection also gives an overview on how to associate technology education with both the recurring topics in the curriculum and the recurring general competences in the curriculum and it points out several connections with other subjects and subject domains (Soobik 2010).

It is important that students understand, how technology as a complete process works and are able to take part in creating technology on their own student level. This is achieved through taking into account the developmental level proper to the students' age and making the process understandable for them. Also different abilities and interests that students may have are taken into account and their initiative and study motivation is supported. The subject stresses the importance of inventive activity and forms students' professional behaviour and values.

The subject domain of technology (Ainevaldkond … 2010) elicits the list of subjects taught within the domain. These are craft, technology education, and handicraft and home economics. Craft is studied in grades 1-3, technology education in grades 4-9, and handicraft and home economics in grades 4-9. The distribution of technological subjects per week by stages of study are as follows:

1st stage of study	Craft – 4.5 lessons per week;
2nd stage of study	Technology education; handicraft and home economics – 5 lessons per week;
3rd stage of study	Technology education; handicraft and home economics – 5 lessons per week.

Craft in the 1st stage of study covers the basics of handicraft and home economics, and technology education. Boys and girls learn together and the lesson is conducted by the class teacher. For the most part the lessons are carried out in the regular classroom; if possible, the lessons may be carried out outside the classroom, e.g. in the open air or in workshops for older students.

In the 2nd stage of studies students are divided into study groups according to their own wish and interest, choosing either handicraft and home economics or technology education as the subject. This enables students to learn more intensively the subject they are interested in. Dividing students into groups is not based on the gender. As for the current organisation of teaching the distribution into study groups has mainly witnessed boys choosing the technical subject and girls have rather preferred the group, where softer materials are dealt with. In grades 4-9 students swap their study groups for at least 10% of the study time. Technology education is replaced with home economics and handicraft, and home economics with technology education. Each year both of the syllabi – handicraft and home economics, and technology education – include a project learning part that lasts for one term, which allows students to choose between the two study groups according to their interest, independent of whether they are currently studying technology education or handicraft and home economics.

The volumes of subjects in the subject domain of technology and integration between the subjects (technology education)

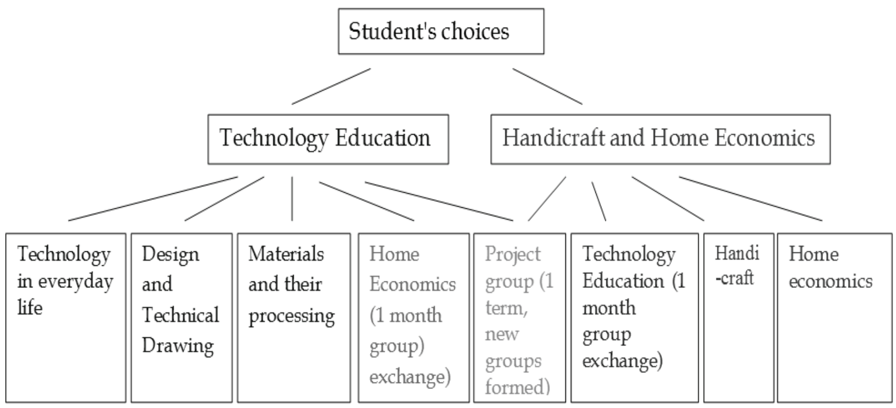
In technology education teaching is divided into five areas: technology in everyday life; design and technical drawing; materials and their processing; home economics; project work. Project work covers approximately 25% of the study volume, home economics approx. 10% and the rest (technology in everyday life; design and technical drawing; materials and their processing) approx. 65%. The order of different parts of the subject is planned by the teacher in cooperation with the teacher of handicraft and home economics. The organisation of studies includes switching the study groups.

In the teaching areas of technology education (technology in everyday life; design and technical drawing; materials and their processing) the ways of thinking, the ideals, and the values of present-day technology are stressed. Taking into account sustainable development students acquire the skills of coping in the present-day technological world that is in the period of fast changes. Students learn to understand and analyse the essence of engineering and technology and its role in the development of the society. The teaching guides students towards combining mental and manual activity and understanding the connections between the knowledge acquired at school and the environment they live in.

In home economics lessons students learn the basics of healthy nutrition, how to put together a balanced menu and cook as well as develop their budgeting skills; analyse consumer behaviour; learn to value environment-friendly consumers, who know their rights and obligations; look for connections and contradictions between people's awareness of a healthy lifestyle and their actual behaviour.

In case of project work students can choose between two or more concurrent selected topics or subject projects. The selected topics may belong to the domain of technology education, handicraft or home economics. The project works may be integrated with other projects, other subjects, inter-class projects and long-term inter-school events. The project works are selected keeping in mind the local traditions, innovative and conventional treatments and the interest to go in depth with a certain topic. The domain of project works forms an independent whole, in which case students are not expected to have prior knowledge and skills related to the topic.

The following illustration figuratively explains the division of the technological domain in the 2nd and the 3rd stage of studies by individual subjects.



If students opt for technology education, they study the following areas: technology in everyday life, design and technical drawing, materials and their processing. Additionally, they take approximately one month of home economics and one term (approx. 2 months) of project work each year.

Syllabus of technology education

The most important task in the work with the syllabi was revising the volume and complexity of study volume, with the aim of guaranteeing that the work in class be appropriate for students' age and abilities. Taking into account the specificity of the subject the work groups made changes that differed in the extent and depth. With regard to subject domains teaching was altered to better meet the everyday needs and the interests of students … (Põhikooli … 2010). The syllabi have been prepared consciously taking into account the achievement of general objectives and competences as well as the integration between subjects; the volumes of subjects were decreased and study results were put down more clearly.

The structure of the syllabus of technology education includes the following:

- general principles, which formulate the schooling and educational objectives; the description of the subject; the provision of education; the physical learning environment; assessment.
- the 2nd and the 3rd stage of studies; each stage expresses the general study results and specific study results and the content of study by parts of the studies (as separate items the following areas are described: technology in everyday life, design and technical drawing, materials and their processing, project works, and home economics).

I will provide and excerpt of the schooling and educational objectives in the syllabus of technology education, so that the reader can get an overview of the general goals of the syllabus.

The goal of technology education is that students:

1) value cultural heritage and coping in the multicultural world;
2) acquire a global view, the ability to analyse and synthesise, and a comprehensive world view;
3) acquire technological literacy; develop their technological knowledge and skills, and enjoy practical self-realisation;
4) are able to relate people and their surrounding environment and to analyse the influences of technology on the environment;

5) creatively solve tasks, master the skill of putting ideas into designs and are resourceful in creating products;
6) take into account ethical, aesthetic, and sustainable convictions;
7) are open to look for new solutions, enterprising, friendly, cooperative and willing to work;
8) acquire knowledge and skills through using different materials, tools, and treatments;
9) are able to creatively apply theoretical knowledge in solving practical tasks;
10) in the work process follow safe and ergonomic techniques and moral rules of behaviour;
11) choosing food products and cooking proceed from the principles of healthy nutrition;
12) are aware of their abilities and are able to make decisions in further choice of profession (Ainevaldkond … 2010).

These goals allow us to draw the conclusion, which professor Marju Lauristin from the University of Tartu has expressively made to illustrate education as a whole, but which also well applies to technology education. She says that an intellectual, a specialist, or a skilled worker of tomorrow is a part of the worldwide high-technology risk society even if his or her parents have never left Võru or Sillamäe (towns in Estonia). They must master the possibilities offered by the information society, be ready to change their place of work and residence; easily pick up and use new technologies; creatively combine knowledge from different domains. Young people raised and educated in Estonia must successfully compete in the European, American, or Chinese market using their knowledge and skills. In order not to lose humanness in the technological environment, schools must value direct and open human relations, cultivate teamwork, support friendliness and empathy. The society of knowledge is a networking community. The worldwide network society offers people new prospects, unexpected choices and cooperation possibilities in every junction of the social space. Thus the Estonian education should also develop into a network of branching and convergent paths, where everyone is free to choose the patterns of knowledge and skills that suit them the best. In order to have new winds blowing in Estonia, the educational system should prepare such members of the society, who are not prepared simply for merciless competition, but are also ready to act as a fast learning swarm striving to wholeness and perfection (Lauristin 2008).

In planning and organising the provision of education the fundamental values of the curriculum, general competences, learning content, and expected study results are taken as the basis and the integration with other subjects and recurring topics is supported.

The provision of education is to the most part established on the developmental cycle of a product, etc. Different stages beginning from searching for information, designing the product, and preparing the product to presenting it to other students are covered. The focus is on creativity (designing, completing the product, etc.), maintaining ethnic working traditions (ethnic product, using motives from the folk art to decorate the product, etc.), and modern technology. Carrying out project based (incl. those between subjects and domains of life, cooperation with businesses, boys and girls together) study formats is very important.

The curricula stress issues that are related to the study environment and its influence on a young person's development. Compared to earlier versions, the updated documents are oriented towards learning rather than teaching. This trend is supported by the principles according to which the school is responsible for organising learning in a way that protects the students’ health and ensures that their study load corresponds to their resources, developing a helpful and trusting environment in the school, and using teaching methods that take into account and are appropriate for the students’ individual traits (Estonian … 2010). For the first time the syllabi go into more detail on the subject of the physical learning environment.

The classrooms and study materials for technology education correspond to the health-protection and the occupational safety requirements as well as to those of ergonomics. The classrooms are equipped with appliances that can be used for carrying out to the practical works chosen by the school, including functioning ventilation in the classrooms. Each student is provided with a workplace and individual tools and materials needed for a practical assignment. The keeper of the school guarantees the maintenance of the equipments and tools and is responsible for supplying materials needed for teaching.

In order to reduce the excessive focus on grades found in the evaluation process, the syllabi underline objectives that are intended to support the students, including the provision of feedback, motivation and guidance to students. The role of grades has been retained as input that supports and shapes students, and as indicators, the basis of which students move from one grade to the next. The often formal grades for behaviour and diligence, which so far were required by the state, have been abandoned in order to make it possible for the schools to engage more meaningfully in handling important issues like the students’ behaviour and diligence (Estonian … 2010).

Study results are evaluated through verbal evaluations and/or numerical grades. Evaluating written assignments especially the content of work is considered, but orthographic mistakes, which are not counted in evaluation, are also corrected. Also students' own self-estimate is important in the evaluation. Carrying out a task, planning and design are assessed next to the skill of making choices and reasoning. Evaluation also focuses on the skill of explaining connections, the preparation process, student's development, the result of work, including carrying out independent tasks and the skill of presenting the product. In student evaluation the rules of cultural behaviour and students' attitudes are taken into account. Evaluating students' knowledge, technical brightness, and creativity also tests, problem solving tasks, competitions, projects works, etc. are used.

The study results of the stage of studies have bees established so that these reflect students' good achievements. The study results of technology education in the 2nd stage of studies have been established so that these can be achieved by the end of the stage of studies, i.e. by the end of grade 6. The study result in the 3rd stage are meant to be achieved by the end of grade 9. The study results of the 2nd stage of studies include altogether 11 fundamental items. Next we will take a look at the study results and learning content of „Technology in everyday life" in the 2nd stage of basic school.

Students:

1) understand the essence of technology and value the importance of technological literacy in everyday life;
2) give examples on systems, processes and resources;
3) make connections between the development of technology and scientific advancements;
4) make connections between technology education and other subjects and domains of life;
5) characterise and compare different means of transport and sources of energy;
6) characterise the use of bikes and energy in the history and today;
7) characterise the influence of human activity and technology on the environment;
8) prepare working models as practical assignments;
9) describe the formation of technical appliances and the development of engineering and its greatest advancements

Content of study

Essence of technology. Technological literacy and its importance. Systems, processes and resources. Technology and sciences. Technology, individual, and environment. Structures and constructions. Means of transport. Sources of energy (Ainevaldkond … 2010).

Also the learning contents of other parts have the same structure (technology in everyday life, design and technical drawing; materials and their processing; home economics; project work) in both the 2nd and the 3rd stage of studies. In case of need and if accounted for, the syllabus of technology education enables to change the learning content and/or the order by stages of study or to treat a topic in depth in the next stage of studies. The order of different parts of the subject is planned and organised by the subject teacher in cooperation with the teacher of handicraft and home economics. For the sake of versatility in teaching the subject, the study groups of handicraft and home economics and technology education are switched. The syllabus does not determine the practical works and applied tasks to be performed in the lessons. In the lessons the subject teacher integrates the learning content with the practical activities of his or her own choice (woodwork, metal work, electronics, etc.)

The new curriculum will be applied gradually. This enables the school and the teachers to take time to prepare for carrying out the teaching according to the national curriculum.

The schools will bring the schooling and educational activity and the school curriculum into conformity with the given regulation as follows:

1) In grades 1, 4. and 7 by September 1, 2011 the latest;
2) In grades 2, 5. and 8 by September 1, 2012 the latest;
3) In grades 3, 6. and 9 by September 1, 2013 the latest.

The study environments will be brought into conformity with the requirements for the physical environment established in the given regulation by September 1, 2013 the latest (Põhikooli … 2010).

In order to apply the curriculum drawing up the textbooks for the subject domains and other auxiliary materials is about start. Recommended teaching materials will be drawn up for the teachers to organise and carry out the lessons. Teachers will also be informed and trained within in-service training courses, and textbooks and educational literature proceeding from the curriculum will be published.

Conclusion

The preliminary versions of the updated curricula and syllabi have repeatedly been amended according to the suggestions made by the subject associations, teachers, and the general public. All the suggestions made in writing were considered, but for many reasons not all the suggestions could be used. Nevertheless, such curricula and syllabi were prepared, which by today have met the approval of the teachers and other interested parties. In the course of many years discussions, but also disputes have taken place, but I maintain that as a result of the process the development of syllabi has taken a qualitative step forward, it has become more modern and comprehensive. Applying the syllabi is a different issue, because it demands a lot of new resources and skilful sharing of the existing resources as well as political agreements.

REFERENCES

Ainevaldkond „Tehnoloogia “ (2010). Vabariigi Valitsuse 28. jaanuari 2010. a määruse nr 14 „Põhikooli riiklik õppekava” lisa 7. [*Subject Domain „Technology“ (2010), Appendix 7 of the regulation No 14 „National Curriculum* *for Basic Schools" of the Government of the Republic dating from January 28, 2010]* In: RIIGI TEATAJA. URL: (cited 15.08.2010) https://www.riigiteataja.ee/ert/get-attachment.jsp?id=13275450

Gümnaasiumi riiklik õppekava (2010). (2010). Vabariigi Valitsuse 28. jaanuari 2010. a määrus nr 13. [*National Curriculum for Upper Secondary Schools, 2010. Regulation No 13 „National Curriculum for Basic Schools" of the Government of the Republic dating from January 28, 2010]* In: RIIGI TEATAJA. URL: (cited 15.08.2010) https://www.riigiteataja.ee/ert/act.jsp?id=13272925

Elango, A. (1996). Peeter Põld teerajajana eesti pedagoogikas. *[Peeter Põld as a Pioneer in the Estonian Pedagogy]* In: Peeter Põld oma ajastu peeglis *[Peeter Põld as Reflected in His Own Era]*, 64–72. Tartu: Tartu University Press

Estonian Ministry of Education and Research. Riikliku õppekava lähteülesanne põhikooli ja gümnaasiumi riikliku õppekava arendamiseks aastatel 2008-2011 (2008). *[Terms of Reference for Preparing the National Curriculum for Basic Schools and Upper Secondary Schools in 2008-2011]* URL: (cited 15.08.2010) http://www.hm.ee/index.php?0511284

Estonian Ministry of Education and Research. Põhikooli ja gümnaasiumi riiklik õppekava (2010) *[National Curriculum for Basic Schools and Upper Secondary Schools]*. URL: (cited 15.08.2010) http://www.hm.ee/index.php?0511290 (cited 15.08.2010).

Kananoja, T. (1999). Letters of Uno Cygnaeus and Otto Salomon the 22nd of June 1877- 1st of January 1887. In: Development of Technology Education – Conference-98. Edited by Tapani Kananoja, Jouko Kantola and Minna Issakainen. University Printing House Jyväskylä, 32-57.

Lauristin, M. (2008). Hariduse ideaalmaastik *[The Perfect Education]*. In: Postimees. November 21, 2008. URL: (cited 15.08.2010) http://www.epl.ee/artikkel/449267

Parikka, M., Rasinen, A., Kantola, J. (2000). Kohti teknologiakasvatuksen teoriaa. Teknologiakasvatuskokeilu 1992-2000: Raportti 3. Jyväskylän yliopisto. Opettajankoulutuslaitos, Tutkimuksia 69.

Põhikooli ja gümnaasiumi riiklik õppekava *[National Curriculum for Basic Schools and Upper Secondary Schools]* (2002). In: RIIGI TEATAJA I, 20. URL: (cited 15.08.2010) http://www.riigiteataja.ee/ert/act.jsp?id=1008388

Põhikooli riiklik õppekava (2010). Vabariigi Valitsuse 28. jaanuari 2010. a määrus nr 14. *[National Curriculum for Basic Schools (2010). Regulation No 14 of the Government of the Republic dating from January 28, 2010* In: RIIGI TEATAJA. URL: (cited 15.08.2010) https://www.riigiteataja.ee/ert/act.jsp?id=13273133

Põld, P. (1993). Töökasvatus koolis *[Work Education at School]*. In: Peeter Põld: Valitud tööd I, 26–36. *[Selected Works I]* Tartu: Tartu Univeristy, Eesti Akadeemiline Pedagoogika Selts *[Estonian Academic Association of Pedagogy]*.

Soobik, M. (2010). Lõiming tehnoloogiaõpetuses. Kogumikus: Jaani, J. Aru, L. (koost.) Lõimingu võimalusi põhikooli õppekavas. *[Integration in*

Technology Education. In collection: Jaani, J. Aru, L. (eds.) The Possibilities for Integration in the Curriculum for Basic School] The Educational Research and Curriculum Development Centre, University of Tartu. URL: (cited 15.08.2010)

http://www.ut.ee/curriculum/orb.aw/class=file/action=preview/id=772212/l%F5imingukogumik_08+03+10.pdf

Standards for Technological Literacy: Content for the Study of Technology. (2000). International Technology Education Association. URL: (cited 15.08.2010) http://www.iteea.org/TAA/PDFs/xstnd.pdf (Third Edition)

Tuulik, M. (1996). Eesti Vabariigi esimene pedagoogikaprofessor Peeter Põld ja tänapäev. *[Peeter Põld, the First Professor of Pedagogy in the Republic of Estonia, and the Present Day]* In: Peeter Põld oma ajastu peeglis *[Peeter Põld as Reflected in His Own Era]*, 113-117, Tartu: Tartu University Press

Õppekava internetileht (2010) *[Curriculum web page]* URL: (cited 21.08.2010) https://www.oppekava.ee/

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CREATIVITY, INNOVATION AND ENTREPRENEURSHIP IN EDUCATION 2020 – SOME CONSIDERATIONS FROM CRAFTS PART

Abstract

Through the initiative of Uno Cygnaeus craft and design took place first in the world in Finnish schools named as crafts (sloyd in Nordic counties). Cygnaeus insisted that at school there is a need for the subject which will teach pupils entrepreneurial attitude, skills and use of knowledge in one's own work. The meaning of making things by using techniques and materials was educational. (Kantola 1997.) Since 1866 the name of the subject has been changed many times from boys' and girls' handicrafts to textile and technical work. Crafts reveals how work has been gender based in society (Marjanen 2007; Suojanen 2000). The tradition has very long lasting in textile work as an area for girls and technical work as an area for boys. According to the National core curricula for basic education (2004) crafts should be taught in the spirit of a holistic craft process including design, implementation and evaluation.

In the future people have to be active and creative citizens capable for solving problems and developing innovative solutions in their close environment as well as societal, even global ones. This challenge requires reconsiderations of goals and contents in education. To be able to answer future needs on society and individual level a Nordic Council of Ministers financed a research project named Creativity, innovation and entrepreneurship in education (CIE-project). The project is targeted to answer in what ways creativity, innovation and entrepreneurship are integrated to education and to teacher education in Nordic countries. The research project aims to stimulate developing an educational system with more space to experiment and risks.

An Expert group Education 2020 proposed in May 2010 that the knowledge-based contents of arts and crafts subjects as well as teaching hours in Finnish basic education should be checked (OKM 2010). However it is questionable if the ideas and objectives of educational crafts on personal level and active membership on societal level are seen important for every student in lower secondary education according to a proposal of an Expert group Education 2020.

This article discusses on some preliminary results of the CIE-project in the light of suggestions made by the Expert group Education 2020. It is questioned if the proposal of basic education 2020 will support creativity and innovation in crafts teaching in the future.

Key words: creativity, innovation, entrepreneurship, crafts, basic education

Crafts in Finnish basic education

Crafts as a school subject in the Finnish basic education is intended to teach pupils' skills and knowledge to allow them design and make solutions of their own (Curriculum 2004). This is supposed to be achieved by a holistic craft process in the frame of common craft. According to Curriculum 2004 the task in instruction in crafts is:

> to develop pupils' skills with crafts so that their self-esteem grows on that basis and they derive joy and satisfaction from their work. In addition their sense of responsibility for the work and the use of material increases and they learn to appreciate the quality of the material and work, and to take a critical, evaluative stance towards their own choices and the ideas, products and services offered. The instruction is implemented through projects and subject areas corresponding to the pupils' stage and development and uses experimentation, investigation and invention. The instructional tasks in crafts are to guide the pupil in systematic, sustained, independent work, and to develop creativity, problem-solving skills, an understanding of everyday technological phenomena, and aesthetic, technical, and psychomotor skills. The pupil receives an introduction to the cultural traditions of handicrafts among Finns and other people.

The holistic craft process (Anttila 1993; Kojonkoski-Rännäli 1995) means that one person proceeds with a design and making process starting with ideas and going on with planning the aesthetic, expressive and functional properties of an invented solution as well as the implementation and evaluation of the end result and the entire process. A concept of the holistic craft process is distinguished from a partial craft which does not include design and planning. Creativity, problem solving, evaluation and reflection are features of the holistic craft process. The design and implementation process of the holistic craft is made by some techniques and materials at a time. It does not depend specifically on some technique or material. The holistic craft process can be done in any technique. (Lindfors 2010a; Pöllänen & Kröger 2006; Pöllänen 2009; Seitamaa-Hakkarainen 2006.)

The basic idea is that crafts is a common subject with a varied content of textile and technical work. The concept of common crafts is used to point to a combination of textile and technical work instead of choosing the one and dropping the other. The Curriculum 2004 states very clearly that the crafts is a subject common to boys and girls. Textile work has its traditions in girls' handicraft and technical work in boys' woodwork. It has suggested that the content of technical work should be developed as a separate subject called technology education (Rasinen 2000). The other suggestion is a subject named as craft and technology (Lindfors 2001).

For the first four years girls and boys study together but from the fifth class they can or they are put to choose to make choices what to study and what to drop out: textiles or technical work. The minimum of lesson hours in crafts in elementary education in grades 1-4 (pupils 7-11 years) is 8 and in lower secondary in grade 7 (pupils 14-16 years) it is 3. Pupils have crafts 11 weekly lessons as a minimum in basic education. In grades 8-9 crafts is an elective subject. The weekly lesson (45 min.) indicates 38 hours per year. Usually pupils have 14 weekly lessons in crafts: 80 % in grades 1-6 and 20 % in grade 7. In 14 % of schools there are no voluntary courses available in crafts. (OPH 2009.)

The Curriculum 2004 imposes high demands on instruction. Criteria for final assessment grade 8 (the scale is 4-10) require that pupils will:

In visual design and technical planning

- *observe problems independently, create ideas creatively, and with guidance, design products in which attempts have been made to consider the available time, the tools, the materials, the aesthetics of the products, ecological value, durability, economy and suitability for purpose*
- *understand the products they are designing as a message to the environment, too*
- *document designs e.g. illustrations, verbally, with samples, with the help of miniature models, or by other means, so as to reveal the nature of the idea and its intended method of production*
- *know how, in their planning, and with guidance, to use elements from the technological, design, and crafts cultures of the Finns and other peoples.*

Production

- *work appropriately and carefully, observing work safety instructions, and attend to the order and comfort of their working environment*
- *master basic techniques, so that the products is appropriate for its purpose, polished, ecological, and aesthetically pleasing*
- *know how to work purposefully alone on in teams*
- *know how to apply advanced technology, with guidance, in their work; they will understand technological concepts and systems , and their applications*
- *know how to apply the knowledge and skills they have learned in other subjects*

Self-evaluation and considering of the process

- *be able with guidance, to examine their personal work and learning*
- *observe to strengths and weaknesses in a process and results*
- *demonstrate a tolerance for criticism in the evaluation process, and want to direct their actions in accordance with the feed-back*
- *evaluate their ideas and products by the criteria of aesthetics, economy, ecology and appropriateness for purpose*
- *understand the interdependence of technology, culture, society, and nature*
- *form a realistic picture of their skills and potential for improvement.*

Class teachers (master of education) teach 80 % of crafts in elementary education mainly on the basis of multidisciplinary studies. Student teachers have few compulsory studies as background knowledge and skills in arts and crafts as they start their studies in teacher education. Craft didactics courses vary from 4-6 ECTS credits (one ETCS credits is 27 hours work) courses in multidisciplinary studies (60 ECTS). The content of the studies is to be subject-specific didactics, not knowledge of the subject knowledge and skills therein. The specialised class teachers (e.g. crafts as a minor subject, 25 ECTs) have only some more lessons to teach than teachers without specialisation (Korkeakoski 1998.) In grades 7-9 the teacher is required to hold a master's degree in a subject taught in school. However in arts and crafts in particular there are challenges to qualify teachers for grades 1-6 during multidisciplinary studies due to weak knowledge and skills in crafts on the basis of background studies. (Lindfors 2010c; Lindfors & Kokko 2009). A subject teacher with deep competence in subject knowledge and skills teaches pupils mainly from 7th grade. The way of organising instruction at school means that 80 % of the demanding criteria of basic education should be reached in the guidance of teachers with narrow studies in crafts and crafts didactics.

The proposal for basic education 2020

The Expert group Education 2020 is targeted to renew the basic education. It named objectives into five groups for the skills an individual needs in the society: Thinking skills, Ways of working and interaction, Crafts and expressive skills, Participation and initiative, and Self-awareness and personal responsibility. According to the proposal, in future there will be six different multi-disciplinary subject groups in basic education: Language and interaction, Mathematics, Environment, science and technology, Individual, enterprise and society, Arts and crafts and Health and personal functionality. (OKM 2010.)

The number of pupils' minimum amount of annual weekly lesson hours is proposed to be increased by four (4) in order to strengthen national equality. The minimum number of lesson hours and the number of elective lesson hours are proposed to be increased in arts, crafts and physical education in particular. Pupils' opportunities to choose optional lesson hours in these subjects will be strengthened. The number of elective lesson hours will be increased significantly in grades 3-9. This aims to give pupils and education providers more opportunities to different options and flexible solutions as well as to increase the motivation to study. Elective lesson hours will be part of the pupils' minimum number of compulsory lesson hours. It is proposed that there are 13 weekly lesson hours per year in grades 3-6 and 21 weekly lesson hours per year in grades 7-9 (of which a minimum of 6 lesson hours for arts and crafts). The optional lesson hours will be placed in different multi-disciplinary subject groups. The expert group proposes two new school subjects: ethics and drama. Within the multi-disciplinary subject group Individual, enterprise and society, ethics is to reinforce the basic values of the Finnish society and to enhance a dialogue amongst pupils representing different world-views. The objective for drama is to strengthen a comprehensive approach to art education in the multi-disciplinary subject group of Arts and crafts.

Compared the Proposal 2020 to the Curriculum 2004 the minimum amount of obligatory studies is the same, 11 weekly lessons (table 1). From 2004 there have been in practise 3 weekly lessons in grades 1-2 and 8 weekly lessons in grades 3-6 plus 3 weekly lessons in 7th grade, altogether 14 weekly lessons. Compared to practise of applying Curriculum 2004 in the proposal 2020 there is one weekly lesson more in grades 1-2. Minimum for grades 3-6 is the same, although in the proposal there are two more elective weekly lessons to be divided for crafts, music, arts and drama. This will mean 8 weekly lessons for grades 3-6 in crafts. The biggest difference is in grade 7. Weekly lessons of crafts will diminish from three hours to one. It is impossible to forecast how many pupils would elect crafts in the future. A research in 2007 revealed that half of pupils elected crafts (Lindfors 2007).

TABLE 1 Weekly lessons in crafts in grades 1-9. Differences between the Proposal 2020 and the Curriculum 2004.

Weekly lessons in Crafts in grades 1-9	**Grades 1-9**	**Grades 1-2**	**Grades 3-6**		**Grade 7**		**Grades 8-9**	
			min.	elective	min.	elective	min.	elective
Curriculum 2004	11	2	6	6*	3	-	-	6*
Proposal 2020	11	4	6	8*	1	2**	-	3***

*Weekly lessons common to crafts, music, arts and sports.
**Weekly lessons common to crafts, music, arts and drama.
***Weekly lessons if a pupil will elect crafts.

Creativity, innovation and entrepreneurship

People live in a society which is more demanding than ever before. The challenges to cope in life are many. Personal everyday life as well as working life demands abilities to cope in altering circumstances and to live in chaos. Individuals should be able to take responsibility on decisions of their own (Moisio & Huuhtanen 2007; Sawyer 2007). To be able to answer the future needs of society and individuals a Nordic Council of Ministers financed a research project named Creativity, innovation and entrepreneurship in education (CIE-project). The project is targeted to answer in what ways creativity, innovation and entrepreneurship are integrated to preschools, primary and secondary education as well as teacher education in Nordic countries, including the autonomous regions Åland, the Faroe Islands and Greenland. The research project aimed to stimulate developing an educational system with more space to and experiments and risks. The main research included two sub-studies: Arts and crafts in education and Science teaching in education. The final report will be published in December 2010.

To answer problems or future challenges, e.g. globalization, environment problems, new technology and changes in population aging (see The Innovation Strategy of Finland 2008) people have to be active and creative citizens capable for solving problems and developing innovative solutions in their environment: in personal life, in family occasions as well as societal, even global environments (Lindfors 2010d). Here creativity has a decisive role.

Creativity is seen today as a diverse and multidisciplinary structure in people's lives connected to their personal history and social environment (Csikszentmihályi, 1988, 1996; Sternberg & Lubart, 1999).Creativity is a combination of the person's cognitive processes, personal capacity and features as well as the influence of the environment. How to perceive problems and challenges and how to find ideas? How to deal with and develop possible solutions? Ideas and solutions are seen as innovative if they are answers to certain needs and if they promote creativity. It is evident that innovation is connected to people's ability and capacity to invent and to think creatively.

Inventions and a will to manage have developed life in the history of people. Sometimes it seems that the new invention was created by accident. In real life the question is not so simple. The solutions are based on knowledge and skills in the form of critical analyses and study of reality and opportunities both intuitive and purposeful. (Lindfors 2010d.) Sawyer (2007) and Himanen (2007) consider that innovation can no longer be the work of a single person in a certain branch of science. Collaborative ways of doing things promote dialectic processes between people, different types of knowledge and practical actions as well as skills in finding problems, evaluating possibilities, testing different solutions and making decisions. Creativity is not only individual use of knowledge. It is thinking, considering and sharing together. The work in empirical situations helps to create ideas for new solutions (Ljungblad 2008).

Innovation is something we try to reach to cope in life, not just today but also in the future. Some people argue that innovation in the pedagogical context is a dirty word and they see it to refer only to business and economy. Innovation is no longer seen only as a solution which is economically viable and increases corporate profitability. Innovations are looked for and developed in all branches of society. The target is to find new ways to do things and develop actions in practice. In many cases the need to modify the praxis is a starting point. Future innovations are designed in relation to practice with multicultural and multidisciplinary as well as practical collaboration. Innovations may be large in the world context or tiny details in an individual's own environment. Innovations are either material or immaterial. An innovation may be a solution to some private or local problem, greater or smaller or it may prove to be a worldwide system, such as the Internet. Innovators may be neighbours negotiating together on how to solve the problem created by rabbits in urban gardens or world-class experts trying to save the planet. In sum, innovation is defined as a new or redeveloped future-oriented solution, a product, a process, a method or a service, designed and taken into practice on the basis of multiple collaboration to achieve purposes and objectives. (Lindfors 2010d.) To enable the use of new ideas and to invent better solutions people should be encouraged and supported to invent creative ways of doing things instead of taking routines and traditions for granted. After the creative ideas and functional solutions have been perceived as answers to people's needs and purposes in general they will be seen afterwards as success stories of creativity, design and technology.

Entrepreneurship and entrepreneurship education emphases practical active, experimental and creative processes (Backström-Widjeskog 2008; Lehtonen 2010; Remes 2003). Increase in uncertainty in various life areas is especially challenging for the young people's life management and future orientation. Entrepreneurship education focuses on organising learning environments which support acquiring active, responsible and creative attitude and towards life and challenges. Enterprising attitude is a way of acting and promoting life. It is necessary to an individual in personal life management as well as in studies and at work. In entrepreneurship education the learning environment is crucial. It should promote real actions to reach practical goals, e.g. how to secondary school pupils could support elementary school pupils to decrease bullying.

User-centred research and design puts user's psychological and physiological experiences in focus. This point of view offers a crucial method for enterprising education. According to the literature (Coleman 1999; Kwahk & Han 2002; Lindfors 2002; Redström 2006) usability refers to a relation between a product, its user and the environment. To solve future problems in reality and to enable creative alteration of praxis pupils must identify and study the real problems people have. One main feature in user-centred design is to study and evaluate user's experiences, needs and problems in real situations. In this way it is possible to experience, understand and reflect on the given situation and environment where the solution will be used. Open and practice oriented learning environments in schools but especially outside of schools offer natural places to learn enterprising attitude and manner.

Crafts as a subject focuses on promote holistic processes as individual or team work (Lindfors 2010b). Stimulation of the individual and social entrepreneurship requires experimental, personal and self-guided activity which can support the development of knowledge and practical skills in certain material area but also the personal features like initiative, creativity, curiosity, motivation and goal orientation (Lindfors 2010e). This develops pupils' attitudes to find and notice problems and challenges, to stand uncertain situations and risks, to be optimistic and to make decisions as well as practical actions. A need to alter praxis will come to light when people are not satisfied in a specific situation or if there is a will to do something differently than before, e.g. slowly or simply or with fever resources. Creativity has a decisive role in problem solving in comparing, evaluating and assessing, choosing, combining and using knowledge and skills to reach a practical solution. Various design and practical making up process models describe steps to finding ideas and creating solutions and assessing these solutions in reality (Anttila 1993; Lindfors 2008). Instead of gender based work the future image and value of craft has to do with well-being in chaos and changing circumstances and innovations as practical examples of creative problem solving processes in society as much as with creativity and initiative as personal and collaborative competence in everyday life. (Lindfors 2009.)

The future of crafts in basic education

Cygnaeus did not know the challenges of 21st century when he insisted 150 years ago that at school there is a need for the subject which will teach pupils entrepreneurial attitude, skills and use of knowledge in one's own work. As we look the goals and the evaluation criteria of crafts we see that Cygnaeus' ideas and educational goals were still present in 2004. In 2010 Nordic governments (CIE-project) are concerned about people's capability of using knowledge, being creative and innovative. They want to know how to promote entrepreneurship in education. At the same time the national Expert group Education 2020 named the skills an individual needs in the society: Thinking skills, Ways of working and interaction, Crafts and expressive skills, Participation and initiative, and Self-awareness and personal responsibility. The group points that there is a need to increase number of lesson hours in arts, crafts and physical education in basic education to reach the goals. (OKM 2010.)

We have come to end of an idea that only by sitting, reading and writing alone could be reached such knowledge and skills which would promote creativity, innovation, entrepreneurial activity, life management and future orientations (see Lindfors 2010a; 2010b). Cygnaeus knew this. That is the reason he pointed skills and use of knowledge in pupil's own work. One of the main findings of CIE-project is that in curriculum there are lots of content which is meant to promote e.g. creativity. However in researches students tell that they do not learn creativity at school. Among school subjects crafts seems to be the one which focuses on promoting innovativeness in reality. Ideas and knowledge are tested always in practise in crafts. The other finding in CIE-project is that experimental learning in science subjects (physics, chemistry, geography and biology) has a lot of common features with process oriented arts and crafts learning. The problem of promoting creativity, innovation and entrepreneurship in school is not the content of curriculum, it is a way of teaching and learning. (CIE-project 2010.) Integration of subjects under themes of reality (past, present and future) would promote creativity, innovation and entrepreneurial attitude and behaviour. Crafts as a subject and as a way of working, offers lots of opportunities to other subjects. Integration of science and crafts would offer ideal projects to experiment and to process as well as to be entrepreneurial with creative mind and innovative attitude.

The Expert group Education 2020 proposes that crafts is usable for all pupils as a common content only in elementary school (Table 1). They suggest that only 9 % of obligatory crafts should be learnt in secondary and 91 % in elementary education. By increasing the elective weekly lessons the group points that only some pupils need to study crafts with its creative and processional nature. This will be fatal for the quality of teaching. It means that class teachers with narrow studies in craft didactics will have the main responsibility (see Korkeakoski 1998) on crafts in basic education in the future (e.g. Lindfors 2010c). This will not promote high-level teaching in crafts. Instead it can even end the subject teacher education in crafts in the future. If pupils have only one obligatory weekly lesson of crafts in 7th grade and few pupils will elect crafts there will not be enough teaching hours for a permanent subject teacher in one school.

An ultimate target of education is to support children so that they are able not only to cope in the society of today but also in the future. The common task of education and school is that pupils should be encouraged to develop themselves as future citizens who are willing and able to promote the material and especially the social well-being of society. The group 2020 has come to the decision that there is need to increase arts and crafts subjects at school. At the same they have come to a decision that there is the need in lower secondary education to diminish obligatory weekly lessons of the subject which specifically promotes process-oriented work, entrepreneurship, creativity and innovation. Instead of leaving crafts mainly elective in lower secondary there should promote integration of crafts with science and other subjects. There should be obligatory integrative courses instead of the possibility to elect only some subjects and focus on them. This would offer pupils experimental learning and they would learn how to use skills and knowledge in one's own work, just like Cygnaeus meant it. This would develop working culture of schools in a form of co-operation of teachers and integration of several subjects.

REFERENCES

Anttila, P. 1993. *Käsityön ja muotoilun teoreettiset perusteet.* Helsinki:WSOY.

Backström-Widjeskog, B. (2008). *Du kan om du vill. Lärarnas tankar om fostran till företagsamhet.* Åbo: Åbo Akademis förlag.

Coleman, R. 1999. Inclusive Design – Design for All. Ini Green, W. & Jordan, P. (ed.) *Human Factors in Product Design. Current Practice and Future Trends.* USA: Taylor & Francis Group, 159–170.

Csikszentmihalyi, M. 1988. *Optimal Experience: Psychological Studies of Flow in Consciousness*. Cambridge, NY: Cambridge University Press.Csikszentmihalyi, M. 1996. Flow and the Psychology of Discovery and Invention. New York.

Curriclum 2004. *National core curricula for basic education (2004).* http://www.oph.fi/ops/english/POPS_net_new_4.pdf, downloaded 04.06.2010.

Himanen, P. 2010. *Kukoistuksen käsikirjoitus*. Helsinki: Werner Söderström. Hämtad från http://www.wsoy.fi/wsoy/digipaper/wsoy/381/index.html, downloaded 04.06.2010.

Himanen, P. 2007. *Suomalainen unelma innovaatioraportti. Teknologiateollisuuden 100-vuotissäätiö.* Helsinki: Artprint.

Kantola, J. 1997. In the footsteps of Cygnaeus: From handicraft teaching to technological education. Jyväskylä university. Jyväskylä studies in education, psychology and social research. 133.

Kojonkoski-Rännäli, S. 1995. Ajatus käsissämme. Käsityön käsitteen merkityssisällön analyysi. Turun yliopiston julkaisuja. Sarja C. 109.

Korkeakoski, E. 1998. *Lasten ja nuorten taidekasvatus peruskoulussa ja lukiossa.* Arviointi 9/1998. Helsinki: Opetushallitus.

Kwahk, J. & Han, S. 2002. A methodology for evaluating the usability of audiovisual consumer electronic products. *Applied Ergonimics* 33, 419–431.

Lehtonen, H. 2010. Growth of enterprising and entrepreneurial behavior. In E. Lindfors & J.

Lindfors, E. 2010a. Käyttäjälähtöinen suunnittelu - oppilaiden kokemukset ja ideat innovaatioiksi. Teoksessa T. Laine & T. Tammi (toim.) Tutki, kehitä ja kokeile. Hämeenlinnan normaalikoulun julkaisuja nro 10. Tampere: Tampereen yliopiston jäljennepalvelu, 139–155.

Lindfors, E. 2010b. Everyday practice and innovations as challenges of research and sloyd teaching. In E. Lindfors & J. Pullinen (eds.) In the Tradition of Uno Cygnaeus: 90 years of teacher education in Hämeenlinna. university of Tampere. Hämeenlinna, 97-117. In https://www.uta.fi/laitokset/okl/hokl/dokumentit/juhlakirjaweb.pdf, red 19.08.2010.

Lindfors, E. 2010c. Do teachers have the competence to teach? – the dilemma of arts and crafts. Ruismäki, H. & Ruokonen, I.(Eds.) 2010. Rights of the Child to the Arts, Culture and Creativity. 2nd International Journal of Intercultural Arts Education Conference: Post-Conference Book. Research Report. University of Helsinki.Faculty of Behavioural Sciences. Department of Teacher Education. Helsinki: University Press. (In press)

Lindfors, E. 2010d. Innovation and user-centred design. In J. Sjøvoll & K. Skogen (eds.) Creativity and Innovation. Preconditions for entrepreneurial education. Trondheim:Tapir Akademisk Forlag, 53–63.

Lindfors, E. 2010e. Kreativitet, innovation och entreprenørskap i det finska utbildningssystemet. In J. Sjövoll (ed.) Kreativitet, innovation och entreprenørskap i Norden. Nordic Council on Ministers. In print.

Lindfors, E. 2009. Crafts in basic education – a Challenge for craft science. In L. K. Kaukinen (ed.) Proceedings of the Crafticulation & Education Confrence. Research in Sloyd and Crafts Science. Techne Series. A:14/2009, 290– 298. Saatavana verkkoversiona osoitteessa http://hdl.handle.net/10224/4810.

Lindfors, E. 2008. How to teach innovation? – A case in teacher education. In Mäenpää, M.& Rajanti, T. (eds.) *Creative Futures Conference Proceedings.* Publication of Creative Leadership. University of Art and Design, Pori School of Art and media. Taideteollisen korkeakoulun julkaisu C 6 / 2008, 256-267. http://www11.uiah.fi/creativeleadership/cf07/cl_180608.pdf, downloaded 1.9.2009.

Lindfors, E. 2007. Sloyd in education – Student teacher perspective. In Johansson, M.& Porko-Hudd, M. (eds.*) Knowledge, Qualities and sloyd. Research in Sloyd and Crafts Science.* Techne Series. A:10/2007, 53-73.

Lindfors, E. 2002. *Tekstiilituotteen teknologiset ominaisuudet.* Tekstiilituotteen käyttö- ja hoito-ominaisuuksien tarkastelu kuluttajan näkökulmasta. Tekstiilituotteen Joensuun yliopisto. Kasvatustieteellisiä julkaisuja n:o 77.

Lindfors, E. 2001. Art and Technology - Two Pespectives on Sloyd and Sloyd Education. In C. Nygren-Landgärds & J. Peltonen (ed.) Visioner om slöjd och slöjdpedagogik. Forskning i slöjdpedagogik och slöjdvetenskap. B:10/2001, 240-250

Lindfors, E. & Kokko, S. 2009. Taide- ja taitokasvatuksen haasteet luokanopettajankoulutuksessa. Esimerkkinä käsityö. Teoksessa E. Ropo, H. Silfverberg & T. Soini-Ikonen (eds.) Toisensa kohtaavat ainedidaktiikat. Ainedidaktinen symposiumi 13.2.2009 Tampereella. Tampereen yliopiston opettajankoulutuslaitoksen julkaisuja. A31, 215-228.

Ljungblad, S. 2008. *Beyond Users. Grounding Technology in Experience.* Stockholm University http://www.viktoria.se/~saral/beyond_users.pdf, downloaded 10.08.2010.

Marjanen, P. 2007. Kasvattavaa vai käytännöllistä käsityötä? – kansakoulun ja alkavan peruskoulun koulukäsityön tavoitteiden ja sisältöjen analyysi. Oulun yliopisto. Kasvatustieteiden tiedekunta. Kasvatustieteiden ja opettajankoulutuksen yksikkö. Lisensiaatintutkimus.

Moisio, E & Huuhtanen, H. 2007. Arki hallussa?: Suomalaisten asiantuntijoiden näkemyksiä työstä, perheestä ja vapaa-ajasta vuonna 2015: Delfoi-paneelin tuloksia. Helsinki: Työterveyslaitos. http://www.ttl.fi/Internet/Suomi/Tiedonvalitys/Tyo+ja+ihminen/tutkimusraportti_31.htm, downloaded 22.08.10.

OPH 2009. Perusopetuksen taide- ja taitoaineden seuranta. TAITAI. Taide- ja taitokasvatus. http://www.oph.fi/download/122507_yhteenveto_taitai_seuranta_2009.pdf

OKM 2010. Basic education 2020 - the national general objectives and distribution of lesson hours. Reports of the Ministry of Education and Culture, Finland 2010:01. In http://www.minedu.fi/OPM/Julkaisut/2010/perusopetuksen_tuntijako.html?lang=fi&extra_locale=en, downloaded 9.8.2010.

Pullinen (ed.) *In the Tradition of Uno Cygnaeus: 90 years of teacher education in Hämeenlinna.* Tampereen yliopiston opettajankoulutuslaitos. Hämeenlinna, 127-142. https://www.uta.fi/laitokset/okl/hokl/dokumentit/juhlakirjaweb.pdf, downloaded 19.08.2010.

Pöllänen, S. 2009. Contextualising Craft: Pedagogical Models for Craft Education. Volume 28 (3), 249-260.

Pöllänen, S. & Kröger, T. 2006. Kokonainen ja ositettu käsityö paradigmamaailmoina. Teoksessa L. Kaukinen & M. Collanus (eds.)

Tekstejä ja kangastuksia. Puheenvuoroja käsityöstä ja sen tulevaisuudesta. ARTEFAKTA 17. Tampere: Akatiimi Oy, 86−96.

Rasinen, A. (2000) *Developing Technology Education. In Search of Curriculum Elements for Finnish General Education Schools.* University of Jyväskylä. Jyväskylä studies in education and social research. 171.

Redström, J. 2006. Towards user design? On the shift from object to user as the subject of design. *Design Studies* 27, 123–139.

Remes, L. (2003). *Yrittäjyyskasvatuksen kolme diskurssia. Three discourses in Entrepreneurial Learning University of Jyväskylä*. Jyväskylä Studies in Education, Psychology and Social Research. Nro 213. Hämtad från http://urn.fi/URN:ISBN:951-39-1426-7, läst 25.05.2010.

Sawyer, K. 2007. *Group Genius: The Creative Power of Collaboration.* New York: Basic books.

Seitamaa-Hakkarainen P. 2000. *The Weaving-Design Process as a Dual- Space Search.* University of Helsinki. Department of Home Economics and Craft Science. Research report 6.

Sternberg, R. & Lubart, T. 1999. The Concept of Creativity. Prospects and Paradigms. In Sternberg, R. (ed.) Handbook of Creativity. Cambrige: Cambrige University Press, 3-15.

Suojanen, U. 2000. Slöjd och samhällsförändring. In U. Suojanen & M. Porko-Hudd (eds.) *World-Wide Sloyd. Ideologi för framtidens samhälle* Åbo Akademi. Institutionen för lärarutbildning/Enheten för slöjdpedagogik och huslig ekonomi. Techne Serie. Forskning i slöjdpedagogik och slöjdvetenskap. B: 8/2000, 65–98.

The innovation strategy of Finland 2008. http://www.innovaatiostrategia.fi/files/download/nationella_innovationsstrategi_12062008_sv-20080613.pdf, downloaded 10.08.2010.

Contents

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GENDER DIFFERENCES IN TECHNOLOGY EDUCATION; SEARCHING WAYS TO ENCOURAGE GIRLS TO STUDY TECHNOLOGY

Introduction

The results of the various studies (during UPDATE -project) revealed that in spite of the guidelines of general or national curricula and existing materials of various EU countries, there is a great demand for new learning materials and pedagogical practices in technology education. There is also a need to raise pupils', particularly girls', interest and participation in technology education.

Technology is traditionally seen as a male dominated area. In Finnish primary schools technology is taught mainly during craft, particularly technical craft lessons. Those girls who have chosen to study textile craft have to exclude their technology studies. Dow's (2006) research revealed that technology teachers emerged as holding on to the belief that technology education is still very much based upon skill mastery and is vocationally orientated. Also various research have indicated that technology lessons across the developed world have tended to orientate around the concept of craft skill development relating more to the perceived needs of industry (Dakers, 2006; Dow 2006). This can also be observed in schools in Finland. Our article focuses on finding out viewpoints to develop more holistic approaches and pedagogy for learning and teaching technology education by attempting to move away from the skill-oriented, working alone model of learning. In addition to this we are interested to study how girls could be encouraged to study technology. In this paper we will investigate and discuss about the problem solving project called "Trick-track" in gender point of view. Also another questionnaire study about girls' motivation towards technology education in school is presented.

Cooperative learning in technology education

Cooperative teaching methods are very adequate when teaching heterogeneous groups. When learners' skills or abilities differ a lot, working in a group offers opportunities for different students to make good use of their strengths. In early stages of cooperative learning (when the method is new for learners) it is advisable to let learners to have roles where their can exploit their strengths rather than support their weaknesses. Group's interdependency and strong support between members are also very important when working with difficult tasks like problem solving. (see Saloviita, 2006, Slavin, 1995.)

Some important characteristics to cooperative teaching methods are clear roles for learners, strong feeling of responsibility and strong interdependency in group. Learners' roles may differ during learning process which sometimes causes difficulties for students whose acceptations are that everyone must do same work and learn same things. In Finland craft lessons are traditionally based on the culture where working alone and developing students own skills are important. Important is also that everybody understands how they are responsible not only his or her own learning but also learning of other group members. This crucial part is often neglected in classroom although it is unquestionable necessity for quality co-operative learning. (see for instance Harris & Hanley, 2004, Johnson & Johnson, 2005, Sahlberg & Sharan, 2003.)

Dow and Dakers (2008) studied how to change pupils' perceptions and how to increase the interest of girls in Design and Technology (in Scotland). The study was conducted by inviting outside agencies related to engineering and technology to visit the school and work for the duration of one day on various activities. The intention was to give the girls continuous experience of what were considered to be activities which they would find interesting and which would alter their perceptions of both engineering and Design and Technology education. The results addressed that the activities had some impact on how the girls preferred to learn. One of the results was that after the activities a higher number stated a preference for working in groups rather than in pairs. There were a number of problems that clearly have to be addressed in future studies. One of them is the need to consider the theoretical assumptions underlying the type of pedagogy adopted in the various technological tasks.

A case study of Trick-track project as a problem solving activity

Based on Dow's and Dakers' (2008) results and our experiences as teachers in technology education, we decided to study how *cooperative learning* in a practice called the Trick-track project would work when teaching teacher education students to understand technological problem solving process, cooperation and to practise materials, tools and techniques.

Problem solving is a thinking process, which emerges in problematic situations. In the situation problem solver must have a goal, which he/she tries to solve, but can't solve it directly with the knowledge he or she has. During the problem solving process students select information based on their previous experiences and are encouraged to apply their knowledge into practice. Working at the limit of competence is an essential feature of progressive problem solving. This definition includes the idea of the starting up component in the problem solving process. The problem solver must have motivation to solve the problem. (Leppäaho 2007, 41-42.) The assumption that problem solving skills are developed during the project is based on the following idea: the learning process leads students to situations in which there is a discrepancy between their current understanding and the demands of the task. These discrepancies will be caused especially when students make errors during constructing their idea of the trick track. (see Suomala 1999, 25.) In the problem solving process various aspects of learning can be comprised.

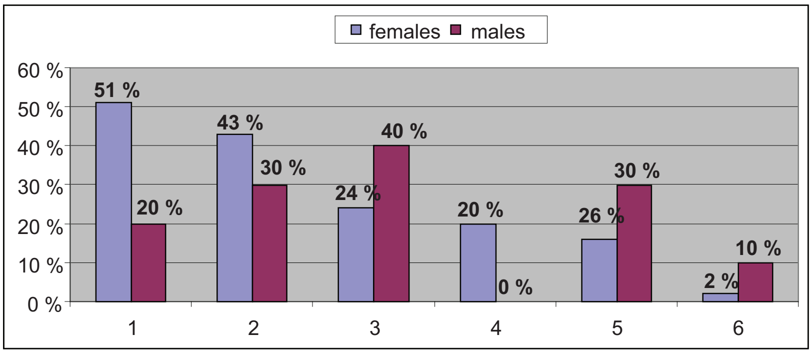
This study started in a year 2009 and it is still continuing in the University of Jyväskylä, Department of Teacher Education. The project is called "The Trick track project". It's a part of a basic course in primary school teacher education program and it is compulsory for all the students. The emphasis is on pedagogy, but in addition basic technical working skills are studied. Based on our earlier experiences we were worried about the possibility that during this kind of hands on -project students concentrate too much on developing only their skills instead of the pedagogical/philosophical ideas behind the activities. Because these students will be working as primary schools teachers, we found it important to study how students find this project and if there is gender related differences. Students are guided to understand why problem solving and application are important skills for pupils. Project is done on collaborative groups who have to design and build up a roller-coaster for a ball. The study was implemented by asking 2nd year basic course students to fill out a questionnaire in the end to the Trick track -project session (4 hours). Data includes 59 students' answers, 10 males and 49 females.

The questionnaire is divided in four parts. Three questions are titled but not structured and one question is with a scale from 1-5 (1=poor, 5=excellent). The questions are: 1) What was the best in the trick track –project? 2) If you could change the instruction or contents of the project what would you change? 3) Do you think this kind of project would be suitable for elementary school pupils, which grade and why? 4) Please evaluate trick track -project in scale 1-5.

Outcomes so far

When asking '*what was the best in the project for my own learning*' more than 50% of students evaluated this kind of project as a good practise for using various materials, tools and techniques. In addition cooperation and working in groups was mentioned in several students' answers. Interesting difference between the answers of females and males was that 60% of males, but only 24% mentioned about creativity and finding new solutions.

When asking '*what was the best in the project pedagogically*' half (51%) of female students and 20% of males mentioned that their pedagogical understanding of the problem solving process was developed during the project. The secondly mentioned aspect among females and males was cooperation, working in a group (social aspect of learning). The difference between females and males answers was in creativity, sussing and playfulness. Only 24 % of females but 40 % of males mentioned that it was a pedagogically best aspect in the project. (see graph 1.)



1 = pedagogic of problem solving
2 = cooperation, working in a group (social aspect of learning)
3 = creativity, sussing out, playfulness
4 = use of various materials, tools and techniques
5 = new idea / aspect
(6 = no answer)

GRAPH 1 Pedagogical aspects of the Trick track

When asked '*what students wanted to change in the project*', there was a difference between the answers. Only 35% of females, but 60% of males thought that the project should be bigger and/or more challenging. When asking if this project would be suitable for primary school pupils 72% of all students answered yes and 22% absolutely yes. In scale of 1-5, 54% of all students evaluated this project as 4 and 15% as 5 (1=poor, 5=excellent).

The sample in this study was relatively small (N=59) and it includes only 10 males. Therefore it can be analysed only as giving us some guidelines, this far. In the future reliability will get better, because every year one hundred new student will answer the questionnaire.

Gender specific interests in technology education

Traditionally technology has been a field dominated by males and it's seen as a topic closely connected to the male gender stereotype. At the beginning of primary school, children's gender stereotypes adhere to the cultural standards concerning toys, activities and vocational roles. The toys of boys' are often electronic and girls' based on developing social skills (Weber & Custer 2005, 55-56).

A questionnaire study was conducted to investigate pupils' motivation towards various technological activities. Data consists of 301 fifth and sixth graders answers, together 150 girls and 150 boys, one not known (N=301). In the beginning of the structured questionnaire there were some questions concerning about the background information: age, gender, and what pupils have studied (technical craft or textile craft or both) at school, what kind of activities pupils have done at school and what kind of material they have used ect. After marking the background information pupils marked their degree of agreement or disagreement in Likert scale of 1-4 (1= I fully agree, 2= I partly agree, 3= I partly disagree, 4= I fully disagree) with statements concerning different technological activities dealing with various types of motives. The questions were divided in categories based on Kosonen's 1996 theory of motivation. These categories are 1) Motives based on emotional experience, 2) Motives based on contents of technology, 3) Motives based on accomplishment and achievement, 4) Motives based on social interaction, 5) Reluctance, 6) Working process. Data was collected at spring 2009 and pupils were chosen from schools in bigger towns and some from smaller communal schools, different parts of Finland.

Results based on category frequencies

When pupils were asked which content area of craft studies they have studied at school: 143 (29 girls and 114 boys) have studied technical craft, 98 (92 girls and 6 boys) textile craft, and 55 (28 and 27 boys) have studied both. 5 didn't answer to this question at all.

Motives based on emotional experience

When pupils were asked about craft artifacts or use of tools and working in craft lessons, the answers were very positive in general. From all pupils over 86 % fully or partly agreed with the statements:"*I like the crafts that we do at school*" and "*I find it important that my artifact is well done looks nice*". Majority of pupils found it nice that they can use tools well. However 64% of boys but 46% of girls totally agreed with the statement "*I find it nice if I can use tools well*". In addition over 73% (77% of girls and 73% of boys) of pupils fully or partly agreed with the statement "*When working in craft lesson, the work carries me away*".

Motives based on contents of technology

Over 86% of pupils fully or partly agreed with the statement *"I like the craft that we are doing at school"*. Also when pupils were asked about what kind of projects they would like to do, 79% of girls and 84% of boys fully or partly agreed with the statement of *"I would like to do an useful artifact to my home"*. When pupils were asked about *"The best for me is if I can create my own idea and realize it"*, the majority (78% of girls and 85% of boys) fully or partly agreed with the statement. The most of the pupils, but a little difference in answers between girls (74%) and boys (85%) fully or partly agreed with the statement *"I like building and constructing things"*. Majority (over 70%) of the pupils fully or partly disagreed with the statement *"I would like to study how commercials effect on people"*.

The statements that had some or remarkable difference between the answers of girls' and boys' are the following. With the statement *"It's fun to learn how to use different tools"* 42% of boys and 33% of girls fully agreed, but more girls compared to boys partly disagreed with the statement. Statements dealing with the environment and nature divided girls and boys strongly: 63% of girls but only 42% of boys fully or partly agreed with the statement *"I'm interested in to invent solutions for keeping environment clean"* and 75% of girls and 50% of boys *"I would like to learn how to preserve the nature"*. Only some (8%) of girls but more (20%) of boys fully disagreed with these statements. When pupils were asked about the projects that are done in craft lessons 74% of girls and only 50% of boys fully or partly disagreed with the statement *"I don't care what kind of artifacts we are doing in craft lessons"*. And when asked *"I like to do decorative artifacts"*, 74% of girls and 49% of boys fully or partly agreed with the statement. Only 17% of girls but 55% of boys fully agreed with the statement *"I like to build electronic devices"*. One explanation for this difference might be that girls who have studied textile craft (majority in this data) maybe haven't ever done electronic devices. With the statement *"I want to learn the risks of using internet"* 56% of girls and 41% of boys fully or partly agreed, but more boys compared to girls disagreed with this.

Motives based on accomplishment and achievement

The statements that are included in this group of motives had a difference between the answers of girls and boys. With the statement *"I'm afraid of doing something wrong"* 64% of girls but only 44% of boys fully or partly agreed. When considering the statement *"I think that we are doing too easy projects in the craft lessons"* only 64% of boys and 77% of girls fully or partly disagreed with the statement.

Motives based on social interaction

The statements that are included in this group of motives had also a difference between the answers of girls' and boys'. Girls found it more important to get support from the teacher, because the majority (82%) of girls and only 61% of boys fully or partly agreed with the statement *"I think it's important that teacher supports and encourages me".* With the statement *"My family encourages me to do crafts"* 25% of girls and 12% of boys fully agreed with the statement. More boys compared to girls answered that they partly disagree with the statement.

Reluctance

Pupils' answers for the statements that are included in this group had no difference between girls' and boys'. The majority (over 80% of girls and 72% of boys) of pupils fully or partly disagreed with the statements *"I feel often bad when doing craft"* and *"Craft teacher is too demanding"***.** The same holds true also with the statement *"I think doing craft is boring*", because 73% of pupils fully or partly disagreed with the statement.

Working process

Some of the statements that are included in this group had a remarkable difference between the answers of the genders. More boys (compared to girls) seemed to like to solve problems independently because 20% of boys but only 5 % of girls fully agreed with the statement *"I want to solve problems completely myself*"**.** On the other hand 22% of girls and 8% of boys fully disagreed with the statement. More than half (58%) of boys also fully agreed with the statement *"I find it interesting to test and try different kind of things"*, when only 38% of girls answered that way.

Majority (68% of girls and 61% of boys) fully agreed with the statement *"I think it's good that teacher tells exactly what to do next"***.** When pupils were asked about working in a group or alone, there were no remarkable differences between genders. Over 81% of all pupils fully or partly agreed with the statement *"When I face a problem I want to try to solve it myself with the help of my friend or the teacher"* and over 85% of pupils with *"I like working on groups*". Result was almost the same in statement *"I think group working does not suit to craft lesson"*, because on average 70% of all pupils fully or partly disagreed with the statement. There was a little difference between the answers of girls' and boys', when pupils were asked if they would rather work alone or with a friend. Almost half of girls (44%) and less boys (36%) fully disagreed with the statement *"I rather work alone than with a friend*". Pupils were also asked what they think about of doing identical artifact. Over half (63%) of all pupils fully or partly disagreed with the statement *"I like it when everyone makes exactly the same kind of artifact"*. However it seemed that couple more boys fully agreed with this statement.

Gender related differences in motives of technology education

T-test (SPSS for Windows) was used to compare the means of two groups', girls' and boys' answers and to find significance of the differences between them. Before running the T-test, the data was cleaned; the empty answers for the statements were compensated with mean value of that statement. The final data included 281 answers (N=281). The statements that had statistically significant difference between the answers of girls' and boys' can be found from the table 1. The null hypothesis (H_0) was rejected when *P*<.01 **.

Statement	boys' mean	girls' mean	mean difference	sig.
I like to build electronic devices	1,67	2,52	0,85	***
I like to do decorative artifacts	2,48	1,88	0,60	***
I would like to learn how to preserve the nature	2,55	1,97	0,58	***
I want to solve problems completely myself	2,31	2,78	0,47	***
I'm interested in to invent solutions for keeping environment clean	2,72	2,27	0,45	***
I'm afraid of doing something wrong	2,69	2,25	0,44	***
I think it's important that teacher supports and encourages me	2,31	1,88	0,43	***
My family encourages me to do crafts	2,59	2,21	0,38	***
I find it interesting to test and try different kind of things	1,55	1,91	0,36	***
I don't care what kind of artifacts we are doing in craft lessons	2,50	2,85	0,35	**
I like building and constructing things	1,63	1,95	0,32	**
I think that we are doing too easy projects in the craft lessons	2,63	2,95	0,32	***
I find it nice if I can use tools well	1,43	1,67	0,24	***

* $P < .05$
** $P < .01$
*** $P < .001$

TABLE 1 T-test results

The greatest statistically significant differences between the motives were linked to the group of "Motives of the contents of technology education". Compared to girls, boys liked more to build electronic devices. One explanation for this difference might be that those projects are done only in technical craft lessons and most of the girls in this data (and in general in Finland) have studied textile craft in school. Because of this girls don't know much or anything about building electronic devices. Secondly biggest difference was that girls cared more than boys that their artifact would be decorative. Also girls were more interested in how they could preserve the nature and find solutions for keeping the environment clean. Although we can't say how much these contents are related to technology education when girls answered them, but we can say that based on these results preserving the nature and environmental themes could be contents that motivate girls in technology education. Boys liked more (comparison to girls) to build and construct things, but in general boys didn't care that much what is done during the craft lessons.

There were also differences in motives of girls' and boys' linked to the group of "Motives based on accomplishment and achievement". Boys thought more than girls that the projects that are done in craft lessons are too easy and girls answered to be more afraid of doing something wrong. Boys also (comparison to girls) found it nice that they can use tools well. Boys seemed to master better working in craft lessons and were more self confident about themselves than girls. When the pupils were asked about the craft process or working in craft lessons, in general boys wanted to solve problems independently themselves and found it interesting to test and try different kind of things. Social interaction seemed to be important for girls, because girls found it more important to get support and encouragement from the teacher. Also the family members encouraged girls to do craft.

Conclusion

In Finland, studies of craft as a subject, has been traditionally divided into technical work (boys' craft) and textile work (girls' craft). In most schools, pupils are still forced to choose between technical craft and textile craft. This division could also be seen from the data (N=301) of the questionnaire study in this article. As a result of this division girls have been excluded from various technological studies. Because of the long tradition of gender based division the contents of textile and technical craft have consisted in a certain way that they maintain traditional gender stereotypes. Giving pupils equal chance to study technology is not enough. In order to raise girls' interest towards technological studies gender sensitive approaches should be applied. Based on the questionnaire results girls were more interested in environmental aspects and preserving the nature. Another aspect was that girls appreciate the aesthetics dimensions when doing artifacts of their own. In technical craft girls might associate the way of working and the products to rough and masculine, not much aesthetic. The aspects mentioned above should be emphasized in technology education. In addition to this teachers and parents should pay attention to support and encouragement of girls in technological studies. Girls seem to need appreciation of their technical competences by their teacher (Rasinen et all, 2009, 378). Cooperative project trick track, works as an example of how pedagogical theories (problem solving, collaborative learning) can be studied in hands on project. Students with very varying backgrounds can participate in project, have positive experience and reach objectives of the course. It is also important to notice that female students, despite of their limited experience of the materials used in project, gave very positive feedback and it seems that this kind of practice encourages females to study technology.

REFERENCES

Dakers, J. 2006. Towards a Philosophy for Technology Education. In (Ed.) John R Dakers, Defining Technological Literacy: Towards an Epistemological Framework. Palgrave MacMillan. New York. pp 145-158.

Dow, W. 2006. Student Technology Teachers' Values and Assumptions: How they impact on Teaching Practice. PATT 17 (Pupils Attitudes Towards Technology) Conference proceedings. Available at: http://www.iteaconnect.org/Conference/PATT/PATT19/Prefacefinal1719.pdf

Dow, W. & Dakers, J.R.2008. Exploring issues related to gender in technology education. Colloque international, Efficacité et équité en education. Rennes Universite. France 19.11.2008.

Harris, J. & Hanley, B. 2004. Cooperative learning in teacher education. A four-year model . Teoksessa E.G.cohen, C.M. Brody & Sapon-Shevin, M (ed.) Teaching Cooperative Learning. The Challenge for Teacher Education (p. 65-81). Albany: State University of New York Press.

Johnson, D.W. & Johnson, R.T. 2005. The Cooperative Learning Center at the University of Minnesota. http//wwwco-operation.org/

Kosonen, E. 1996. Soittamisen motivaation varhaisnuorilla. Jyväskylän yliopisto. Musiikkikasvatuksen lisensiaattityö.

Leppäaho, H. 2007. Matemaattisen ongelmanratkaisutaidon opettaminen peruskouluissa: ongelmanratkaisukurssin kehittäminen ja arviointi. University of Jyväskylä. Jyväskylä Studies in Education, Psychology and Social Research 298.

Rasinen, A., Virtanen, S., Endepohls-Ulpe, M., Ikonen, P., Ebach, J. & Stahl-von Zabern, J. 2009. Technology education for children in primary schools in Finland and Germany: different school systems, similar problems and how to overcome them. International Journal of Technology and Design Education 19, 368-379.

Sahlberg, P & Sharan, S.2003,(ed.) Yhteistoiminnallisen oppimisen käsikirja. Helsinki:WSOY

Saloviita, T. 2006. Yhteistoiminnallinen oppiminen ja osallistava kasvatus. PS-Kustannus. Opetus 2000.

Slavin, R. E. 1995. Cooperative learning. Teoksessa L.W. Anderson. (ed.) International encyclopedia of teaching and teacher education. New York.Pergamon.

Suomala, J. 1999. Students' Problem Solving in the LEGO/Logo Learning Environment. University of Jyväskylä. Jyväskylä Studies in Education, Psychology and Social Research 152.

Weber, K. & Custer, R. 2005, Gender-based Preferences toward Technology Education Content, Activities, and Instructional Methods. Journal of Technology Education 16 (2), 55-71.

Contents

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FINNISH SLOYD AND EDUCATIONAL HANDICRAFTS

Uno Cygnaeus (1810 – 1888)

Historical Background and Introduction

From 1809 on, Finland was part of the czaristic Russian empire. According to the peace treatment signed in Paris in 1809, Czar Alexander II supported the Finns in 1856 to get a full primary school (folk school) in order to make betterments for the underdevelopment of the Finnish general education. The historic reason was the gratitude of the popular Czar of Russia for getting support from Finland during the Russian war against the invading army of French emperor Napoleon; this is the short story as told by Alpheus Bennett (Bennett, 1937, 57).

Founding the Finnish education system was a measurement of the Russian Czar. At that time at the end of the 1850s and at the beginning of the 60s this founding caused a change of paradigm in Finnish education policy and had an impact on educational thinking and methodology (Iisalo, 1979, 52-58).

In order to find out how traditional Swedish developed to school handicrafts, i.e. educational slöjd as a pedagogical means, we must mainly and understand the development of the Finnish *educational handicrafts*, as it was started by the Finnish educator Uno Cygnaeus (1810 – 1888); this is because in his beginning, Otto Salomon acquired his pedagogical inspirations from Uno Cygnaeus so he could develope an organized handicraft pedagogy that would contain a rationale and strands with defined goals. The straightforward exchange of information between Salomon and Cygnaeus personally played a decisive role in the development of Nääs to become the Swedish educational 'Handicraft Centre'**:**

The development in Finland must be presented detailed in the following because Uno Cygnaeus was the first one who brought the best of educational thinking from the Middle of Europe to Scandinavia, primarily based on the ideas of Friedrich Fröbel, Adolph Diesterweg and Pestalozzi. In the present German scientific literature this peculiar circumstance is actually not recognized. Heller only mentions that in the "traditional descriptions usually the 'charming' events are told about … that the idea of work education... after a tour in North Europe for 40 years returned in 1880." (Heller, 1990, 37) This unclear remark of Heller can be scrutinized at this point and with the basis of the handled literature it can be revised and thought over more exactly**:**

Founding on their mutal exchange, Uno Cygnaeus and Otto Salomon were successful in adapting knowledge about work education, which Otto had already been thinking over, and so he could go on creating a concept of handicraft education on a systematic pedagogical basis.

So first of all, it was Uno Cygnaeus to bring German pedagogic ideas from Prussia, Bremen, Austria and Switzerland to Finland and it was Uno who also inspired Otto Salomon in that pedagogical direction. On the other hand, later, financially backed by his uncle Abrahamson, it was Salomon to influence educators in Osnabrück (Brandi, Raydt), Posen (Wilhelm Gärtig) and Berlin (Pestalozzi-Fröbel-Haus), further to Switzerland (Samuel Rudin, Adolpf Ferriere), Great Britain (Sloyd Association of Great Britain and Ireland, City & Guilds of London Institute, vd. Foden, 1970, 225) and last but not least, in the United States (Gustaf Larson, Boston, and Åron Heidengren, Cuba).

Uno Cygnaeus – Reformer of the Finnish Folk school

Uno Cygnaeus (1810 - 1888) was a priest, who became a historic figure in the history of his own country as the reformer of the Finnish education system but became widely known also outside the country. He was famous in Scandinavia and Russia because of founding the Finnish Folk school system (*Till Uno Cygnæus Minne–Festpublikation*). His influence in that was remarkable, and it was just Cygnaeus who created the concept of '*school sloyd*' as the first one in Scandinavia to a means of educational work at school **(**Kananoja, 1990; see also Lilius, 1910, 83-100).

Uno Cygnaeus was born in Hämeenlinna town in 1810. He belonged to an old Finnish family of protestant priests, the forefather being the Protestant-Lutheran pastor Johannes Martin in Kristiina town; he died in 1721. The name "Cygnæus" is a Latin paraphrase for *swan* what was the maiden name of his mother, *Birgitta Svahn*. Svahn translated into Latin as *cygnus* for *swan*; (Swedish = *svan*). From this on the family and the following generations used the name *Cygnaeus* (Nordisk Familjebok, 1931, 239). The writing of the name differs in the literature: *Cygnæus*, *Cygnäeus*, *Cygnaeus*; in the following the spelling *Cygnaeus* is used.

After school Uno Cygnaeus took mainly religious studies in Turku and continued his studies in 1835 at Helsinki University, which was moved there after Turku had burnt down. He finished his studies in 1836. One year later he was promoted at Helsinki University as a Master of Theology (Salomon: *Minne av Uno Cygnaeus* in: *Slöjdundervisningsblad* 1/33, 1888). After serving some time as a priest in Vybourg he worked for the Russian-Swedish Company of Commerce, and became a priest on Sitka Island in Alaska from 1839 to 1845; Sitka-Island belongs to the Alexander archipelago, which lies in the south-western part of the Pacific at the coast of British Columbia. The archipelago belongs to Alaska. At that time, Finland alike Alaska were either parts of the Russian empire.

> "*Cygnaeus lived in St. Petersburg in 1846-58 and worked as the principal of the Finnish school in town. In 1858, however, something happened what made him publish a plan for education of which he had thought over already for a longer time. When Czar Alexander II visited Finland, he found out that in Finland was a need for an appropriate elementary education, and so he founded a committee to design a plan for that purpose.*" (Salomon: *Life of Uno Cygnaeus.* In: *Hand & Eye*, Vol.3/1895, p. 239)

After returning home in 1846, Uno Cygnaeus worked on as priest and teacher in the Swedish-Finnish community of St. Petersburg. We might assume that Uno, when living in St. Petersburg, learned to know the local teacher seminary (MacArthur (1886, 97): Chap. VI: Education for Hand and Eye). Cygnaeus influenced the education policy of his own country the first time in 1847 when he published his opinion on Finnish education policy. He criticized the simple religious policy of education for rural population and presented a new concept for Folk-School, which was in concord with the pedagogic ideas of the time as he adapted them by his travel through Central Europe. His paper was taken quite seriously in Finland, because he reinorced the cultural emancipation from Swedish occupation and its cultural guardianship what had lasted for hundreds of years.

As a teacher in St. Petersburg Uno Cygnaeus became also acquainted with practical educational problems and there he drafted the educational development program for Finland. This also included education for work: "*The aim of the Folk school, which must be considered as the general basic school, is: by balanced nurturing of the powers of mind and body to develop the growing generation to fear of God, understanding and useful people for the society; ... also with general dexterity, ... especially as the greatest benefit for the labour class.*" (Cygnaeus according to Lönnbeck; 1890, 98). Fore mostly the teachers were to be trained now in this concept of the basic school, because there was no teacher training in the country before.

The becoming education, the contents of which was limited in writing, arithmetic and catechism, had until that time in Finland been taken care of by the church clerk, who served the diocese chapter. (Lönnbeck, 1890, 44). "*Porvoo diocese chapter orders, that the church clerks are obliged whole the year take care of teaching children's concept development and also arithmetic and reading* " (Lönnbeck, 1890, 44).

Lönnbeck states the thoughts of the diocese that the chapter schools for writing and religious education were meaningful in order to educate the servants of the church in their own seminary: "*The diocese proposed that every diocese town should have a seminary in order to prepare clerks for their work.*" (Lönnbeck, 1890, 44). However, Cygnaeus, even if he was a priest and theologian himself, opposed that kind of folk education, which was defined, controlled and confined by the church: "*The idea of Cygnaeus about education had a totally different point of view.*" (Lönnbeck, 1890, 45). In his writing `*Strödda tankar om den allmänna folkskolan i Finland'* ('Scattered thoughts about the general Folk school in Finland'; Cygnaeus, Uno: *Strödda tankar... 15. Sept. 1857,* in: Lönnbeck, 1890, 45-51. See also Salomon: *Life of Uno Cygnaeus.* In: *Hand & Eye.* Vol.3/1895 p. 240)

In "*Suggestions concerning the proposed system of Primary Education in Finland*", Cygnaeus strongly opposed the diocese. He made up his opinion that education for activity should be epochal for the development of the civilisation of the people (Lönnbeck, 1890, 45). The '*Scattered thoughts*…' were a sharp stand, which had the following main demands for reforms:

Above all and from the start up teacher seminars must realize:

- Illustrativenes as the educational basis instead of abstraction.
- Women and men must be trained in the same way to be teachers.
- Gymnastics and training the body (physical education) should be tasks of the school.
- Education must happen in the Finnish language.
- The social privileges of the higher classes should be removed. (Lönnbeck, 1890, 45-51).

Alas, handicraft education or education for work was not presented in this context.

Just after returning from his study tour through Middle Europe in 1859 Cygnaeus integrated handicraft (*Slöjd)* as an education for work with the concepts above a thought and a move, that as the essential basic feature Otto Salomon adapted and developed further later on. (Salomon: *Blad till Minne af Uno Cygnaeus*, in: *Slöjdundervisningsblad* No. 1/33, (4/2) 1888)

The influence of Pestalozzi and Fröbel on Cygnaeus

From 1858 up to 1859 Cygnaeus travelled in Middle Europe in order to study the folk school systems in different countries. The tour took him via Stockholm, Gothenburg and Copenhagen to Lybeck, Hambourg, Bremen, Leipzig, Dresden, Halle (Sachsen-Anhalt), Berlin, Weissenfels, Austria and Swiss Confederation (Lönnbeck, 1890, 57).

In Bremen Cygnaeus became acquainted with the methodology of Diesterweg: "*Cygnaeus made his tour to Bremen in order to meet director A. Lüben, who was one of three best known experts in education methodology in Germany and the closest person to Diesterweg at that time, maybe the most famous name amongst the German Folk school educationists.*" (Lönnbeck, 1890, 58). Director August Lüben made Cygnaeus acquainted with his teacher seminary in Bremen, which he had founded in 1858. August Lüben was a student and trustee of Adolph

Diesterweg; Lüben used to be the director of the Diesterwegian and Pestalozzian Teacher Training Seminar in Bremen (Pilarczyk, 1990, 396). Cygnaeus was interested in Diesterweg's methodology at use and of its learning results: "*...Cygnæus found out that teaching in the seminary was very advanced. 'Without seeing that kind of an institution,' he says in one of the travelling reports, 'you can hardly understand that electrifying talent, which one man can give for 50 - 60 youngsters. Hearing that in the normal school, seeing its life, that observation, that order in the classrooms, is totally amazing.*" (Lönnbeck, 1890, 58).

Cygnaeus was astonished, when he saw 50 to 60 students properly organized in handicraft education and, moreover, the order could be maintained in the classroom. Later on during his tour Cygnaeus met Adolph Diesterweg in Berlin. However, he had already made research on his writings beforehand and these had influenced him deeply: "*A special joy for Cygnæus was to get to meet in Berlin the most famous educationist in Germany at that time, the fearless representative of the liberal Pestalozzian A. Diesterweg, whose writinigs he had already earlier studied and got strong influences from them.*" (Lönnbeck, 1890, 60) At the same time Cygnaeus became also acquainted with protestant theologian Stiehl whose rigid methodology was prevailing in Prussia and Berlin: "*During the Cygnaeus' tour to Germany the focal educational idea was "time of regulatives"* (Lönnbeck, 1890, 61). Lönnbeck agreed with Cygnaeus about the "*reactionary*" Prussian teaching guidance (Stiehl, 1854: *Die drei preußischen Regulative vom 1., 2. und 3. Oktober 1854*) and on Prussian minister-counsellor Ferdinand Stiehl: "*The regulatives were the new orders for the seminaries and Folk schools given from the reactionary Prussian authorities in 1854.*" (Lönnbeck, 1890, 61).

In his travelling documents, which were published in September in 'Litteraturbladet' ('Literature magazin') in 1859, Cygnaeus commented the Prussian teaching methodology: "*...[he never] had heard this kind of stone hard dogmatic and polemic theology done not only with the students in the seminaries but also with the twelve years old school children."* (Cygnaeus according to Lönnbeck, 1890, 61). Cygnaeus wrote the final report about his study tour (1860) and about his recommendations for reforms (1861) for the Russian Cszar, who gave the recommendations and orders according to those. Cygnaeus' recommendations are scrutinized more closely in the following, because from here the conceptual basics for work education, which served Otto Salomon as the mental tool, can be found.

Cygnaeus, folk school and handicrafts education

In 1861 Cygnaeus had written his concepts about the Finnish basic education; in 1863 he followed his calling to found and organize the Finnish school system. In Jyväskylä he founded the teacher training seminary and worked the first years as the director there. In 1869 the office responsible for education was founded in Helsinki, The National Board of Education, and Cygnaeus became its director (Taimo Iisalo, 1978, 54; Tapani Kananoja in: Rolf Oberliesen et.al., 125 - 141).

Cygnaeus published his basic pedagogical thoughts in two books: "Proposal for the nature of the Finnish folk school" (1861) and "Reply to the orders and proposals of the research committee" (1862) (Cygnaeus 1861: *"Förslag rörande Folkskolväsedet i Finnland"*; see Iisalo, 1979, chapter 2.6).

In the following shortly the thoughts of education and schooling of Uno Cygnaeus (Salomon 1888: *Cygnaeus och den pedagogiska slöjdundervisningen.* In: *Slöjdundervisningsblad fram Nääs* No. 1/33 and 4/2)**:**

- Schools and teacher training should form an entity.
- Discrimination on gender must be ended.
- Educating pupils and teachers together (independently of their gender) was patently obvious.
- Independent scientific way of work was declared to be the aim of teacher training.
- Handicraft education was to be given in Folk schools and in teacher training.

Cygnaeus justified his understanding of education with the Diesterwegian interpretation and application of Pestalozzi (see also *Slöjdundervisningsblad 4/2*, Nääs 1888). The basic prerequisite for the new kind of school system for Cygnaeus was teacher training; subsequently he also developed a conception for a teacher seminary:

"*...further training institution, with the aim of not only to familiarise the students with independent studies so that they afterwards can continue studies* ***on their own****, but also to bring them a clear view about these disciplines, which can be considered as important for the common people, ... and added to that a skill to mediate in a simple, clear and popular way in the folk school the results of Science, which are useful in practical life.*" (Cygnaeus according to Lönnbeck, 1890, 102)

The whole school system covers not only training the pupils for independent studies but also that they can continue studies independently, in order get a clear general view about the scientific disciplines themselves; the rural population can so get the most important knowledge, which must be mediated in the Folk school clearly and popularly but scientifically and illustratively; the practical, living and useful results had to be mediated... This model had also the seminaries to follow (The Nordic seminaries), where respectively the female and male students would be trained (Lönnbeck, 1890, 102). Here must handicrafts be integrated as an educational school subject, which already after Cygnaeus had an open road to the civilized world: *"The thought developed and realized by Cygnæus is spread all over the civilized world adopting* ***handicrafts*** *in education* ***in pedagogical meaning*** *and as an equal school subject to other subjects.*" (Lönnbeck, 1890, 103; bold text in the original). Pedagogical aim and benefit of this kind of work education could be "general dexterity" (Lönnbeck, 1890, 103). Lönnbeck quotes the information given by Cygnaeus on his study tour in 1859: "*I have already for 17 years had the conviction, that practical handicrafts must belong to the Folk school as an essential education tool, but always I had an opinion, that mechanical type of work only cannot satisfy that* *need."* (Cygnaeus according to Lönnbeck, 1890, 104)**:** *"The thought was, however, not to learn technical skills for immediate professional use, even if Cygnaeus did not totally exclude this possibility. He thought, ... that most important for children was to get certain general skills, which matched with simple mathematics and scientific knowledge. This he regarded as a road to more intellectual work. So a school subject had always also a 'formally' educative function, and on the other hand Cygnaeus talks about 'pedagogical handicrafts'."* (Iisalo, 1979, 55).

According to Pestalozzi the human nature covered not only *knowing* and *thinking* but also *skills* and *handling*, which also need combining the important knowledge and with peronal power, the capacity to do something: "*That is why also skills must be developed, and not less than knowledge..*" (Lönnbeck, 1890, 105).

Lönnbeck sees in Cygnaeus' basis of his Pestalozzian thought connected to Fröbel: "*The idea of handicrafts of Cygnæus was clearly formed by reading Pestalozzi, but, however, to realize it he was mainly led by the model of Fröbel.*" (Lönnbeck, 1890, 105). Cygnaeus complains the absence of any essential demanding concept for either general dexterity and skill in pedagogical handicrafts: Up to present time there has been no practical experience of research within this question; unfortunately written concepts only, as loud as they seem to be, remain just paper: "*No one, who does not* ***really*** *know this method, or not only in theory but in practice and as results from the practice, cannot more doubt, that just that will bring about a global reform in education of children in general and influence with blessing especially the children of the workers' class.*" (Cygnaeus according to Lönnbeck, 1890, 106; bold text original).

Added to that above Cygnaeus saw in Rebel's organised and intentional play a great educational impact, where he aimed at the harmonious development of the mental and physical powers of the child (Iisalo, 1979, 55) and he demanded also introduction to *developmental physical exercises* in the school, which he considered necessary. Iisalo quotes further the guidance of Cygnaeus, which also mention play, gymnastics, sport, hygiene and connection to popular water therapy.

Cygnaeus did not regard the school only as a mediator of external knowledge for the knowledge itself. According to Pestalozzi Cygnaeus stood for the opinion that knowledge as such was not only oriented ethically to one person. That is why the school should take care of this, change knowledge mediated by human being to be a living conviction. Knowledge would get its meaning only when the pupils will govern it independently; and this will happen, when the learner can apply knowledge successfully in his/her skills. Here Cygnaeus applied the thoughts of Pestalozzi and Fröbel in his own educational ideas, according to which the connection of play, work and learning at its best meets the education process equal to the models (freely according to Taimo Iisalo, 1979, 56).

Charles Bennett interprets the opinions of Cygnaeus further, as Iisalo writes**:** "*...I got ideas, that we are not guided in our school only according to the spirit of Fröbel, but such handicraft work and exercises should be organised also for older pupils. They develop their dexterity, aesthetic sense of form, and so we help the youngsters to develop general practical competence, which is useful in the daily life:*

Work of carpenter, wood turner, basket maker, etc. However, none of these should be done vocationally, it must happen strictly only according to pedagogic aims." (Bennet, 1937, 58-61:"*Sloyd in the Normal School established by Cygnaeus*").

According to the idea of Cygnaeus handicrafts in the Folk school should lead to the future practical skills; this functional aim of handicrafts should be an integrated part of school education. Bennett clarifies the view of Cygnaeus: "School handicrafts should not be realized too artistic and not purely mechanically; there must always be the pedagogic aim in mind; the development of the eye, form and haptic feeling; consideration of general hand skills and none possible special skills: Even more I have a strict view that the basic handicrafts education in the basic school as general education, where this subject has its position like the other subjects, should be taught by the same teacher, so that handicrafts would not be twisted only as an ornament." (Bennett, 1937, 59).

Bennett quotes the ideas of Cygnaeus thoroughly when revealing the basics of pedagogic further development by the Swede Otto Salomon: "When the male students have reached the needed readiness of handling the tools of carpenter and wood turner when making the general household things and agricultural tools (scythe handle, rakes, sleds, tables, etc.), finally these skills should be used producing such artefacts, which need more consideration: Simple geometric and physical equipment like triangle ruler, compass, pulley, pumps, models for agricultural tools, etc." (Bennett, 1937, 59 -).

The proposals and ideas of Uno Cygnaeus for the development of the Finnish education system were given by the order of Czar Alexander II, the Finnish Grand Duke at that time; Kananoja translates the first paragraph as follows**:**

> "*The merciful statement of His Czaristic Majesty concerning the measures for organizing the Folk School system in Finland, given in Helsinki, 17th of March 1863 and will be read in the church pulpit, states the following: "... - "As long as the Seminary will be located in town (Jyväskylä), the essential agricultural work cannot be done. However, the male students have to exercise technical skills of the hand and female students the female handicrafts and household activities, and all student gardening." (Chapter 10 of the decree, in: Kananoja, 1993, 130, 135).* Kananoja quotes decree No. 12 "*in the collection of the decrees in the Grand Duchy of Finland in 1866*":

> "*We Alexander II, the Czar and the Monarch of the whole Russia, Absolute Ruler, Czar of Poland and Grand Duke of Finland, etc., etc., are stating in Gods Mercy: When Our Senate in Finland has most obediently done a proposition to found the folk school system in the Grand Duchy, We have most mercifully stated:* (the quoted decree repeats the already handled decree and gives in the chapter concerning the "School subjects" the following: "... *the girls have to exercise female handicrafts and the boys dexterity and boys' handicrafts....*"

The terminology in the decree, which Kananoja quotes from chapter 12, is not uniform: For example "...boys' handicrafts education..."; according to the translation of the Czaristic decree by Kananoja, the decree in 1866, chapter 12, will aim at "...(demand in technical handicrafts: To exercise general dexterity and skilfulness in some handicrafts best applicable to the people", and further: "... technical skills in work of a carpenter and wood turner and in use of blacksmith's tools and making the agricultural equipment, especially these, the construction of which needs more consideration...".

From 1884 to 1886 Cygnaeus was the chairman of a Committee, which had to write the curriculum for school handicrafts. The recommendations of this Committee mentioned in the catalogue of handicrafts "woodwork, brush making, spoon-, weaving-, bark-, cardboard-, wire- and sheet work ". This Committee report wrote for the first time model series of 70 artefacts, out of which 55 were woodwork and 56 were tools. 'Here the first practical possibilities were created for boys to get organized handicrafts education in the Finnish schools." (Kananoja, 1993, 134)

Any realization of the didactic and methodical concepts did not succeed in Finland at that time. Even if Cygnaeus emphasized that handicrafts just like the physical and mental powers of children must be reinforced together (see Kananoja, 1993, 125) at that time there was no systematic or usable concept for education for work according to the literature of the period.

During his lifetime Cygnaeus was regarded as an acknowledged and honoured educationist; his educational ideas were, however, debated and some Finns of the time regarded him as an utmost radical reformer. Iisalo assumes the idealistic educational concept of Cygnaeus from his long stay abroad, which gave a distance from the Finnish conditions: "*He had an idealistic nature and his stay abroad had made him some kind of a stranger in the Finnish conditions*.". (Iisalo, 1979, 53). This evaluation does not diminish the value of Cygnaeus and his services for the Finnish school system, which emancipation was his and which he enriched: Appreciation of Cygnaeus is seen for example among other things in the honorary title given to him already during his life time, "The Father of the Finnish Folk School" (Lönnbeck, 1890, references taken from Iisalo, 1979, 60). The international esteem of Cygnaeus is also emphasized by the Honorary Doctorate, which was granted to him by Swedish Uppsala University in the jubilee year 1877, he received the degree together with Henrik Ibsen, the Norwegian novelist. (Geijer 1897, 264: "*Till filosofie hedersdoktorer och promeverades vid jubelfesten 1877 trettiosex ... för hvilkas vetenskapliga litterära och medborgerliga förtjanster fakulteten ville på detta sätt betyda sin aktning, nämligen: ... finnar öfverinspektor Uno Cygnaeus.*" Otto Salomon sees n him clearly as the founder of the Finnish Folk School system:

> "*Finland owes gratitude for the school system to its founder, Uno Cygnaeus.*"(Salomon, 1882: *Slöjdskolan och Folkskolan,* Gothenburg; *translation published in Second Report of the Royal Commissioners on Technical Instruction*, London, 1884).

Uno Cygnaeus and Otto Salomon

In 1877 Otto Salomon travelled to meet Uno Cygnaeus in order to find out the development of school handicrafts in Finland, because there was already experience of it for several years. From Cygnaeus Salomon got the idea that handicraft was to be done on a pedagogic basis instead of for example to try to get economic profit by selling the handicraft products. Here Salomon found that handicraft could be attached without difficulties in the curriculum of general education.

> "*In 1877 Otto Salomon visited Finland and met there Cygnaeus, the creator of the folk school system in the country. From Cygnaeus Salomon got the idea that handicraft should be a part of basic education, and it should be organized more on a pedagogic than economic basis. Cygnaeus wanted handicraft teacher to be the (trained) teacher of the school. He had begun to realize his plans by teaching teachers in the Normal school in handicrafts but had not yet fully developed his system for the Folk schools.*" (Bennett, 1937, 64; see also Lönnbeck, 1890, 111; Otto Salomon: *Uno Cygnaeus, in: Slöjdundervisningsblad 4/2 1888*).

In the fifth anniversary festivities for crowning the King Oscar II in 1877 Uppsala university gave the title of Honorary Doctor among others to Henrik Ibsen and Uno Cygnaeus: "*…and in 1877 celebration 36 doctors were promoted ... whose scientific literal and civic assets the faculty wants to namely: ... the Finnish Chief Inspector Uno Cygnaeus.*"(Geijer, 1897, 264). August Abrahamson, the sponsor of Nääs, had already become close friends with Oscar II; so we might assume that in 1877 celebrations, Abrahamson occasionally made acquaintance with Uno Cygnaeus and thus arranged the contact with Cygnaeus and his nephew Otto Salomon.

At that time in 1877, when 28 years old Salomon, in spite of everything, was inexpert in matters of education and teaching. And meeting 66 years old Cygnaeus was a well of inspiration, as Finnish educational ideas were in leading position and in the discussion (Iisalo, Taimo, 1979, 52). For Otto Salomon at that time was amateur in pedagogy and get-together with the Nestor of the Finnish pedagogy of handicrafts and folk school was a source of inspiration and knowledge to further his ideas. We leave now discussion of the development in Finland. The quoted references only substantiate that the relationship with Cygnaeus and his main ideas inspired Otto Salomon to develop systematically the Swedish *home slöjd –tradition (hem-slöjd)* and made Otto instigate new pedagogical ways and means in order to apply sloyd at folk schools.

REFERENCES

MacArthur, Arthur (1886): *Education in its Relation to Manual Industry*; New York-US: H. Holt.

Bennet, Charles Alpheus (1937): *History of Manual and Industrial Education 1870 – 1917*, Peoria, Illinois-US: Manual Arts Press.

Cygnaeus, Uno (1861): *Förslag rörande Folkskolväsedet i Finnland*; references from Iisalo, T.: *Uno Cygnaeus and the pedagogy of the elementary schools*; chapter 2.6, 1979.

Cygnaeus, Uno *Strödda tankar om den allmänna folkskolan i Finland, St. Petersburg, 15. Sept. 1857,* in: Gustaf Lönnbeck: *Uno Cygnæus...* , 1890.

Foden, Frank (1970) Philip Magnus – Victorian Educational Pioneer, London/ GB: Vallantine

Geijer, Reinhold (Ed.) (1897): *Upsala Universitet 1872 - 1897, Festskrift med anledning af Konung Oscar II:s Tjugofemårs Regeringsjubileum*, Stockholm-S: Uppsala Universitet.

Heller, Dieter (1990): *Die Entwicklung des Werkens und seiner Didaktik von 1880 bis 1914*; Heilbrunn-D: Klinkhardt.

Iisalo, Taimo (1979): *The Science of Education in Finnland 1828 - 1918*; Helsinki-SF: Societas Scientiarum Fennica / Finnish Society of Sciences

Iisalo, Taimo *Uno Cygnaeus and the pedagogy of the elementary schools*; Chapter 2.6 in: Iisalo 1979.

Kananoja, Tapani *Uno Cygnaeus - Vater der finnischen Volksschule und Slöjd*; Vortrag Otto-Salomon-Symposium in Nääs 1990. In: Rolf Oberliesen / Günter Wiemann: Sonnenberg Internationale Berichte.

Kananoja, Tapani *Uno Cygnaeus - Vater der finnischen Volksschule und seine Ideen zur Slöjd-Pädagogik*; in: Rolf Oberliesen / Günter Wiemann: *Sonnenberg Internationale Berichte zur Geschichte von Arbeit und Technik im Unterricht*, Braunschweig-D.

Krueger, Bernhard (1970): *Stiehl und seine Regulative*; Weinheim-D: Beltz.

Lilius, Albert (1910): *Om uppfostran till arbete*, in: *Till Uno Cygnæus Minne - Festpublikation,* Helsingfors-SF: Lilius & Hertzberg.

Lönnbeck, Gustaf F. (1890): *Uno Cygnaeus-Finska Folkskolans Fader*, Helsingfors-SF: Söderström.

Nordisk Familjebok (1931), 3. printing, Stockholm-S: Familjebokens Förlag.

Oberliesen, Rolf u.a.: *Sonnenberg Internationale Berichte zur Geschichte von Arbeit und Technik im Unterricht*, Braunschweig-D: Internationaler Arbeitskreis Sonnenberg.

Pilarczyk, Ulrike (1990): *Jubelfeiern und Lobgesänge in Wilhelminischer Zeit – Diesterweg und seine Jünger; Katalog zur Ausstellung zum 200. Geburtstag Diesterwegs*. Weinheim-D: Beltz.

Reincke, Hans Joachim (1995): *Slöjd - Die schwedische Arbeitserziehung in der internationalen Reformpädagogik*, Europäische Hochschulschriften, Frankfurt/Main-D, New York-US: Peter Lang.

Reincke, Hans Joachim (1997) *A Pragmatic View on Nääs' Educational Sloyd – Profiles in Search for a Scientific Basis*, paper and lecture presented at Conference of Slöd-Design, Esthetics and Technology, Linköping University–S, Department of Craft and Design.

Reincke, Hans Joachim (2001) *Swedish Sloyd in America: Stanley Hall's Critique on Sloyd*; essay in: Nygren-Landgärds and Peltonen (ed.): *Visions on Sloyd and SloydEducation, Sloyd Conference in Iceland*, pp. 343-352, NORDFO-Nordisk Forum för Forskning i Slöjd, Vasa-SF: Abo Akademi Förlag.

Salomon, Otto (1888): *Cygnaeus och den pedagogiska slöjdundervisningen.* In: *Slöjdundervisningsblad* No.: 1(33), (4/2) Nääs.

Salomon, Otto *Blad till Minne af Uno Cygnaeus*, here part of it: *Cygnaeus och den pedaogiska slöjdundervisningen.* In: *Slöjdundervisningsblad* No.: 1(33), (4/2) Nääs.

Salomon, Otto *Life of Uno Cygnaeus.* In: *Hand & Eye* (journal) Vol.3/1895, London, 1895.

Salomon, Otto *Slöjdskolan och Folkskolan*; Gothenburg 1882; translation into English published in *Second Report of the Royal Commissioners on Technical Instruction*, London, 1884.

Salomon, Otto *Life of Uno Cygnaeus.* In: *Hand & Eye.* Vol.3/1895 (May '95), 240 -: "*Suggestions concerning the proposed system of Primary Education in Finland*"

Schleunes, Karl A. (1989): *Schooling and Society – The Politics of Education in Prussia and Bavaria 1750 – 1900*; Oxford, New York, Munich: Berg.

Stiehl, Ferdinand (1854): *Die drei preußischen Regulative vom 1., 2. und 3. Oktober 1854*; Berlin-D: Hertz.

Stiehl, Ferdinand (1861): *Die Weiterentwicklung der drei preußischen Regulative*; Berlin: Hertz.

Stiehl, Ferdinand (1872): *Meine Stellung zu den preußischen Regulativen*; Berlin: Hertz.

Till Uno Cygnæus Minne (1910) - *Festpublikation*, *Finlands allmänna Svenska Folkskollärer och Lärarinneförening*, Helsingfors-SF.

Whittaker, D. J. (1964): *The slöjd system: A Scandinavian Contribution to Education with Special Reference to Britain*. MA-thesis, University of Liverpool. [This thesis, 399 pages on microfiche, is available by internet-order at British Library, Boston/Spa-GB]

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Contents

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DO WE BRING UP PASSIVE CONFORMISTS OR ACTIVE CONSTRUCTORS? SOME THOUGHTS ABOUT TECHNOLOGICAL DETERMINISM AND ITS REFLECTIONS IN FINNISH COMPREHENSIVE SCHOOL

Abstract

The Finnish comprehensive school is a fundamental element of the Finnish version of Scandinavian welfare society. It has not only satisfied the needs of society, but also headed towards ambitious ideals concerning the growth and development of children. Recently, changes in western cultures have challenged these ideals. There is a threat that the role of schools changes from the education of active constructors of the future to the upbringing of passive conformists.

Introduction

This paper focuses on the role of information and communication technology (ICT) in Finnish comprehensive schools: How it is utilised in the organisation of education, and how it appears as a learning topic. As such, this might sound like just another issue in school life. We argue, however, that the discussion about the role of ICT leads us to the very core of our education politics and system.

Finnish comprehensive schools have a very special role in our nation's societal and economic development, which has been recently praised (Newsweek 2010). As a small nation, we cannot afford to loose intellectual and other human resources just to maintain old social structures. Since talents are – despite the arguments of conservative forces – equally distributed in all social classes (Wyner, Bridgeland & Di Iulio, 2007), it has been important for us to provide all citizens with an opportunity to access high quality education. Larger nations perhaps can afford to maintain systems in which it is not your capacity but your socio-economic background that primarily determines your educational opportunities. On the other hand, offering equal opportunities for everyone is in accordance with widely acknowledged fundamental values concerning human beings.

Along with its predecessors, which were based on the work of Uno Cygnaeus a Finnish comprehensive school thus serves both individuals and society. This is quite obvious since there is no individual without a community and there is no community without individuals. Public interest is ultimately private interest as well. Therefore the two cannot be separated. All a comprehensive school's aims, which are formulated to concern an individual, finally serve the whole of society.

For the reasons above, the development of comprehensive school system can be argued to reflect the development of the whole society. Furthermore, the changes in primary and secondary education not only reflect, but bring about changes in society. Therefore, topical societal issues should not only be reflected in school, but the educational system should have an active role in the development of the future.

The recent development of ICT– or as we prefer to say 'changes of ICT' – is one of the most salient socio-technical changes in human history. Therefore, analysis of the role of ICT in the curricula of comprehensive schools tells us a lot about the history, current state and the future of school and the whole of society. In this paper, we focus on the National Core Curriculum for Basic Education (Finnish National Board of Education, 2004). We don't try to generalise the conclusions to other countries. However, the detected phenomena are hardly exclusive to Finnish basic education.

ICT in Finnish schools

All curricula of Finnish comprehensive schools are based on the National Core Curriculum for Basic Education, which determines at a basic level the aims, content and organisation of teaching and learning in comprehensive schools. The principles of this national framework are refined in local, council and school level curricula. To achieve as broad as possible view of the reality of Finnish schools, we use the National Core Curriculum, rather than local curricula, as an object of analysis.

The second chapter of the framework, "Starting points for the provision of education", describes, in general terms the values and mission of comprehensive schools. It contains noble ideals of how we should educate active and responsible developers of a democratic society. The same kinds of ideals have been repeated over the years in documents which describe the objectives of the Finnish educational system. Ultimately, they date back to the days of Cygnaeus. They stressed the responsibility of an individual to serve society. The construction of a good society has been seen to be based on the potential of individuals. How these ideals appear in other chapters and how they concern technology, will next be discussed from two points-of-view:

1. ICT inside the school, i.e., ICT as educational technology
2. ICT as an object of education – what kind of skills and attitudes should be taught in school for pupils to face ICT in real world

ICT as educational technology

There is an essential difference between the uses of computer based and other kind of educational technology. Information technology, at least in the form of computers, was not *designed* as educational technology, as Seymour Papert (1982) pertinently states. Rather, computers were *declared* as educational technology once brought inside school buildings. The basic problem with ICT as educational technology is thus not technical or pedagogical, but administrative by nature. The use of so called high technology in schools is an illustrative example of the introduction of technical solutions to many other areas of life – a technical solution is introduced without questioning its suitability for the intended use. In addition, many applications which are marketed as educational applications have been designed – especially in the early stages of computerised schools – without pedagogical expertise. The National Core Curriculum refers directly to the required technical facilities in the schools in the chapter (3.2) which is about preparing pupils for an information society:

> *The learning environment must also be equipped so as to support the pupil's development into a member of today's information society, and provide opportunities for the use of computers, other media technology, and, as possibilities allow, data networks.*

Probably the most common interpretation of this statement is that there has to be a large number of workstations with broadband connections, as accessible for the pupils as possible in all comprehensive schools. Unfortunately, this kind of technical interpretation of up-to-date schooling does not support the overall aims of the Core Curriculum. Equipping schools with fluent internet access is a questionable demand without detailed justification in terms of the content – what is the broadband needed for? Without appropriate justification broadband access is like delivering sharp knives to all the pupils without instructions for what to do with them. Recent statistics by Symantec (2009) reveal that the three most popular keywords in internet searches among children are, curiously, "Youtube", "Facebook" and "Google". The next most popular ones, in all age groups (<8, 8-12, 13-18) are "sex" and "porn". This kind of statistic should bring the glorifiers of an internet based information society back to reality.

A couple of decades ago, before the internet revolution, there were already a lot of computers in comprehensive schools. There were ambitious national and international projects in which we learned how to utilise computers to achieve the goals of comprehensive schooling. The most familiar applications were obviously word processors and drawing tools. In addition, programming was sometimes studied. In all these activities, the active role of the pupil was of key importance. The pupil produced text, drawings and programs.

The internet changed the usage of computers in a radical way. Currently, the content that the pupil is concentrating on is rarely self produced. On the contrary, pupils are effectively accessing the products of other people. Surfing the net and searching things in the internet undoubtedly requires some specific skills and even active involvement. It can still be argued, however, that internet access usually makes the computer user more passive than before, by offering easy and rapid solutions.

The Core Curriculum obliges the school to support the pupil's development into becoming a member of today's information society. Could this be interpreted so that the school should educate pupils to actively construct an information society? Namely, there is a danger that the *information society* in this statement is taken as given. This should be the primary concern of teachers who are obliged to educate children to face this mysterious phenomenon. As will be discussed in the next sub-sections, the National Core Curriculum reflects this kind of submissive attitude to the development of society. We call this "techno determinism". In it, the development of our technical and socio-technical environment is seen as an organic process – something, that takes place inherently, like under natural laws. No-one is really responsible for the process, it just happens. All we can do in schools is to prepare the pupils to face this inevitable change.

ICT as an object of education

The aim of basic education is to provide necessary skills and knowledge for the whole lifetime. In other words, the aims are clearly future oriented. In order to understand the underlying attitudes about the relationship between a pupil, the future and technology, we now analyse the National Core Curriculum in terms of the occurrence of expressions which refer to the future and technology. In section 2.2, *Mission of basic education*, the educational aims have been expressed in a general way:

> *In order to ensure social continuity and build the future, basic education assumes the tasks of transferring cultural tradition from one generation to the next, augmenting knowledge and skills, and increasing awareness of the values and ways of acting that form the foundation of society. It is also the mission of basic education to create new culture, revitalize ways of thinking and acting, and develop the pupil's ability to evaluate critically.*

An interesting issue in the quoted paragraph is that in it, the future is something that is being *built* by the pupils. The cornerstones of the building project are values, cultural heritage, and striving to make things better ("augmented knowledge", "increasing awareness", "create", "revitalize", "evaluate critically"). It could be interpreted, that in the construction of the future the permanent issues are history and values. Everything else could be exposed to critical evaluation and creative ideas. In other words, the future does not appear, but we construct it. This view of the future is based on the assumption of active citizens, who want and are able to contribute to a better – in terms of the common values – society. The view of active construction of the future can be seen in several expressions in the section 2.2 (Mission of basic education) and in particular in section 7.1, sub-section 5 (Responsibility for the environment, well-being, and a sustainable future). In a section describing the objectives of education, it is stated that

> *The pupils will… come to understand that, through their choices, individuals construct both their own futures and our common future; the pupils will learn to act constructively for a sustainable future.*

In this quotation, the active role of citizens in the building of the future is stated in a quite straight forward way.

However, when proceeding from general objectives to subject specific sections, the expressions concerning the future, are quite different. In these descriptions the future is no more built, but evaluated, spoken about, studied and faced. In the section concerning human being and technology, the attitude towards technology is very similar: technology is understood, evaluated and used. The future, and technology in particular, is not constructed but taken as given. In different subjects, technology is used, utilised or applied.

The National Core Curriculum could therefore be interpreted so that our future will be more and more technical, and the development of technology takes place by "someone out there". The aim of school is to educate citizens who are active constructors of the world, except concerning technology; in terms of technology, the outcome of Finnish comprehensive school is a conformist, an observer and an exploiter.

What would Uno say?

In the general objectives of the National Core Curriculum, as discussed above, values are a cornerstone on which the society can be constructed with the help of skilful, broadly civilized citizens. In the current reality, however, ICT products and related services appear to be the fundamentals which we are not allowed to question and on which we need to build our society. What if schools prioritised the general aims and questioned the overwhelming jargon about the blessings of an internet-based information society? What would be the conclusions in everyday life in basic education? We now discuss this question in the form of two theses.

1. *The objectives of basic education can be reached without any ICT applications*.

The need for computers and internet access at schools is usually expressed in technical terms. We count the number of workstations per pupil, or the capacity of available broadband. Frequently, we can read statistics about the progress of the information society in different countries – these are also based on data about technical capacity. However, we argue that in comprehensive schools we will need to look at the objectives of education in the first place. Our teachers are highly educated and competent to choose the appropriate ways to organise teaching and choosing the right kind of educational technology. Rather than prioritising certain kinds of technology in the curriculum, school administration should encourage the teachers to use their expertise and to develop education on the basis of general objectives, as well as the teacher's own skills and interests.

In some situations, contemporary ICT applications can provide truly effective and appropriate support for learning. However, individual teachers and schools have limited resources, which they have to allocate wisely in terms of educational goals. Investing a lot of money and time in the computers is always taking it away from something else.

Computers and the internet are not the only ICT applications in school life. One of the most salient devices appears to be a mobile phone or some sophisticated versions of it. Referring to the discussion above, even the emergence of mobile phones at school should be exposed to the objectives. Do we find it desirable that children (not to speak about adults) are electronically connected to each other all the time? Currently, young people feel they are excluded from any social life if they are not "online" or at least reachable with text message, a phone call or some other way. According to a recent study in the UK, 75% of young people feel that they cannot live without the internet (Hulme, 2009). Is the current situation desirable? If not, how should school react? In many countries, schools are either banning or considering banning the use of mobile phones at school. Could a critical attitude towards ICT, which has not contributed the reaching of any educational objectives, be included in the curricula and public discussions?

2. *By openly questioning the overwhelming push of ICT-applications to our daily lives, comprehensive school could retain its role as a backbone of the society.*

Finnish comprehensive school system has achieved an international reputation for its contribution to a nationwide project, in which the diet of the citizens has been dramatically changed. The so called North Karelia project started by acknowledging the facts: our unhealthy eating habits were a major reason for an excessive amount of cardio-vascular health problems. Comprehensive schools had an essential role in educating Finns to eat a healthier diet.

We recognise a clear need for a similar kind of nation-wide education project, this time concerning technology education or, if you like, media education. However, there is a clear difference between dietary education and any proposed media-diet. Changing diet did not only cause problems for the existing food industry, but also provided new opportunities for new industry that replaced the old one. On the contrary, trying to educate people to spend less time with ICT products and services would mean a threat to related businesses without obvious new business opportunities. Therefore, it appears to be extremely difficult to get publicity for ICT criticism (see e.g. Halttunen, Maksimainen & Pirhonen, 2010). The same phenomenon has been found in other domains, as well. For instance, reported drug trials are significantly more positive whenever there is industrial funding, even partly, behind a study (Bourgeois, Murthy & Mandl, 2010). Therefore, when analysing the current state of ICT at schools, in the life of our off-spring, and in our culture in general, we find it extremely important to be aware of the backgrounds of the source of information. All support for the claims of this paper is really bad news for the ICT industry.

It could be good news, as well. We have witnessed numerous symptoms of the too hectic lifestyle, which is boosted with electronic applications. Comprehensive school, which would follow the values and principles expressed by Cygnaeus and implemented by several generations, could show a direction to a mentally, socially and physically healthier society.

Finland has recently tried to profile itself as a modern high-tech society, and as a producer of digital products and services. Could we finally admit that the amount of technology does not indicate well-being, or a high level of culture? The mobile phone business or any other toy-story is coming and going. Our comprehensive schools would have the potential to be a much more sustainable highlight of our culture – something of which we could be proud of and whose principles we could share with others.

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REFERENCES

Bourgeois, F. T., Murthy, S. & Mandl, K. D. (2010). Outcome Reporting Among Drug Trials Registered in ClinicalTrials.gov. Annals of Internal Medicine 153(3), pp. 158-166.

Finnish National Board of Education (2004). National Core Curriculum for Basic Education 2004. Vammala: Vammalan Kirjapaino.

Halttunen, V., Maksimainen, J. & Pirhonen, A. (2010). Less, slower, better. Do information society visions have healthy alternatives? In Suomi, R. & Ilveskoski, I. (eds.) Proceedings of the Third International Conference on

Well-being in the Information Society (WIS 2010). TUCS General Publication no. 56, University of Turku, 77-88.
Hulme, M. (2009) Life support: Young people's needs in a digital age. YouthNet.
http://www.youthnet.org/content/1/c6/06/00/73/Life%20Support%20-%20Young%20people%27s%20needs%20in%20a%20digital%20age.pdf Accessed 10/8/2010.
Newsweek (2010). The world's best countries.
http://www.newsweek.com/content/newsweek/2010/08/15/interactive-infographic-of-the-worlds-best-countries.html. Accessed 17/8/2010.
Papert, S. (1982). Mindstorms: Children, computers, and powerful ideas. Brighton: Harvester Press.
Symantec. (2009). Kids' Top 100 Searches of 2009.
http://onlinefamilyinfo.norton.com/articles/kidsearches_2009.php Accessed 11/8/2010.
Wyner, J. S., Bridgeland, J. M. & Di Iulio, J.J. Jr. (2007). Achievement Trap. Washington D.C.: Jack Kent Cooke Foundation.
http://www.jkcf.org/assets/files/0000/0084/Achievement_Trap.pdf Accessed 9/8/2010.

Contents

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UNO CYGNAEUS REGARDING ARTS AND CRAFTS DESIGN; WE NEED A NEW, DEEP GOING READING METHOD AND LEARNING

Did analyze and interpretations of Arts and Crafts Design even since Uno Cygnaeus' times fade? What can we do to wake it up again? The historical notes about Arts and Crafts Design are showing that implemented by Uno Cygnaeus in late 1800, the subject became as an elementary school branch of study and even pride of Finns. (Ahvenainen 1986.)

A magnificent aim of Uno Cygnaeus was to bring forth the scope of pedagogic educating aspects in elementary school teaching Arts and Crafts Design. Implementing the education ability Cygnaeus was impressed by as well Pestalozzi as the emigrants that were settled in North-American Sitka Island. During the travels abroad in Central Europe he realized that Arts and Crafts Design teaching could be affecting as a viable tool enhancing the human mental growth. According to Pestalozzi's idea of education Cygnaeus contributed to the vision that knowledge ethically wasn't aimed only for one-person him-/herself. The knowledge became significant only when a pupil is controlling it independently. This will be realized when the pupil succeeds in applying the knowledge for his/her skills. The school should transform and build the knowledge transmitted by people into living conviction. (Nurmi 1988.)

On Uno Cygnaeus' times the mission of learning arts and crafts design also was aiming towards commodity and gaining profit. His contemporary scholars and opinion-leaders for example Snellman and Cleve were for another principles to be included in arts and crafts design learning. Cleve thought that an artifact found its lucid form in visual expression. Snellman represented the ethical, moral line of education that aimed for enhancing pupils' exact perception and sense of shape and forms. Meurman for example emphasized teaching the handicrafts skills for making necessary artifacts and tools for agriculture. (Tuomikoski-Leskelä 1979.)

Arts and crafts design learning without analysis

Cygnaeus was years 1884-1886 chairman of a committee, appointed to make the program for arts and crafts design teaching at school. Recommendation for the committee was that subjects listed were "woodworks, brush binding, shaving-, twining-, birch bark-, cardboard-, yarn- and sheet works." The report composed for the first time a model series of 70 artifacts; 55 of them were woodworks and 56 tools. So "the fist practical arts and crafts design teaching frames were created for systematically teaching boys in Finnish schools". (Kananoja 1991; Lindfors 1993.)

General handiness

According to Cygnaeus' idea the educational aim and the best merit of workshop school -education should be the "general handiness" (Heinänen 1990). The arts and crafts design shall be integrated with teaching as an educational subject. "Across the whole civilized world has the idea spread, developed and realized by Cygnaeus, namely embracing the arts and crafts design into teaching as a pedagogic meaning and equal with other subjects." (Cygnaeus 1910.) Tue true pedagogy, defended by Cygnaeus, making to observe relationships between phenomena and things and know how of contents of pedagogy was to step aside, because the most qualified Cygnaeus' dreams about educational philosophy, the history of ideas and education concerning the arts and crafts design teaching at school, were to fade and stayed as dream never to come true. These ideas even considered to be dead weight. (Nurmi 1988.)

Ignoring making to observe relationships between phenomena and things was supported It was justified with the idea about kind of one´s own will: "each one shall make the house his way!" There were reasons in time: the poor people made their artefacts needed of the material they could afford. (Lappalainen 2005.) Because of that the working method -centerd arts and crafts design learning was developed, still living even today. The interaction in connection with skill according to Cygnaeus' heritage has not been defined. And that's why since 1800-century a working method one after another has been taught and learned in our educational system and schools. The amount of working methods applicable has been the measurement and definition for the difficult to expression able skills and know how and/or learning the arts and crafts design even recent times. Increasing the amount of methods has become an ideal. The interaction in connection with skill according to Cygnaeus' heritage has not been defined. (Lappalainen 2005.)

Are we allowed to interpret the arts and crafts learning?

Can the arts and crafts design be analytic and interpreted, or are the norms conducted from the values, attitudes raised from norms, schemes raised from attitudes preventing this? If the interpretation of arts and crafts design learning is lacking, the result may be regression of arts and crafts design learning. Several phenomena and relationships between things and matters still have not been defined and named. The arts and crafts design learning is connected with many unused and not benefitted philosophic -, educational - and history of ideas areas.

We also in arts and crafts design process may succumb to deliberate oldfasionism, lean on tradition without renewing it or use childish ways of realization, someone may get fond of ladylike, old-womanish style (Lappalainen 2005.)

Keeping up the narrow ethos for making just like I want it in primary schools, we'll stay with defensive attitudes concerning the arts and crafts design learning. When will it be time, in arts and crafts design learning, for instead of imagination to emphasize creating visions, images and recollections? Keeping up the ethos for making the artefact just like I want it, to be looking just like I want to, is hiding behind pupils/children working with artefacts.

This narrow ethos of personal creativity unfortunately is continuously supported

When there will be in arts and crafts design learning process a real interaction with an individ and learning groups and interaction with selections for materia, colours, forms, styles, models, constructions, working methods, tools, and objects to be processed (Lappalainen 2005.) ?

The old roots and remains, the dead weight, will be broken, when in the future we use the integration pedagogy of arts and crafts design in dialogue. If we are regarding right, the processes will continue as analyses and interpretations. Along with this "trip" we'll also take the cyclic processing and important conscious foundation for arts crafts design. (Lappalainen 2005.)

Revealing analogies, this makes connections and points in common between subjects in contexts of arts and crafts design learning. There we can use annotations, denotations and connotations and combinations of them. What is this difficulty expressionable cultural sensitivity in arts and crafts design learning? The hands and material will be tools for culturally sensitive interaction

For advancing the future arts and crafts design learning and loosing away the dead weight we need:

> dialogue about philosophy and educational history of ideas. This will come true via integration, interpretation and interaction between didactics and contents of pedagogy subjects. (Lappalainen 2005.)

The intersections and borderlines with points in common will be observed. Now in teacher education for arts and crafts design, with processes in learning, it's time to wake up and raise and use the deep going reading method. Then also the cultural awareness, sensitivity and tastefulness will support the interpreting, perceiving and analyse. (Lappalainen 2005.)

Cultural awareness, sensitivity and tastefulness will support the interpreting, perceiving and analyse. Haptic touch and visual sense transfer the shape and outlines into human brains.

There it will unite thinking, knowledge and skill into interaction, when the vision and hand are in connection with artefact, bringing forth or brought about conscious process in the arts and craft design and/or learning it. (Lappalainen 2005.)

The new point of view: The arts and crafts design is material- and colour expression in context with culture and working. The arts and crafts design material is a way to express, this should be interpreting and analysing its essence made phenomena.

The problem solving process: The problem solving process shall also be emphasized in arts and crafts design learning process; there the artefacts are analysed, based and planned their realization and working process. In connection with this also is the conception of skill: there is respectability: in context with know how, the practiced, experienced, perfected action is skill.

Pondering: What is arts and crafts design?
The skill on one hand is theoretically functional and on the other it's silent knowledge. Skill is something like ability, capacity, which is gained through experience, it is through personal connection with reality. The arts and crafts design skill also can be joined with other kind, almost supernatural powers.

An artefact, made skilfully, is often supposed to be like created, born, not looking like made. The arts and crafts design process is happening: on the skin and body, senses of body movements, body language, feelings about the material, how it works, movements of the tools with body, human gestures and expressions.

The problem solving process does not seem to be highlighted enough in arts and crafts design learning. The products should be analysed, based and planned along the process and working. In training and instructing at school and work this should be emphasized and improved.

Here we need flexible, diverse, analytic orientation and interpretation, considering and understanding the connections between phenomena, matters and things.

Conclusion

Analyse belongs to processes in arts and crafts design intention, planning, producing and interpreting the ready-made artefact. The borderlines and indistinct connections between matters, phenomena and things are to be taken with analyse, interpretation and examining the arts and crafts design learning.

This is the way, that respecting Uno Cygnaeus' ethos, the arts and crafts design is working as a viable tool advancing the human mental growth.

REFERENCES

Ahvenainen, M. 1986: Käsityönopetuksen aloittaminen Jyväskylän seminaarissa. Jyväskylä: Jyväskylän yliopiston opettajankoulutuslaitoksen katsauksia 14.

Cygnaeus, U. 1910: Uno Cygnaeuksen kirjoituksen Suomen kansakoulun perustamisesta ja järjestämisestä. G. F. Lönnbeck (toim.) Helsinki: Kansanvalistusseura.

Heinänen, S. 1990: Käsityön ulottuvuuksia. Lievesture: Suomen kotiteollisuusmuseon julkaisuja 7.

Kananoja, T. 1991: Teknologian opetuksen suuntaviivoja. Turun yliopiston kasvatustieteiden tiedekunta.

Lappalainen, E-M. 2005: Kulttuurisesti sensitiivinen opettajuus. Käden, kielen ja kulttuurin oppimisen yhdistäminen maahanmuuttajien koulutuksessa ja opettajan kasvupolulla. Akateeminen väitöskirja. Oulun yliopisto. Jyväskylä: Gummerus. Press 1–3.

Lindfors, L. 1993: Slöjdforstran i kulturkampen Del I. Studier i den finlänska skolslöjdens läröplaner 1912–1994. Publikationer från Pedagogiska fakulteten 4/1993. Vasa: Åbo Akademi.

Nurmi, V. 1988: Uno Cygnaeus suomalainen koulumies ja kasvattaja. Helsinki: Kouluhallitus. VAPK.

Tuomikoski-Leskelä, P. 1979: Taidekasvatus Suomessa I. Taidekasvatuksen teoria ja käytäntö koulupedagogiikassa 1860-luvulta 1920-luvulle. Jyväskylä: Jyväskylän yliopiston taidekasvatuksen laitoksen julkaisuja 5.

Contents

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THE INTRODUCTION OF FRÖBELISM AND KINDERGARTEN IN FINLAND -THROUGH THE AGE OF UNO CYGNAEUS –

Abstract

The histories of primary education and early childhood education and care (ECEC) in Finland were regarded to have different backgrounds. And it was not considered that the early relation between primany education and ECEC in spite of both of them have F.W.A. Fröbel's idea on its backbone. Moreover, Uno Cygnaeus was considered as the history of Finnish educational system itself in early studies though there were many people interested in education. So, first the author reviewed how Fröbel's idea was introduced to Finland. Fröbel's idea was introduced around the middle of the 19th century. Sakari Topelius, Catharina S. Böcker, and a booklert for women introduced the ideology. At almost the same time, Uno Cygnaeus also introduced it. Second, the author examined how Uno Cygnaeus involved with Fröbel's idea. While other actions did not connected to actual Kindergarten, Cygnaeus established Kindergarten. Although this Kindergarten was a little bit different from the one Fröbel described in his books, it adopted the play for its main axis and it could be called Kindergarten.

In this paper the author showed the characteristics of Cygnaeus' actions; (a) he was not the first man to introduce Fröbel, but the first man to establish Kindergarten in Finland. (b)he wasnot the man who just embodied the history of education in Finland, but the man who arranged and embodied these ideas introduced from foreign countries.

Introduction

It is popular to pick up Finland as the research object for the system of education or child daycare in Japan. However, both of them are studied in the view of recent educational system, since 1970s. Since Finland got good results in PISA research of OECD, the system of education, especially primary education, has brought global interest. Thus, the centre of interest is in the practical way for the class or educational method. Currently application and introduction of the Finnish method are being discussed. As the purpose of academic research, it is common to study the changes of curriculum or teacher training system after 1970s. For example, Fukuda (2007) is studying the pedagogical idea and ideology of achievement for these years. For each subject, Yamaguchi (2010) studies the mathematic education. Kitagawa et al. (2006) studies pedagogical method for mother language. Iriguchi et al. (2009) studies P.E. curriculim, and Tahara (2009) studies curriculum for music. After the PISA test, researchers of most of the subjects are interested pedagogical methods. Then, Iwata et al. (2010) studies the recent teacher training system. These researches were done with field work and by pure practical methods.

On the other hand, child daycare has created the most interest in the system since ”Laki lasten päivähoidosta” was made in 1973, and is researched as the welfare service for families. There are few studies done concerning the educational / pedagogical view about the contents and the history. For example, Hashimoto (1984) and Takahashi (1992) are studying integrated child daycare system since 1873.

Therefore, all of them have the common ground that they are interested in the recent situation of Finland, ”country of education”, ”social democratic country”, or ”welfare state”, and there are very few researches about historical or ideological roots of the educational system or child daycare. What have ealier studies done for the history? The fields of primary education and early childhood education and care (ECEC) are separated just like other countries. Is there any relation between primary education and ECEC? In this paper, the author has two aims. The first is to review ealier studies in Japan about Finnish history of education. The second is to study the relation between Primary education and ECEC with taking Fröbelism as one of the ideological roots of both primary education and ECEC in Finland. The author examines the process of the introduction and the development (transformation) of Fröbelism, through Uno Cygnaeus who included Fröbelism into his idea. It is possible to find the characteristics of relation between primary eudcation and ECEC in Finland by studying the process of the introduction and the development (transformation) of Fröbel’s idea.

Ealier study and the task

(I). Earlier Studies in Japan

As the author said above, there are few earlier studies about the history of Finnish educational system or child daycare system, and they are separated.

However, the well-organized systematic study of the the history of Finnish education is done by Matsuzaki (1976). According to Matsuzaki, the first primary education for folks was started in church like other European countries. Gezelius and his son acted for the primary education for folks in the 17th century. After Ahlman school in the beginning of the 19th centuries, the interest in primary education for folks was spread through newspapers and journals. The discussion was very active after 1840s under the influence of Sweden. Then, Alexandor II invited people for senate to construct an educational system, and the idea written by Uno Cygnaeus affected the committee. During the process Matsuzaki mentioned Cygnaeus' birth, his profile, his travel to Europe, and the process he founded his folk school. Matsuzaki wrote that the idea of Cygnaeus consisted of J.H. Pestalozzi, F. Diesterweg, T. Rudenschöld, and F.W.A. Fröbel. Matsuzaki said that he emphasized mainly Pestalozzi and Diesterweg, and "he combined and organized these ideas to apply for the practice in the real conditions of Finland". Matsuzaki added another important point of Cygnaeus and his folk school in the view of handcraft education. Matsuzaki also mentioned J.V. Snellman, and it was said in the contexts of Finnish Nationalism and education. Cygnaeus was considered as mainstream in Finnish history of education.

Matsuzaki wrote other papers about Uno Cygnaeus and the history of primary education system. One of them mentions that he supervised some infant schools at St. Petersberg, not only boy schools and girl schools during his stay in Russia after returing from Sitka. The other one mentioned Pestalozzi, Diesterweg, Fröbel and Rudenschöld for the origin of Cygnaeus' pedagogical idea, and his idea was a mixture of these educator, especially former two. Later Matsuzaki underlined the fact that Finland was the first country that included handcraft education as a compulsory subject in folk school, and studied it in the relation between Otto Salomon from Sweden and him.

After decades, Honda (2005) studied Cygnaeus. Honda followed the studies by Matsuzaki, he examined Cygnaeus as the man who found the importance of handicraft in Finland from the ideas of Pestalozzi and Fröbel and introduced handcraft education into general education. Honda examined Cygnaeus himself and his achievements from the view of educational science with materials written in Finnish. It was for the first time in studies of educational science in Japan.

Whereafter, Yokoyama (2006) examined Otto Salomon and Swedish Sloyd. Yokoyama mentioned Cygnaeus, and he took the roots of Cygnaeus' idea from Pestalozzi, Fröbel, and Diesterweg.

According to above, this is seen as the characteristics of historical research for Finnish primary education system. First, Matsuzaki emphasized Cygnaeus as the main leader of the primary education system, and in the following historical studies about Finnish education system, he was considered as the ideologial leader or ideological fronteer in Finland. That is, the former ideological background in Finland is not mentioned. And Matsuzaki underlined the fact that his folk school introduced handcraft education as a compulsory subject for primary education as the first in the world, Cygnaeus was noticed mainly by researchers of handcraft or technology education in Japan.

Then, there are some researchers of Finnish ECEC. Nakajima (1983) said that Fröbel had strong influence about Finnish child daycare, and the idea and pedagogical method of Fröbel were taught in teacher training school at Jyväskylä in 1863. Takahashi (1998) also mentioned Cygnaeus founded Kindergarten at Jyväskylä in 1863 before Hanna Rothman founded one in Helsinki. According to these studies, Cygnaeus seemed to have big influence in the field of ECEC and he practiced not only theoretically introduced. They, however, did not examined the details, and after these descriptions, there are no studies about the relation between Cygnaeus and ECEC.

(II) Coming tasks

Here the author reviews ealier studies about Finnish education history of the 19th century in Japan.

(a) The pioneer of well-organized primary education system for folks is Uno Cygnaeus, and his ideological background was influenced with Pestalozzi, Diesterweg, Rudenschöld and Fröbel.
(b) It seems that the history of Uno Cygnaeus is regarded as the history of education in Finland.
(c) Uno Cygnaeus is introduced with the term ”Father of folk school”, however today he is wellknown and studied in the field of handcraft, sloyd, and technology education.
(d) It is examined that Uno Cygnaeus related with practice of ECEC through Fröbel. Although there are some descriptions about that, it is not examined in detail.
(e) In the practice for education in 1863, the history of primary education and the one of Kindergarten have common points that are the idea of Fröbel and Uno Cygnaeus. Although there seems to be firm relations, they are treated as separate fields and subjects. And there are few researches for practice and the details.

Thus, after the results of these ealier studies, the author picks up the ideas of Fröbel and Uno Cygnaeus which have common elements for both primary education and ECEC. Then, the author places the idea of Fröbel as the axis and examine Cygnaeus’ actions, not regarding him as the centre.

So, when was Fröbel’s idea imported to Finland? The author examines it in the next chapter.

The Introduction of Fröbel’s idea

There were some infant schools founded under the influence of England and Sweden for small children in working class[1]. Fröbel’s idea was imported to Finland by leading intellectuals. It was split and they were running parallel to these actions.

These studies were done by Hänninen, S-L. & Valli, S. (1986). According to them, the first description about Fröbel was found in the report for Kindergarten in Dresden and Fröbel’s idea written in January 1855 by Ekendali, a Swedish man in Helsinki.

After this, Fröbel’s idea was imported to Finland almost the same era by three ways in three different points of views.

(I) Topelius and his era

First, Sakari Topelius transrated Fröbel’s books into Swedish, and published as ”Huru Doktor Fröbel Uppfostra Små Barn”[2]. Topelius was in Helsinki University at the same time and acted for Finnish Nationalism with John Ludvig Runeberg and Uno Cygnaeus in 1830s (Momose et el, 1998). He worked on mainly literature in Swedish. Then he got interested in education and supported infant schools. He also belonged to the first study group of Fröbelism Kindergarten. This work was done as a part of it. At the end of the article, he said his idea connected to Fröbel’s for all the parents and his friends.

Thus, the introduction of Fröbel’s idea was done with the interest in education born in the folk romanticism in Finland. This character seems to be close to the ideas made in the end of the 18th century to the beginning of the 19th century by the educators of philanthropinismus in Germany.

(II) Böcker and her era

Second, Catharina Sofia Böcker, a secretary of Suomen Talousseura, the economic assosiation for rural district, and a daughter of Kaarle Kristian Böcker who was a supporter of education for folks, imported the idea of Fröbel. She transrated the book written by Bertha von Marenholtz-Bulow about Fröbel’s pedagogical methods into Swedish as ”Barnet”, and introduced his idea.

According to Kantola and Rasinen (2006), Suomen Talousseura which she belonged to was founded ”in the spirit of physiocratism” ”to develop agriculture and increase freedom of trade”. At the beginning of the 19th centuty, Gabriel Ahlman donated big amount of his property to it for preparing schools for folks (Matsuzaki, 1976, ibid). He committed the establishment and managing of the schools, and it founded some schools called ”Ahlman schools”. These were the first schools which were not supervised by churchmen, and introduced the important knowledge for farming as the subject. Suomen Talousseura was founded to develop the lives of farmers, and as a part of the practice it had schools. Teaching in these practices were ”planned to be practical, illustrative and enjoyable in accordance with continental ideas of education”(Kantola & Rasinen, ibid). Suomen Talousseura had an interest in education through their action, and it also got interested in Fröbel’s idea. So, it was considered that Fröbel’s idea was introduced in the veiw of economic for rural disrtrict to develop their lives.

(III)As a booklet for female education

Third, a booklet ” Fröbels Barnträdgård” was published as Christmas gift for female education in 1860s.

Thus, Fröbel’s idea was imported to Finland by these three ways in almost the same age. All of them were introduced by translating Fröbel’s idea into Swedish. And each of them have different characters. The starting points and the aims ware different.

(a) Topelius, a leading intellectual, imported Fröbel’s idea in the view of education based on Finnish Nationalism.
(b) Böcker, a secretary of Suomen Talousseura, imported Fröbel’s idea in the view of education besed on development of folks in rural district.
(c) A booklet was published in the view of education for women.

Then, in these phases, it is remarkable that though Fröbel’s idea and his pedagogical methods were imported to Finland as a translation of his books or ideas, but it was not to be introduced and realized as a practice Kindergarten.

In addition, it is considered that the aims to import Fröbel’s idea was not education for small children itself, but was more result-oriented. They were not linked to the movement to establish Fröbel’s Kindergartens. Although his idea was imported, it was not spoken as an istitute to replaced infant schools for folks. In these phases, his idea was introduced as one of the ways to make Finnish society better by leading intellectuals, however for usual folks there were still infant schools to give daycare and the first education to their children. It seems that there was estrangement between the idea and the practice.

The author examines the relation between the idea and Cygnaeus in the next chapter.

[1] The author reviewed these activity in the master thesis.
Ito, Takao. 2009. The birth of Kindergarten in Finland in the end of 19th century. Master thesis. Nagoya University.

[2] This article is available at National Library of Finlamnd. http://digi.kansalliskirjasto.fi/sanomalehti/secure/showPage.html?conversationId=3&action=entryPage&id=506244

Fröbel, Cygnaeus, and His Kindergarten

(I) Uno Cygnaeus and his work

While many infant schools were founded as educational practice for usual folks, Topelius or Böcker imported Fröbel's idea to Finland around the middle of 1800s. However they were not realized as the practice of institute for small children, Kindergarten. Although there were still many infant schools, it seems that it was not discussed as a new form.

In the situation the author mentioned above, Uno Cygaeus was said as the first man who established Kindergarten in Finland (Takahashi, ibid). The author examines him and his works for Kindergarten in this chapter.

As earlier studies says, Cygnaeus worked for education, especially for establisment of Folk School (Kansankoulu). As the relations between Cygnaeus and Fröbel, Cygnaeus has visited Luise Fröbel's Kindergarten teacher training centre (Bildungs-Anstalt für Kindergärtenerinnen) at Dresden when he met Diesterweg during the travel in 1858 (Hänninen & Valli, ibid). He knew Fröbel's idea and got new sight in his mind. He had the idea about the importance of the relation between the labour and the play for child education by thinking and reading books, and the view of nature and holistic education, and it was similar to Fröbel's. About the relation Nakajima says that "Cygnaeus, who was called the Father of folk education, said "labour education by labouring" and completed Sloyd-ism, they were because of he knew well the theory and practice of Fröbelism in Germany"(Nakajima, ibid). As he says, Cygnaeus found common points in Fröbelism and his idea, and he got very interested in Fröbel.

Then, Cygnaeus visited some daycare centre for under three-year-old when he went to Dresden and Berlin. Cygnaeus noticed the necessity of daycare/early childhood education for small children who needed parents' supports also in Finland at the same time. He recognized the importance of care and education for small children (Hänninen & Valli, ibid).

Then, Cygnaeus visited infant schools in Finland in 1859 after the travel abroad. He pointed that any infant schools were done in low levels, the methods made children tired, and the environment was not enough. And he required the enrichment of early childhood education.

Cygnaeus made the plan for the practice of Kindergarten in 1860. It was mentioned that Lower classes of folk schools accept four- to five-year-old children in particlar cases, and Kindergarten has three- to six-year-old children following to German cases which he saw there. And it is also described that the methods were based on Fröbel's idea.

As Nakajima said that Fröbel's idea and pedagogical methods were taught in teacher training school which Cygnaeus founded at Jyväskylä in 1863 (Nakajima, ibid). He established an institute for small children attached to the teacher training school. This institute was called as Kindergarten, but had two classes, and it was for four- to seven-year-old children and for seven- to ten-year old children. It adopted Fröbel's method, but it was a little bit different from typical Fröbelism Kindergarten in the character. In addition, he established créche for lower children. It was said that he worked to realize Finnish Folk Schools in Finland, but he established few independent Kindergartens for folks (Hänninen & Valli, ibid).

(II) The Influence of Cygnaeus

By spreading Cygnaeus' travel abroad and his report about education included Kindergarten, some Fröbelism Kindergartens influenced Cygnaeus were established in Finland. Some of them were newly established, however others were changed from former infant schools to Kindergarten. Selma Witting established Kindergarten at Porvoo in 1862. Sedmigradsky Infant School (Sedmigradskyn pikkulastenkoulu) and Marias Asyl (Maria's shelter) in Helsinki also introduced Fröbel's method in 1862. Ida Lindroosi started a Kindergarten in 1863. A Kindergarten was established in Turku in 1868. After Cygnaeus, some Kindergartens were started.

When Uno Cygnaeus introduced Fröbel's idea, it was realized as Kindergarten for the first time in Finland. Although he arranged the idea more or less for his folk school system and it was not "pure" Fröbelism, they were under the strong influence of Fröbel and named Kindergarten, and adopted his method for their curriculum. And these Kindergartens were classified as these two types [3].

(a) The ones of them introduced Fröbel's idea and the methods, and replaced the curriculum which emphasized too much knowledge concerning the play, with using just the same building, staff, and facilities. Most of them were infant schools for poor folks by the association of women before introducing. Infant schools were mainly made for children of folks by the time, then Kindergarten was replaced. The target was usual folks.

(b) The others established attached to Folk schools or girl schools and been included as one part of the folk school system. These Kindergartens were actually for the children in middle class, and the children who could go were limited. Children who were under seven-year-old could go there. These Kindergartens were not connected directly to the later Kindergarten system which continued to today, but they remained by the 19th century as the institute for small children which attached to folk school. Hanna Rothman, who established Helsingin Fröbel-laitos (Fröbel's house in Helsinli) which was called "ensimäinen kansanlastentarha" in 1888 in Finland, opened her first Kindergarten in 1883 at Unioninkatu (Union Street) after returning back from the study at Pestalozzi-Fröbel Haus in Berlin. The Kindergarten was supported by Elisabeth Blomqvist, who was a teacher of Rothman in Swedish girl school and a supporter of folk school system, and it had both the side of Kindergarten and infant school linked to folk school system. Later it got independent as Kindergarten. It seems that there was the idea that Kindergarten was also a part of folk school system and attached or connected to it.

[3] The author identified the elements of Kindergarten and infant school, and analyzed these practice in Finland from several perspectives in Master thesis. According to it, These Kindergartens in 1860s had the element of Kindergarten and were to be called as Kindrgarten.

Conclusion

Here the author summarize the paper. Actually there was several phases to introduce Fröbelism and Kindegartren. Before Fröbel's idea was imported, there were institutions like créche to take care of children, then infant schools made in England and came to Finland via Sweden were established in 1830s. Infant school was popular also in Finland. It was for poor usual folks.

After Ekendali mentioned Fröbel, while infant school was developing in Finland, some leading intellectuals imported Fröbel's idea and published it in Swedish. There were three ways, but all of them were different to each other. First, Sakari Topelius introduced it in the view of Finnish Nationalism. Second, Catharina Sofia Böcker introduced it in the view of development of lives in rural district. Third, it was introduced for women education. These three ways introduced Fröbel's idea for education for small children, but they did not establish actual institute, Kindergarten.

Almost the same time, Cygnaeus also introduced Fröbel and his idea in his report after his travel abroad. Although he arranged and reorganized Fröbel's idea to suit to his folk school plan, he had his practice in his Kindergarten in Jyväskylä. He taught early childhood education theory in his teacher training school there. In addition, because his report or practice influenced over Finland, some Kindergartens were established. There were two types. (a) One was an infant school before and changed to Fröbelism Kindergarten introducing the play under the influence of Fröbel inroduced by Cygnaeus. This one was done by giving up the methods of infant school which had emphasis on knowledge putting. Although the building, equipment, and facilities were different from the ones Fröbel thought, it was for usual folks and pioneer in Fröbelism and folk Kindergarten in Finland. However, it was not organized well and did not last systematically. (b) The other one was Kindergarten included or attahed to folk school. It was for children in middle class as a result.

In conclusion, in earlier studies the history of primary education was regarded as the history of Uno Cygnaeus, and it was not in macro view. Moreover ECEC was not mentioned in the context, though it was mentioned that Cygnaeus had his ideological background from not only Pestalozzi and Diesterweg, but also Fröbel.

Thus the author investigated the process of introduction of Fröbel's idea first, and then examined Cygnaeus. By examining Cygnaeus comparing with other people who introduced Fröbel's idea, the author found differences from others. In the middle of 1800s there were several ways that introduced Fröbel's idea, but only Cygnaeus realized his own Kindergarten. Then, though other importers' actions were not linked to actual Kindergarten movement, Cygnaeus' idea was spread around Finland and some Kindergartens were established.

Cygnaeus' remarkable achievement was that he did not work for only folk school, over seven-year-old children, but also worked for smaller children and the institute Kidergarten. And it was also remarkable that he was not the first man to introduce Fröbel, but the first man to establish Kindergarten in Finland. This is not about the man who just embodied the history of education in Finland, but the man who arranged and embodied the ideas introduced from foreign countries in the situation of Finland that there was a big stream of Finnish Nationalism and the interest in education and many ideologies were imported in the middle of the 19th century.

REFERENCES

Fukuda, Seiji. 2007. Kakusa wo nakuseba kodomo no gakuryoku wa nobiru: Odoroki no Finlad Kyoiku (If we stopped making gaps between students, the achievement would be better: Surprising Finnish education). Aki-shobo.

Hänninen, S-L. & Valli, S. 1986. Suomen Latentarhatyö ja varhaiskasvatuksen historia. Otava.

Hashimoto, Noriko. 1984. Josei no jiritsu to kodomo no hattatsu: Hokuou Finland ni manabu sono ryoritsu eno michi (The independence of women and the development of children: Learn the way to be consistent from Finland, Northern Europe). Gunyo-sha.

Honda, Yushin. 2005. Uno Cygnaeus to shuko kyoiku (Uno Cygnaeus and handcraft education). Kyoikugakuzassi (Journal of Pedagogy). v40、Nihon University.

Iriguchi, Yutaka et al. 2009. "A study on the curriculum reform of physical education in Finland (1) [in Japanese]". Memoirs of Osaka Kyoiku University. Ser. 5, School subjects and allied problems. Osaka Kyoiku University. v58(1).

Ito, Takao. 2009. The birth of Kindergarten in Finland in the end of 19th century. Master thesis. Nagoya University.

Iwata, Shotaro et al. 2010. ″Study on Actual Situation of Qualitative Assurance in Pre-service Education of Finland″. Gakkokyoiku Jissengaku Kenkyu (Study for practicein school education). Hiroshima University. v16.

Kantola, Jouko & Rasinen, Aki. 2006. "Development of Craft Education in Finland during the Time of Uno Cygnaeus". Bulletin of Institute of Vocational and Technical Education. v2. Graduate School of Education and Human Development, Nagoya Univershity.

Kitagawa, Tatsuo & The group of Finnish Method. 2005. Zukai Finland Mesoddo nyumon (Illustrated Finnish Method guidebook). Keizaikai.

Matsuzaki, Iwao. 1970. ″Uno Cygnaeus to Finland no shotokyoikuseido no seiritsu katei (Uno Cygnaeus and the process of establishment of primary education system in Finland)″. Bulletin of Aoyama Gakuin Women's Junior College. v24. Aoyama Gakuin Women's Junior College.

Matsuzaki, Iwao. 1973. Suroido Kyoiku no siso to jissen – Cygnaeus to Salomon. (The idea and the practice of sloyd education –Cygnaeus and Salomon-)″. Gijutsu Kyoiku (Technology Education). Minshu-sha.

Matsuzaki, Iwao. 1976. ″Finnish history″. The world history of education. 14 Education in Northern Europe. Kodan-sha.

Momose, Hiroshi et al. 1998. Hokuoshi (Northern European History). Yamakawa-shuppansha.

Nakajima, Hiroyuki. 1983. ″Hokuo (Northern Europe)″. Sekai no Yoji Kyoiku 4 Hokuo / Swiss (The early childhood education in the world 4 Northern Europe / Switzerland). Nihon-raiburari.

Tahara, Masako. 2009. ″Music Education in Finland I : Case Study of Practical Applications at the Finnish School in Japan and Music Classes in Finnish Primary Schools [in Japanese]″. Journal of Poole Gakuin University. Poole Gakuin University. v49.

Takahasi, Mutsuko. 1998. ″Social welfare in Finland″. Social Welafare in the World 1 Sweden-Finland. Junpo-sha.

Yamaguchi, Takeshi. 2010. "Special issue: Mathematics textbooks in Finland [in Japanese]″. Journal of Japan Society of Mathematical Education. Japan Society of Mathematical Education v92(6).

Yokoyama, Etsuo. 2006. ″Otto Salomon no shoki suroido kyoiku –Nääs Shonen suroido gakko ni okeru jissen no totatsuten kara mita Cygnaeus no eikyo (Otto Salomon's early sloyd education –The influence of Cygnaeus by examining the practice at Nääs boy sloyd school)″. Bulletin of Japan Society for the Study of Vocational and Technical Education. v36(1). Japan Society for the Study of Vocational and Technical Education.

Contents

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FROM ART & CRAFT EDUCATION TO DESIGN & TECHNOLOGY EDUCATION, A THIRTY YEAR STORY!

(Translated from French by Robert Watson)

Summary

In 1985, France swapped manual and technical education for Technology Education (TE); the question of the teaching of this new subject as part of general education for all arose. With this introduction, many different activities became a part of people's schooling: design, engineering and production of technical objects. This paper raises some questions in connection with the study of a specific field of knowledge, that of TE, taken in a specific context, that of the process of teaching-learning.

Examining the process of teaching-learning in TE requires an affirmation of two major preliminary aspects: there is something to study in TE and there would supposedly be multiple conditions for studying, even different ones. These two points allow the distinction to be made between the subject to be taught and the manner of teaching it; interactions between these two aspects need to be meaningful. The definition of learning in school situations cannot be considered without thinking about how the transmission of knowledge and the logic of how pupils learn are organised. Thus, the teaching of TE has something to do with the industrial production of technical objects (the subject to be taught) and with the organisation of this industrial production (the way of teaching it). However, this relationship is not clear cut, and the hierarchies established for one have direct effects upon the other, facilitating or preventing one choice or another.

Introduction

In 1985, France swapped manual and technical education for Technology Education (TE); the question of the teaching of this new subject as part of general education for all arose. With this introduction, many different activities became a part of people's schooling: design, engineering and production of technical objects. This paper raises some questions in connection with the study of a specific field of knowledge, that of TE, taken in a specific context, that of the process of teaching-learning.

Examining the process of teaching-learning in TE requires an affirmation of two major preliminary aspects: there is something to study in TE and there would supposedly be multiple conditions for studying, even different ones. These two points allow the distinction to be made between the subject to be taught and the manner of teaching it; interactions between these two aspects need to be meaningful. The definition of learning in school situations cannot be considered without thinking about how the transmission of knowledge and the logic of how pupils learn are organised. Thus, the teaching of TE has something to do with the industrial production of technical objects (the subject to be taught) and with the organisation of this industrial production (the way of teaching it). However, this relationship is not clear cut, and the hierarchies established for one have direct effects upon the other, facilitating or preventing one choice or another.

General background of the French school system

In France, school is compulsory for all children between the ages of five and sixteen. However, infants' schools have an obligation to provide nursery care for children from the age of two or three years old, and none can leave school before the age of eighteen unless they begin vocational training or a job. The legal obligation in fact becomes an obligation to be in education from three to eighteen. The French school system is organised into two levels, primary education and secondary education.

Primary education involves two schools, infant school and elementary school. Secondary education starts with four years of schooling in lower secondary school (called Collège in France) for all 11-15 year-old pupils. The upper secondary school (called "Lycée") is organised for 15-18 year-old pupils in three different ways: the general way, with literary, economics and scientific courses, the technological way with industrial, tertiary and medico-social courses and the professional way which prepares pupils to work in a job. These secondary studies conclude with the Baccalaureate examination and, in the year 2000, approximately 70% of French pupils reached this level of education. This open access to secondary education is accompanied by a re-definition of the aims and objectives of each of the education levels. In the context of education for all, the aim of the upper secondary school is to guide pupils towards vocational training through the professional branch and towards university education through the general or technological one. General education deals with an equal access to culture, citizenship, and social integration while vocational training deals with the equal opportunity to access a qualification and a profession. The Ministry of Education is in charge of general education as well as vocational education. Both these educations are deeply linked through the correspondence between each diploma and the different level of qualifications. The pupils opting for either of these options is determined by their own assessment and by the opportunities to join a vocational course. But of course, despite considerable efforts being made, training possibilities and employment opportunities are difficult to bring together, considering the low qualification levels. Some independent institutes (CEREQ[1], CNP or DEP) contribute to appreciate the needs of the job market and to develop curricula. A major problem appears between the training offered and the young people's wishes. All of this has a significant impact upon how schooling is organised, particularly with regard to TE.

Overview of French TE curricula

TE was introduced in the early eighties and was different in primary school, lower secondary school and upper secondary school. This paper presents a brief overview of these curricula for primary and upper secondary school, and focuses on middle school.

Primary School

In primary school, there is a combination of TE with science education: "*discover the world*" for 3-5 year-olds, "*discovery of the world*" for 5-8 year-olds, and "*scientific and technological initiation*" for 8-11 year-olds. The main school subjects, "*technology education*", "*science education*" or "*life and earth sciences*" at lower secondary school, expand upon this. Children progressively use a constructivist approach to examine the differences between these subjects through educational activities, using methods to observe, manipulate, experiment, make, manufacture, design… The pupil learns new knowledge as a result of the discovery activities conducted in class. The pupil does not organise it in terms of pre-defined school subjects, but by defining the subjects' format via these principles of a specific and unique curriculum (Develay, 1992) that can be assessed in relation to teaching and learning issues (Charlot, 1997). The delimitation of subject boundaries results from this process and is not like an imposed definition; there is a unification of criteria such as the nature of handled knowledge, the possible actions, methodologies used to organise the activities (Ginestié, 1999). School is the place where pupils undergo a transition from having a sensitive and intuitive perception of the world to a rational relationship via knowledge learnt in school subjects.

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1 CEREQ : Centre d'Étude et de Recherche sur l'Emploi et les Qualifications ; CNP : Conseil National des Programmes ; DEP : Direction des Études et de la Prospective

At primary school, teachers teach all the subjects and they focus mainly on the teaching of French and mathematics, this is known as fundamental learning. Some of them attempt to teach science and TE and among those, the majority teach biology through observation of life development (plants or small animals like goldfish or mice); a few develop some electricity experiments and fewer still try to implement some TE. This last part is widely interpreted as handicraft or applied science (building a pocket torch through application of electrical circuits); it is called TE based on the use of skills and materials such as scissors, cutters, cardboard or glue. The Ministry of Education tried to develop science and TE through two initiatives (PREST[2] and Lend a Hand); but the results were not really satisfying, mainly because of inappropriate teacher training.

Upper secondary school

TE appears in a different form depending on the goals of each kind of secondary school: as an option in 'general' secondary schools (3 hours per week), as a main compulsory subject at technological schools (3-6 hours per week) and as an area connected with professional skills and knowledge at vocational schools (6-9 hours per week). The nature, goals and organisation are different in each kind of establishment. For the first one, TE is a general subject designed to develop the pupils' relationship with the technological world. The majority of these pupils will never choose a technological study course or career; they study TE to develop their own general literacy in this field. For the second type of school, TE is also a general subject, but it is an introduction to university vocational training, i.e. to become an engineer or technician. For the third one, TE is directly linked to the professional domain; for example mechanical technology, component technology, biotechnology, or any other specialised area or technology. The goal is to give young people the necessary technological background to understand professional skills and context.

Vocational training in France for the qualifications (workers, office employees…) is based on three types of education: general education, vocational education (in school) and vocational training (in companies) by alternating between a period in school (the majority of the allocated time) and practical work experience in companies. The specialisation is based more on a group of jobs in the same domain, rather than pupils specialising in a specific job, with the idea being to give them extensive background knowledge in order to provide professional flexibility.

Lower secondary school

At lower secondary school, TE is a compulsory subject, introduced in the early sixties but generalised in 1985 following on from the curricula for primary

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[2] PREST : Plan de Rénovation de l'Enseignement des Sciences et de la Technologie

school (Ginestié, 2001a). This evolution has represented a very important change of orientation. Understanding the world of children goes hand in hand with organising that world into different knowledge areas, from the general view to the specific description given for different subjects. At the same time, there was a major development of the project pedagogy with a move away from the traditional viewpoint about teaching approaches based on the dogmatic transmission of academic knowledge. Under pressure as a result of mass access to secondary schooling, project-based pedagogy was presented as a possible solution for meeting the needs of pupil diversity, addressing their individual needs, and developing pupil autonomy (Ginestié, 2002). It was in this context that this new subject, TE, was introduced and we can note four stages in the establishment of TE since 1985.

The first curriculum: 1985-1991

The new subject replaced the old one (manual and technical education) with the same timetable, same classrooms and same teachers. This curriculum emphasised the industrial environment as being related in terms of the social and professional world of industrial production (COPRET, 1984) and is based on two parts: the first one described TE in terms of overall goals, context, and aims through the development of a positive attitude towards technology (as many papers described it, e.g. de Vries, 1994; Jones, 1997; Compton & Jones, 1998; Gardner & Hill, 1999; Dugger, 2000; Kantola et al., 1999). This approach was well placed as an intermediate cycle where pupils had to make their own personal plan for school, and TE was responsible for indicating possible career choices. The second one described the organisation of concepts based on four domains of reference: mechanical construction, electrical construction, management and computer science. Clearly, the chosen references oriented TE in the world of industry towards electro-mechanical production, with the exclusion of other possibilities (Ginestié, 2001b).

The main problem with this curriculum has been that it linked general aims to the specific fields (Sanders, 1999; Ginestié, 2004) and difficulties appeared at the time of the implementation of continuous teacher training programmes. Earlier, educational authorities affirmed that TE was not a compendium of a little bit of mechanics, a little electronics, and business management with different aspects of computer science to bring it all together; TE could not be a simple substitution of handicraft or cooking for mechanics or electronics (Ginestié, 2003). But how is it possible to connect general aims and specific concepts into an overall pedagogical project (Ginestié, 2006)? A lot of original experiments were conducted at the same time, developing new teaching approaches (differential pedagogy, autonomous work, cooperative work, personal projects, etc.), integrating new references about industry, market economy, new labour organisations, introducing concepts such as needs, design, production, marketing, use… The major plan was to combine the pedagogical project with a theoretical industrial project method (IPM). We can note comparable initiatives in England and Wales at the same time (e.g. Hennessy & Murphy 1999).

Curriculum evolution

1992-1999: introduction of the Industrial Project Method (IPM)

IPM appeared as the correct solution for implementing TE – most probably because it has taken an overwhelmingly predominant place in TE, leaving no other alternatives for organising TE courses – and became official through different additions and modifications to the initial curriculum. This approach allowed for the simultaneous definition of content and organisation of the teaching-learning process: it provides content (knowledge, support and technical language) and methods through the normal process arrangement by which one can go from idea to product. Its implementation brought all the pedagogical aids with which a teacher could plan and organise the completion of a new project each year for each group of pupils. Among various practices, the commonest was the choice by all the teachers in the same school to have the same project for the same level of schooling (Ginestié, 2002). Remember, in France, curricula are prescriptive; detailing goals, activities and contents, and teachers are under pressure due to the individual assessment made by a teaching inspector.

1999-2004: the second curriculum

Two things reduced the role of the project in TE. Firstly, projects were mainly single production projects without any real progression from one year to the next. Secondly, a social pressure was exerted on the teachers so that they develop openings with regard to new technologies and new working patterns. The profile of teachers evolved considerably during this period to the benefit of new graduates coming from advanced technological universities. These young teachers come mainly from much specialised studies (mechanical or electronic engineering) but without an extensive background in all the technological dimensions of the project. The implementation of the new curriculum took four years and the changes attempted to organise the relationship between the respective roles of the project and the concepts. During the first three years, pupils studied different independent modules as part of the whole project and, during the last year, they did a complete project (Ginestié, 2001c). The IPM is always a very strong frame of reference for TE; the curriculum focusing on the different socio-professional roles required organising, managing, executing, etc. of the different tasks to put a new product on the market. Through this, pupils can discover different jobs, the corresponding qualifications and the training involved (Ginestié, 2002).

2005: and beyond, another change

A new phase of curriculum change was initiated by the ministry, promoting pupils' individual choices regarding their future and, as a consequence, the studies they have to do. There is a real reduction of TE as a general and cultural subject. The general aspects are more and more applications of sciences; the general method is no longer the process of design and technology but more and more the process of observation and experimentation (as is found in science education). The key knowledge, which was clearly identified as technological knowledge, has been banished and the draft of this new curriculum promotes links with scientific knowledge. The IPM is still a point of reference but it is now more an object of study than a method to use with pupils.

Some concepts to think about in TE

All these evolutions, probably necessary to create a school subject, are indicative of the importance of references. Certainly, this development questions the distinction between sciences and technology. Evidently, we have to define an epistemology from both viewpoints: reference epistemology and school epistemology. Many investigations in France show the distance between these two epistemologies and the process carried out to go from one to the other. Surely, we need to answer this question: what should the aims of the subject be if we have TE for everybody in general education?

Some directives to define the general background for technological education

Five aspects directly concern this subject: user of technical objects, product buyer, user of technical systems, and social 'actor' in production systems and citizen of a city. (i) *User of technical objects*: our societies develop more and more objects that play a key role in our everyday life; their sophistication induces new relationships between man and object. TE is not only a question of having a positive attitude but also of developing the ability to be well versed in the usage of objects. TE has to give meaning to their use. (ii) *Buyer of products*: the diversity of brands, models, and range of products makes it increasingly difficult to buy. The need-wish-cost relationship pressures the individual into making choices, embedded into the sociocultural context and emphasised by advertising. Having the same common functions in a multitude of products allows infinite variations of identification functions that lead the consumer to decide which product he buys, rather than another one. Developing understanding about the production and existence modes of technical objects means to add rational thoughts to pure emotions, thus increasing the possibilities for critical choices. (iii) Consumer of technical systems: social organisations link networks of increasingly technical systems; these systems strongly influence people's activities and their environmental evolution. The use of a technical object cannot be limited to its simple use but in a global interaction between technical production, environmental evolution and the modification of social relationships. (iv) Social actor in the production system: a human being holds an active position in how society is organised, through his work and the social contribution he makes. Our society has developed the model, meaning that anyone can have a job, get paid enough to give him purchasing power and opportunities to be a consumer of technical objects that need to be produced… This model is culturally and historically marked and strives to generalise liberal values with a socially accepted idea of work being something that grants access to a standard way of life, to health, education, security… recent events show the limitations of this model in terms of development, environment, security, employment, etc. (v) Citizen of a city: modern democracies are based on sharing power by sharing knowledge. Very often, this principle is jeopardised, in many cases where knowledge relates to technological changes and thus to their social impact; that becomes a job for specialists who confiscate some of the power through the idea of common wellbeing. Many situations show that it is important to control this development and to give citizens the opportunity to understand the changes, their impact and their significance.

These five points give us an interesting overview but are not formal enough to define content for technological education and to distinguish it from science education.

Some directives to define technological education

The French TE curriculum is unstable. This can be traced back to the major changes that have occurred since the first curriculum was established. These changes are not linked to technological evolution but are mainly due to a lack of understanding of the position held by TE in the general system and to a misunderstanding about the aims of this subject and the knowledge taught. This lack of knowledge is obvious when we observe its structure. We asked this question relating to knowledge in the introduction to this paper, but the analysis of the study conditions for relevant TE knowledge presupposes an agreement based on two points: there is something to study in TE; and there are said to be multiple ways of structuring teaching.

These two points have not been clear for a very long time. TE is a minor subject that mixes handicraft and other elements to highlight vocational training choices (Ginestié, 2000; Chatoney, 2006; Brandt-Pomares, 2008). From this point of view, knowledge coming from sciences and TE is only a question of activities or applications. This weak position of TE in schools is key to understanding the French evolution. Evidently, this is not the way we choose to do things in Gestepro; to understand this significance of TE, we work on the anthropological approach.

The anthropological approach

The anthropological approach is based on activity analysis in which pupils accomplish a task, bringing together the way to do it and the meaning of what they have to do. Knowledge, from this perspective, is the way of giving people the power to act on the environment, in a social context. The link between the task and the technique defines a know-how that shows the way to accomplish a determined type of task (Ginestié, 1995). Getting away from individual and private action hints at the mediation of language to extract a praxeology from the individual praxis. The praxeology is indicative of the way of completing the types of task and the context of these tasks; there is progressive development of meanings from task to technique and then to technology, perhaps to theory. Knowledge relates praxis, as activity connected to finality, and praxeology as an area of meaning linking practice to technology and/or theory (Ginestié, 2001c). The nature of this knowledge, as evoked in the anthropological perspective above, structures the different epistemology and references for the school subjects (Ginestié, 1997). For TE, we can define some areas of reference:

i. the world of technical objects, their mode of existence and social organisations through and for which these objects exist so as to register technological education in human and social areas of activity;
ii. the links between functioning, function, structure, shape, material through interdependence and the different ways of describing an object;
iii. the connection between design, production, use, in particular for the references given on the processes concerned for each area, but also in a more global way, either in a specific approach to an object, or in an evolutionary way from the point of view of a history of technical activities;
iv. the link between object, activity, language as described by ergonomists (thing to object to tool and then to instrument) and as an indicator of the relationship between gestures, techniques and technologies.

Obviously, this qualifying of different fields is somewhat flimsy and needs specification for reading existent curricula and understanding interactions between teacher and pupils in TE courses. From the curricular approach, the problem is not the transposition of praxis but the transposition of the organisation of praxeology; it is not difficult to ask pupils to make something, but the question of what meaning he creates in doing so is vital. Certainly, the instability of the French curriculum comes from this difficulty in developing meaning.

School institutionalisation

School institutionalises the interactions, and in fact the tensions, between pupil, teacher, and knowledge. Describing these interactions requires a methodology of description. Thus, analysing the conditions of study concerns the school institution context, the knowledge to be studied and the way of organising this study. Our analysis is based on the relationship between task and activity:

- the task signifies knowledge as it appears in the situation created by the teacher in the fixed framework (curricular structures, conditions of exercises, specific constraints, etc.);
- the activity refers to the work undertaken by the pupil progressing in the task that is set by the teacher and representative of the process for learning knowledge.

The initial framework, developed by this analysis method, does not prejudge knowledge, pedagogical organisation developed by the teacher and activities developed by the pupil (Ginestié, 2008). These two analyses, task and activity, characterise the interactions between three complementary or conflicting logics: curricular logic, teaching logic and learning logic. The first one based on knowledge structure requires an epistemological study; the second one describes the teacher's activity through his organisation, his style, his manner of doing things, the professional acts he develops; the last one concerns pupil activities, highlighted by learning theories. These logics have a strong influence upon school situations and are significant in terms of the different references and timescales. It is one of the ways we chose to analyse how these three logics are stressed in school institutions and the effects produced (Ginestié, 1996).

The analysis of the task allows one to characterise the organisation and the structural elements that have an impact upon the process of teaching-learning as a suitable expression of interactions between subject logic and teaching logic. It expresses simultaneously what is involved, the context in which it is situated and what the pupil should do in order to carry it out. It is indicative of the values, designs, knowledge which founds the discipline references and the position of the teacher. The analysis of the task shows how the curriculum is implemented, the pupils' activities that it induces and also the epistemological, curricular, didactical or pedagogical presumptions made by the teacher (Ginestié, Brandt-Pomares, 1998).

Activity analysis is another viewpoint on the process of teaching-learning through the interaction of teaching logic and learning logic, and concerns the activity of both people involved in the situation: the teacher and the pupil. From the pupil's point of view, activity is characterised by how he understands the task, what he thinks he has to do, how to do it, which action to take and how to plan this action, what he needs in order to achieve the task. From this perspective, we can notice difficulties that he meets, the manner in which he processes them, adopted strategies and the planning of his different courses of action (Ginestié, Andreucci, 1999). From the teacher's perspective, activity concerns what the teacher does when the pupils work, which kind of guidance, help, he brings them and how, which indicators he appreciates and how his appreciation of the development of the pupils' activity leads him to regulate this development (Amigues, Ginestié, 1991).

School organisation and pupils' work

As we can see, implemented organisation has a direct influence on the activity of the teacher and of the pupils, whether or not it makes them learn something. Clearly, it is important to specify what the teacher expects of the pupils, which resources they have at their disposal, how they can organise their activities. So evidently, the kind of goals to be reached, the assessment and the indicators through which the pupils can appreciate (how) they have to do it and to do it well contribute to defining the process of teaching-learning through the task-activity analysis.

Analysing the task

The analysis of the task gives some understanding of the object of study through the formalisation of praxeology in the different task references; it is the last stage of the didactical transposition in which the teacher defines what he expects of the pupils and anticipates their activity and their learning. There are many indicators to characterise the task, among them:

- the type of knowledge that he exhibits,
- the displaying of the result expected at the end of the teaching,
- the spatial and temporal organisation type that he puts into action,
- the strategies that he uses to orchestrate pupil activity,
- the various levels of evaluation that he plans to use (evaluation of his activity, of how the teaching develops, the pupils' activity, achieving the envisaged results),
- the mediation and remediation devices that he envisages,
- etc.

Others indicators allow us to note explicit or implicit models that he uses for the organisation of this end product to his teaching:

- model of the logic of pupil learning organised around acquisition of skills with regard to the range of significant observable behaviours versus a constructivist approach based on the development of knowledge;
- model of the pupils' activity based on a logic of eradicating difficulties versus a logic based on confronting obstacles;
- model of a teaching structure linked to a logical way of guiding pupils' learning versus a logic of problem-solving;
- model of the organisation of knowledge references that one can caricature in a binary alternative: in TE, there is nothing to know versus there is only knowledge.

Supported by theoretical reference, these models allow us to compare the reality and to appreciate what pupils do, what they learn and the efficiency of the process of teaching-learning. Of course, we acknowledge three different viability risks: one is an instant risk about what happens with regard to the course that is going to take place here, at this time, in this classroom, with this teacher and these pupils; second is a progression risk concerned with what happens for the duration of the class, the linking together of the different sessions and how they follow on from one another; third is a durability risk relating to the permanency of teaching at such a level, in such and such a class, in such and such a context, depending on evolution, development, interaction with the other subjects as a kind of general educational ecology.

Analysing activity

The analysis of activity characterises the logic of pupils through their organisation and planning of action, and how they progress to achieve the task. The indicators refer directly to theories of learning, notably through:

- the strategy they adopt,
- the way of organising their actions,
- the way of noticing and anticipating difficulties and to overcome them or to avoid them,
- the way in which constraints imposed by the scenario are acknowledged or not,
- etc.

This analysis measures the distance between what is expected of the pupils and what they really do. Evidently, the situations are dynamic ones and the role of the teacher, as well as the interactions between the pupils are not neutral and the characterisation of the distance has to measure their effects. At the end of the proceedings, the data collected through these two analyses brings meaning with regard to the efficiency of the way the school is set up, but also an understanding of the nature of and the difficulties of the obstacles met by pupils. This increases our understanding of the teaching-learning process in TE. An understanding of efficiency gives us some strong indications about the tasks, how to design, develop and organise them but also of the teacher training requirements.

This challenge is important if we want to reinforce the position and the role of TE as a general education subject. Through our French experience, but also through some related experiences in different countries, we are now in a period that is changing. The first period of innovation and implementation is definitively over. Many countries have experienced a period where less pupils have shown an interest in TE: a reduced budget, reduction of school time devoted to the subject, integration of TE as science and technology education... At the same time, more and more teams are developing investigations in TE and providing many different choices, understanding and developments to think about with regard to TE, its nature, its aims and its content.

REFERENCES

Amigues R., Ginestié J. Représentations et stratégies des élèves dans l'apprentissage d'un langage de commande : le GRAFCET. *Le travail humain*, 1991, Vol. 4, pp. 1-19.

Brandt-Pomares, P. (2008). Searching for information on the internet about the link between task and activity. In J. Ginestié (Ed.), *The cultural transmission of artefacts, skills and knowledge: Eleven studies in technology education* (pp. 173-192). Rotterdam: Sense Publishers.

Chatoney, M. (2006). The evolution of knowledge objects at primary school: study of material concept as it is taught in France. *International Journal of Technology and Design Education, 16*(2), 143-161.

Compton, V. & Jones, A.: 1998, `Reflecting on Teacher Development in TE: Implications for Future Programs', International Journal of Technology and Design Education, n° 8 vol. 2, pp. 151-166.

COPRET: 1984, Proposition de la COPRET pour l'enseignement de la Technologie au Collège, Ministère de l'Éducation Nationale, Paris.

De Vries: M.: 1994, `Technology education in Western Europe', in D. Layton (ed.), Innovations in Science and Technology Education, Vol. 5, UNESCO editions, Paris.

Dugger, W.: 2000, `Standards for Technological Literacy: Content for the Study of Technology', Technology Teacher, n° 59, vol. 5, pp. 8-13.

Gardner, P. & Hill, A-M.: 1999, `Technology Education in Ontario: Evolution, Achievements, Critiques and Challenges. Part 1: The Context', International Journal of Technology and Design Education, n° 9, vol. 2, pp. 103-136.

Ginestié J.: 1995, Knowledge or know-how: Overview about development of Technology education. In Blandow D. & Wahl D., Innovation and Management in Technology Education, Erfurt, WOCATE editions.

Ginestié J.: 1996, Computer based control in Technology education: Some questions about introducing and teaching. In Tamir A., Report of the Jerusalem International Sciences and Technology Education Conference, UNESCO, Jerusalem, section 3, pp. 21-29.

Ginestié J., Brandt-Pomares P.: 1998, Distanced resources access in Technology education, In Kananoja T., Kantola J., Issakainen M., The principles and practices of teaching Technology, Jyvaskyla, University of Jyvaskyla editors, pp. 150-159.

Ginestié J., Andreucci C.: 1999, Designing and building: how children do this. In Benson C., Second international primary design and Technology conference: celebrating good practices, Birmingham, CRIPT-UCE editions, pp. 62-66.

Ginestié J.: 2000, An integrated project with university, teacher training, school and enterprise, In Theuerkauf W., Dyrenfurth M., Proceeds of the International Conference in Braunschweig: Consequences and perspectives of a global approach on technology education, Erfurt, WOCATE editions, CD-ROM publication.

Ginestié J.: 2001a, Technology education in French primary school: Which direction for which goals? In Benson C., Third international primary design and Technology conference: quality in the making, Birmingham, CRIPT-UCE editions, pp. 70-74.

Ginestié J.: 2001b, Interés y perspectivas por una educación tecnológica para todos. In Benson C., De Vries M., Ginestié J., et al. Educación tecnológica, Santiago, Chili: LOM Ediciones, Fernando Mena Editor, pp. 19-30.

Ginestié J.: 2001c, Qué metodología, para qué educación tecnológica. In Benson C., De Vries M., Ginestié J., et al. Educación tecnológica, Santiago, Chili: LOM Ediciones, Fernando Mena Editor, pp. 55-82.

Ginestié J.: 2002, The industrial project method in French industry and in French school, International Journal of Technology and Design Education, vol. 12, n° 2, pp. 99-122.

Ginestié J. : 2003, Quelle place pour une éducation technologique pour tous ? Le complexe culturel à l'égard de la chose technique. In Actes du colloque international La culture technique, un enjeu d'éducation, Paris, novembre 2003.

Ginestié J. : 2004, Évaluer les élèves dans les formations initiales d'enseignants en éducation technologique. In acte du colloque international Finalités et évaluations en éducation technologique, Paris, mars 2004, AEET

Ginestié, J. (2006). *Teacher Training: preparing young people for their future lives. An international study in Technology Education* (C. Benson, Trans. Ginestié, Jacques ed.). Santiago: Éditions Los Salesianos.

Ginestié, J. (2008). *The cultural transmission of artefacts, skills and knowledge: eleven studies in technology education* (R. Watson, Trans.). Rotterdam: Sense Publishers.

Hennessy, S. & Murphy, P.: 1999, `The Potential for Collaborative Problem Solving in Design and Technology', International Journal of Technology and Design Education n° 9, vol. 1, pp. 1-36.

Jones, A.: 1997, `Recent Research in Learning Technological Concepts and Processes', International Journal of Technology and Design Education, n° 7, vol. 1-2, pp. 83-96.

Kantola, J., Nikkanen, P., Kari, J. & Kananoja, T.: 1999, Through Education into the World of Work, Institute for Educational Research, University of Jyvaskyla, Jyvaskyla.

Sanders, M.: 1999, `Technology Education in the Middle Level School: Its Role and Purpose', NASSP Bulletin, n° 83, vol. 608, 34-44.

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CYGNAEUS, FRÖBEL AND THE FINNISH NATIONAL CURRICULUM OF HANDICRAFT

Cygnaeus, the primary school and educational crafts

Uno Cygnaeus (1810 - 1888), who has been called as 'The Father of the Finnish Primary School system', was trained to be a priest but he had grades also in Science and History, communicated in several languages and worked and travelled abroad. (Kananoja 1999). Cygnaeus was appointed as Inspector of the primary schools in 1861. With the knowledge of educational ideas of the time and experience of school teaching in several countries he was given the task from the Senate to prepare a proposal to establish a teacher seminary and an primary school in Jyväskylä. The seminary started in 1863 under Cygnaeus leadership and the policy ideas and the plan of action followed the Central Europeans teacher seminaries. (Vuorinen 2003).

Adolph Diesterweg (1790-1866) and Friedrich Fröbel (1782-1852) were the most influential German educationalists in 1850's, whose work governed Cygnaeus' educational ideas for kindergarten and primary school. On one hand Diesterweg's propositions of equal potentials in education, harmonious personality as an educational goal, education for all and on the other hand Fröbel's theory of learning through play and active participation, construction and building made profound indications to Cygnaeus' educational ideology. (Günther 1993, Heiland 1993). Also Johann H. Pestalozzi's (1746-1827) thinking about the development of human nature in three dimensions of head, heart and hand made a powerful influence on Cygnaeus. Instead of dealing only with words children should learn through activity and through things. They should draw their own conclusions through observation and reflection, and try to make sense of experiences and situations. (Soëtard 1994).

Cygnaeus emphasized the school's role in developing children's personality and emotional and physical resources. The school was not only to concentrate on written knowledge but also on the cognitive skills needed to be cultivated. To promote this Cygnaeus developed the idea of craft teaching. In practice, this meant that in Finland the school curriculum included craft first in the whole world. The main idea of Cygnaeus was to develop the school for every child despite of their social background and handicrafts were to promote pupils' activity and independent enterprise. Jyväskylä seminary expanded to a popular place to study. Teachers' work was seen as a mission and teacher students required such characteristics as high morality, charity, justice and religiosity. In addition, the future teacher was supposed to be practical and handy. (Vuorinen 2003).

Historical background of Finnish school crafts

Cygnaeus was among the first to use concept of 'school craft "(slöjd) to describe the educational work linked with craft to be done in school. In his writings he also used words teollinen (industrial), kone (machine) and tekniikka (technique/technology). When interpreting his writings the temporal context has to be considered. According to the Finnish dictionary of etymology, in the 1850's the term "kone" meant a tool and a way of doing something by hands. The original meaning of word "teollinen" is practical (teko=) and word "teknologia" is originally way to learn how to do objects. All this is obviously quite different from what these terms mean to us today. (Nykysuomen etymologinen sanakirja 2004).

When working in St. Petersburg 1846-1858, Cygnaeus familiarized himself with the latest eductional knowledge thanks to the German Joseph Paulson (1825-1898). Paulson was one of the most famous educationalists in St. Petersburg at the time. He published a journal for teachers (Utzitsel) which concentrated on both theoretical and practical issues of education. An article about Cygnaeus' European journey was published in the magazine in the 1861. (Utzitsel 1861-1863). Paulsons influence in St. Petersburg was wide. In 1851 he set up an educational association and later the Fröbel association of Russia. He also was one of the teachers of Emperors' children. (www.humanities.edu.ru). Paulson was invited to Jyväskylä by Cygnaeus in 1867. This was when the first class of teachers graduated from Jyväskylä Teacher seminary. (Halila 1963).

After St. Petersburg time Cygnaeus travelled widely in Central Europe to make himself familiar with the primary schools, kindergartens and teacher seminaries in various countries acquainting himself with among others Diesterweg's teaching methods and the learning outcomes of the seminaries. He familiarized himself also with the systematic and organized craft education there.

> "I have already had a conviction for 17 years, that the practical craft is to be at folk school an essential development tool, but I always understood that the sole mechanical work cannot be the general drift. Therefore the purpose of my educational trip was to encounter so-called 'Education for work and education by means of work' implemented somewhere." Uno Cygnaeus 1859

According to Cygnaeus in the Finnish educational system the school and teacher education were to be developed together; there was not to be gender discrimination; both pupils' and teachers' training were to take place in mixed groups; the core aim of teacher training was to be independent scientific work and both in primary school teacher training and in primary school education there was to be craft education. Craft was to be integrated into the curriculum and taught **as an educational subject** – not merely as mechanic activity. The most important was **to mediate certain generic skills** and to **combine craft with mathematics and science**. Cygnaeus attached the idea of Pestalozzi's "human nature is not only knowing and thinking but also mastering and handling" with Fröbel's idea of educational play. He considered it as educationally influential when the play is organized in a target-conscious way. (Reincke 2005).

Fröbel's influence to Cygnaeus' school craft education

Fröbel had stressed the importance of kindergarten education with the idea of *an active and action-oriented* freedom (Salminen & Salminen 1986). However Cygnaeus expanded these ideas also to primary education with purpose to arrange hand-employed work and exercises for older pupils as well. They will develop the child's **dexterity** and *aesthetic* sense of form, and thus help young people develop *universal practical skills*, which are useful in everyday life like carpenter's, turner's or basket maker's skills – not as professionals but according to pedagogical objectives (Reincke 2005). Fröbel also stressed **the importance of educational working** – from his point learning was too much tied into classrooms which caused physical weakness and laziness. When working the actual tasks and duties teach the child to understand ***the meaning of work*** in the human life.

Fröbel 's gifts and crafts constitute the system which offers playing gifts and occupation gifts. The gifts progress in the prescribed order from easy and simple to more difficult and more complex. All the gifts are intended to promote productivity, formulation, comparison and drawing conclusions. *Playing gifts* are unchanging and the result is unstable. With the playing gifts the child can play with the same materials over and over again, because the result can be taken to pieces and the materials can be used again. The *occupation gifts* consist of variable and changing materials and the result is permanent. In occupation gifts the new materials are used every time, because the result is durable and lasting. The aims of crafts are to respect working and to develop the skills and the desire and will to perform the task.

> "The child and the young person should familiarize themselves thoroughly with the assurance that the work is not a yoke, a burden, but human beauty and glory, the happiness and blessing of the secular life." Uno Cygnaeus 1860

Fröbel’s play gifts were were also connected to aesthetic dimensions and mathematical and shaping skills. Fröbel’s occupation gifts were: (1) Arranging sticks of the same size (to formulate numbers and letters -> reading, writing etc.), (2) Joining sticks of different sizes (-> mathematical thinking, comparing), (3) Folding paper (advancing from 2-dimenstional materials to 3-dimensional objects -> handiness, concentration, mathematical concepts), (4) Binding and braiding paper (handiness, exactness), (5) Weaving paper strips (“carpets” with decorative motifs -> persistence, exactness and aesthetics), (6) Tearing and cutting paper (paper pieces of different shape to be combined according to directions or to the person’s liking -> aesthetics, manual skills) , (7) Drawing (certainty of the hand, imagination), (8) Puncturing (perforating readymade patterns -> manual training, hand and eye coordination, getting practice in craft work and sewing), (9) Painting of the drawn or punctured designs (using the three main colours and colour blending -> conclusions, observation, exactitude, tidiness), (10) Peas work (“three dimensional drawing” -> combining peas (“points”) with sticks (“ lines”) -> concept of wholeness and the composition of parts -> space and size relations), (11) clay handling (basic forms and forming simple objects). (Salminen & Salminen 1986). Toy Gifts and other observation tools were the relevant elements connecting *the teachers, the children and learning* though the curriculum stresses the position of the teacher in the teaching (Helenius & Lehtomäki 2009). In Fröbel’s kindergarten philosophy the teaching starts in each subject area from the easiest task, which has to be learned completely before the next step is allowed. Many of these technologies and products mentioned above are still part of current teaching of handicrafts. Several of Fröbel's educational goals of the "occupation gifts" are mentioned in the Finnish Core Curriculum emphasis being placed on the same objectives.

Finnish rural girls were taught to *"women's crafts" and boys “boy’s crafts"* or carpentry. At school craftworks that were produced were primarily household utensils, such as ax handles, salt dishes, coils for fishing, buckets, flower sticks, socks, gloves, aprons, towels and shirts, and weaving and sewing exercises. From 1881 collection of craft models determined the teaching in primary school, according to which the teaching had to advance the student's abilities and skills moving ahead from easier models to more difficult. Boys were familiarized with distinctive work, order, accuracy, vigilance, diligence and endurance. Model series publications showed which working postures and movements and exercises were required to learn and in what order they should be learned and what tools were used. (Kässäätkö? Koulukäsityön muistiverkko)

Still according to Cygnaeus craft education could not be technical activity using old working methods but it was to develop children both physically and mentally: properly organized craft teaching developed the child's *manual dexterity* and **understanding of shape and beauty** as well as the *student self-reflection, inventions and creativity.*

> “Practical craft work promotes and maintains physical health and prevents pupils from developing in to a narrow-minded academic." Uno Cygnaeus

According to the educational goals the routines of craft work in school were neither to be professional nor mechanical. The pupil should be allowed all the time **to plan his / her craft work** according their imaginary ideas. Practical craft was to be highly appreciated and an equal subject alongside other subjects in the school curriculum. The aims of the subject were to develop both physical and mental abilities, cultivate the sense of form and aesthetics and develop the pupils a sense of general dexterity and handiness.

Cultural knowledge in the background of teacher training

In 1968 the school law in Finland introduced nine-year compulsory education, which guaranteed the university level studies to all children not depending on social status and domicile. The key objective of the elementary school was gender equality. Equality was also reflected in craft teaching: it was possible for girls and boys to study both the technical work and textile handicrafts according to their own choice. At first in primary school craft education the products were based on nature, technology and environment. In theme-based work attention was put on student's own needs, problem setting and ideas. The pupils were also introduced to the traditional Finnish craft techniques and objects. Later on when internationalization was expanding, the crafts education stressed understanding and appreciation both one’s own and other cultures. (Kässäätkö? Koulukäsityön muistiverkko).

The current craft education is according the National Core Curriculum (Finnish National Board of Education 2004) to develop pupil’s crafts skills so that **the pupil’s self-esteem grows** and the student **experiences joy and satisfaction** in her/his work. The aim is also to increase the pupil’s **responsibility for work** and using of materials, to value the quality of work and materials, and to be critical when considering his / her choices, as well when estimating the open ideas, products and services surrounding him / her. In all grades alongside the other objectives also **the planning, creative solutions** and understanding the quality of work and materials are emphasized. Handicraft making requires the ability to **combine technical skills and imagination**. Craft skills consists of versatile skills: there **are cognitive skills** such as thinking and problem-solving skills, bodily skills, such as **hand-eye coordination skills, spatial perception, dexterity, accuracy and speed** as well as social skills such as teamwork and culture of sensory sensitivity. **Getting used to working, the appreciation of work**, and growing to take **responsibility for one’s work** is the essence of the subject. Entrepreneurial education and cultural education are both important dimensions. Handicraft education makes it possible to transmit and reform cultural heritage and it also allows access to other cultures. Handicraft teaching creates the basis for craft skills – this is perceiving and mastering the whole craft process and learning to manage it. (National Core Curriculum for Basic Education 2004).

It is self-evident and clear how the prevailing curriculum of subject craft is based on the historical chain dating back to Fröbel via Cygnaeus. The text above is from the year 2004 but when comparing the bolded words with the words in previous chapter we can notice that Cygnaeus had modern ideas.

Why then study historical features and proceedings in curriculum development in teacher education? The curriculum is a social construction and it has been shaped by ideological and political struggle. It is important to make teachers in practice aware of the historical determination and social conditions. The historical facts widen the understanding why the existing curriculum consists of the subjects it does and why the contents are what they are. The hidden principles explain the struggle between strong-minded and powerful forces that want the dominance in pulling the strings of education as well as to be able to assess the legitimacy of the prevailing presence.

Communicative historical and social ponderings give possibilities and variety for the teachers to take part in the discussion which skills and subjects do we need in the future. Teachers are claimed to be passive citizens who just obey and execute the civil service prescribed curriculum. In Finland there is again the curricular lesson distribution and subject supply under general discussion. Many parties want to influence the decision. In the preparation of the political decision making the Finnish National Board of Education (2009) made a survey about Primary education supervision system of the core curriculum (2004), Lesson division of the curriculum (2001) and Local curriculum and the curriculum planning process. The respondents were head teachers and representatives of education organisers (N=1200). One question was about the basic strengths and the greatest development needs of the national core curriculum. According to the respondent the subjects with too low numbers of lessons are at the forefront art and craft subjects plus physical education. Over half of the headmasters believe that the number of hours in these subjects is too small. The other concern was too much stressing knowledge in school education. On the other hand the concern was: What happens to the manual skills in the future?

REFERENCES

Cygnaeus, Uno 1860. Ehdotuksia Suomen kansakoulutoimesta.

Cygnaeus, Uno 1859. Matkakertomus Suomen senaatille.

Finnish National Board of Education. 2004. National Core Curriculum for Basic Education 2004. http://www.oph.fi/english/publications/2009/national_core_curricula_for_basic_education 12 8.2010.

Günther, K-H. 1993. FRIEDRICH ADOLPH WILHELM DIESTERWEG (1790-1866). Prospects: the quarterly review of comparative education (Paris, UNESCO: International Bureau of Education), vol. 23, no.1/2, 1993, p. 293–302.

http://www.ibe.unesco.org/publications/ThinkersPdf/diestere.pdf 12.8.2010.

Halila, Aimo 1963. Jyväskylän seminaarin historia p. 170.

Heiland, H. 1993. FRIEDRICH FRÖBEL (1782–1852). Prospects: the quarterly review of comparative education (Paris, UNESCO: International Bureau of Education), vol. XXIII, no. 3 / 4, 1993, p. 473–91. http://www.ibe.unesco.org/publications/ThinkersPdf/frobele.PDF 12.8.2010.

Helenius, A. & Lehtomäki, A. 2009. Friedrich Fröbelin Die Menschenerziehung 1826 – 2008: Kääntäminen kontekstissa. Kasvatus ja aika. 3. http://www.kasvatus-ja-aika.fi/site/?page_id=229 12.8.2010.

Häkkinen, Kaisa 2004. Nykysuomen etymologinen sanakirja.

Kananoja, T. 1999. International Relations of Uno Cygnaeus and development of Handicrafts Education in the Nordic Countries. In: Kantola, J., Nikkanen, P., Kari, J., Kananoja, T. 1999. Through education into the world of work. Uno Cygnaeus, the Father of Technology Education. Jyväskylä University. Institute for educational research. Jyväskylä: Jyväskylä University Press, pp. 9 – 17.

Kässäätkö? Koulukäsityön muistiverkko. Historiaa. Suomen käsityön museo. http://www.craftmuseum.fi/kassaatko/kansansivistyksena.htm 12.8.2010.

Opetushallitus. 2009. Opetuksen järjestäjien ja rehtoreiden näkemyksiä ja kokemuksia perusopetuksen vuoden 2004 opetussuunnitelma-uudistuksesta. http://www.oph.fi/download/111770_Kokemuksia_2004_opsuudistuksesta_2009.pdf 12.8.2010.

Reincke, H.J. 2005. Finnish educational handicrafts. www.jyu.fi/tdk/museo/kasityo/REINCKE_SUOMEKSI.rtf 12.8.2010.

Salminen, H. & Salminen, J. 1986. Lastentarhatoiminta - osa lapsuuden historiaa : Friedrich Fröbelin lastentarha-aate ja sen leviäminen Suomeen. Mannerheimin lastensuojeluliitto. 17. Jyväskylä: Gummerus.

Soëtard, M. 1994. JOHANN HEINRICH PESTALOZZI. (1746–1827). Prospects: the quarterly review of comparative education (Paris, UNESCO: International Bureau of Education), vol. XXIV, no. 1/2, 1994, p. 297-310. http://www.ibe.unesco.org/publications/ThinkersPdf/frobele.PDF 12.8.2010

Uzitsel. 1860-1867. St. Petesrburg.

Vuorinen, P. 2003. Jyväskylän seminaari. Finnica / Keski-Suomi –sivusto. Artikkelit. www.finnica.fi/suomi/keski-suomi/artikkelit 12.8.2010. www.humanities.edu.ru/db/msg/83778 23.2.2010.

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STEM EDUCATION AT PH.D. TECHNOLOGY AND ENGINEERING EDUCATION UNIVERSITIES

Countries seeking to improve their economies are concerned about the education their citizens are receiving in the school subjects of science, technology, engineering, and mathematics. Collectively, these subjects are referred to as STEM. "STEM education is important if we are to have a society that is to thrive, contribute in a meaningful way towards building our own future, and provide students with a need to achieve" (ITEA, 2009, p. 2).

The U.S. began using the acronym STEM in the early 2000s, although the study of these subjects has been in various forms for students to learn for many years. The term was coined by the U.S. National Science Foundation for projects that focused on educational research and evaluation in the subjects of science, technology, engineering, and mathematics (ITEA, 2009). Much of the use of the acronym is referring to research in the individual subjects such as mathematics, engineering, or technology education. However, there are projects that have focused on the integration of these subjects to make them more meaningful (contextual) for learners. Early projects that addressed integration were developed by LaPorte and Sanders (1993), TSM Integration Activities, and Satchwell and Leopp (2002), Integration of Mathematics, Science, and Technology (IMaST).

During the first decade of the 21st century, politicians at the federal and state levels in the U.S. began using STEM to refer to the need of scientific and technological workers for the country or individual states. This was an effort to lead the country technological and economically into the future. Compared with other countries, the U.S. has struggled in both science and mathematics student assessments (Program for International Student Assessment, 2003). Many U.S. politicians seek election telling their constituents how they are going to improve the education system. As a result some have pushed agendas, so now there is funding for STEM education projects at both the federal and state levels.

With these economic and political movements pushing for improved STEM workers, U.S. universities who offered individual programs in these areas for the preparation of teachers began to restructure and rename. Ohio State University, North Carolina State University, and Old Dominion University now have STEM or SMT education departments. Others have capitalized on the T and E in STEM and have named themselves as Engineering and Technology Education such as Utah State University or Engineering Education at Colorado State University.

Research problem

The joining of faculties with individual expertise has caused some to work together to better address integrated STEM subjects in teacher preparation and the public schools. This led to the interest for this research project. Its problem was to determine if graduate institutions who offered preparation of Ph.D. students in technology education have blended STEM concepts into their graduate education programs. To guide this study the following research questions were established.

- Determine if Ph.D. graduate programs for technology teacher educators were integrating the teaching of STEM concepts into their programs?
- Determine the teaching strategies utilized to prepare Ph.D. level technology educators to use STEM concepts?
- Determine sample course requirements to learn if universities were integrating STEM concepts into their Ph.D. level technology education programs?
- Determine if technology education Ph.D. granting institutions were collaborating with local school systems to make STEM integration a reality?
- Determine what needed to occur in the future to incorporate STEM concepts into technology teacher education Ph.D. granting programs?

Background and significance

The launching of the Sputnik I (1957) into space set a crisis in the U.S. educational system (Bracey, 2007). This led to the birth of the National Science Foundation (NSF) and other federal educational programs that were fully supported by federal funding. These organizations researched, field tested, and implemented new science and mathematics curriculum into the public education system. This sparked a national movement to improve the teaching and learning of these core disciplines. In the 1960s, the number of graduates in STEM fields in the U.S. escalated (National Science Foundation, 2007). Today, many nations face the same challenges as within the U.S. educational system. There is a growing skepticism that educational systems are not preparing sufficient numbers of students, teachers, and professionals in the areas of STEM education (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007).

STEM education plays an important role in the global economy. However, U.S. students seem uninterested or non-motivated to enter these fields. Business and educational leaders have an intense concern of how students are performing compared to other countries. The trend is not too positive for the U.S. For example, among the 40 countries participating in the 2003 Program for International Student Assessment (PISA), the U.S. ranked 28th in mathematics literacy and 24th in science literacy (PISA, 2003).

A problem identified with STEM education was the quality of teachers' credentials. Research has shown that most U.S. middle school teachers hold a baccalaureate degree, but over 50% did not have a major or minor in the subject field they were teaching (Department of Education, 2002). Both elementary and middle school teachers often do not acquire sufficient STEM content knowledge or skills for teaching the content during their initial teacher preparation programs (National Science Foundation, 2007). Research has shown teachers who have a major in their individual STEM subject area have made a positive impact on their students' achievement (Allen, 2003; Frazier, 2009).

STEM education improvements need to start at the undergraduate level. Researchers have conducted studies during the past 20 years and concluded that the U.S. does not adequately prepare their undergraduates in STEM education (Baldwin, 2007). The future of STEM education starts with Ph.D. level candidates, since they will be the faculty who will prepare future teachers. The skills and techniques they learn will be employed to motivate and prepare future teachers to teach STEM in their classrooms and laboratories. A well prepared community of future teachers and researchers is central to the development of a STEM educated workforce (National Research Council, 2002).

The major reason for conducting this study was to research more efficient ways to integrate STEM concepts into technology education doctoral level programs. Hartzler (2000) has shown that the integration of STEM education concepts increased the learning of children. She conducted a meta-analysis of 30 individual studies of traditional classroom instructions and integrative classroom instruction. Hartzler's analysis revealed students in an integrative classroom consistently outperformed students in a traditional classroom.

Some scholars believe more research needs to be conducted on the integration of STEM concepts within technology education (LaPorte & Sanders, 1995). Also, the profession needs to learn how STEM is being integrated on an international level. The amount of research on this subject is limited. However, Childress (1996) conducted a study on curriculum integration to see if it improves technology education students' ability to solve technological problems. He concluded that there was no significant difference between the group that received curriculum integration and those that did not in the design of their study project, a wind collector. However, those who received correlated science and mathematics instruction did outperform those who did not during the post-test and interviews. Childress postulated that additional research was needed in curriculum integration.

Limitations

The following limitations were realized with this study:

- The research was limited to technology education doctoral level granting institutions worldwide. The population was 17 institutions that provided this type of study in technology education.
- All contact with the international faculty was conducted via electronic mail.
- The graduate course requirements for technology education would vary from the different institutions depending on the interests of the faculty and community. The academic programs of the 17 university programs were structured differently and controlled by university and governmental policies.

Procedures

The method for collection of data began with identification of the Ph.D./Ed.D. granting institutions. These were identified in an earlier study by Ritz and Reed (2007). A questionnaire was developed with specific items that would allow each respondent to tell how their institutions were integrating STEM concepts into their doctoral level technology education programs. The questionnaire was e-mailed to the participants and used to provide data needed for the study.

Findings

The survey was sent to 17 university faculty using the electronic mail method in May 2010. The period of data collection was May-June 2010. Eighty-eight percent of the population, 15 of 17, of technology education graduate program faculty participated in the survey via electronic mail. Table 1 shows the response rate.

TABLE 1
Response Rate

Number Sent	Number Collected	Total Response Rate
17	15	88%

The findings from the questionnaire consisted of fourteen questions related to the initial research questions. The researchers used descriptive statistical methods to organize and tabulate the collected data. The data compiled from the returned questionnaires used number of responses, frequency of answer, and mean to statistically analyze and report the data.

Research Question 1 was *Determine if graduate programs were integrating the teaching of STEM concepts into their Ph.D. programs?* To answer this question, four survey questions (1, 2, 3, and 4) were designed to analyze the results. Likert-scale values assigned to each response ranged from one point for “Very Low”, two points for “Low”, three points for “Moderate”, four points for “High”, and five points for “Very High”. These point totals were used to calculate the mean. If the respondents failed to answer the question, the population (n value) was reduced to properly reflect the population.

In survey Question 1, respondents were asked if the concepts of STEM education are influencing the development of technology education graduate programs. The mean response was calculated at 3.46, which indicated seven of thirteen (54%) perceived to a high degree that concepts of STEM education are influencing technology education programs, while six of thirteen (46%) determined themselves in categories below the mean. See Table 2.

In survey Question 2, the respondents were asked to rate their current programs as incorporating STEM concepts and activities. The mean response was calculated as 3.02, which indicated moderate for this statement. Six of thirteen (46%) respondents determined their programs above the mean in categories of high to very high. Four of thirteen (31%) respondents rated their programs below the mean in categories of low or very low. Additionally only three of thirteen respondents (23%) determined their programs equal to the mean. The Likert-scale frequency of responses and percentage of answers for Question 2 were presented in Table 2.

TABLE 2
Concept of STEM Education

	Did Not Respond	Very Low	Low	Moderate	High	Very High	M
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	
Q #1	0(0.00)	3(20)	1(16)	2(13)	1(08)	6(46)	3.46
Q #2	0(0.00)	2(15)	2(15)	3(23)	2(15)	4(31)	3.02

Note. f = frequency of response; % = percentage; total number of respondents, n = 13; *M* = mean (rounded two decimal value)

In open-ended survey Question 3, the respondents were asked their professional opinions regarding the integration of STEM concepts into their technology education doctoral programs. Similarities in respondent answers were summarized and clustered accordingly to the respondent's opinions. Four of thirteen comments (31%) supported STEM integration. For example, they responded that, "the importance on integration is vital to the success of STEM education". Another comment stated, it "enables students to be prepared to address research and curriculum development in these emerging areas".

Additionally, four of thirteen respondents (31%) stated that STEM education is not mature enough to become a part of the doctoral level curriculum. Two of four of these respondents stated "STEM integration has no impact on my doctoral program". Another common opinion was that STEM integration will only occurs in student and faculty research projects. Four of thirteen respondents (31%) stated "STEM integration only occurs if the research thesis supports integration". For example, if a doctoral candidate's research thesis focuses on the integration of STEM, their research will include STEM integration. This would be the only time that integration is discussed at the doctoral level.

Finally, one of thirteen (8%) respondents focused primary on the integrative approach to STEM education. He stated "the importance of integrative STEM education is on investigation and applications of new approaches". The responses to Question 3 were presented as clustered summaries of the respondent comments in Table 3.

TABLE 3
Open-Form Responses Regarding Integration of STEM

Q#3 Clustered Responses
• Integration of STEM is vital. (n=4) • STEM is not developed at the doctoral level. (n=4) • Research themes of the other disciplines of STEM will support the integration of STEM. (n=4) • Our program focuses on the investigation and application for new integrative approaches to STEM education uniquely sets us apart from other STEM programs. (n=1)

Note. Respondent's comments, n=15

In open-ended survey Question 4, respondents were asked what changes they would recommend to increase the awareness level of STEM integration. Similarities in respondent comments were summarized and clustered into categories that represented their recommendations. Three of thirteen respondents (23%) provided recommendations to increase the awareness of STEM integration. For example, they responded that, "advertise through research listing or distance learning methods would increase the awareness level of STEM integration".

Additionally, four of thirteen respondents (31%) recommended increasing the awareness level through adding classroom discussion on STEM integration in all university classes. Another respondent stated, "each graduate course should include STEM integration or change the textbooks to include STEM integration". Four of thirteen respondents (31%) recommended developing collaborative research teams. One respondent stated, "having students work together in a collaborative team will raise the level of awareness for STEM integration". Another respondent stated "stronger efforts among the different colleges to collaborate will increase the awareness of integration". Finally, two of thirteen (15%) respondents recommended no change to increasing the awareness level of STEM integration. The responses to Question 4 were presented as clustered summaries of the respondent comments in Table 4.

Research Question 2 was *Determine the teaching strategies utilized to prepare Ph.D. level technology educators to use STEM concepts?* To answer this question, four survey questions (5, 6, 7, and 8) were designed to analyze these results. In Question 5, respondents were asked to select the response that defined the amount of time devoted toward new curriculum and instructional strategies. Data indicated that only three of thirteen (23%) respondents have incorporated new curriculum and instructional approaches more than 30% of the time. Additionally, data indicated that six of thirteen (46%) respondents have incorporated new curriculum and instructional approaches less than 20% of the time. The data reported in Table 5 shows the percentages of time that the respondents spent on integrating new curriculum and instructional approaches into the graduate curriculum.

TABLE 4
Open-Form Responses Regarding Recommendation for Integration

Q#4 Clustered Responses
• Communicate and advertise through different electronic methods. (n=3) • Discussion of STEM integration in all college classes. (n=4) • Develop collaborative Research Teams. (n=4) • No Change. (n=2)

Note. Respondents comments, n=13

TABLE 5
Incorporating New Instructional Approaches

	Did Not Respond	Less than 10%	10% to 20%	20% to 30%	30% to 40%	More than 40%
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)
Q #5	0(0.00)	4(31)	2(15)	4(31)	1(8)	2(15)

Note. *f* = frequency of response; % = percentage (rounded two decimal values); total number of respondents, n = 13.

In Question 6, respondents were asked if the integrative approach was the best way for improving young student's development in STEM education. The mean response was calculated as 4.00, which was high for this category. Ten of thirteen (77%) respondents answered at or above the mean and rated responses of high or very high. However, three of thirteen (23%) respondents determined themselves in categories below the mean. The Likert-scale frequency of responses and percentage of answers for Question 6 were presented in Table 6.

In Question 7, the respondents were asked if doctoral students were gaining the necessary skills and teaching strategies to effectively integrate STEM into future work in technology education teacher preparatory programs. The mean response for the respondents was calculated as 3.73, which indicated a high degree of fidelity. Six of eleven (55%) respondents perceived to a high and very high degree that doctoral students are gaining the necessary skills. Three of thirteen (23%) respondents either did not respond or rated very low, citing doctoral candidates should not be developing teaching strategies. The Likert-scale frequency of responses and percentage of answers for Question 7 were presented in Table 6.

In Question 8, the respondents were asked to select the responses that accurately described the teaching strategies that their program employs. Percentages were based on the number of times each item was selected by all respondents. Project based learning was selected eight of thirty (26%) of the time. Both problem based learning and inquiring based learning were selected seven of thirteen (23%) of the time. However, four of thirty (13%) indicated that none of the teaching strategies were employed in their graduate program. The response percentages and frequencies were presented in Table 7.

TABLE 6
Improving STEM Education

	Did Not Respond	Very Low	Low	Moderate	High	Very High	M
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	
Q #6	0(0.00)	1(8)	1(8)	1(8)	4(31)	6(46)	4.00
Q #7	2(18)	1(9)	0(0.00)	4(36)	2(18)	4(36)	3.73

Note. *f* = frequency of response; % = percentage; total number of respondents, (Q#6 n = 13& Q#7 n=11); *M* = mean (rounded two decimal value)

Research Question 3 was *Determine sample course requirements to learn if universities are integrating STEM concepts into their technology education doctoral level programs?* To answer this question, two survey questions (9 and 10) were designed to answer the research question.

In Question 9, respondents were asked to determine the amount of time their doctoral programs addressed STEM concepts in courses and the number of courses related to STEM. Data indicated that only eight of thirteen (60%) respondents spent less than 20% of their doctoral program focusing on STEM. Six of eight (75%) of those respondents have developed coursework in STEM. Respondents stated, “STEM coursework is included in other courses”.

Additionally, data indicated that four of thirteen (30%) respondents spent more than 30% of their doctoral program on STEM. Three of four (75%) of those respondents have developed three or more STEM related courses. One respondent (8%) did not respond because their doctoral program is research based and STEM is only included if the research thesis supports it. The data reported in Table 8 shows the percentages of time doctoral programs addressed STEM.

TABLE 7
Teaching Strategies

	Did Not Respond	None of the Above	Lecture Based	Project Based Learning	Inquiring Based Leaning	Problem Based Learning
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)
Q #8	0(0.00)	4(13)	4(13)	8(27)	7(23)	7(23)

Note. f = frequency of response; % = percentage; total number of responses, n = 30

TABLE 8
Doctoral Programs Designed for STEM

	Did Not Respond	Less than 10%	10% to 20%	20% to 30%	30% to 40%	More than 40%
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)
Q #9	1(8)	5(38)	3(23)	0(0.00)	1(8)	3(23)

Note. f = frequency of response; % = percentage; total number of respondents, n = 12

In Question 10, respondents were asked to list the number and title of doctoral program courses specifically designed to integrate different STEM concepts. Five of thirteen (38%) respondents have courses specifically designed for integration of STEM into their doctoral programs. This was anywhere from one to three courses specifically designed for STEM integration. Three of thirteen (23%) respondents do not have a course specifically designed for STEM integration. However, STEM integration is included when the research thesis supports these concepts. Finally, five of thirteen (38%) respondents do not have any courses designed for STEM integration. One respondent (8%) has an entire doctoral program specifically designed on STEM integration. Table 9 lists the individual courses.

Research Question 4 was *Determine if doctoral granting institutions are collaborating with local school systems to make STEM integration a reality?* To answer the question, three survey questions (11, 12, and 13) were designed. Likert-scale values assigned to each response ranged from one point for “Very low”, two points for “Low”, three points for “Moderate”, four points for “High”, and five points for "Very High". These point totals were used to calculate the mean. If the respondents failed to answer the question, the population (n value) was reduced, not to affect the mean.

TABLE 9
Open-Form Responses Regarding STEM Courses

Doctoral Program	*f%*	Courses
Courses within the current technology education emphasis in the doctoral program	38	• EdD Workforce Education (engineering and technology focus) • PhD Workforce Education (engineering and technology focus) • Foundations for Teaching Technology • Leadership in Technology Education • Scientific and Technical Visualization • Introduction to Technology • Technical Systems
Research Thesis	23	• No specific program courses
Overall Courses in the Complete Doctoral Program	8	• Program Development in Technology Education • Different Issues and Trends in STEM Education • Advanced Study of Thinking, Learning, and Math/Science Education • Advanced Study of Teaching and Teacher Education in STEM Education • History of Curriculum in Math/Science/Technology Education • Survey of Research Methodologies in STEM Education • STEM Education Foundation • STEM Education Pedagogy • Trends and Issues in STEM Education • STEM Education Research • STEM Education Seminar • Biotechnology Literacy by Design • Field Studies in STEM Education • Readings in Technology Education
No Program	38	Not Applicable

Note. Respondents comments, n=13

In Question 11, respondents were asked their professional opinions if collaboration with local K-12 school systems would improve their doctoral programs experiences with STEM. The mean result from the respondents was calculated as 3.75, which indicated that a majority, seven of twelve (58%), perceived to a high degree that collaboration with local k-12 school systems will improve doctoral students experiences with STEM. However, five of twelve (42%) respondents rated collaborations with local K-12 school systems below the mean. The Likert-scale frequency of responses and percentage of answers for Question 11 were presented in Table 10.

TABLE 10
Collaboration with Local School Systems

	Did Not Respond	Very Low	Low	Moderate	High	Very High	M
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	
Q #11	1(8)	1(8)	0(0.00)	4(33)	3(25)	4(33)	3.75

Note. f = frequency of response; % = percentage; total number of respondents, n = 12; *M* = mean (rounded two decimal value)

In Question 12, respondents were asked if they actively collaborated with local K-12 school systems to incorporate STEM integration. Eight of thirteen (62%) respondents were actively collaborating with the local schools. However, three of the eight (38%) respondents perceived collaboration with local K-12 school systems to be below the mean in Question 11. Five of thirteen (38%) respondents were not engaged with the local school systems to incorporate STEM integration. However, two of the five (40%) respondents perceived collaboration with local K-12 school systems above the mean in Question 11. The response percentages and frequencies were presented in Table 11.

In Question 13, respondents were asked to give examples of collaboration methods they currently used in local school systems. Respondents could provide more than one comment, which varied among the nine respondents. Similarities in responses were clustered into separate categories. Four of fifteen (27%) comments used research to implement STEM integration in the local K-12 school systems. Additionally, pre-service teacher training and curriculum development at the local school systems amounted for six of fifteen (40%) of the comments. Another four of fifteen (27%) comments used outreach programs to implement STEM integration at the local K-12 school systems. Finally, one of fifteen (7%) respondents stated, "educating senior school board officials was the key to moving STEM integration into the local K-12 school systems". The consolidated list of the respondents' comments for Question 13 was presented in Table 12.

TABLE 11
Actively Collaborating with Local School Systems

	Yes	Above *M* in Q#11	Below *M* in Q#11	No	Above *M* in Q#11	Below *M* in Q#11
	f (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)	*f* (%)
Q #12	8(62)	5(63)	3(38)	5(38)	2(40)	3(60)

Note. f = frequency of response; % = percentage; total number of respondents, n = 13

Research Question 5 was *Determine what needs to occur in the future to incorporate STEM concepts into technology education graduate programs?* To answer the question, one survey question (14) was designed. In Question 14, respondents were asked to give their opinions on what needs to occur to effectively incorporate STEM concepts into their graduate programs. Respondents could provide more than one comment, which varied among the thirteen respondents. Similarities in respondent comments were clustered into separate categories. Four of fourteen (28%) comments believed that collaboration with the four pillars of STEM (Science, Technology, Mathematics, and Engineering) was the only way to incorporate STEM into their graduate programs.

Additional, three of fourteen (21%) comments believed that there was misconception on what STEM means and what integration consists. However, two of fourteen (14%) believed the need to include STEM in their current plans. Another three of fourteen (21%) commented that STEM was not where it needs to be. They believed that radical changes need to develop in course content along with research methods to include STEM integration in their graduate programs. Finally, two of fourteen (14%) commented that research needs to be involved more. Both teachers and researchers need to discuss where integration of STEM is and how research plays a part in its development. The consolidated list of the respondents' comments for Question 14 was presented in Table 13.

TABLE 12
Open-Form Responses Regarding STEM Integration

Q#13 Clustered Responses

- Research Project (n=4)
    - Doctoral research or other research projects
    - NSF funded PreK-12 projects
    - Research projects
    - Research projects in STEM Education

- Outreach Programs (n=4)
    - Working with local science and technology museum called Imagination Station
    - Graduate students working with robotic design academy
- Implement STEM education through engineering design (n=1)
- Pre-Service Training (n=4)
    - In-service training for teachers (promote activities in science and technology)
    - Pre-service teachers required to teach STEM lessons to elementary grade students
    - Experimental integration with real classes and students
    - Doctoral students work with teachers in local schools
- Curriculum Development (n=2)
    - Gaming and computer curriculum
    - Develop curriculum in STEM Education
- Educate school divisions on integrative STEM implementation (n=1)

Note. Respondents comments, n=15

Conclusions and discussion

The problem of this study was to determine if technology education Ph.D. granting institutions have blended STEM concepts into their graduate education programs.

TABLE 13
Open-Form Responses Regarding Changes to STEM

Q#14 Clustered Responses

- Collaboration with the other disciplines of STEM. (n=4)
  - Joint projects with Science, Math, and Engineering
  - More collaboration with College of Engineering and College of Education; we will need to see if these current proposals get funded, however there is a new class that will bring these stakeholders together in one new course.
  - Course re-alignment and collaboration with school systems, funding and other organizations.
  - The main change is to discuss the different contributions of each epistemology.
- Radical Changes. (n=3)
  - Change the content
  - Research methods
  - Nature of thesis supervision
- Institute current plans. (n=2)
  - Implementation of current plans
  - Move from integration to transformation
- Definition of STEM. (n=3)
  - All components of STEM need to define STEM the same way.
  - Everyone should be on the same page before anything will every happen with STEM integration.
  - What are the contents of STEM and does Integrate mean.
- Research Programs. (n=2)
  - Greater involvement in STEM related research programs.
  - Educational efforts among involved teacher and researcher.

Note. Respondents comments, n=14

The findings collected from the respondents were analyzed and addressed by answering each research question.

Research Question 1, *Determine if graduate programs are integrating the teaching of STEM concepts into their doctoral level programs?* The researchers discovered that a majority of technology education program faculty assessed the integration of STEM concepts in technology education Ph.D. programs as moderate to high. This indicated that graduate technology education programs were integrating STEM into their programs. However, despite these participation levels for incorporating STEM concepts into their graduate technology education programs, most program coordinators have differences of opinions on where to integrate these concepts into their graduate programs. For example, four of thirteen (31%) respondents supported incorporating STEM concepts through the research thesis, whereas four of thirteen (31%) respondents supported integrating STEM through curriculum development and classroom discussion. This indicated that graduate programs are in disagreement on where to focus STEM integration at the graduate level.

Research Question 2, *Determine the teaching strategies utilized to prepare Ph.D. level technology educators to use STEM concepts?* The researchers discovered almost half of the population (46%) was devoting a small percentage (less than 20%) of their time to teaching different instructional strategies for addressing STEM. The majority of graduate programs (73%) were using some form of critical thinking teaching strategy to prepare Ph.D. students. This indicated that technology education pre-service teachers will have the necessary skills to improve K-12 development in STEM education. Although a small percentage of respondents (23%) believed doctoral students should not be developing teaching strategies, nearly ten of thirteen (77%) respondents agreed the integrative approach was the best way to improving learners in STEM.

Research Question 3, *Determine sample course requirements to learn if universities are integrating STEM concepts into their technology education doctoral programs?* The researchers discovered the majority (60%) of respondents spent less than 20% of their doctoral program on STEM. This indicated that STEM was only included in their doctoral program if the doctoral candidates were conducting research in a STEM specific area. However, 30% of the respondents did include STEM concepts into their programs. These courses consisted of three or more STEM related courses. Clearly, this indicated that the philosophies of the different universities and the location of the technology education program influenced what courses were taught in STEM and what types of research was conducted in STEM. For example, Workforce Education was engineering and technology focused courses taught in the College of Engineering and Technology, whereas STEM Education Foundations was a pedagogy course taught in the School of Education. Clearly, both courses teach STEM concepts, however the degree of whether it was pedagogy focused or engineering focused was dependent on where the course was taught.

Research Question 4, *Determine if doctoral granting institutions are collaborating with local school systems to make STEM integration a reality?* The researchers discovered that 62% of the respondents were actively collaborating with the local K-12 schools. Moreover, 46% of the respondents did not believe that collaborating with local schools helped in the development of doctoral students. This indicated that the population believed collaborating with local schools was helpful for the Ph.D. students. Additionally, 61% of the respondents indicated that research and pre-service training were the majority of the collaborations going on in the local schools. This indicated that both students in K-12 and doctoral students gained specific knowledge in these collaboration efforts.

Research Question 5, *Determine what needs to occur in the future to incorporate STEM concepts into technology education graduate programs?* The researchers determined the respondents all had different opinions on what needed to occur in incorporating STEM into the technology education graduate programs. However, all agreed that collaboration would lead to success. For example, researchers from the different disciplines of STEM needed to align themselves to conduct joint projects. This would remove some of the confusion that already exists with what STEM consisted of and help refine some of the research strategies already developed. Also, K-12 teachers need to be involved in research studies and aligning themselves with the other disciplines of STEM education. All the recommendations of the respondents were based on blending the STEM efforts with other disciplines.

Recommendations

This study was performed to determine what technology education doctoral level institutions were accomplishing in their graduate programs related to STEM. The data indicated that most universities had a different approach to how they perceived the integrative approach to STEM education. Based on the findings and conclusions of this study, the following recommendations were made:

- Collaborative efforts between the different STEM fields need to occur to develop an integrative approach. Joint research efforts need to be conducted in STEM subjects instead of isolating (stove piping) them into different STEM fields. These efforts will ensure when one was referring to STEM, everyone would understand their meaning of this acronym.
- Universities that only study STEM through individual student research projects need to analyze their programs to include STEM concepts and teaching strategies, because future faculty (those who are now doctoral students) will be teaching pre-service technology education teachers in the near future. A well prepared community of future teachers is central to the development of a STEM educated workforce (National Research Council, 2002).
- Appropriate courses K-20 need to include STEM and possibly its integration, in both discussion and coursework. This will enable STEM to be standardized in both the education classroom and governmental policies. It will also enhance the learning of complex concepts though integrative and contextual learning activities.
- Further research study was needed to determine where technology education and STEM education should reside at the collegiate levels. Is the College of Education or College of Engineering the correct answer? The correct answer is the one that will benefit the K-12 students of the future and the survival of technology education teacher preparation programs to partner in this education.

REFERENCES

Allen, M. (2003). *Eight questions on teacher preparation: What does the research say?* Washington, DC: Education Commission of the States. Available at: http://www.ecs.org/tpreport/

Baldwin, R. G. (Eds.). (2007*). Improving the climate for undergraduate teaching and learning in STEM fields.* San Francisco: Jossey-Bass.

Bracey, G.W. (2007. The First Time "Everything Changed": *The 17th Bracey Report on the Condition of Public Education. Phi Delta Kappa International, 89*(2) 119-136.

Childress, V.W. (1996). Does integrating technology, science, and mathematics improve technological problem solving? A quasi-experiment. *Journal of Technology Education, 8*(1), 16-25.

Frazier, M.T. (2009). *The effect of technology education on student's state standardized test scores*. Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.

Hartzler, D. S., (2000). *A meta-analysis of studies conducted on integrated curriculum programs and their effects on student achievement*. Doctoral dissertation. Indiana University.

International Technology Education Association (ITEA). (2009). *The overlooked STEM imperative: Technology and engineering K-12 education*. Reston, VA: Author.

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology.* Reston, VA: Author.

LaPorte, J. & Sanders, M. (1993). Integrating technology, science, and mathematics in the middle school. *The Technology Teacher, 52*(6), 17-21.

LaPorte, J. E. & Sanders, M.E. (1995). Integrating technology, science, and mathematics in the middle school. In E. Martin (Ed.), *Foundations of technology education: forty-forth yearbook of the Council on Technology Teacher Education.* (pp. 179-219). Peoria, IL: Glencoe/McGraw-Hill.

National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies. (2007). *Rising Above the Gathering Storm: Energizing and Employing America to a Brighter Economic Future.* Washington DC: National Academies Press.

National Research Council. (2002). *Attracting PhDs to K-12 Education: A Demonstration Program for Science, Mathematics, and Technology*. Washington, DC: National Academies Press.

National Science Foundation. (2007). National Science Board. 2007. *National Action Plan: For Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Educational System.* NSB- 07-114. Arlington, VA.

Program for International Student Assessment. (2003). Paris: OECD Publications. Retrieved from http://www.pisa.oecd.org

Ritz, J., & Reed, P. (2008, November). *Technology Education Graduate Study: State of the Art.* Paper presented at the Ninety-Fifth Mississippi Valley Technology Teacher Education Conference. St Louis, MO.

Satchwell, R.E. & Loepp, F.L. (2002). Designing and implementing an integrative mathematics, science, and technology curriculum for the middle school. *Journal of Industrial Teacher Education, 39*(3), 41-46.

Contents

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CHANGE IN STUDENTS PERCEPTIONS DURING THE CREATING PROCESS ABOUT HERITAGE BUILDING

(Kaasinen, J.)

This study is just in the bullpen. Meaning of this text is to open the idea of this study and argue why I'm doing this study. Study might change during the process but this is where it starts.

Background

Finnish school system has changed since Uno Cygnaeus (1810-1888), "father of finnish elementary school". His probably the most significant achievement to Finnish school system was bringing handicraft as a school subject. Handicrafts had a very practical purpose and it was also strictly separated by gender. Boys learned to manufacture tools and objects that are crucial in agricultural society and girls learned skills that were needed in womens lives back in 19th century. That partition between genders lived on in handicrafts since and is still a big part of Finnish handicraft teaching. Society has changed from Cygnaeus´s times rapidly. Finland has moved from agricultural society through industrialization to society that leans more and more to services and information. In schooling system chance appears to be slower that in society around it. This has also happened to handicraft as a subject. Modern technology around us and equality between genders in modern society places different kind on demands to handicrafts as a school subject.

In handicrafts product orientated point of view has been emphasized always. Skill to manufacture product is technique (Parikka & Rasinen 1994). Technique was enough in phase of industrialization, but modern society reguires deeper understanding that lies behind the technique. At this point the word technology comes to picture. When we talk about handicrafts and technology in Finland in same sentence there is usually also term technology education. We might say that technology education is field of education that aims to teach technology (Layton 1986). Parikka (1998) describes technology as a field of knowledge that handles technological systems and procedures made by human being and highlights understanding the mathematical natural scientific principles behind functions of different kind of devices and working procedures. Keyword is understanding. It is important to learn basic skills and techniques to manufacture objects in handicrafts. When these basic technical skills have been achieved learning should continue by examining how and why we did what we did. Regarding to Lindh (2006) this technological common knowledge is a condition that mankinds future oriented action is possible. The concept of technology is possible to see in wider context in time and content when technology is understood as a historical developing process (Lindh 2006).

It is important to understand past also on the field of technology. Without knowledge and understanding about history of technology creating and applying new is impossible. This idea is one of the guidelines of my study in progress. Goal of my study is to describe and understand what kind of process is handicraft teacher students project where they produce learning material about Finnish heritage building to the 5-6th grades in elementary school. Aim of this study is also to describe students own impressions about heritage building and possible change in those impressions during the process.

Heritage building has not been studied before in Finland from the point of view of a school world. In the national curriculum in Finland (National Core Curriculum for Basic Education 2004) there can be found goals under several school subject about understanding and appreciating heritage building and our build cultural heritage. In many occasions teaching these subject entireties in schools is very difficult. Biggest problems are teachers own lack of knowledge about the topic at hand and lack of teaching material. In my study students design authentic learning tasks by using the process of learning by designing. According to Pöllänen (2009) teacher needs direct models to teach handicrafts. With the help of these direct models handicraft teaching could be directed towards holistic craft process that would support development of pupils generic skills.

Study is a design-based-research and material is collected by many different methods (mixed-method). Describing students designing process will be done by qualitative methods (e.g. videotaping, observation, interviews, diaries, researcher self reporting). Quantitative methods are probable when processing students background information.

Why study heritage building?

Finland is relatively young society. In young societies development has gone forward rapidly especially after the world wars. This rapid development causes that everything new is taken for granted and previous procedures are abandoned without any hesitation. This also happened in Finland and what interests me most, in building engineering.

To most modern day people traditional building materials, and proper usage of it, are completely foreign territory. 60 years ago every builder knew what was the route of a log from the woods to the wall of a house. Knowledge about materials and its proper use transferred from father to son naturally. Strong industrialization of building industry and materials changed all that. During this development lots of so called "*tacic knowledge*" that transferred from generation to generation was about to disappear for good.

During this strong industrialization in Finland everything old was considered shameful and sign of poverty. Old wooden cities were torn down and replaced with concrete apartment buildings in the name of progress. When standards of living was high enough at the end of the 20th century people "*saw*" what was about to disappear. Urge to protect that little what was left raise. People wanted to preserve and refurbish old buildings, but old knowledge about materials and techniques was widely missing. Lot of mistakes were made because modern building solutions didn't suit for traditional buildings. This just reinforced the idea that old buildings were just a relic from the past and it was best to replace them with new buildings. Knowledge about traditional materials and methods has been strengthen in the past decade. People have started to understand the meaning and value of sustainable development also in building industry and value of natural building materials that are refined near the consumer.

Finish people usually experience old buildings and old tightly built wooden cities comfortable places to be. One obvious proof of that is popularity of old cities like Rauma and Porvoo among tourists. When there are so little left of our old buildings we are started to understand that they are important part of finnish landscape of soul and our cultural identity. This gives me also a reason to examine somehow in my study our built cultural heritages influence from environmental-psychological and cultural-anthropological point of view.

When teaching people things for instance about sustainable development we have noticed that *"old dog learns no new tricks"*. That is why children should be our target audience if we want to create permanent change in dominant way of thinking. If we want people to think that sustainable way of living, concern about climate chance and so on is automatic part of individuals thinking structure, we should start from the childhood.

Studys context

Context of this study contains for example wood. The physiology of a tree I deal with several researches point of view (e.g. Kärkkäinen 2003, 2007, Jääskeläinen & Sundqvist 2007, Kaila 1997, Lemettinen K., Absetz, I. & Kanerva P. 1987).

Very important part of heritage building is traditional Finnish use of wood as a building material. Path from the selection of a tree from the woods depending on specific use and the proper way of working to do a final piece of a building I deal with the studies from Kaila (1997) and Metsälä (1998).

I deal climate chance in my study to argue the significance of a wood as a part of slowing down the global climate change (e.g. Jantunen & Nevanlinna 1990, IPCC 2007). Paloheimo (1998), Kellomäki et. al. (2005) and Kuusisto et. al. (1996) handles the role of woods to slow down the climate chance.

For instance Outila (2002) and the National Core Curriculum for Basic Education in Finland (2004) deals with the concepts of sustainable development and life cycle. These concepts are also essential parts of my study. Outila (2002) defines also ecological building and rebuilding which as a terms are part of defining heritage building.

Concepts of technology and technology education are based on various studies, for example deVore (1992), Parikka & Rasinen (1994), Layton (1986), Chen (1996), Lattu (1999), Heinonen (2002) and Lindh (2006). For this study handicrafts / technology was defined in Savonlinna (University of Eastern Finland, Philosophical faculty, School of Applied Educational Science and Teacher Education in Savonlinna) in the following way:

> *Information concerning skill:*
> Handicraft/technology as a subject is based on self-guiding and researching studying and based on integration. Aim is to improve students knowledge about technology, its historical development, about technological systems, invocation of it, social, economical and cultural meaning of technology and learning the subject in elementary school. Subject applies mathematical natural scientific knowledge and provides application targets in praxis.
>
> *Information given by skill:*
> In the studies of handicraft/technology students are guided to self evaluate their skills, to set aims for their studies, to pick contents of studies and to evaluate their learning results. Students are also guided to notice and solve problems and to design and manufacture products by using creatively different kind of materials, handtools, machines and equipments, computers, working processes and technological systems.
> (Heinonen 2002)

In the field of heritage building doers skill can often be called skillknowledge. When skill transfers from doer to doer so called tacit knowledge is in a great part. For instance Niiniluoto (1992), Jernström (2000), Polanyi (1996) and Toom (2006) have dealt the concept of tacit knowledge and concept of skillknowledge in their studies.

Learning by designing

In my study students in the test group are being taught basic things about heritage building, about our Finnish build cultural heritage and how these are connected to the climate chance and sustainable development. Students manufacture learning materials with the method of learning by designing. Principles of learning by designing and design and problem based learning are quite similar, and these both methods are most certainly used when students are working with the learning material.

Learning by designing happens normally in small groups. Each group has to decide themselves the most significant facts that has to be learned that the goal should be achieved. Independent learning by designing process of a group contains much experimenting, reading, finding information and researching. When designing a product, learning material in this case, group has to solve conflicts. When failure happens group must discuss what they understood wrong, what needs correcting or what was left unfinished. In the process of learning by designing group repeatedly has to re-construct and re-test, explain and define their solutions. Planning, editing of information, critical evaluation of implementation and relevant information and correction are being repeated in the process of a group. (Enkenberg 2000)

Empirical part of the study

Study is based on paradigm of constructivism and mostly on social constructivism. Self guidance and self reflectivity are highlighted in constructivism (e.g. Rauste – von Wright 1997, Puolimatka 2002). In my study group of students must create learning material as a self guiding group. Reseacher acts as an observer and only when absolutely necessary as a tutor or expert. Many constructivists are criticized by Puolimatka (2002), because most of them wants to leave the teacher as a “supporter of learning process”. At this case it happens very easily that learners waste lot of time and energy to create structured wholes of information while teacher as an expert of the subject at hand stands aside. According to Puolimatka (2002) teacher as an expert can choose most essential information about topic at hand. These well structured pieces of most essential information can provide to learners a shortcut to the terminology of field they are learning.

Field of heritage building is most likely very strange to most of students in my study. Therefore it is vital to provide theoretical information about heritage building in Finland (lectures, visits, professional visits etc.) before actual creating process of learning material. When students have learned certain basic concepts about heritage building they can concentrate on solving special requirements that concerns learning material that is designed for 5.-6. – graders, for instance:

- What is 5.-6. – grader as learner?
- What are the limits or possibilities that curriculum provides?
- What is good learning material?

My study is *design-based research* that is practical and flexible because it tries to solve problems in real life by designing and executing interventions to learning situations, learning environments or learning methods. At the same time it tries to expand previous theories about phenomenon that is studied. One of design-based researches strengths is integrating different approaches, qualitative and quantitative, depending on needs of a study. In design based research theory and interventions are constantly being developed. Process creates self completing circle. Design-based research takes place in natural learning environment, not in laboratory. (e.g. Barab 2006, Barab & Squire 2004, Brown 1992)

In the field of pedagogics there are no previous studies, at least in Finland, about chance of students perceptions during learning process about heritage building. This fact means that goal of this study is to create new theory. Examinees of this study will be selected from precisely determinated group of students. All students are making their subject studies in handicrafts. This guarantees that group has certain basic technical capabilities and they are able to perform technological thinking during designing process. There will be at least two groups in this study, each has about 15 students. Most likely men and women students will be equal amount.

Small N doesn’t give possibility to emphasize quantitative point of view. Quantitative material of this study contains students background information and their overall perceptions about heritage building. This information might give direction to qualitative analysis of collected material. Research material will be collected through the study and material will be collected in various ways. Diverse material gives opportunity to reconstruct co-operation between learners and inner processes of an individual learner during the process into form that can be studied.

Results

In my study a model would be created which helps students to design learning tasks about heritage building suitable for children. This model would be validated and put in to practice at least by two different groups of students. Purpose of this study is to advance students knowledge and certain skills about heritage building with help of learning material project. At the same time a model (learning material) would be created to help teachers to teach contents of

Finnish build heritage, heritage building and how these things are connected to Finnish woods, global climate change and sustainable development in elementary school.

Study might benefit others also than just teachers. For instance different kind of theme days and workshops about history to school children are being organized by museums and different kind of cultural heritage foundations. Study might give them information how to design learning tasks for children at their level of skills and knowledge. There are several learning institutions in Finland that educates professional carpenters, architects, engineers and so on to field of concervating building. This study might give them information about how elementary school teachers comprehend the concept of heritage building and its meaning to Finnish built culture.

My personal goal is to increase knowledge and understanding about our built national heritage before. Many old technical solutions, traditional knowledge about nature materials and different kind of working methods are being forgotten although they might be applied to modern world. It is important to make people understand that old buildings in our neighborhood are existing links to the past generations and also to our nations history and development through times.

THE NEW PEDAGOGICAL MODEL FOR TECHNOLOGY EDUCATION

Contents

(Olli, T.)

Background

The main purpose of this research is to develop new pedagogical model of technology education for the teacher education in Savonlinna campus. Savonlinna is one of the three campus areas of University of Eastern Finland. In Savonlinna you find teachers education in kinder garden-, textile-, home-economics- and classroom teacher study programs. Home-economics is only program which don`t consist technology education/ technical work. Names like technical work or craft are used both on the curriculum of University of Eastern Finland, but with this research, name technology education is hoped to be the universal name like it is in world wide. With a name change research wants to give stronger position for technology education in Finnish system of education. Name issue is one of big changes which this research is aiming. Another is to find a good way combine a traditional Finnish craft teaching, like Uno Cycnaeus presented to curriculum of crafts on public school, and modern time technology education. What kinds of basic skills of craft today´s children needs to become members of civilization and to understand future world where they are living.

This research concentrates on classroom teachers study program, where is four courses of technology education/ technical work. Compulsory studies in classroom teachers program is only one course (2 study points) and after that students can choose voluntary courses. In voluntary courses is course for technology education (3 study points), basic studies of craft (25 study points) and subject studies (35 study points). Subject studies give a qualification to work as a technical work teacher in basic school.

This abstract presents the research plan trough research problems. Three research problems are aimed to give answers for the new pedagogical model technology education solution in educational way and also in contents of technology education.

The base of the new pedagogical model of technology education

This research like is mentioned earlier tries to built a new pedagogical model for technology education. First research problem concentrates on surface that pedagogical model is built on. First the research tries to find solving to educational point of view, which theories of education fits on technology education. Also how technology education courses should be built to support students learning road. Educational theories of learning that are planning to use, to build new pedagogical model of technology education, are constructivism at the start. Also the behaviorist idea of learning is important for example to teach a new technique.

Lot of the students that starts to learn to become classroom teachers' haven´t had lot of experience from technology education/ technical work or crafts. For example they have taken on course on third grade of basic school. That why it is very important to plan first course to motivate them to learn and to feel safe on a new environment. With different kinds of learning models and various working ways research is hoping to reach good level of teaching and to support their technology thinking. One of the research start point is that teachers still have influence on their pupils/student, so teachers can move all or parts of technology thinking forward to pupils/ students. To guide students towards last sentence research must take notice also ways that student develops his/her personal skills and because research is aimed on teacher education also how he or she can have best results on learning road to become a teacher.

Learning theories and – models are important, but to develop technology education it is important to research to find those theories of technology education which are most suitable for the research and to the pedagogic model. To answer the first research problem it is planed to find the situation of teacher education, specializing in technology education, on nationally and also internationally. To have an idea of situation, research is planned to find out information from different teacher education departments curriculums. To get deeper information researcher interviews lectors if it is necessary.

With literature check of theories, that are mentioned earlier, and the situation check of technology education in teacher education research is planned to produce a first pedagogical model. That model is planned to use for one or two years in teacher education in Savonlinna and to collect feed back from teachers and from students to evaluate the model. With feedback the model is developed again to make it better.

How experts see the new pedagogical model of technology education?

In research second problem is to develop the model to meet demands that different areas of civilization sees important on technology education from contest of teaching and from contents of necessity. (Few examples: 1. What are those skills that educational field sees important to have when student/pupil move to work life? 2. What are the contents of technology thinking that should be teach in basic school? 3. What kind of working skills is needed on tomorrow work life?)

To solve second problem in this research is planned to create expert panel from different areas of life. On panel is hoped to find members from educational side and from economic side. Construct of panel is also hoped to be local, national and international, because research is hoped to form pedagogical model that has lot of different point of views to produce information that is meaningful for local, national and international people who works with technology education or has some kind of influence from that.

With first two research problems of research is hoped to give enough information what is needed to form the new pedagogical model of technology education and research can proceed to next part.

Where the new pedagogical model of technology education is based on?

Third research problem is aimed to produce a last version of the new pedagogical model of technology education. Third problem is hoped to solve from answers of earlier research problems and form a model that is examined from educational contest and contest of skills and information, what surrounding society sees important to know or to have skills for it.

Methodological part of research

Research is qualitative and it is based on paradigm of constructivism. Research information is produced from literature check, classroom teacher students, teachers from teacher education and experts from different areas of society. Ways to get information is by interviews, writings and to explore documents.

Results

Research hopes to produce pedagogical model witch is oriented for technology education witch combines traditional Finnish craft skills and international technology education. Main idea is that model pays attention on pedagogical side for teacher education and contextual side of technology education. Model is also wanted to notice movement between courses to learn skills and information that is needed to teach technology education. If technology education is leaved outside of the pedagogical model, can pedagogical model be used in every subject witch is based on skills.

REFERENCES

Barab, S. 2006. Design-based research. A methodological toolkit for the learning scientist. In Sawyer, R. (ed.) The Cambridge handbook of the learning sciences. Cambridge university press

Barab, S. & Squire, K. 2004. Design-based research: Putting a stake in the ground. The journal of the learning sciences, 13(1), 1-14

Brown, A. 1992. Design experiments: Theoretical and Methodological Challenges in Creating

Complex Interventions in Classroom Settings. http://depts.washington.edu/edtech/brown.pdf (read 4/2009)

Enkenberg, J. 2000. Oppimisesta ja opetusmalleista yliopistokoulutuksessa. In Enkenberg, J., Väisänen, P. & Savolainen, E. (edit.) 2000. Opettajatiedon kipinöitä. Kirjoituksia pedagogiikasta. Joensuun yliopisto: Savonlinnan opettajankoulutuksen verkkojulkaisuja http://sokl.joensuu.fi/verkkojulkaisut/kipinat/JormaE.htm

Jernström, E. (2000). Lärande under samma hatt. En lärandeteori genererad ur multimetodiska studier av mästare, gesäller och lärlingar. [Teaching-and-learning under the same hat. A theory of teaching-and-learning generated by multimethodological investigations of masters, journeymen and apprentices.] Luleå: University of Technology.

Jääskeläinen, A., Sundqvist, H. 2007. Puun rakenne ja kemia. Helsinki: Otatieto.

Kaila, P. 1997. Talotohtori. Rakentajan pikkujättiläinen. Porvoo: WSOY.

Kärkkäinen, M. 2007. Puun rakenne ja ominaisuudet. Hämeenlinna: Metsäkustannus Oy.

Kärkkäinen, M. 2003. Puutieteen perusteet. Hämeenlinna: Metsälehti Kustannus.

Layton, D. 1986. Innovators' dilemmas: recontextualizing science and technology education. In Layton, D. (edited.) Innovations in science and technology education. Vol I. Tournai: Unesco, 9-28.

Lemettinen, K., Absetz, I. & Kanerva, P. 1987. Puun rakenne kosteuden sitoutumisen ja siirtymisen kannalta. Espoo: TKK.

Lindh, M. 2006. Teknologiseen yleissivistykseen kasvattamisesta – Teknologian oppimisen struktuuri ja sen soveltaminen. Oulun yliopisto, kasvatustieteiden ja opettajankoulutuksen yksikkö, E83

Niiniluoto, I. 1992. Taitotieto. In Halonen, I., Airaksinen, T. & Niiniluoto, I. (ed.) Taito. Helsinki: Suomen filosofinen yhdistys ry.

Parikka, M. & Rasinen, A. 1994. Teknologiakasvatuskokeilu. Kokeilun tavoitteet ja opetussuunnitelman lähtökohdat. Jyväskylän yliopisto, opettajankoulutuslaitos, 15.

Parikka, M. 1998. Teknologiakompetenssi. Teknologiakasvatuksen uudistamishaasteita peruskoulussa ja lukiossa. Jyväskylän yliopisto, studies in education, psychology and social research, 141.

Polanyi, M. 1966/1983. The tacit dimension. Gloucester, MA: Peter Smith/Doubleday & Company, Inc.

Puolimatka, T. 2002. Opetuksen teoria. Konstruktivismista realismiin. Vammala: Kustannusyhtiö Tammi

Pöllänen, S. 2009. Contextualizing craft: Pedagogical models for craft education. The International Journal of Art & Design Education. 28(3)

Rauste – von Wright, M. 1997. Opettaja tienhaarassa. Konstruktivismia käytännössä. Juva: WSOY

Toom, A. 2006. Tacit Pedagogical Knowing: At the Core of Teacher's Professionality.

University of Helsinki, Faculty of Behavioural Sciences, Department of Applied Sciences of Education.
http://ethesis.helsinki.fi/julkaisut/kay/sovel/vk/toom/
http://www.ipcc.ch/ (IPCC 2007 report, read 15.8.2010)

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TEACHER STUDENTS' INDIVIDUAL GROWTH INTO THE CRAFTSTEACHERSHIP

Abstract

The purpose of this article is to describe how sloyd (technology) teacher education supports the teacher students' individual growth into the craftsteachership (profession of craftsmanship and teachership). Sloyd education is the discipline and the main subject of the sloyd (technology) teacher education in Finland in the University of Turku, Department of Teacher Education in Rauma. The novel framework for students process creating is described, linked to the sloyd education core curriculum and contents with technology learning. Further it is described how learning and teacher training is involved in students' pedagogical and research based learning. As the conclusion of these descriptions there is introduced the key elements of teacher students' individual growth into the craftsteachership.

Keywords: Sloyd education, technology education, craft and design, teachership

Introduction

The purpose of this article is to describe how sloyd (technology) teacher education supports the teacher students' individual growth into the craftsteachership (profession of craftsmanship and teachership). The idea is derived from Uno Cygnaeus' philosophies of education in the 19th century.

Cygnaeus noticed that sloyd should not be established in schools for vocational means of handicraft industries but to fight against routines of mechanical work. Sloyd is not to apply any special skill in certain techniques but for means of general education and civilization. For Cygnaeus sloyd was to educate pupils in esthetics, design and general handiness. In the beginning sloyd teachers were for example professional carpenters with no pedagogical education, and the idea of Cygnaeus' sloyd was not achieved. As early as 1883 the national board of educational services gave directions for sloyd in general education schools. Directly after that the first committee for sloyd education (1884-1886) under Cygnaeus' supervision gave guidelines for schools and teachers. The first directions of the qualification of sloyd teacher were given in 1890. (Harni 1949.) Sloyd education has a basis in schools at the beginning of 1866 first in the world in Finland and teachers have been educated in teacher seminars. (Metsärinne 2008 and Kantola 1997, 20). The education changed into the university level at the beginning of the 1973, so that the first students started to study towards master's levels studies in 1979. The master's level studies as the main subject of the sloyd education has been clarified by the discipline development since 1994. In the University of Turku there are educated sloyd (technology) subject teachers which are specialized to teach technology education of the sloyd in comprehensive school and in high school. Student can study sloyd education as the main subject from the basic studies to the end of the master's studies in teacher education. Master's level studies of the sloyd education are condition of competence to teach sloyd in school grades 7-9 in Finland. Subject teacher qualification of the sloyd can be reached also by the students who study some other main subject in the masters level including pedagogical studies and also bachelor studies (basic and subject studies) of the sloyd education (University of Turku and Åbo Akademi by Swedish language in Finland) or the craft science (University of Helsinki and University of Joensuu). This article concentrates views of sloyd education from University of Turku.

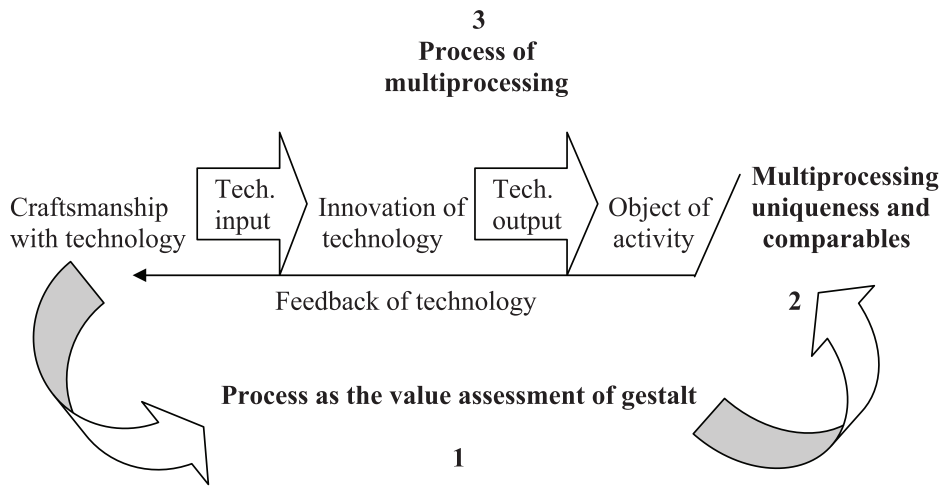
Sloyd education and school sloyd comprise plenty of the same principles as technology education (for examp. International Technology Education Association 2000). However connection between Nordic sloyd and so called overall technology of education is not established because of many unique combinations of content in the other countries. (Borg 2007, 57-65). That is correct definition about all Nordic sloyd, but Finland had a little bit different kind of development, because of old school subject technical work has been developed in quite same contents of technologies than technology education in many countries. (Kankare 1997, Kantola 1997, Rasinen 2000, Kananoja 2005 and

Metsärinne 2008). From that point of view technologies of technology education are included in the sloyd education (SE&T) in university of Turku and in general schools sloyd.

In Finland there are no posts for a full professor of technology education (TE) and no subject as technology in comprehensive school (based on the 1998 law). SE includes sloyd technology and this could be enough for the development of technology. From a scientific point of view general technology is a very problematic concept because all school subjects at a basic level must have a scientific basis in Finland. The scientific background to pure TE in Finland is very weak. (Peltonen 2009a.)

TE in the school sloyd is also problematic, because technical work and textile work are combined in the same subject of sloyd. Usually both contents are taught as much in grades 1-4. After that pupils can choose one or the other. Sloyd is a compulsory subject up to seventh grade and then optional subject. A few schools have chosen the way that the both subject are taught a half of sloyd time 1-9 and so each contents had to halve. This reform is not created from the academic sloyd education but from the changed new law of teaching basics (1998) and of the newest curriculum basics of comprehensive school 2004.

The EHEA (European Higher Education Area) by 2010 – strategies have varying ways of developing SE&T in Finland. The strategies highlight the continuity of the whole educational system from the kindergarten to the higher national doctoral level and to the highest research level of the new 'European University'. In this case the point is that TE in Finland has no direct academic path from the bottom to the top and it includes only BA-degree level studies in Finland. This fact adds to the motivation and need to integrate these disciplines because SE has an open path to the top of the European Higher Education system. The institutional element was the first element used as a criterion for comparing these disciplines. Second element is the goal structure. For example the difference between Finnish SE and American TE as school subjects is the individual intention to use and make tools. SE highlights the ability of the individual to change their own life reality through Finnish sloyd. American TE highlights the individual ability to extend their technological world-view and the ability to create new innovations by using and managing technology. (Peltonen 2009a.) Students' individual growth into the craftsteachership comprises both of these highlights in their novel processes creating.



1, 2 and 3 = Method phases to create and assess a craft process of SE&T

FIGURE 1 A novel framework for process creation in SE&T (Metsärinne 2010)

Process creation in SE&T usually does not start with goal oriented thinking through which man defines his goals of well being and his needs for shaping technologies from the objects of nature. This means that the projects of preparation create the need to set up goals of well being freely selected as a situation in life man is about to face. (Peltonen 2009a.) In the process creating this is involved in the contents of technology in discipline of sloyd education. A general discipline which would produce an all-around substitute general technology does not exist. The teacher and students envision their artifact visions with their own technical know-how, from where they construct broader comprehension of technology and take use new technologies to sloyd if possible and meaningful. They know what they have done by means of sloyd technology and other technologies before linking them to their process creating. That is described in Figure 1 in bold. (Metsärinne 2010.) It comprises sloyd creating by the product-process-impact theories and handiness theories. The first means that the individual persons way to make and use tools with help of product-process-impact –thinking. The latter highlights the individual growth of handiness or dexterity to the expected skill level. (Peltonen 2009b.) They take individual questioning and conceiving of one's own craftsmanship and teachership in three phases: 1) Process creating as the value assessment of gestalt comprises the question what for hand, work, artifact and education are with one another, 2) Multiprocessing comprises the question how uniqueness and comparables exists in different kind of model processing and 3) How reliability and quality control is tested in process of multiprocessing. (Metsärinne 2010.)

Students' problem solving conceiving and/or technological causal reason effects are formed parts of process creating (middle of figure 1). It comprises the SE as techno-science theories and also as science and culture theories. The first is intended to define (first) the SE so, that it is long lasting producing project that is directed with constructed usage theory of tool making with technology. That includes 1) technology as the quality plan of the large and deep tool system and 2) the technique as the way to use technology to implement the mission of the certain science. The evaluation of the new technological tool is intended to use as the test for the validity estimating of usage theory of tool making by technology. The latter highlights the intention to get acquainted with pure technology of any kind of science. The analyzing of ends and means of one certain science is the first base to find the already known technological method for getting deeper acquainted in that area. The educative mission is primarily to educate a person to learn the science facts and develop to understand the science way to illuminate the reality net of the world. The science education and vocational education represent the area the science and culture theories based on SE&T.

The idea of the core curriculum in the SE&T education

In traditional definitions of the sloyd there has been strong connection in concrete making though immaterial constructions have became more popular in recent studies (e.g. Metsärinne 2007, Johansson & Porko-Hudd 2007, 1, Kojonkoski-Rännäli 2009, 2005, 292-297, Klemola 2004, Lepistö 2004, Syrjäläinen 2003 and Nygren-Landgärds 2000). There is no difference between material and immaterial products or processes. (Sennets 2008). Producing processes as technologies of the sloyd is discovered throughout in past decades and there are several models to understand how the process and the product are developed together in interaction (e.g. Sjöberg 2009, Anttila 1993, Suojanen 1993. & Zeisel 1981, 15.). Craftsman is a human with ability to take a responsibility of control over his work. (Dormer 1997, 137-140). He is mastering the available technology irrespective of whether it's a mould, hand tool or electrically controlled machine or computer. The role of the hand is not defining the craftsmanship but the knowledge that empowers the craftsman to manage the technology. Finally neither teaching skills, developing new techniques or technologies are not primary tasks of sloyd educational research but the individual growth into craftsmanship. From SE&T point of view the task of craft is to support pupils' capability to intentionally maintain or reform the environment of life more viable (Peltonen e.g. 2007). Due to this definition processes and products are technologies of the sloyd.

The idea of the Core Curriculum of the SE&T includes 5 main points (Peltonen 2009c):

1) The principle of the core substance: It is not possible to understand the sloyd or the sloyd technology in the Finnish school without the producing operation and its relationship to the human work with hands and with meaningful, hand surrogating tool systems (the sloyd technology).

2) The principle of the core intention: The intention of the sloyd is to change the surrounding reality with possible and meaningful products based on the impact of the new tool product to the individual and social life style.

3) The principle of the doing: It is not possible to understand the sloyd without the idea of four steps of the doing: a) first is doing by doing, b) second is learning by doing, c) the third is teaching to do with doing and to teach to learn by doing and d) the last is to teach to learn the individual communication with other persons like pupils, students and experts including the shaped wholeness of producing operation based on the knowledge based information and even scientific made knowledge based information.

4) The principle of the continual sloyd education: The sloyd is always the wholeness of the hand related making process directed with individual sloyd thinking based on the human desire to do the change for the own tool surroundings. The human being is preparing all the time to learn to prepare to meet him- or herself as the tool making prospect and learn to think how to go meaningfully thorough the prospect to the expected end and to learn to handle and live with new made tools. The prospect expectation varies from the childhood to adulthood. Because of that there must be a continual connection with kindergarten education to school education and to the higher academic teacher education and finally to the teacher in-service education. That's the main point of the sloyd core curriculum.

5) The principle of the theory: Inside the higher academic sloyd teacher education it is important to understand that the purposes and aims of the sloyd teacher education are originated from the very many, historically organised sloyd and sloyd education theories between the dimensions of the four kind of theories: a) the human being as a individual, developing actor in the real life, b) the human being as the mastermind behind the plans of the sloyd prospects and education for the future, c) the human being as the designer and artists of the new tool products and d) the human being as the technologist and innovator.

Technology in SE (sloyd education)

The SE exists at least in three realities. They are: 1) reality of life in craft with technology educational projects, 2) reality of the discipline in the sloyd teacher education and 3) reality of the school sloyd. Together they comprise the complementary visioning elements as productions, technologies and artifacts. (Metsärinne 2009b.)

Life comprehension and SE goal analyses define technology. That techno-value thinking can consider from: 1) the techno-semantic -domain, 2) the techno-science –domain and 3) the techno-risk-tolerance -domain. (Peltonen 2009a, see Scharff & Dusek 2003). Techno-semantic domain of technologisation goals can form by positivistic analysis, philosophical-anthropological surrogate analysis or the socio-constructivist signification analysis of socio-technical systems. Techno-science domain of technologisation can form by the hermeneutic-holistic technoscientific analysis or discipline as the definer of the content of technology.

The scientific basis of SE&T in life is included in processes creating in teacher education. It usually comprises technology of designing, manufacturing and methods and the working situations. (Lindfors 1999, 50-52). Those parts are shown also in the framework of planning activities and activity contents of technology in SE&T. (Metsärinne 2009b). The process can create by five elements in the SE&T: 1) The communication and information technologies, 2) The technologies in technical work and textile work contents or new combination, 3) The technological craft systems, for example electronic circuits and networks or special technical structure of artifacts, 4) The control technologies in all learning areas and combined machinery/tool systems, for example modular electronic construction planning systems and all machineries and tools as one control technology, 5) The automation technology, machine/hand tools in their own many sided meanings of doing. In small group studies students have not applied these technologies systematically, but they have been conceived the main aims of technological understanding and practical skills by these elements in their reports.

The combined visions of productions, technologies and artefacts are in between the four planning activity fields. They are technological literacy, craft, work and design. (Metsärinne 2009b.) They are derived from researches of the problem of the difference between craft and prevocational education in primary education (Peltonen 1995), sloyd vision teaching and learning (Metsärinne 2003a) and a goal analysis of teaching technical school sloyd (Metsärinne 2003b).

TECHNOLOGICAL LITERACY

WORK → | ← **DESIGN**

Visions of productions,	**Technologies,**	**Artifacts**
The production items	The communication and information technologies	The characteristics the envisioned artifact
The projects	The technologies of technical and textile work	The functioning characteristics of the artifact
The processes	**Gestalt of technological systems in the sloyd**	The parallel characteristics of the artifact
The operations	The control technologies of learning areas	The structural characteristics of the artifact
The many-sided skills	The automation technology, machine tools and hand tools	The original characteristics of the corresponding artifact

CRAFT

FIGURE 2 The knowledge elements for the planning activity tasks in the SE&T (Metsärinne 2009b)

In planning activity tasks from technological literacy learning of communication and information technologies with technical and textile work technologies are emphasized. They are involved in aims of artefacts envisioning and aims of products functioning in human action. So the aims of technology and design are involved in the aim of one's vision of production item. The whole planning activity goes from defining technological literacy tasks to craft tasks by holistic visioning. (Metsärinne 2009b.)

One's earlier technical skills and knowledge of craft made artefacts are emphasized in planning activities from craft tasks. Craft is usually seen as logically based skill and task development as a hierarchical levels. They go below to up in the figure above. It is a realistic way to plan craft activities for pupils. However this way is slow when teacher and pupils are trying to plan some new activities by them. (Metsärinne 2009b.)

Planning activities in work tasks are emphasized to production item ideation and the many-sided skills of innovative technologies towards artefact envision. These tasks demand constructive learning, entrepreneurship and preparedness and readiness of working life for one's own doing with. (Metsärinne 2009b.)

Planning activities in design tasks are emphasized to knowledge of designer and artefacts end users. The nature of technical artifacts is seen in a physical and a functional nature. (Vries 2007, 17-29.) The aims can be constructed by different kind of characteristics elements of artifacts for artefact production (Figure 2).

All the planning activity task fields have their own priorities for generating the activity learning tasks in SE&T. Aims of sloyd technology for learning are planned by these tasks, but the activity contents of technology are not sharply defined not until some main task is focused in education. The main idea is to guide students' own technological system creation by the elements for planning activity tasks, not to innovate certain technological systems as such. Students must consider his inner technological value to SE&T and external drive value of understanding technology for his future craftsteachership. (Metsärinne 2010, 2009 and 2007b)

School SE&T is not introduced in this article, but for example Peltonen (1988, 305), Lindfors (1992, 116) and Metsärinne (2004, 194) make clear the models of the sloyd teaching and learning which illustrates how a teacher and students both create the students learning tasks. Also the model done by Hallam and Ireson (1999, 79) illustrates the reciprocity of teaching in a way that previous 'process' models of teaching seem to miss, and provides a basis for understanding how a learning dialoque might work. (McNair & Clarke 2007, 275-276).

As a sum SE&T in teacher education gives preparedness for students to plan their own learning tasks and processes for pupils in the cultures of schools. Learning tasks creation for schools is not the goal in researches of teacher education as such.

University studies in SE&T

The idea of individual growth towards craftsmanship and teachership as craftsteachership is integrated into scientific studies of the sloyd teacher education in figure 3, but not mentioned in-service education and doctoral level studies because the purpose of this article.

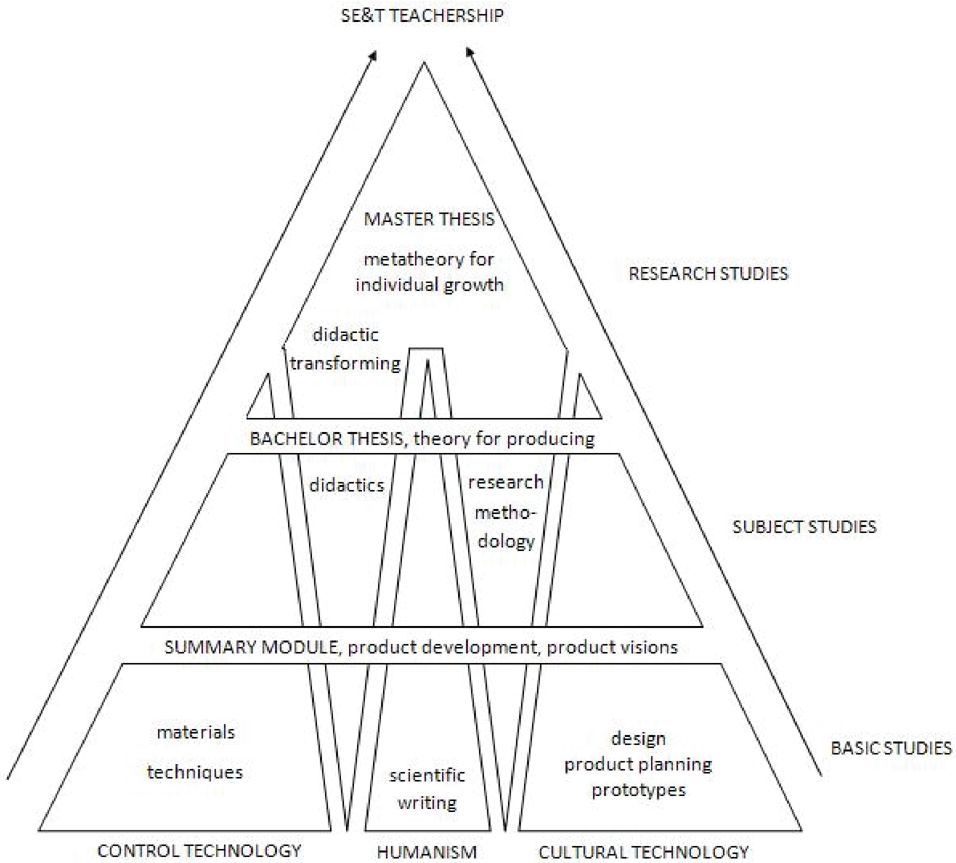


FIGURE 3 Students' individual growth into SE&T during teacher education in University of Turku in Rauma (compare Peltonen 2001).

The sloyd teacher education includes study contents in bachelor's level for example a) the studies of artifact design, b) technology studies, like electronics and technologies of wood, metal, plastics and textile work c) mechatronics, d) some mechanical engineering, e) information technologies as technical drawing d) research methods for artifacts developing and e) pedagogical studies. Students craft mostly on wood, metal, plastic, textile and even stone materials. In the all studies students can apply technologies and different materials with their special techniques. Course materials and tasks for students are exposed often via moodle - a virtual learning environment. The pair of students is for example expected to familiarize themselves to the curriculum of one Finnish comprehensive school, and then regard the quality and sufficiency of the curriculum. Students should plan learning tasks or adapt their craft processes to suit for comprehensive school purposes. Students have to reflect how to apply the process of searching a problem, defining and realizing it, designing and manufacturing a realization suitable for the comprehensive school context. Students must write and present scientific argumentation for their problem finding and solving and also product solution before, during and after their producing.

The basic studies develop readiness for students to confront the occurrence of education within SE&T by means of scientific thinking and readiness for crafting. The students receive the basic skills for designing and manufacturing craft products. In the basic studies there is a summary module where all basic technologies of the first year's studies are integrated.

The subject studies support students to learn and receive, to read up on and apply knowledge, activities and values of the study gestalt of craft education in their future work as a teacher. Teaching is conducted in some extend by lectures, but the main emphasis is on students' individual or collaborative knowledge construction, design and crafting. Students work with different learning tasks. Related to this, techniques and technologies applicable are defined and conducted by the teacher, but problems, solution to them and realization of them is carried out by the student. The purpose of these tasks is to support students' craft sense: thinking, crafting, working skills and management of different kinds of techniques and materials. They achieve pedagogical knowledge and patterns of activities for teaching skills. The bachelor thesis is made in the end of SE subject studies.

During the subject studies there are teacher training periods 1 and 2. The students' teaching training takes place in university training school and local schools. Evaluation is done by the help of portfolios. The aim of the training 1 (5 credit points) is many-sided knowledge-building by students peer groups. Training is held in comprehensive school levels 1-6. The main goal for this two weeks training period is to get familiar with different ages of pupils and their special needs in the sloyd subject. Students are responsible to plan teaching methods and learning contents together with subject teacher. Students orientate themselves in to teacher's profession and take part in every day life situations of schools. Teacher's role in this training period is to be more present in actual happening than in the other training periods. Students reflect their learning by constructing portfolio during this training period. The aim of the training 2 (6 credit points) is to plan learning tasks and individual teaching in classroom. Students are expected to reach good skill level in utilizing different learning methods into practice. Also students need to pay attention to working safety, good practice skills and how to vary different techniques on demand. Students became trained to follow their progression by evaluating holistically their own learning and both teacher's and other students' actions. In this training period student get familiar with training schools' sloyd classrooms, teaching materials and equipments. Students also get to know how curriculum is guiding learning through levels 7 to 9. Students plan learning tasks and learn how learning must be organized during training period. Students consult subject teacher and didactics lecturer when learning tasks are planned. Didactic lecturers and subject teachers keep also lessons and steering hours in the field of didactics. Students are expected to follow performing of other students in other schools and also give and share feedback with them.

Master's level studies include for example studies of pedagogic with producing digital learning materials, research methods and history of craft and school sloyd and also studies in which student can specialized some areas of technology education. (Metsärinne 2009a.) The entity of the individual growth through craft is explored especially in master's thesis. In the master's thesis each pair of students create usage theory of technology and test it by planning and creating a unique artefact with the scientific writing. (Peltonen 2003, Metsärinne 2009a, compare Williams 2009, 533). The artefacts have been material or immaterial.

Advanced training period is included in the master's degree studies of SE. Altogether students have 21 credit points compulsory training in their studies. That means computationally 562 hours of working time. In bachelors degree studies training is compulsory to all students. In master's degree studies training period in leaded by the choice of secondary subject. If students choose to learn for example mathematics this advanced training can be carried out in that subject area. Mainly main subject students do their advanced training period in the main subject area. The purpose of advanced training (10 credit points) is that students have a clear vision and deep understanding how to apply curriculum into practice of 7-9 grades. Students obtain readiness to utilize different learning methods. Furthermore students gain a wide range of planning skills, knowledge of resourcing and working safely with technology environment. Students plan independently learning tasks in comprehensive and high schools. (see Metsärinne 2007). They learn different methods to explicit pupil evaluation.

Conclusion

Sloyd education studies produce an invisible output of growth as a conclusive construction of visible outputs: processes and products. The SE&T paradigm might be based on beliefs of product-impact theories, techno-science theories, handiness theories or science-culture theories. (Peltonen 2009a) These dimensions are often applied in one and same study task. However it is the question of the usage target finding when a task is located in the field of paradigms. In principal there is no task that has impact in one and only paradigm: when aiming to handiness values, the product with impact is created at same time and the impact to other paradigms exists as well. When a product-impact is applied some handiness is achieved too and nothing is done without affected by techno-science or science-culture paradigms or without effecting to them. The paradigms are culminated in the two technologies of sloyd: processes and products.

The general model of a process of SE&T combined to the scientific research of it is called craft sense –method (CSM). (Peltonen 2007, 23-26) It is based on the idea of a craft sense as an intentional craft-managing thinking.

CSM is focusing to the capability of a craft sense to manage the craft-process. (Metsärinne 2009a). In the very beginning of the craft-process, even before it is adopted as a craft-process, there is a value analyses and problem. They appear as lack of technology and can be considered as a risk as well (Kallio 2010). Before the idea of teleological technology is imagined, the idea could be constructed through values of process creation (Peltonen 2009b). On the other hand the expected values of a teleological product should be defined and on the other hand the expected values of the techno-process should be defined as well. The question of the values of the process is largely intellectual because the process is controlled through thinking. As a result of setting teleological values for as well process as product there is a set of teleological values constructed of several quality factors. (compare figure 1 and figure 4).

The CSM is largely used in SE&T research in master level thesis. (Metsärinne 2009a and Peltonen 2007). In this article it is to research the students' growth into the world of craftsteachership. The idea is that by CSM the measurable factors of a technology are explored and thereby the final result is the definition of the competency of the students' craft sense. (Kallio 2010.) Researching the growth of the craftsman's craft sense is a task of SE as distinct from other disciplines like education. Creating and using technologies during the process is a tool of SE to support ones growth for craftsteachership.

Students are growing into the world of SE&T by research based crafting (figure 4). When exploring through the craft process one finds himself capable to manage the environment by himself with his own recourses under control of his own mind. The growth is researched at least through the key elements by comparing the starting point of one's studies to the final goal of them. The overall method seems to focus in the quality of a production and a product with transformational methods of didactics. By measuring the specific quality-factors only these measurable factors can be explored and the human factor is found. In the context of SE&T studies the factor indicates the students' growth into the world of craftsteachership.

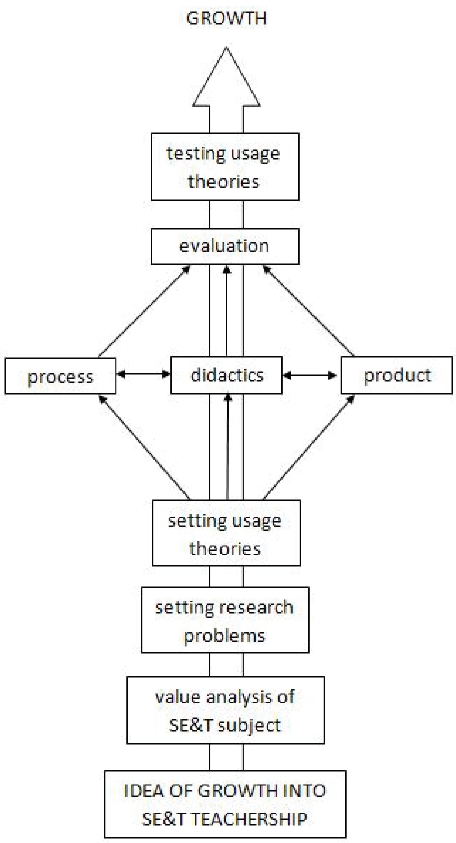


FIGURE 4 Key elements of teacher students' individual growth into the craftsteachership

REFERENCES

Anttila. P. 1993. Käsityön ja muotoilun teoreettiset perusteet. [Theoretical Basis of craft and forming]. WSOY. Helsinki.

Borg, K. 2007. Processes or/and Products – What do teacher assess? Design and Technology Education: An International Journal 12, 2. 57-65.

Dormer, P. 1997. The Challenge of Technology. Craft and the Turing Test for practical thinking. In Dormer, P. 1997 (ed.) The Culture of Craft. Manchester University Press.

Finnish curriculum basics of comprehensive school. 2004. National Board of education.

Harni, E. 1949. Poikien veiston opetus [Sloyd teaching of boys]. WSOY.

International Technology Education Association. 2000. Standards for Technological Literacy. Content for the study of Technology. Technology for All American Project.

Johansson, M. & Porko-Hudd, M. 2007. Knowledge qualities within the field of sloyd. In: Johansson, M. & Porko-Hudd, M. (eds.) Knowledge, Qualities and Sloyd Research in Sloyd Education and Crafts Science. Techne Series. Research in Sloyd Education and Crafts Science. A:10/2007. NordFo Nordic Forum for Research and Development in Craft and Design. 1-4.

Kallio, M. 2010. Managing Values and Risks of a Product and a Production by Craft Sense and Safety Sense. In the conference publication the Insea European Congress 2010 in Rovaniemi, Lapland, Finland 21.24. Traces: Sustainable Art Education.

Kananoja, T. 2005. Technology education in Finland. Available 26.5.2010: https://www.iteaconnect.org/Conference/PATT/PATT15/Kananoja.pdf

Kankare, P. 1997. Teknologian lukutaidon toteutumiskonteksti peruskoulun teknisessä työssä. [Technology literacy in technical work of comprehensive school] Turun yliopisto. Rauman opettajankoulutuslaitos. Sarja C. 139.

Kantola, J. 1997. Cygnaeuksen jäljillä käsityönopetuksesta teknologiseen kasvatukseen. Jyväskylän yliopiston julkaisuja 133.

Kasvatustieteiden tiedekunnan opinto-opas Rauma 2009-2011. [Programme book in Science of education in the University of Turku in Rauma 2009-2011]

Klemola, T. 2004. Taidon filosofia – filosofin taito. [The philosophy of skill – skill of a philosopher] Tampere University Press.

Kojonkoski-Rännäli, S. 2005. Käsityön filosofian lähtökohtia. [Starting points of the slöyd filophy] In: Kullas, S. & Pelkonen, M.-L. The relationship of Nordic handicraft studies to product development and technology. Techne Series. Research in Sloyd Education and Crafts Science. B:14/2005. NordFo Nordic Forum for Research and Development in Craft and Design. 284-301.

Kojonkoski-Rännäli, S. 2009. Quality of the Maker. In Kaukinen, L. (ed.) Proceedings of the Crafticulation & Education Conference. Techne Series. Research in Sloyd Education and Crafts Science. A:14/2009. NordFo Nordic Forum for Research and Development in Craft and Design. 84-92.

Lepistö, J. 2004. Käsityö kasvatuksen välineenä. [Sloyd as an Educational Tool] University of Turku.

Lindfors, L. 1992. Formgivning I slöjd. Ämnesteoretisk och slöjdprdagogisk orienterisgrund med exempel från textilslöjdundervisning. [Designing in sloyd. An orientation on a subject-theoretical and sloyd educational basis. Examples from teaching textile sloyd]. Rapporter från Pedagogiska fakulteten vid Åbo Akademi nr. 1. Vasa: Åbo Akademi.

Lindfors, L. 1999. Sloyd Education in the Cultural Struggle Part VIII. An outline of a sloyd educational theory. Reports from the faculty of Education, Åbo Akademi University. No.4.

McNair, V & Clarke, R. B. 2007. Effective technology and design teaching: getting it right in the classroom. International Journal of Technology and Design Education. Vol. 17, No. 3, 271-290.

Metsärinne, M. 2003a. Teknisen käsityön visio-opetus ja –oppiminen. Toiminta- ja Tapaustutkimus peruskoulun 9. luokalla. [Sloyd vision teaching and learning. Case and action research on the 9th class. Turun yliopiston julkaisuja. Annales Universitatis Turkuensis. Sarja – ser. C osa – tom. 198.

Metsärinne, M. 2003b. Preparing a Goal Analysis of Teaching Technical School Sloyd. In Virta, K (edit.) Current research on Sloyd Education. Techne Series. Research in Sloyd Education and Craft Science A 5: 63-77.

Metsärinne, M. 2004. Projektikäsityöopetus. Tapaustutkimus projektikäsityöhön ohjaavista opetusmuodoista sekä projektikäsityöopetuksen suunnittelun ja ohjaamisen perusteista. [Sloyd Project Teaching, Teaching Methods of Project Sloyd: Three Case Studies]. Techne Series. Research in Sloyd Education and Craft Science A: 6.

Metsärinne, M. 2006. Käsityön (tekninen työ) syventävän opetusharjoittelun portfoliotuloksia ja teorian rakennusaineksia [Sloyd Teacher Training at master's level]. Techne Series. Research in Sloyd Education and Craft Science A: 8.

Metsärinne, M. 2007. Käsityön oppimisen innovointi [Sloyd learning innovation] In: Metsärinne, M & Peltonen, J (toim.) Katosiko tekninen työ Turun yliopistosta? & Käsityön oppimisen innovointi. Research in Sloyd Education and Craft Science A: 11. Techne Series. Research in Sloyd Education and Craft Science A: 11. 81-186.

Metsärinne, M. 2007. Käsityökasvatuksen didaktiikka ja oppiminen käsityön aineenopettajaksi opiskelevien HOPS-suunnittelun ohjauksessa. [Sloyd education didactics and learning in guiding of the sloyd teacher students personal learning plans] In: Metsärinne, M & Peltonen, J (eds.) Katosiko tekninen työ Turun yliopistosta? & Käsityön oppimisen innovointi. Research in Sloyd Education and Craft Science. Techne Series A: 11. 187-215.

Metsärinne, M. 2008. Suomen koulukäsityön neljä aikakautta opetus-suunnitelmien ja teknisen työn oppikirjojen kuvauksena - kohti monipuolista koulukäsityön tutkimusta ja käytänteitä. [Four School Sloyd Periods of Finland by Description of the Curriculums and the Technical Work Schoolbooks - Toward Multilateral School Sloyd Research and Practice] Techne Series, Research in Sloyd Education and Craft Science A: 13/2008.

Metsärinne, M. 2009a. A Theoretical Approach to Artifact Development in Sloyd/technology Education. In: Kaukinen, L. K (Ed.) Proceedings of the Crafticulation & Education Conference. 299-306. Techne Series, Research in Sloyd Education and Craft Science A: 14/2009.

Metsärinne, M. 2009b. Technology in the sloyd/technology education. In conference publication: Development of universities in the context of internationalization of higher education. The Baltic Sea Region University Network. 143-153.

Metsärinne, M. 2010. How to assess the quality of creation processes in craft education? CD-publication in the Insea European Congress 2010 in Rovaniemi, Lapland, Finland 21.24. Traces: Sustainable Art Education.

Nygren-Landgärds, C. 2000. Educational and teaching ideologies in sloyd teacher education. Åbo Akademi University Press.

Peltonen, J. 1988. Käsityökasvatuksen perusteet. [Grounds of Sloyd Education]. University of Turku, Faculty of Education, series A:132.)

Peltonen, J. 1995. The problem of the difference between craft and prevocational Education in primary education. In Lasonen, J & Stenström, M - L. (eds.) Contemporary issues of occupational education in Finland. Institute for Educational Research University of Jyväskylä: Jyväskylä: Kopi- Jyvä Oy.

Peltonen, J. 2001. Den slöjdpedagogiska teorins filosofiska grunder [The philosophical grounds of Sloyd pedagogical theory] In: Visioner om slöjd och slöjdpedagogik. Visions on Sloyd and Sloyd education. Techne Series. Research in Sloyd Education and Craft Science B:10. 313-330.

Peltonen, J. 2003. The chain of rational theories as the directing means of productive activities in academic Sloyd Education. In In Virta, K (edit.) Current research on Sloyd Education. Techne Series. Research in Sloyd Education and Craft Science A 5. 78-96.

Peltonen, J. 2004. Reflections on technology and Sloyd technology. In: Sloyden, minoritetene, det flerkulturelle og et interasjonalt perspektiv. Techne Serien, Research in Sloyd Education and Craft Science B: 13/2004. 155-165.

Peltonen, J. 2007. Katosiko tekninen työ Turun yliopistosta? [Has the Technical Work Disappeared from the University of Turku?] In Metsärinne, M. & Peltonen, J. (eds.) 2007. Katosiko tekninen työ Turun yliopistosta? Käsityön oppimisen innovointi. Techne Series. Research in Sloyd Education and Craft Science A:11/2007. Nordic Forum for Research and Development in Craft and Design.

Peltonen, J. 2009a. The Technology as the value construction and its implication to the Sloyd/Technology Education. In: Metsärinne, M (edit.) Käsityökasvatus tieteenalana 20v - Sloyd education 20 years as discipline. Techne Serien, Research in Sloyd Education and Craft Science A: 15/2009.

Peltonen, J. 2009b. Core Curriculum: linkki yliopiston käsityökasvatuksen, tutkimuksen sekä peruskoulun käsityön opetuksen välillä. (The idea of the Core Curriculum between at the Sloyd Education Research in university and school sloyd). In: Metsärinne, M (edit.) Käsityökasvatus tieteenalana 20v - Sloyd education 20 years as discipline. Techne Serien, Research in Sloyd Education and Craft Science A: 15/2009. 39-46.

Peltonen, J. 2009c. The Role of the Hand in Handicraft. BSRUN-conference presentation. 14.12.2009. University of Turku, Department of Teacher Education in Rauma.

Rasinen, A. 2000. Developing Technology Education. In Search of Curriculum Elements for Finnish General Education Schools. Jyväskylä studies in education, psychology and social research 171. Jyväskylän yliopisto.

Scharff, C. R & Dusek, V. (eds.). 2003. Philosophy of Technology. The Technological Condition. An Anthology. Blackwell Publishing.

Sennet, R. 2008. The Craftsman. Yale University Press. New Haven & London.

Sjöberg, B. 2009. Design Theory and Design Practice within Sloyd Education. International journal of Art & Design Education. Vol.28. Issue 1, Pages 71-81.

Suojanen, U. 1993. Käsityökasvatuksen perusteet. [Grounds of Sloyd Education] WSOY. Porvoo.

Syrjäläinen, E. 2003. Käsityön opettajan pedagogisen tiedon lähteeltä: Persoonalliset toimintatavat ja periaatteet käsityön opetuksen kontekstissa. [On the source of a craft teachers' pedagogical knowledge: Personal procedures and principles in craft teaching context]. Kotitalous- ja käsityötieteiden laitos. Helsingin yliopisto.

Vries, M. J. de. 2007. Technological Knowledge and Artifacts. In Dakers, J. R. (edit.) Defining Technological Literacy. Towards an Epistemological Framework. Palgrave Macmillan. 17-30.

Williams, P. J. 2009a. Teacher education. In: Jones, A. & de Vries, M. (ed.) International Handbook of Research and Development in Technology Education. Sense Publishers. 531-540.

Zeisel, J. 1981. Inquiry by Design. Tools for Environment behavior research. Monterey. California.