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DESIGN IN EDUCATION

Tell me, I will forget. Show me, I may remember.
Involve me and I will understand.

Master's Thesis in Education
FACULTY OF EDUCATION
Intercultural Teacher Education
2014



Kasvatustieteiden tiedekunta
Faculty of Education

Tiivistelmä opinnäytetyöstä
Thesis abstract

Department of Educational Sciences & Teacher Education Intercultural Teacher Education		Tekijä/Author Heikkilä Anni-Sofia	
Työn nimi/Title of thesis Design in Education			
Pääaine/Major subject Education	Työn laji/Type of thesis Master's thesis	Aika/Year November 2014	Sivumäärä/No. of pages 76 + 15
Tiivistelmä/Abstract <p>The low rates in school motivation and enjoyability amongst students are recently discovered facts, noted especially in Finland during the past few years. According to earlier studies, the gap between student interests and school practices is what has partly caused poor engagement and low motivation for students. That is, students have experienced lack in the practicality and usefulness of some of the activities and topics taught at school; the benefits of such activities have been questioned in relation to the later professional engagement of students. Furthermore, the new era of digital representations and smart technology also introduces its challenges, demanding for additional multimedia skills and skills of critical thinking to be practiced with students.</p> <p>Therefore, the aim of this study is to critically examine what kind of pedagogical practices actually hold value in the current society, and moreover, what kind of activities could increase the meaningfulness of school tasks, and thus, engage students.</p> <p>The study consists of examining the topic in relation to relevant theoretical framework as well as through empirical research. The qualitative case study was conducted by interviewing teachers (N=5). The teachers took part in the <i>Innovative Technologies for an Engaging Classroom</i> –project between the years of 2010 – 2014. The aim of the interviews was to examine the teachers' experiences and understanding related to meaningful and engaging pedagogical practices.</p> <p>The study introduces <i>designing in education</i> and <i>design-oriented pedagogy</i> as possible solutions in addressing the issue of relevancy and meaningfulness in school activities in the 21st century. Designing can be described as a form of student-centred project work in which the students are highly involved in every phase of the learning process, from planning to execution. The teachers provide guidance and support for students, encouraging collaboration in finding relevant solutions to tasks. Furthermore, the integration of the students' personal interests and expertise as well as the integration of the community members and outside-of-school experts are seen as essential elements in a stimulating and engaging learning experience.</p> <p>Based on the findings of this study, the engagement of students was found to increase in cases where the activities were inquiry-based, student-centred, and open for multiple ways of execution. Often, the collaboration of students produced innovative and novel solutions to tasks. Furthermore, in such cases, the teachers experienced themselves as stimulators, guiders, and enablers in the learning processes of students.</p>			
Asiasanat/Keywords: Design education, collaborative learning, 21st century learning			



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Tiivistelmä/Abstract <p>Suomalaisten lasten heikko koulumotivaatio ja -viihtyvyys ovat viime aikoina nousseet esiin useissa tutkimuksissa. Yhtäältä syynä tähän mainitaan erityisesti kuilu oppilaiden omien mielenkiinnonkohteiden ja opetettavien sisältöjen ja työskentelytapojen välillä. Toisin sanoen koulussa harjoitettavia taitoja ei koeta käytännönläheisiksi. Toisaalta koulutehtäviä ja niiden tavoitteita on kyseenalaistettu myös työelämässä tarvittavien taitojen näkökulmasta. Esimerkiksi 2000-luvun digitaalisuus ja älylaitteet haastavat opetusta omalla tavallaan; oppilaille on opetettava enenevässä määrin multimediaaitoja sekä kykyä kriittiseen ajatteluun.</p> <p>Tämän tutkimuksen tavoitteena on tarkastella, millaiset pedagogiset käytänteet voivat vastata nyky-yhteiskunnan haasteisiin. Tavoitteena on myös selvittää, millaiset toimintamallit voivat parantaa oppilaiden kouluviihtyvyyttä ja näin ollen edistää oppilaiden sitoutumista koulutyöskentelyyn.</p> <p>Tutkimus koostuu tutkimusaiheen teoreettisesta tarkastelusta sekä empiirisestä tutkimuksesta. Laadullinen tapaustutkimus toteutettiin haastatteleamalla perusasteen opettajia (N=5). Opettajat osallistuivat <i>Innovative Technologies for an Engaging Classroom</i> –hankkeeseen vuosien 2010 – 2014 aikana. Haastattelujen tarkoituksena oli tarkastella opettajien käsityksiä mielekkäistä oppimiskäytännöistä.</p> <p>Tutkimuksessa esitellään käsitteet <i>design-opiskelu</i> ja <i>design-orientoitunut pedagogiikka</i> mahdollisina ratkaisuin 2000-luvun pedagogisiin haasteisiin. Design voidaan määritellä oppilaslähtöiseksi projektityöskentelyn muodoksi, jossa oppilaat osallistetaan prosessin jokaiseen vaiheeseen aina suunnittelusta toteutukseen. Opettajat tukevat ja ohjaavat oppilaita prosessin aikana ja kannustavat oppilaita yhteistyöhön ongelman ratkaisemiseksi. Lisäksi oppilaiden omat kiinnostuksenkohteet ja heidän asiantuntemuksensa nähdään osana mielekästä ja innostavaa oppimiskokemusta. Ulkopuolisten asiantuntijoiden ja muiden yhteisön jäsenten osaamisen hyödyntäminen nähdään myös tärkeäksi osaksi oppimisprosessia.</p> <p>Tutkimuksen tulokset osoittavat, että oppilaiden sitoutuminen koulutehtäviin kasvoi tilanteissa, joissa tehtävät olivat oppilaslähtöisiä, tutkivan oppimisen menetelmiä hyödyntäviä sekä useita erilaisia opiskelumenetelmiä yhdisteleviä. Oppilaiden yhteistyön tuloksena ongelmiin löydettiin usein innovatiivisia ja uudenlaisia ratkaisuja. Kyseisissä tapauksissa opettajat kokivat oman roolinsa stimuloijiksi, ohjaajiksi ja mahdollistajiksi oppilaiden oppimisprosessissa.</p>			
Asiasanat/Keywords: Design-opiskelu, yhteisöllinen oppiminen, 2000-luvun oppiminen			

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1 INTRODUCTION

Since the November of 2012, I have been fortunate enough to have had a chance to work with Pasi Kurttila and Markku Lang on the two amazing projects; *Muuttuva Oppimaisema (Changing Learning Landscapes)* and *iTEC, Innovative Technologies for an Engaging Classroom*. In Finland, Kurttila and Lang have been leading these projects; encouraging educational professionals in rethinking their practices, experimenting with modern learning tools, and creating novel pedagogy to suit the 21st century.

Working on these projects has also led me to question the currentness, appropriateness and authenticity of our present ways of teaching and learning at schools. In the past decades, the focus has strongly been on studying and processing information from printed materials (i.e. books, research articles, etc.), but the current generation, the children born in the 21st century, have been welcomed to the world of multimedia with strong emphasis on digital representations. The multimedia, the information and communications technology (ICT), as well as the effortless “twenty-four-seven” access to the Internet, is what has led the current younger generation to become creative and efficient users of these digital tools – so called *digi-natives*. (Järvelä, 2014a: 5.) From the point of teaching and learning, this now means that the students have equal access and opportunities to find information, and they are able to better regulate their learning according to their personal interests.

These digital elements in learning in the 21st century force us to change and re-define the meaning of pedagogy and didactics in the field of educational sciences. Where in the past, one of the most important roles of the teacher was to provide the students with information, now, the challenges of the profession are not necessarily related with how to teach and pass on information, but rather in finding ways of pedagogically guiding the students in their learning processes (Palincsar, 1998: 346 – 349). In other words, while learning might have previously been associated with the modelling of the teachers’ examples and the mastering of the same set of skills, now, competencies such as creative problem-solving, collaboration and self-regulation seem more valuable (Nelson, Stolterman, 2003: 3).

This further introduces the second area of interest of this thesis: a variety of research suggests that collaborative learning, meaning the interactive learning processes amongst peers, show to be more productive, creative, and meaningful than many of the teacher-led learning scenarios have shown to be. Furthermore, studies show great results in utilizing stu-

dent-centred, self-regulated learning activities. (Seitamaa-Hakkarainen, 2011: 3 – 12.) However, even though many pedagogical professionals seem to be aware of these facts, conducting such learning activities does not seem to be as easy. In fact, it is usually precisely seen as the problem. For this reason, there is a need for conducting studies such as this. More information on how we, as current and future teachers, could develop our teaching practices to truly match the world we now live in is needed. Therefore, the aim of this study is to critically examine what kind of pedagogical practices truly hold value in our current time. The more specific research questions of this thesis are the following:

- 1) What kind of pedagogical practices actually hold value in the current society, and moreover, what kind of activities make learning meaningful?
- 2) What is Design Education and how can we benefit from its ideology in our teaching practices?
- 3) In relation to the information and communications technology (ICT) becoming one of the most dominant learning tools of the 21st century, how do teachers understand their role as educators?

The first question aims to discuss the relevancy and habits of our dominant pedagogical practices on a larger scale, while the second question focuses on the phenomenon of designing in education more specifically: how it is understood both theoretically and in the empirical findings. Finally, the third question assesses the ways in which the everyday use of the information and communications technology inevitably changes our pedagogical practices, as well as the role of the teachers in the classrooms.

In relation to the research questions, and especially in relation to my personal history, the nature of the *Innovative Technologies for an Engaging Classroom* –project must briefly be explained. According to the official webpage:

iTEC is a four-year project in which European Schoolnet is working with education ministries, technology providers and research organisations to transform the way that technology is used in teaching and learning. With 26 project partners, including 14 Ministries of Education, and funding of €9.45 million from the European Commission's FP7 programme, iTEC is the largest project undertaken by European Schoolnet to date, and the largest initiative yet on the design of learning and teaching for the future classroom. (iTEC webpage, 2014.)

When the project began in 2010, the first tablet-computer had just arrived. The teachers participating in the first pilot in 2011, were eager to integrate the new technology as a part of their teaching, however, in ways that would not interrupt other experiences shared at school. In Finland, teachers used the technology to enable collaborative learning: for reaching out to expertise outside of school, and for digital reflection tools (such as blogs and broadcasting) to document student learning. Furthermore, the upcoming years introduced the arrival of several new technological devices and software, leaving the teachers to experiment their use pedagogically. (Kurttila, Lang, 2014a.)

By the year 2013, ITC-tools had become a normal part of our everyday interaction, also shifting the emphasis of technology in the fourth piloting cycle of iTEC. The focus of the pilots came to be on creating meaningful learning scenarios and activities that would stimulate the students, and engage them in collaborative inquiries making use of technology if needed. Pedagogically, the aim was to enable and encourage innovation and practice skills of creative problem-solving, often proven to be needed in later life. (Kurttila, Lang, 2014a.)

Currently, the iTEC –pilots have been executed in over 2500 classrooms all over Europe, introducing modern project activities for teachers and students. (iTEC webpage, 2014) In my two years of work experience on the project, I have also become inspired by these learning stories and have wanted to research the field even further. This thesis is an attempt on this.

1.1 Structure of the Research Report

The research report will proceed in the following way:

The empirical study of this thesis will be described first, as after this, the empirical findings proceed throughout the thesis alongside the theoretical framework. In relation to the empirical study, the nature of the chosen research methods will be described first, after which, the analysis procedure will be explained.

From the third section onwards, the results of the study are discussed in relation to both literature and the empirical findings; the theoretical framework is supported by discussing findings found from the empirical data.

Throughout the third section, the different concepts related to designing in education are discussed in somewhat chronological manner; with each introduced element, the section builds up the understanding of the reader on the phenomenon of designing in education. As is understood towards the end of the study, the first two research questions are highly linked with one another. The second question, related to designing specifically, is viewed as a sub-question in the discussion of valuable and meaningful pedagogical practices. Therefore, sections **3.2 DESIGN EDUCATION** and **3.3 DESIGN AS A PROCESS**, aim to answer the first two research questions. Furthermore, sections **3.4 CHANGES IN PEDAGOGY** and **3.5 21st CENTURY SKILLS** aim to answer the third research question, on the topic of recent changes in pedagogical practices and the role of teachers, also further discussing perceptions of meaningful and valuable pedagogical practices.

Since designing in the field of education is quite a new topic, not much suitable literature is yet available. Theoretical framework on design-oriented pedagogy produced by; J. Enkenberg et al., and K. Hakkarainen & P. Seitamaa-Hakkarainen et al., is used considerably. Of course, relevant literature on the relating themes is also used as support (i.e. the works of S. Järvelä, K. Lonka, S. Mitra). In addition, classical views on designing by N. Cross, and H. Nelson & E. Stolterman are represented, and furthermore, views from historically relevant educational psychologists have also been added to increase the reliability of the study. As one of the main findings suggests, designing is a natural way of processing the problems around us, and is therefore already visible in many historically relevant educational paradigms.

2 THE EMPIRICAL STUDY

This study is a qualitative research in which the theoretical framework and the empirical findings proceed through the thesis alongside one another. Even though the simultaneous consideration of both theory and empirical analysis is not the most typical way of conducting such research, according to Eskola and Suoranta (2003: 240 – 242), the method is often used to emphasise the connection between the two; findings from the theoretical framework are further discussed or explained by bringing up a discovery from the empirical data to support one's interpretation. In regards of this research, the simultaneous approach was found as the most suitable way of analysing the data, as the gathered data was so contently rich, and moreover, both the theoretical and empirical findings discussed a rather ill-defined phenomenon (design in education) bringing about a need to present the phenomenon from different perspectives simultaneously. As the writer, I also noticed that the findings from the interviews naturally fitted alongside the theory, as the teachers' comments made such professional and incisive additions to support the theoretical findings. By only analysing the data as a separate section, my interpretations on the theme would not have necessarily reached its fullest potential. This is why the simultaneous approach on both the theoretical framework and empirical findings was chosen.

This thesis addresses the empirical findings first, followed further by simultaneous reflection on both the theoretical framework and some empirical findings as support. Finally, in the concluding sections, the empirical findings are gathered in repetition to discuss the reliability and validity of the study in the light of the theoretical findings as well.

Now, in the following chapters, the qualitative methodologies of case study and phenomenography will be explained, followed by exploration of the data collection and the qualitative content analysis process.

2.1 Methodology

Like many educational and social studies, this thesis is carried out as a qualitative study. According to the qualitative paradigm, reality is constructed through social experience, visible in interaction. Qualitative research does not place much value on the quantity, amounts, or frequency of the found results, but rather focuses on the interesting details that

a data may withhold; such as in how individuals construct, process and give meaning to different concepts and phenomena (Denzin, Lincoln, 2003: 1 – 13.).

This thesis studies the phenomenon of *design education* and *design-oriented pedagogy* from a phenomenographic point of view. However, because the simultaneous approach of discussing the theoretical framework and the empirical data was chosen, the analysis procedure was not conducted in traditional phenomenographic manners, but rather according to the paradigms of qualitative content analysis (Eskola, Suoranta, 2003: 68 – 70). The relationship between the used research methods will now be further be discussed:

The nature of phenomenographic research is often inductive, meaning that the analysis of the empirical data often begins by examining the found details; similarities, differences and interesting remarks on the perceptions of a certain phenomenon – and from these empirical findings, more abstract and theory-related concepts are formed. (Niikko, 2003: 8 – 30 ; Metsämuuronen, 2006: 108 – 109) In this study, the relationship between the empirical findings and the theoretical framework is more complex. Due to my work experience, I have been exposed to the teachers' and other professionals' thoughts prior to conducting the interviews for this research. Therefore, I cannot purely state that the empirical findings and conclusions of this study are only gathered from the interviews, further supported by the theoretical framework. My prior knowledge and interest on the topic have inevitably effected the outcome, making the line between the theory and empirical findings harder to define.

The simultaneous style of discussing both the empirical findings and the theoretical framework does not suit the phenomenographic paradigm at its best, but rather asks for more multifaceted ways of conducting analysis. Therefore this thesis is rather a qualitative, theory-driven study, in which some of the phenomenographic paradigms are followed. Additionally, the thesis also withholds features of a qualitative case study due to the unique nature and the singular presentations of the iTEC –project. (Cohen, Manion, Morrison, 2000: 181 – 185.) In the following, these research styles will be further explained.

2.1.1 Case Study

A case study examines a single instance; such as a person, event, or community, and with the exploration of that specific case, aims to discuss the chosen themes more generally. A

case study evaluates an instance in action, analysing the interactions between people in a certain context. The approach also recognizes the effects and power different contexts may have – the dynamics of people in unique contexts can expose novel, rich and vivid content to the researcher. On the other hand, disadvantages in case studies usually relate to failures to later on in the attempts to repeat the study, and this, of course, decreases the reliability of the study. Nevertheless, case studies often present interesting examples to its audience. (Cohen et al., 2000: 181 – 185.) In this case, this research began by examining the iTEC – workshops of the participating teachers. From my viewpoint, by observing the teachers at work, the themes and topics of this thesis advanced from theory to practice. Therefore, the very essence of this thesis resembles a case study.

2.1.2 Phenomenography

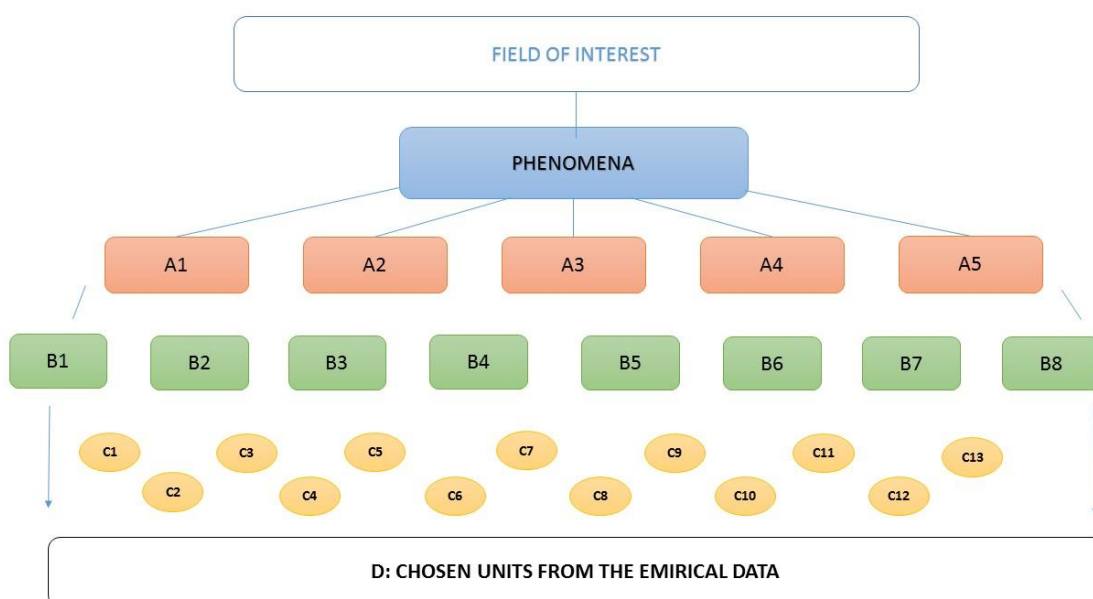
The word *phenomenography* comes from the Greek words; *fainemon* (appearance) and *graphien* (description), meaning a study of interpreting how a phenomena appears or is understood by individuals. Phenomenographic research is not interested on the quantity of the found results, but rather on the interesting descriptions and differing perception of individuals on a certain concept or phenomenon. Each individual sees the world through a personalised lens, constructing and processing information uniquely. Therefore, phenomenography is the study of secondary perceptions, as the person conducting a phenomenographical study cannot purely state the findings as they are, but introduces them through personal understanding. According to Niikko however, by examining a variety of individual interpretations, we are able to find common perceptions on which to build shared understanding upon. With these findings, we are able to view the values, beliefs and philosophy of the dominant culture around us. By interviewing the teachers on their perceptions on meaningful pedagogical practices, on their role as pedagogical professionals at school, and on the perceptions they have on designing in education, I hope to find valuable understanding on how schools as learning facilities could foster designing and successfully execute meaningful pedagogical practices. (Niikko, 2003: 8 – 10, 25 – 28.)

The most common phenomenographic way of gathering data, is through the use of individual, open-structured or semi-structured interviews. The aim of an interview is to gather information on the relationship between an individual and the phenomenon in question. A phenomenographic interview process is an interactive dialogue between the interviewer

and interviewee. It consists of larger, rather open questions, formed around the phenomenon. The trusting and dynamic relationship between the interviewer and the interviewee is seen as a key element in a successful interview: the interviewee is encouraged to reflect and share his/her understanding on a phenomenon from multiple dimensions, while the interviewer sensitively further guides the process by conducting possible sub-questions on the topic. Furthermore, by not conducting a too structured interview, the dialogue may proceed to a deeper understanding on the relationship between the individual and the phenomenon – the answers of the interviewee are actually the elements shaping the interview process. (Niikko, 2003: 31.) The interview procedure of this study was developed to allow precisely this.

According to Niikko (2003: 33 – 41), an understanding of the interviewees perceptions on a phenomenon is developed through careful analysis of the empirical data. Structure and form is given to a certain phenomenon: by selecting different meaningful expressions, *units*, from the data, by grouping each of the units to present a theme, and by grouping those themes to present larger essential elements of a phenomenon. The following represents this process.

Image 1: The Writer's Presentation of Niikko's Phenomenographic Analysis Process



Level **D** represents the chosen units found from the empirical data, while levels **C** and **B** represent the grouping of the units into themes to produce different categories and sub-categories. Finally, the level **A** boxes resemble larger sub-topics connecting the findings from the empirical data with the *theoretical framework*. Each sub-topic resembles an important element of the phenomenon in both the theory and the empirical findings.

Critique on phenomenographic research has also been put forth. Some argue that all phenomenographic findings are highly context bound, too personal, and even false information; when circumstances change, understanding and interpretation of a phenomenon also changes, leaving the significance of a phenomenographic study rather small. (Metsämuuronen, 2006: 109 – 110.) In the case of my research, the circumstances, the context, and the background of the interviewed teachers most definitely affect the findings. Already the aspect of seeking for additional professional training (in the form of the iTEC –project), states the teachers’ willingness of wanting to develop their pedagogical practices. This of course, is not the case in regards of all teachers in Finland, but rather a very specific group of people. Nevertheless, due to their pedagogical expertise, I find that studying their perceptions on meaningful pedagogy may show to be useful information for everyone in the field. Therefore, the phenomenon of designing in school contexts is analysed in a phenomenographic manner.

2.1.3 Qualitative Content Analysis

To support the phenomenographic analysis model, Tuomi and Sarajärvi’s (2004: 105 – 107) model on qualitative content analysis was chosen to be introduced. Tuomi and Sarajärvi see content analysis as a possible way of systematically and objectively analysing a variety of empirical data in its written form. A content analysis does not conclude findings in itself, but rather organises the data into a form from which findings are easier to conclude. Since the relationship between the empirical data and the theoretical framework showed to be more complex, content analysis was found to support the phenomenographic paradigm well.

Usually, three different ways of conducting a content analysis are recognized: *inductive*, *deductive/theoretical*, or *theory-driven content analysis*. In this case, the theory-driven analysis was chosen to interpret the data, because it allowed the introduction of multiple theoretical findings to discuss a phenomenon. In my opinion, the theory-driven analysis

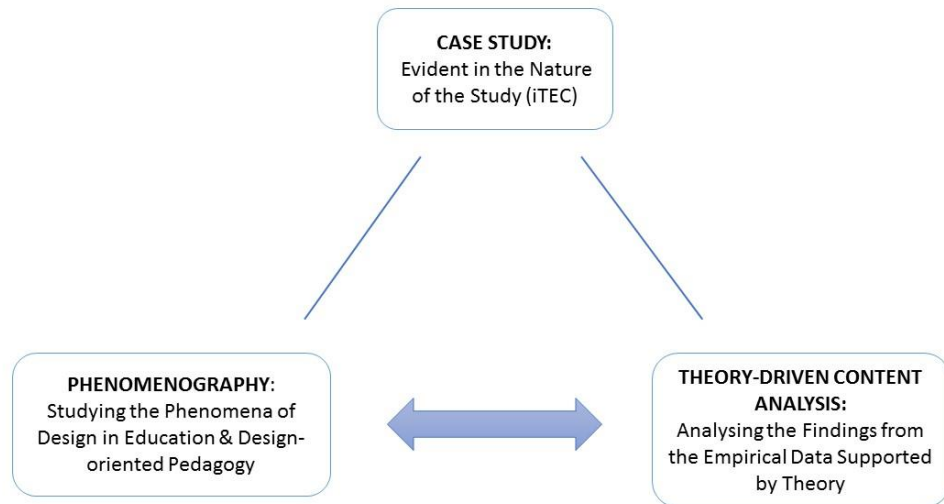
suits the ill-defined phenomenon of designing in education especially well, and furthermore, supports my choice in the style of simultaneously addressing both the empirical findings and the theoretical framework (Tuomi, Sarajärvi, 2004: 98 – 99.).

Similarly to Niikko's phenomenographical model, Tuomi and Sarajärvi's model (2004: 108 - 111) consists of the following steps: **1) Reduction of the data, 2) Clustering of the data, and 3) Abstraction of the data to support the theoretical framework.** More specifically, the process consists of the following:

1. Transcribing the interviews word for word
2. Reading the interviews and familiarizing with the content
3. Searching for themes and underlining them
4. Listing the themes
5. Searching for similarities and differences among the themes
6. Uniting the themes and forming sub-categories
7. Uniting the sub-categories and forming (the main) categories
8. Uniting the categories to represent the phenomenon as a whole

As a conclusion, the analysis of this study is based on phenomenographic traditions in relation to studying the phenomenon of designing in schools. Originally, the plan was to analyse the data in a purely phenomenographic manner, but throughout the process of analysis, more multifaceted ways of explaining the data had to be added. Therefore, theory-driven procedures were also included to support my choice in simultaneously discussing both the theory and the empirical findings. Once the simultaneous approach was chosen, the manners in which different sub-topics would be introduced, became very clear – the report found its structure. Furthermore, the unique nature of the iTEC –project must not be forgotten either; my interests on the topic as well as the element of finding which teachers to interview, present the nature of a case study. The following image further demonstrates the complex relationship between the research methods used in this thesis.

Image 2: The relationship between the used research methods



2.2 Collecting Data

For gathering the empirical data for this research, the execution of semi-structured interviews was chosen. Even though meaningful pedagogical practices could have been discussed in a quite open dialogue, designing in education is a more unknown, ill-defined phenomenon in need of more structured questions.

For the empirical data, I chose to interview five teachers, coded as T1, T2, T3, T4 and T5 in this thesis. Between the years of 2010 – 2014, all of the five teachers participated in the *Innovative Technologies for an Engaging Classroom* –pilots in Finland. By working on the project and being able to observe the teachers at work, I chose to ask to interview teachers representing a heterogenic group among the Finnish iTEC –participants as a whole (approximately 80 teachers took part in the cycles in Finland). The five teachers differed in working experience, age, gender, residential area, taught subjects, and age level of taught students.

All of the five teachers were Finnish native speakers and taught by using Finnish as their primary language of instruction. Therefore, I wanted to interview the teachers in their mother tongue. This was also done to make sure that none of the teachers' thoughts and expressions would fall short due to possible shortage in their English language vocabulary

or grammar. Instead, I chose to translate the interviews into English as a later step. Therefore, all of the teachers' comments are my interpreted translations. Both the English and Finnish interview structures are attached as an appendix, *Appendix 1*.

2.3 Analysis

The following presents an example of this research report's analysis procedure according to Tuomi and Sarajärvi's model (2004: 108 - 111). After carefully familiarizing with the empirical content, the teachers' original statements were reduced into sub-categories, and by uniting the similar categories, larger themes were formed. The following presents an example of this process:

1) Reduction of the data:

Original Statement: *"...once you start to look, you notice that every student has made progress. Only in a few weeks' time, their actions have already become goal-oriented and extremely determined."* T4

➔ **Reduction:** Inner motivation

Original Statement: *"The older the students get, the more responsibility we should give them."* T1

➔ **Reduction:** Responsibility of one's own learning

Original Statement: *"I think schools should demand self-regulation from students. Not right away, but once they get slightly older... I think it's one of the most important things; to be able to plan one's own schedule, know one's own abilities, and be able to challenge oneself once in a while."* T2

➔ **Reduction:** Skills of life management

2) Clustering of the data:

Inner motivation Responsibility of one's learning Skills of life management

➔ SELF-REGULATED LEARNING

3) Abstraction of the data to support the theoretical framework:

“Self-regulated learning is an active, constructive process whereby learners set goals for their learning and attempt to monitor, regulate, and control their condition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment”. (Pintrich, 2000: 453)

“Self-regulating learners control their emotional state, adapt to the surrounding environment to better support their goal striving, and seek help when needed.” (Järvenoja: 2010: 22)

➔ Self-regulated learning as an essential element in designing in educational contexts, noted in both the chosen theoretical framework as well as in the empirical findings. The teachers' original statements support the theoretical descriptions of self-regulated learning, allowing the reader to see the theory in relation to the everyday practices of teachers.

However, while executing the procedure, some of the original statements were more difficult to reduce into sub-categories or themes; some of the statements were ambiguous in nature and unique in tone. It is also for this reason that the most significant statements from the empirical data were chosen to be presented alongside the theoretical framework – none of the intriguing details in the original statements get lost, once reading them singularly throughout the text.

From the aforementioned analysis process, five supporting themes, found from the theoretical framework and further supported by empirical findings, were gathered to support the phenomenon of *design education*:

1. The Design Process

2. Collaborative Learning

3. Self-regulated Learning

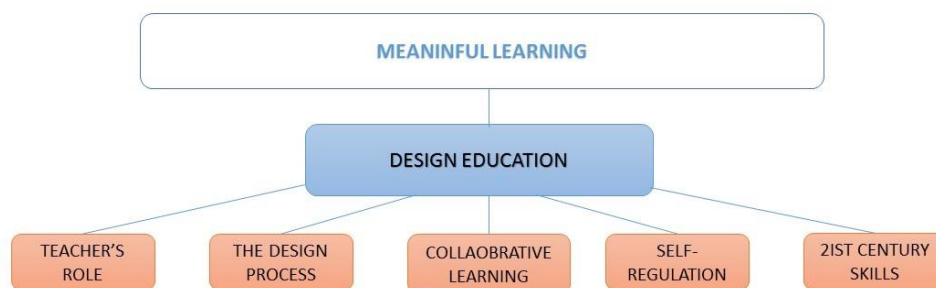
4. Teachers' Role

5. 21st Century Skills

The sub-categories for each theme are found in **Appendix 2**, further demonstrating the process of analysis.

When viewing the found themes from a phenomenographic point of view, they each represent an essential element of the phenomenon of design education. Furthermore, based on the findings, *meaningful learning* is seen as an “umbrella concept” and main reason for fostering designing in education. The following image presents these relations.

Image 3: The Phenomenon of Design Education



The image further demonstrates that as *meaningful pedagogy* and *designing in education* are such large scale concepts, introducing the empirical data and theoretical findings separately would have enlarged the thesis into something quite clumsy and impractical. Therefore, the simultaneous approach was found as especially useful. The following table, **Table 1.**, demonstrates the relationship between the theoretical framework and the empirical findings, also introducing some of the underlying themes under each sub-category.

Table 1. Theoretical and Empirical Findings alongside One Another

THEME	<i>Example from Theory</i>	<i>Example from Empirical Data</i>
<p>The Design Process:</p> <p>Innate ability to create Natural Meaningful Novel</p>	<p><i>“Genesis is ongoing. As human beings, we continuously create things that help us form the basis of the world as we know it. When we create these new things – tools, organisations, processes, symbols and systems – we engage in design.” (Nelson, Stolterman, 2003: 1)</i></p>	<p><i>“What stimulates them, is the fact that they get to be involved in the planning. They get to suggest and design. Those are the type of situations that allow realization and that epiphany and joy of ‘hey, now we’ve come up with something new’ to happen.”</i> <i>T2</i></p>
<p>Collaborative Learning:</p> <p>Shared meaning-making Interactive learning Student-centred learning</p>	<p><i>“A coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem” (Dillenbourg, 1999: 12)</i></p>	<p><i>“...mainly, they seem to prefer it to be a bit more free. To be able to make their own choices along the process and to be able to work together.”</i> <i>T5</i></p>
<p>Self-regulated Learning:</p> <p>Self-regulation Self-assessment Differentiation Self-organised learning environments</p>	<p><i>“Self-regulated learning is an active, constructive process whereby learners set goals for their learning and attempt to monitor, regulate, and control their condition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment”. (Pintrich, 2000: 453)</i></p>	<p><i>“I thought it was quite close to an idealistic learning process... The way it formed an entity – and how assessment was naturally involved in each step. The students were goal-oriented, cooperative and interactive... and motivated. -- I’d like more of that to support all the factual content that the students need to learn; so that they would want to develop novel things, train</i></p>

		<i>their memory in new ways, and learn different ways of constructing information.” T4</i>
<p>Teachers’ Role:</p> <p>Stimulator</p> <p>Guider</p> <p>Enabler</p> <p>→ Interactive learning environments</p> <p>Current and relevant pedagogy</p> <p>Design-oriented pedagogy</p>	<p><i>“--teachers’ or other supporters’ deliberate efforts are needed to develop new pedagogical and social infrastructure.” (Ruismäki, Ruokonen (Eds.), Seitamaa-Hakkarainen, 2011: 9)</i></p>	<p><i>“I see myself as a coach – or something along those lines. Teaching has changed and is changing all the time. Now, teaching is rather enabling matters and making oneself needless. We need to have the courage to take a few steps back and let the kids figure it out when things seem to start rolling. Nowadays, the emphasis is on pair work, group work, and overall, the ability to engage with others.” T1</i></p>
<p>21st Century Skills:</p> <p>Problem-solving</p> <p>Creativity</p> <p>Collaboration</p> <p>Novel solutions</p> <p>Designing</p>	<p><i>“Creativity, which is concerned with problem-solving, is essential if we are to generate new solutions to massive and complex problems in the unknown future. Our next generation needs an educational platform where they can be taught to possess creativity. Design education is such a way to foster students’ creativity.” (Siu, Wong, 2011: 437)</i></p>	<p><i>“We need to guide the children to see certain things; the things that can be changed from the things that cannot be changed. They need to be able to separate the two, and learn how to grab onto the things that can be changed; to be brave and entrepreneur-like – and design.” T4</i></p>

3 RESULTS BASED ON CHOSEN LITERATURE AND EMPIRICAL FINDINGS

In the following, the theoretical framework and the empirical findings proceed through the thesis alongside one another. The final conclusions drawn from the empirical data are future discussed in section, *4.1, Summary of the Main Results*. A reader may either choose to read the conclusions drawn of the empirical data straight away, or alternatively, first read the sections in between to see how the teachers' comments support the theoretical framework.

3.1 In Search for Meaningfulness

As is known, a variety of research is done every year to examine both the success and the enjoyability of the students at their schools. Last year, one of the most famous international studies, *PISA (the Programme for International Students Assessment)*, showed that while Finland still continues to thrive success wise, our students do not seem to enjoy their time at school as much; based on the results, Finland was the sixtieth country on the chart (OECD-webpage, 2014). While these results may leave many matters aside, such as culture, characteristics, and so on, the study undoubtedly states that something has to be done to raise the level of the students' motivation.

Fortunately, research has also been done on school enjoyability. As an example, Professor of Educational Psychology, Kirsti Lonka, currently leads a *Mind the Gap* –research project with an aim to find out more about the reasons behind poor school motivation. According to the group's findings, the “gap” between school contents (topics and learning practices) and the students' interests outside of school seem to differ even more from one another (Lonka, 2014) – the learning scenarios at school are not experienced as authentic or practical enough. In other words, students may not actually believe that they will benefit of some of the skills taught at school in their future. According to Sugata Mitra (2013: 1), Professor of Educational Technology at the University of Newcastle, these worries are not entirely groundless:

We have a romantic attachment to skills from the past. Longhand multiplication of numbers using paper and pencil is considered a worthy intellectual achievement. Using

a mobile phone to multiply is not. But to the people who invented it, longhand multiplication was just a convenient technology. I do not think that they attached any other emotion to it. We do, and it is still taught as a celebration of human intellect.

To clarify, in his article Mitra is not stating that longhand multiplication is not a needed skill, but simply that it is not an achievement in itself any longer. Multiplication is one of the most basic mathematical skills – and without a doubt, it still needs to be taught – but because we now have technology that can also do the calculations for you, other types of stimulus are needed to keep the students motivated. This leads us to think of the worthiness of certain skills taught at school: what is the purpose behind each taught skill in the time being?

Mitra also questions the current exam scenarios in which students are made to individually reproduce facts from their memory: *“They do not talk to anyone or look at anyone else’s work. They must not use any educational resources, certainly not the internet. But when they complete their schooling and start a job, they are told to solve problems in groups, through meetings, using every resource they can think of. They are rewarded for solving problems this way – for not using the methods they were taught at school”*. (Mitra, 2013: 1.) In relation to this, Professor Jorma Enkenberg shares his findings on studies that show the students’ wishes to work together in groups, on practical matters, and with ICT-tools. Enkenberg also states that in order for learning to be truly meaningful, it has to be related to and appeal to the practicalities of the dominant surrounding culture. (Enkenberg, 2012: 2 – 6.) The lack of natural interests on the topics at school was also evident in the empirical data of this research:

“At the end of the day, many of the topics in the curriculum, and there are many of them, are such that do not naturally interest the children.” T4

“Well, for some the topic in itself is really interesting and that will spark them up and get them going. But if the topic does not naturally interest some of the kids, I have to focus on the way I present the topic to them – and that’s the trickier part: to make it interesting for all of them so that learning would happen as an outcome.” T1

To conclude, by looking at some of the most current research, it seems that the students presently attending their basic education find the type of learning scenarios meaningful that introduce authentic, real-world phenomena and give them a chance to engage in collabora-

tive and creative learning situations. (Enkenberg, 2012: 10.) As an example, right now it seems that the natural way of finding out information, often through the use of ICT-tools, is not used at schools to its fullest potential. It also seems that the “gap” between schools and the interests of the communities keeps on getting wider, as the content of the curriculum does not match the challenges we face or the development that is visible in the world we live in today. However, one of the interviewed teachers explained;

“The hard thing is that we should be able to educate the students, and together, practice the competencies that they will need in their future professional lives... But those professions don’t necessarily exist yet. This gives the school quite a responsibility.” T1

The Finnish National Curriculum is being developed as we speak, and presumably, the intention is to increase the teaching of digital processing and handling of the multimedia. However, there is a valuable point in the above comment: what other competencies are worthy of being taught, if we do not know how the future will shape out to be? How could educational professionals maintain schools as the interesting knowledge-construction communities that they should be?

This study presents *design education* in providing essential tools for enhancing relevance and meaningfulness in schools. The following chapters will introduce the phenomenon of design education in more detail; attempting to answer the second research question on the ideology of designing in educational settings.

3.2 DESIGN EDUCATION

The following quote aims to describe the essence of designing: *“Genesis is ongoing. As human beings, we continuously create things that help us form the basis of the world as we know it. When we create these new things – tools, organisations, processes, symbols and systems – we engage in design.”* (Nelson, Stolterman, 2003: 1.)

In other words, designing is a natural human ability. Whether we are conscious of it or not, on a daily basis, we come across these novel, ill-defined problems with a personal desire of wanting to solve them in a relevant manner. While we figure out how to best tackle these problems, we usually reflect our actions in relation to the surrounding environment, as well as in relation to the available resources and assistance around us. If the problem is similar to what we have experienced before, we tend to memorise the previous processes and

adapt them to suit the present problem. However, if we are facing a totally new type of problem, we are forced to come up with a brand new solution – this explains the philosophy of designing and of design-based learning at its core. Designing is about finding new and relevant solutions to real-world problems around us. (Seitamaa-Hakkarainen, 2011: 3 ; Nelson, Stolterman, 2003; 2 – 10.)

A design *problem* is usually open-ended and the *process* typically includes both creative thinking and problem-solving, as well as innovative activity. Innovation tends to differ from the outcomes of creativity, as it is often action-oriented and “--*achieved through the manifestation and integration of creative concepts into the real world. Design is also a compound of rational, ideal and pragmatic inquiry – constituted of reflective thinking, productive action and responsible follow through.*” (Nelson, Solterman, 2003: 4 – 5.) During a design process, a person usually seeks for information and manipulates that information and knowledge to come up with a novel solution (Siu, Wong, 2012: 437). Designing is about engaging in knowledge-seeking inquiries and promoting one’s self-expression with novel, personal ideas (Seitamaa-Hakkarainen, 2011: 3 - 4).

The uniqueness of designing is also evident in its ways of constant self-reflection. A person engaging in design has to repeatedly look back at the process to be able to develop. The final outcome of the process can also be seen as a reflection of its success. Doppelt (2007: 57) explains the general steps of a design process in the following way:

1. Defining the problem
2. Identifying the need
3. Collecting information
4. Introducing alternative solutions
5. Choosing the optimal solution
6. Designing and constructing a prototype
7. Evaluation

As mentioned before, a successful design process is often related to its fruitful self-assessment practices. Often a person’s own assessment mirrors an authentic, purposeful learning path, turning the design product in itself into something purposeful as well.

Use in the field of Education

According to Enkenberg (2012: 6), in comparison to the present, the future seems to withhold more problems which require innovative and collaborative working methods and relate to understanding complex phenomena in their different forms and settings. Already today, professional fields are in need of people who are able to challenge the dominant ways of thinking: set themselves to see different tasks from other points of view, and tackle problems in creative, unforeseen ways. Siu and Wong (2012: 437) agree with Enkenberg:

Creativity, which is concerned with problem-solving, is essential if we are to generate new solutions to the massive and complex problems in the unknown future. Our next generation needs an educational platform where they can be taught to possess creativity. Design education is such a way to foster students' creativity.

The aim of designing and of design-oriented pedagogy, is to promote the type of competencies and skills at school that will most likely be needed by the future citizens of our societies in the future. The practices also aim to allow the students' own skills, prior knowledge and personal interests to shape the learning process, aspiring for deeper awareness in internal thinking, as well as intellectual, social and emotional development. As an outcome, the students will hopefully be comfortable and confident in integrating in the professional communities they choose to engage in, sharing their knowledge and skills with others. (Doppelt: 2007: 57 – 59 ; Enkenberg, 2012: 8.) The empirical data also showed many similar results:

“ – [as teachers] we create the opportunities for learning to happen; we motivate the students in the beginning and arrange the setting. But then, they are free to start wondering and processing the information – and that's how they'll usually learn for sure. They really seem to like the fact that the process is more free and they get to decide how they work. Of course there'll be conflicts among them, but we usually learn something from them too.”

T5

“The job of the teacher, is to give different alternatives to carry things through – while also listening to the students to see if they've come up with additional ideas as well.” T2

“We need to guide the students to see certain things: to understand what kind of things can be changed and what cannot. They need to be able to separate the two, and learn how to grab onto the things that are changeable; to be brave and entrepreneur-like – and design. I

think these things are related to one another; it is not enough to think 'Oh, I'll do good at school, learn the things I should, wait for a good enough job to come along, and then do the same thing for the rest of my life.' No. We have to think in a new way every day and stay current in our time. Each one of us is in charge of creating a job for ourselves, and in charge of marketing our own competencies and abilities in learning how to learn. I hope we won't get stuck into thinking 'this is how it's always been done, so why change anything'. Then we might also be blinded by the things that don't work well... But in these things too, we have to evaluate the process as a whole; not to change everything if it is not working for one student, but instead, make individual learning paths and differentiated solutions easier to carry through... And as teachers, just think of what things will end up falling apart if the students work on their own pace, as long as they are working on the verge of their own abilities." T4

As can be seen, many of the interviewed teachers showed high interest and passion in allowing the students to work in their own terms, adapting to the surrounding learning environment and coming up with creative and different working methods. On a larger scale, these methods relate to the philosophy behind design education.

Design education has a fairly simple philosophy at its core, but also shares some quite complex ideologies and practices. In order to truly understand the concept's versatile nature, one needs to look into the history of the educational sciences, as well as assess some of the more current ideologies related to designing in education. As mentioned before, on the basis of both the theory and the empirical data, five supporting themes were gathered to further explain the phenomenon: **1. The Design Process, 2. Collaborative Learning, 3. Self-regulated Learning, 4. Teachers' Role, and 5. 21st century Skills**. The thesis will touch upon each of these topics, simultaneously building up on the ideology of design education.

3.2.2 Development of Trends in Education

In the early 1900s, one of the most mainstream educational trends was behaviourism. Many psychologists, such as Pavlov, Watson and Skinner, believed that children were born as *tabula rasas*, blank canvases, and that their personalities could be shaped by the repeat-

ed practices represented to them throughout live. (Vilkko-Riihelä, 1999: 49 – 51, 317, 320 – 323.) In regards of teaching and didactics, this was manifested as an emphasis on direct instruction teaching, such as modelling the teacher and learning from demonstration. When looking at the teaching practices of today, we might notice that direct instruction teaching is still often used, and there are valid reasons behind it. In fact, while research shows direct instruction teaching to be an efficient way of teaching factual content, it also shows less results on the information transferring to deeper levels of cognitive understanding, reasoning and ability of using the information in new and different situations. (Palincsar, 1998: 346 – 347.)

Already in the late 1900s, behaviourism was overruled by the representations of cognitive psychology. Cognitivists argued that the personality is not only shaped by following existing models, but that the mind is full of personal meanings, *schemas*, which reflect the way a person constructs and processes knowledge in their memory. In the field of education, this introduced a spectrum of problem-oriented collaborative practices; “*Researchers hypothesized that by drawing upon a larger collective memory and the multiple ways in which knowledge could be structured among individuals working together, groups could attain more success than individuals working alone.*” (Palincsar, 1998: 349.) Furthermore, the famous Russian psychologist, Lev Vygotsky, came up with a socio-constructivist theory proving the great benefits of collaborative practices, or as he preferred to call it: *productive interaction*. Vygotsky’s theory on the Zone of Proximal Development, ZPD, highlights the differences between independent and collaborative problem-solving practices. The state of independent problem-solving, which a child is able to reach on their own, is viewed as the actual state of development, while the potential state may be achieved only through the help and collaboration of an adult or peers. The state in between these two is the *zone of proximal development* and it has been shown to be the most productive stage of learning, leading to greater levels of cognition. (Palincsar, 1998: 348 – 356 ; Vilkko-Riihelä, 1999: 216 – 218, 337 – 338.)

In his research, Vygotsky also emphasized the importance of the social surrounding. By *internalization*, he referred to the processes of socially and culturally relevant matters transferring into personalized meanings in interaction. More generally, the socio-constructivist paradigm is based on the following: learning and cognition cannot be separated from the social, cultural and personally meaningful contexts of the individual. Therefore, the believers of socio-constructivist psychology argue that teaching should always be

matched with the child's personal level of development, and linked with the socio-cultural surrounding. (Vilkko-Riihelä, 1999: 216 – 218, 337 – 338 ; Ageyev, Gidis, Kozulin, Miller, 2003: 1 – 39.)

In relation to the educational trends in the past, it now seems that in the 21st century, the most dominant practices base on both cognitive psychology and the concept of personalized schemas, as well as on socio-constructivist psychology and its views on the interdependence of the surrounding environment and the individual. It also seems, that while many educational professionals understand and agree with these findings, the successful execution of such activities is found as more difficult. Fortunately, studies on productive interaction and purposeful scaffolding methods have also been conducted; it seems that while adult-child learning situations have shown to be productive (as in the adult leading the process), interaction is often most productive when the participants are seen as equals in the process; sharing the same level of cognition and life-experience, and aiming for the same outcome. Often, these type of 'brainstorm sessions' are best formed amongst peers with whom interaction is more free and spontaneous. More generally, the described child-centred interactive learning processes go under the theme of *collaborative learning*, aiming at joint meaning-making and finding a common ground on which to build shared understanding upon. (Järvenoja, 2010: 31 – 34 ; Palincsar, 1998: 349 – 360.)

The following chapter will discuss collaborative learning practices in more depth, as according to research, student-centred collaborative learning practices have shown positive results in engaging students in school tasks. In this study, collaborative learning is seen as an essential element in the phenomenon of design education, and moreover, essential in regards of answering the first research question on meaningful and valuable pedagogical practices. (Dillenbourg, 1999 ; Enkenberg, 2012.)

3.2.3 Collaborative Learning

“If you think about it, that type of [child-centred, collaborative] learning situations are often quite chaotic and unpleasant for the teacher. Or it's not as convenient as everyone sitting still and quietly listening to you – I think that's the memory and ideal we've got from our own childhood... But that's just so rare nowadays, so it's better to put the kids to

work. Still, there'll be constant requests for you to show how, help out and tell them what's next. You'll have to present them with quite many alternatives and possibilities before the working becomes something even close to self-sufficient." T4

As this teacher points out, child-centred collaborative practices are often not as clearly formulated as the typical teacher-led teaching sessions would be. Due to this, it may not be as easy to find the needed pace and suitable working methods to foster collaboration. In order to weigh the true possibilities that collaborative practices offer for learning, the act of collaboration needs to be defined.

In collaborative learning, two or more people attempt to learn and understand something together. Collaboration among the participants can happen both consciously or unconsciously, or in face-to-face or other types of discourse. As mentioned before, collaborative processes are often quite freely formed, novel and creative, so timing (time frequency and repetition) and the physical learning environments are often shaped along the process to fit the needs of the participants in question. Sometimes, collaboration can be really intimate and happen between only a few people (in pairs or small groups). At other times, collaboration can involve an entire classroom, a community of hundreds, or even a society of thousands of participants. It all depends on the task at hand as well as the available interactive environments. (Dillenbourg, 1999: 1 – 12 ; Järvenoja, 2010: 31 – 33.)

Nowadays, with the help of the Internet, we are able to reach people from the other side of the world and expand our working environments even further. Collaborative learning can happen anywhere: in school, outside of school, via the Internet, in the form of creative activities and hobbies, and even through lifelong practices. Usually, in order for collaborative learning to be motivational and engaging, it happens amongst people with roughly the same level of cognition and roughly the same performance in action, working towards a common goal. (Dillenbourg, 1999: 1 – 12.) For these purposes, schools and other professional working environments often create the perfect platform for collaboration. *"The research on social creativity suggests that the core of humans' intelligent performance is not the individual mind but groups of minds in interaction with each other and with tools and artefacts (Fisher et al., 2005 ; John-Steiner, 2000). Collaboration and mediating artefacts have been found to be instrumental to human thinking processes."* (Seitamaa-Hakkarainen, 2011: 7.) As Seitamaa-Hakkarainen points out, working and learning through collaboration is a natural way of processing information. The empirical data suggests the same:

“...mainly, they seem to prefer it to be a bit more free. To be able to make their own choices along the process and to be able to work together.” T5

In other words, students may naturally desire to work with each other instead of learning through teacher-led practices. The realizations developed through peer-work often resemble natural collaboration and shared meaning-making and understanding, in equal levels of cognition. The participants co-regulate to achieve a common goal.

“What stimulates them, is the fact that they get to be involved in the planning. They get to suggest and design. Those are the type of situations that allow realization and that epiphany and joy of ‘hey, now we’ve come up with something new’ to happen.” T2

However, even though child-centred collaboration is often natural and productive amongst the students, the teacher’s role in the process is equally as important. As in Vygotsky’s theory, the *potential* zone of development is often reached with the guidance of an adult. (Vilkko-Riihelä, 1999: 218) Therefore, “--fostering learning through collaboration requires the teacher or tutor to design, enact and evaluate certain kind of teaching and learning settings, paying attention to the nature of the task, its context and supportive pedagogy”. (Seitamaa-Hakkarainen, 2011: 7.) In supportive pedagogy, the teacher’s role is to plan the outlines of the process, still leaving room for the students’ inquiries to lead the way. However, as pointed out earlier in this section, often a lot of ground work and practice has to be done in order for the practices to become student-regulated, collaborative processes, as student-centred learning situations often call for the ability to be confident in taking a bigger role in one’s own learning. The teacher’s job is to guide and support the students along the process through encouragement, different sub-tasks and other tentative practices.

“The younger the students are, the more visual and concrete things need to be. I think it’s as clear as that, whether it’s about mathematics or science and social studies – it’s the ability to observe and explore that is so very important.” T3

“I let the students come up with the questions, and at the end, we’ll come back to those questions and see what we have learned. That way, they feel like they’ve been heard and that really motivates them.” T5

So for teachers leading a collaborative learning process, the task is not to precisely teach, (to pass on information) but to rather introduce the theme, guide and show support along

the process. Section **3.4, *Changes in Pedagogy***, will touch upon the role of teachers as supportive pedagogies in more depth, as this section aims to discuss the starting points, nature and different aspects of collaborative learning. But, as one of the teachers plainly pointed out;

“In the end, I think it mostly comes down to really knowing your students and what they are into.” T1

Furthermore, instead of just the individual, collaborative pedagogy sees the whole group as the cognitive system; explaining one’s thinking to another further leads to deeper cognitive processing, and this in turn, triggers different learning mechanisms in the collaborative group. Moreover, collaboration amongst the participants creates additional useful competencies, such as; explanation, argumentation and disagreement skills, further leading to mutual regulation and internalisation. Working together has also shown to reduce the cognitive load of the participants. This may be one of the reasons for collaborative learning to be so enjoyable. (Palincsar, 1998: 349 – 353.)

In addition, one of the most important aspects of collaborative learning is, that the ability to collaborate and interact with others, is one of the most valuable skills needed after one’s basic education. In collaborative practices, individuals tend to engage in situations where the tasks and themes are somewhat new and unknown to them. Therefore, to find possible solutions to these tasks, the students learn to not only copy existing practices to produce duplicates, but show *competence* and skills in coming up with novel solutions, answering to a specific context and need (section **3.3.4, *Examples of Design Tasks***, will address the topic of purposeful learning tasks even further). These competencies ask for much more than merely using one’s memory to remember factual content – they rather represent ‘life skills’, such as; critical thinking, creativity, shared meaning-making, negotiation, and a variety of problem-solving skills that may be called for in a number of different scenarios in the future.

Computer-supported Collaborative Learning

Another task for schools as a learning societies, is to keep the education of students current and relevant. As mentioned before, collaboration does not only mean the mediating of the participants in the process, but it also concerns the most convenient tools that transform the

ideas from the mind into its concrete form (whether in the form of written text, tangible objects, presentations, or other outputs). One of the most commonly used and widest resources of information today, is the Internet. Computers and laptops have been around since the 1980s, and the first smartphones since the 1990s. The most recent invention, the tablet computer, was only introduced four years ago, in 2010, and has since been popularly used in mainstream households. Together these tools – the computers, smartphones and tablets – form what is called the *Information and Communications Technology* (ICT), and since their fast development from the beginning of the 21st century, they have shown to out rule the use of printed texts. (Leinonen, 2010: 11 – 19.)

As mentioned in the introduction, the current generation attending school (anywhere from the primary levels to university) have already become accustomed to these technologies on a daily basis. However, according to research, the use of ICT-tools at schools has not been as efficient and authentic as it is in many professional communities or in the youths' time off school, in their free time activities. This could be one explanation to the recently discovered low rates of school enjoyability (Korkeakivi, 2014: 16 – 21.).

“...we should also consider the kind of world these kids live in. It's just so natural for them to spend time in virtual environments and we should respect that [in regards of didactics] so that learning at school would continue to be pleasant and interesting for them.” T2

As this teacher points out, the widely popular ways of using the Internet cannot just be diminished in education. As educational professionals, we have to be able to keep up with the ways of the world and show our abilities in developing in our profession.

One possible solution to making learning at school more meaningful is to allow *computer-supported collaborative learning*, CSCL, to become a part of the everyday practices. This means, that the used ICT-tools are integrated with a purpose to mediate and support social action and collaboration – *not* to replace it with virtual learning environments. (Stahl, Suthers, Koschmann, 2006: 8 – 12 ; Lassiter, Orvis, 2007: VII.)

Rapid advances in computer and communication technologies in recent decades, like the Internet, have dramatically changed the ways in which we work, play, and learn. No form of technology, however, no matter how cleverly designed or sophisticated, has the capacity, in and of itself, to change practice. To create the possibility of an enhanced form of practice requires more multifaceted forms of design (bringing in expertise, the-

ories and practices form various disciplines): design that addresses curriculum (pedagogical and didactic design), resources (information sciences, communication sciences), participation structures (interaction design), tools (design studies), and surrounding space (architecture). (Stahl et al., 2006: 10)

One of the aims of CSCL, is to create activities that allow intellectual exploration in interdependence with collaborative practices. In comparison to using printed texts (such as school books) to find information, the use of these new technologies allow almost endless exploration of any topic in question (Stahl et al., 2006: 1 – 4).

However, as the empirical research points out, as the very first steps, teachers should practice the safe and responsible usage of the Internet with more simple subtasks to assure that the students know how to look up purposeful information. As mentioned in an earlier quote by one of the teachers, the self-sufficiency of students is often reached only after many tentative practices. Furthermore, all of the five interviewed teachers stated; that practicing critical thinking in regards of the multimedia, is one of the most important tasks they now face in their profession. Some of the comments consisted of the following:

“The purposeful use of ICT-tools. Without it, it would be like sending them off to sea without their life vests!” T4

“We need to raise these students not to accept information without critically thinking about it first – I mean I’m talking about the abilities to construct and process information, have a critical outlook on things, question and doubt the information that’s given to you, and so on... And that of course, is one of our most important tasks.” T1

“We need to help the students see what’s relevant and sort it out from all the irrelevant stuff... Because there’s massive amounts of information out there and its hitting their screens from every direction! All that data, and only a portion of it is really relevant. That’s what media-skills are practiced for.” T3

As can be seen, the appropriate use of ICT-tools was discussed with great importance and emotion. Based on the teachers’ word choices, facial expressions and somewhat firm tone of voice, the appropriate use of ICT-tools seemed to cause worry and a sense of great responsibility among the teachers. However, one of the teachers made an incisive comment on the purpose of schools as safe and interactive learning environments. Schools as institutions, already protect the children from some harm:

“We also need to look at the other side of things. If we spend a lot of time in the social media, we will also have to be able to face a person ‘in person’. That’s why schools exist; we come to a certain building to practice being with others. I hope that never changes.” T2

After analysing these comments, it is also important to analyse the benefits of computer-supported collaborative learning. As is viewed in socio-constructivist psychology, the dominant ways of functioning in the surrounding society cannot be separated from the ways of learning at school. Humans process information through the lens of the dominant culture, and if the ways of that differ largely to the ways of learning at school, the level of motivation is unlikely to be high. Therefore, similar tools need to be used to mediate information. (Vilkko-Riihelä, 1999: 337 – 338 ; Enkenberg, 2012: 11 – 12.) However, as much worry as the appropriate use of the Internet may cause, it is the dominant way of mediating information, and therefore inevitably a part of education now and especially in the future.

“What we teach at school now, will be oooold – oh, so old, when they start working! They’ll have no use of the things we try to teach them technologically, but if they even get the sense of courage here, that they are able to master and use these technological devises for many different purposes, that will already encourage them in using the new and more developed devices in the future. They’ll be confident and start to figure what they’re all about.” T5

According to Stahl et al. (2006: 12 – 14), computer-supported collaborative learning is affective because the representations done with technological devises are dynamic, meaning that they are easy to save, move around or undo. Furthermore, the technologically made outputs are easy to replicate and reform to suit other contexts. This also allows technology to work as a new type of communication channel in addition to only communicating with the people next to you. In addition to this, ICT-tools have the ability to “*turn communication into substance*” as each activity can be recorded, saved, replayed and modified to suit the purposes of the users (Stahl et al., 2006: 13). This means that every act of collaboration and every fruitful thought, may easily be saved to be looked at later on.

The next section will look at self-regulation and the needed competencies to self-regulate one’s learning successfully. Saved recordings of one’s actions in different projects are one useful way of self-assessing and perceiving what has actually been achieved, but as the following section will show, self-assessment and self-regulated learning require a lot of

practice and effort from students. In this study, skills of self-regulation are seen as essential in designing, as the whole process of designing is dependent on the students' inner motivation and engagement in the process.

3.2.4 Self-regulated Learning

Already in 1973, child psychologist Jean Piaget stated that a person, who independently constructs knowledge with spontaneous effort, is able to use and benefit from that knowledge throughout their life. In a larger sense, according to the cognitive and constructivist psychology paradigms, people learn for a *purpose*, consciously guiding their learning process towards a certain goal, and simultaneously taking advantage of any previous experiences, knowledge, and life lessons to use them as the basis for more developed and profound understanding. (Vilkko-Riihelä, 1999: 337.)

In other words, new information is best learned and understood when the information is actually *needed* by the individual. Individually experienced and self-constructed needs appear as high motivation in learning outcomes – a fact which some of the learning activities at school may often lack. The school activities that lack purpose may often show in the levels of the overall motivation of students. As a matter of fact, according to the most radical constructivist beliefs, the action of actually *teaching* someone is considered as impossible, as each individual is only capable of constructing one's own learning and understanding. (Vilkko-Riihelä, 1999: 337 – 338.)

However, some education is inevitably needed as the basic skills of knowledge-construction (the learning strategies and abilities to receive, construct and adapt information to suit particular needs) are not often automatically developed (Vilkko-Riihelä, 1999: 338). The way students start to understand new content and see themselves as learners is deeply affected by the social influences and contexts in which they learn. The students are not passive listeners but rather active participants influencing the learning dynamics in the environment. The way the students develop understanding and recognize causation between matters makes them want to learn more and engage in further inquiries. (Hadwin et al., 2011.) That, in turn, will make learning more meaningful for them.

“It’s a matter of letting the students participate in the planning. Letting them suggest and come up with ideas”. T2

“Personal experiences... and the fact that they get to be involved. They get to see, feel and experience.” T3

According to research, one way of assuring purposeful learning experiences seems to be related to the use of self-regulated learning activities. As Hadwin et al. (2011) explain it, self-regulated learning is deeply related to individual learning abilities. However, self-regulatory skills also originate in others and are effected by the contexts in which the learning occurs in. Humans are social beings, observing and regulating their learning through a variety of different social levels. This means that while self-regulation can be first viewed as action in socially experienced and normalised practices, later it usually develops and becomes a part of the individual understanding, showing in one’s personal practices. Self-regulated learning is the ability to strategically use one’s self-regulatory processes to reinforce internal standards of cognition. It is the ability to regulate one’s metacognitive, motivational and behavioural actions to engage in different activities. (Hadwin et al., 2011.)

Järvenoja further explains, that self-regulation is also related to protecting oneself from possible threats throughout life (as in the self-control and management of individuals). Academically, this means that a person uses their cognitive skills, motivation and self-control to simply make learning easier. Self-regulative persons *“control their emotional state, adapt to the surrounding environment to better support their goal striving, and seek help when needed.”* (Järvenoja: 2010: 22.). Furthermore, such persons often have the ability to recognize cultural and contextual aspects that may also effect the learning process and outcome. Self-regulated persons have the ability to strategically use their skills to benefit them. (Järvenoja, 2010: 22 – 23.)

However, becoming a self-sufficient and strategic learner is not an easy skill to master. In school contexts, self-regulatory skills need to be practiced on a daily basis.

“I think schools should demand self-regulation from students. Not right away, but once they get slightly older... I think it’s one of the most important things; to be able to plan one’s own schedule, know one’s own abilities, and be able to challenge oneself once in a while.” T2

“The older the students get, the more responsibility we should give them.” T1

An element also mentioned by the teachers on self-regulation, was the ability to evaluate and self-assess one's learning. According to the teachers, goal-oriented practices and self-assessment abilities go hand in hand with each other. In order to successfully succeed and meet individual goals, students need to be able to, first of all, set realistic goals, and secondly, realistically assess their working abilities during the process. With enough practice on smaller tasks, the students learn to reflect on their work and have the courage to set greater goals in the future.

"We start practicing it with very small and concrete tasks." T5

"...once you start to look, you notice that every student has made progress. Only in a few weeks' time, their actions have already become goal-oriented and extremely determined... Well, some of them might still want to get an A, that's external motivation, but they also want to really understand the matter. That's really pleasing! They'll even stay after class to further ask what I've meant by something. The former 'will this be in our exam' – questions are no longer asked... And that's what they used to frequently ask – or 'why do we need to learn these things', and I don't hear that any longer." T4

Like mentioned in the previous section, collaborative, inquiry-based learning scenarios are a good way to spontaneously practice self-regulatory skills among peers. When engaging in collaborative inquiries and projects, students have a chance to show their individual abilities and use them to tackle problems. Student-centred collaborative learning situations demand self-regulatory skills as each student is in charge and has the responsibility of delivering a certain element of the output. Brainstorming and negotiations have to reach an agreement on how to best tackle the problems in question. Furthermore, collaborative activities support differentiation and individual learning paths among the students, as the students need to unite their skills and expertise to complete a task, while also applying support, teaching and explanatory skills to make sure that each step is understood by each member of the group. This deepens the students' realisation on the abilities that they withhold: their true potential, but on the other hand, their limitations in certain skills as well. (Dillenbourg, 1999: 1 – 12 ; Palincsar, 1998: 349 – 353.)

As even psychologist Howard Gardner explains, *intelligence* is not a singular trait but rather competence in factors such as: problem-solving, creativity, and collaborative skills. These skills are culture-related and emphasised differently in each culture (Vilkko-Riihelä, 1999: 430). According to Gardner's theory on *Multiple Intelligence*, eight different forms

of intelligence are recognised in people; verbal-linguistic, logical-mathematical, musical-rhythmic and harmonic, visual-spatial, bodily-kinesthetic, naturalistic, interpersonal (socio-emotional intelligence), and intrapersonal (self-regulatory intelligence). Each person is a mixture of these intelligences, varying in the interests and skills that naturally dominate. (Gardner, 1993: 5 – 49.) By engaging students in student-centred collaborative activities, the students have the ability to show intelligence in more multidimensional ways, creatively finding solutions to problems. Furthermore, students varying in their ‘dominant ways of being intelligent’ often produce well-functioning, supporting and heterogenic groups, simultaneously further enhancing the process of making the students efficient participants in any kind of collaborative environment. (Enkenberg, 2012: 12.) Moreover, in self-regulated learning situations, room is left for each student to find their best way of observing situations, learning new content, and processing information. As teachers, support and encouragement needs to be shown to foster these strengths, but also, have the ability recognize the weaknesses of students. A key element to foster self-regulation, is to discuss which of the students weaknesses need strengthening in practice, and which on the contrary, do not matter as much, as they may be compensated with the students’ strengths. This is how the strategic learning abilities of each student may begin to be developed. (Kurttila, Lang, 2014b.)

However, even with the many benefits of practicing self-regulation in collaborative practices, in school contexts, the choice of working independently must still exist. Research team McCaslin et al. (2006) have that found some students to show anxious, withdrawn, disengaged or distracted behaviour in collaborative situations, rather preferring the teacher-led type of learning (Hadwin et al. 2011). In relation to this, one of the interviewed teachers also stated:

“Some learn better together, others by themselves. Of course we should know how to do both, but we are all individual in how we learn best... And if we think about working methods, group work, collaboration, and action-based learning are now highly spoken of, but some of the kids just really love the feeling of doing things by themselves, with no-one disturbing them. That’s why I always try to do lots of different things with my students, so we’d have something for everyone... So that it wouldn’t be just hassle from day to day, because some of them still enjoy their peace, and so there needs to be room for that too.”

What this comment states, is that schools as learning facilities still need to resemble a safe and supporting environment to learn in. Much like in any profession, self-regulation in collaborative practices will not continue to be productive or enjoyable for students if not balanced with other types of activities. However, often collaborative activities present lots of alternatives and flexibility in how tasks may be done – commonly some of the activities need to be executed independently before and after collaborative stages. Furthermore, even if students prefer entirely independent work, the ability of working in collaboration is nevertheless important to practice, as it is valuable in regards of possible collaborative working environments in the future. Alternatively, the interviewed teacher may have tried to explain how students, as young individuals, occasionally need breaks from being *in charge* of something. The opportunity of learning without a specific goal or planned outcome still needs to exist, as children are also eager in just learning and understanding new matters. (Hakkarainen, Mielonen, Raami, Seitamaa-Hakkarainen, 2003.)

3.2.5 Interactive Learning Environments

Now, the nature of collaborative, self-regulated practices have been described to highlight the importance of activities that originate from the students – student-centred inquiries. Another aspect relating to such working methods, is the aspect of convenient and interactive learning environments. A statement spontaneously expressed by all of the five teachers, was related to the importance of holistic learning environments:

“Learning happens outside of the school context – everywhere.” T1

“...in all sorts of environments, not only at school. Learning happens all of the time, formally and informally, and also in virtual learning environments. At school, learning mostly happens in interaction with others. I think we should all remember that.” T2

“We learn constantly – not only in particular contexts, but anywhere and everywhere”. T3

“Everywhere. When the students have goals and objectives, in any given context, they will naturally steer their thoughts and focus towards situations and environments where those matters are discussed.” T4

“Everywhere, all the time. Often the kids learn more somewhere else than here [at school]. It is really important that learning environments are not tied to a certain place, like the desk, as some enjoy working under the desk, outside of class, or something along those lines.” T5

The understanding of learning happening constantly may seem self-evident, but like Krista Kiuru, the Finnish Minister of Education and Communications, recently explained, the learning environments at schools are still very similar to what they used to be a hundred years ago; with desks as individual learning spaces and a board in front of the class to allow demonstration. Professional work environments, on the other hand, have already become much more versatile and up to date, fostering the holistic views of learning and of more creative, multifaceted problem-solving (Huomenta Suomi, 2014). Therefore, the aspect of creating more interactive and holistic learning environments will now be briefly discussed.

According to Enkenberg (2012: 8), learning environments should be formed in relation to:

1. The assignment in question, **2. The social surrounding** of the students, **3. The learning context** (as in the dominant surrounding culture, the school building, and the nature around the students), and **4. The technological surrounding** (the use of the most relevant ICT-tools). Enkenberg et al. highlight the relationship between holistic learning environments and the philosophy of design-oriented pedagogy. The following image represents this relationship:

Image 4: Design-oriented Pedagogy



Enkenberg, J. Liljeström, A. Vartainen, H. (2012). Design-suuntautunut pedagogiikka

Enkenberg et al.'s image expresses the purpose of more expanding learning environments: the everyday life of the students (in the form of personal interests and technological devices, as well as in the form of involvement in the surrounding community) is experienced within the school context. Co-development with peers, teachers and other outside of school experts is used to develop ideas and projects even further. (Enkenberg, Liljeström, Vartainen, 2012.)

In Finland, the effect of more multifaceted learning environments has also been studied, for example, in the form of the *UBIKO* –project. The University of Oulu's Teacher Training School, Oulun normaalikoulu, has turned one of their units into a more modern interactive learning space. Originally consisting of four separate classrooms and a corridor in between, the unit now consists of a variety of different learning spaces giving the students a chance to choose the most convenient learning environment for each task specifically. Project manager Heikki Kontturi explains that while previously typical units consisted of classrooms as private learning spaces and the corridor area as a public space, the new unit

now consists of private, semi-private, semi-public, and public learning environments (Kontturi, 2013).

Image 5: The UBIKO –unit layout



The UBIKO layout: www.oppimaisema.fi

Some of the learning spaces in the UBIKO –unit are closed, intimate environments while others are more or less open to additional participants and observation. Furthermore, areas for especially sharing ideas and outputs are also an important element of UBIKO; the semi-public and public learning environments can be seen in the form of circularly shaped furniture and objects throughout the space – as well as in the form of the ‘theatre seats’ for bigger presentations at the corridor’s right end. The entire unit is soundproofed with glass doors to allow better use of the corridor as a learning space, and the doors of each classroom are sliding doors with the ability to be opened or closed according to need. The students and teachers also have access to tablet computers and smart-boards to be used as more modern tools for handling information. According to the project’s webpage, the aim of such a learning environment is to support self-regulated, holistic learning, and enhance collaboration among teachers and their students. The research team also shares their ideas on the developing of the next national curriculum, with an attempt to create more flexible environments for individual learning. (Kontturi, 2013.) As can be seen, the layout of the UBIKO –unit looks more like a professional work space (a more project-friendly environment) than a typical classroom and corridor area.

Projects like the UBIKO –project, show great example in how learning environments may be developed to innovate learning, better suiting the learning methods and needs of the 21st

century. However, the findings from the interviews also state that sometimes the optimal learning environments for students often arise from the students themselves, and from their creativity:

“One time, a few of my students stuffed themselves into this cupboard in our class with their iPads, and when I opened the cupboard door, they were really working together. I think they just needed an intimate little space to work in.” T5

“Well, our classroom is what it is – nothing we can do about it! We haven’t got the money...but often my students like to work under my desk, and that’s when we got the idea; to build such an area for them. Now we have a place in the class, we call it the nest; with a big soft rug on the floor, pillows, and some cupboards moved around it. So rethinking things does not always require money, but it does require a second to stop and think what I could personally do to improve the situation.” T3

Furthermore, when having asked about the teachers’ thoughts on the most optimal type of learning environments, their thoughts were not as focused on architectural elements as they were on the concept of expanding learning environments beyond the school context.

“...nature would be near, and the internet – and the library as well. Then we’d have pens and paper, and many types of groups and places to work in. I’ve noticed that interacting in a circle is much more natural compared to me standing in the front... And I also think it’s important to keep changing the learning environments, as especially children are kinaesthetic beings – they don’t want to sit all day.” T4

“Different aged students would be learning together. No desks or chairs, but rather stations to work in. In my dream school, there wouldn’t be just lessons, but we’d learn from bigger entities and phenomena. We could spend a few days studying a certain phenomenon and give the students the time and freedom to truly focus on each inquiry.” T2

“The group size wouldn’t be too big so I could observe them as a group, but also as individuals... And that we’d have the ability to go – visit different places. Many museums are free, the seaside is free. As I said, learning happens everywhere.” T3

In conclusion, there is clearly a need to update the current learning environments both within and out of the school context. With more dynamic learning environments, the students are exposed to a variety of different elements stimulating their learning even further.

3.3 DESIGN AS A PROCESS

Now, different elements of the phenomenon of designing in education have been touched to illustrate its abilities, diversity and complexity in the field of the educational sciences. All of the concepts described before; collaboration, computer-supported collaboration, self-regulation, differentiation, and holistic real-world learning environments, describe the philosophy of designing in education – each of the described elements represent an element of the phenomenon. Next, the nature, paradigm and purpose of designing in educational settings will be looked into in more detail. Once again, the aim is to discuss designing in relation to the second research question, and thus, also relate the discussion with the first research question on meaningful pedagogical practices.

3.3.1 The Nature of Designing

According to Nelson and Stolterman (2003: 10), designing *“is the ability to imagine that-which-does-not-yet-exist, to make it appear in concrete form as a new, purposeful addition to the real world”*. Ruismäki and Ruokonen (2011:1) believe that designing represents a new and meaningful add to our current pedagogical practices, as it is a process in which different problems can be efficiently discussed, understood and solved. Furthermore, Ruismäki and Ruokonen believe designing to be a generic cultural activity, necessary to be fostered in our basic education.

Often however, design processes seem difficult to foster as they are usually so ill-defined. As Mawson (2006: 163) explains it, design processes do not typically have exact starting or finishing points – they more or less evolve through different stages. Especially this aspect of designing may make design practices hard to fit with the school context, as schools are also tied to certain school-related boundaries such as the schedule, the length of the lessons, et cetera. In one of the teacher’s words:

“Just as we have this amazing drive going on, the bell rings and the students are off to P.E. or something... It’s pure agony!” T3

Buchanan (1996) calls design-natured tasks *wicked problems*:

--the information they carry is usually confusing and includes conflicting values and vague user needs. There is no right or wrong solution to a wicked problem, only more

or less satisfactory solutions. Design problems are conceptual artefacts that guide the design process, but are likely to significantly transform when the process advances and progresses through successive iterative stages. The stages cannot be completely foreseen before actually implementing ideas in design of an artefact. The wickedness of design problems appear to stem from the necessity of going through iterative efforts of “translating” conceptual ideas to materially embodied artefacts, a process in which ideas and prototypes of artefacts evolve. (Seitamaa-Hakkarainen: 2011: 6.)

As is explained, the design process withholds many complex characteristics that may leave its viewers doubtful and uncertain in fostering such a process independently. Therefore, in order for schools to start fostering design processes, teachers and students need to be able to understand the differences between designing and other inquiries. Siu and Wong (2012: 437 – 439) have found that often students produce and present routine products with no novel or creative aspects in them. However, if teachers had the ability to separate creative designing from routine outputs, they would also quite likely master the ability to guide their students through creative design processes.

When conducting research on the topic of designing, one may notice that a design process is closely connected with a creative process – hence the term *creative design process*. The following section will further examine the relationship between designing and creativity.

Creativity in Designing

The nature of designing withholds many similarities with the nature of creativity. Siu and Wong (2012: 441) describe creativity in the following way: *“Whenever an individual generates an idea, he/she will evaluate it unconsciously. -- A creative thinking process is considered as the interaction between convergent and divergent thinking. Creativity might then be seen as the ability to switch from thinking mode to another thinking mode without difficulty”*.

According to a famous four-step model, first created by mathematician Henri Poincaré, a creative process consists of (Hakkarainen et al., 2003):

1. *Conscious thought processes*; knowledge-seeking and constructing a problem to solve, after which

2. *An incubation* stage where one processes the topic unconsciously. Then,
3. *An illumination* stage of insight (a flow experience), and as the last step,
4. Elaboration and *verification*.

To clarify the interdependence of designing and creativity; commonly a design is the output of ideas that have been developed through time and experience (like in the first stage), and the creative element of the process, is the illumination and fruitful adaptation of one's ideas to fit the particular context, place and time. (Hakkarainen et al., 2003.)

In other words, creativity consists of both the *novelty* and *appropriateness* of an idea in a certain context. Usually, it also consists of additional elements of some of the following: unobviousness, adaptivity, a change from the current, an unexpected outcome, transformation, new resources, comparisons, or a leap towards the unknown. Osbourne-Parnes (in Siu, Wong: 2012: 439 – 442) also states that a creative process often starts from a mess (a chaotic state) before it precedes into something inspirational and fruitful. One of the interviewed teachers made an incisive comment on this:

“..and it's hard for us teachers to guide creative thinking as we tend to pretty much be the type of people that like our classes to be neat and tidy – for even the students' artworks to look like a series production, making a lovely neat row on the back wall... What we should really try to get, is that the creative process doesn't always look that beautiful, and encourage the students, even if it doesn't.” T4

Another teacher humorously made a remark on her role in a project with ICT-tools that where novel to her and to most of the students:

“I felt like a complete wanderer! I just tried to push them and say ‘great, you're doing good, keep going, excellent’ and so on. I didn't think I was teaching them at all – not a darn thing... And I think it's a miracle how they succeeded and what they came up with.” T3

This statement exemplifies some aspects of creativity (such as the elements of unexpectedness and leaping towards the unknown) that need to be sometimes allowed in order to produce creative outputs. When further asking the teacher if she would lead such a novel project again, she replied:

“Absolutely. It was so much fun! We had our ups and downs, but we really can’t learn anything new if we don’t learn how to mess up. Sometimes we need to mess up...” T3

Designing in education challenges the ways of organising teaching and learning. Schools as learning facilities usually fail in this precisely because they do not trust in the children’s abilities to survive when handling complicated situations or complex phenomena. In his article on design-oriented pedagogy, Enkenberg states that the student-centred collaborative learning scenarios have shown to be surprisingly efficient, even though the participants have shown proficiency in different types of skills and a different level of readiness in regards of the projects; students from different age levels, learning stages, and even special needs students have shown to do remarkably well when engaging in creative design processes. In fact, teachers participating in Enkenberg’s research have stated that the special needs students have been almost unrecognizable in these heterogenic groups. (Enkenberg: 2012: 12.) This also demonstrates the naturalness of creative designing for children.

According to Hakkarainen et al. (2003), collaborative creative processes are automatically more multidimensional compared to individual processing, as each participant’s thoughts need to be laid out, explained and named in some form of discourse to begin the creative process. In cognitive psychology, this phenomenon is called *socially distributed cognition* and it refers to the process of individuals sharing their knowledge, skills and cognitive resources to achieve something that an individual by his or herself could not achieve. Furthermore, in *physically distributed cognition*, mediating artefacts (such as databases, machines, tools and smart technology) are used by individuals or collaborative parties to reduce their cognitive load and develop their work. By sharing the cognitive load and individual expertise of each individual, the participants are often able to produce something of greater purpose.

Furthermore, Mihaly Csikszentmihályi, probably the most known psychologist to study creativity, describes the following elements to often lead to creative outputs (Hakkarainen et al., 2003):

The person: personal characteristics (such as self-confidence, curiosity, determination and the ability to tolerate critique) and the level of motivation often determinate creativity. Motivation can be roughly categorised into two types: inner and external motivation. External motivation may be developed through different external elements, such as; expectation, encouragement, bribery, et cetera, while inner motivation is usually developed through

deeply engaging in the process out of one's own interests and will. An innerly motivated person usually shapes a creative process to be personally meaningful and particularly relevant to them – they may even develop feelings of love for the project. The absolute 'peak' of inner motivation is the *flow*-experience. It is a state in which a person totally immerses oneself in the process and feels genuine pleasure, joy and happiness of working and of realising something profound. Moreover, flow-experiences usually take place at the very verge of a person's understanding, which makes them exceed even further in their thoughts. This in turn, makes a person work even harder and immerse oneself in more complicated tasks. Furthermore, it has been studied that because children experience most things as new and exhilarating, they may actually experience a flow-state quite often. As teachers, we should make use of these feelings and motivate the children in engaging them in creative designing processes. (Hakkarainen et al., 2003.)

The domain: people usually develop creative outputs for a certain domain or area of expertise. The domain withholds its status and area of expertise, while certain individuals slowly shape the domain through their creative outputs. (Hakkarainen et al., 2003)

The field: the field, which is even a larger concept than the domain, is where the validity of the new ideas are experimented. According to Csikszentmihályi, each field consists of *gatekeepers* who decide which ideas will 'make the cut'. At schools, for example, the gatekeepers would be teachers, guarding the students' ideas. Gatekeepers often withhold the needed understanding to know whether an idea is only personally novel to a student (personal creativity) or novel in a wider sense (historically creative). (Hakkarainen et al., 2003.)

In conclusion, a creative process usually calls for the factual understanding of the topic as well as the ability to memorise data to be able to **create connections between matters**. Secondly, the process requires creative competence, as in the **ability to see matters from different perspectives and have the will and courage to experiment**. Third of all, a creative process requires **sensitivity, cognition, skills and motivation especially tuned for the specific task in question**. (Hakkarainen et al., 2003.)

Designing in Relation to Science

As final thoughts on the nature of creativity, the Board of International Research in Design, BIRD, have referenced some researchers in explaining how the nature of design differs from the nature of *science*:

5. According to Gregory (1966), science is mostly related to problem-solving behaviour as it aims in finding out what already exists, whereas design is focused on inventing things of value which do not exist yet. *“Science is analytic; design is constructive.”* (Cross, 2007: 24)
6. According to Simon (1969), natural sciences study the way things are now, while designers try to envision how things ought to be.
7. Finally, according to March (1976) *“To base design theory on inappropriate paradigms of logic and science is to make a bad mistake. Logic has interests in abstract forms. Science investigates extant forms. Design initiates novel forms.”* (Cross, 2007: 24)

As can be seen, the BIRD also focuses on emphasising the novelty of the design tasks. Possible solutions to such tasks are often not just found in data, but need to be creatively constructed by the participants involved the process. (Cross, 2007: 24 – 25.)

In conclusion, the nature of designing is largely connected with both novelty and creativity. The ways in which design processes proceed are sometimes hard to explain, because the processes often *“lie outside of verbal discourse: they are literally indescribable in linguistic terms”* (Cross, 2007: 38.) The very purpose of design education, is to challenge this statement as it aims in defining the process more clearly to be practiced in schools all over the world. With our expanding learning environments, sophisticated and smart technology, and the multiple ways of saving data, attempts can at least be made to try to make the design process more conscious, naming at least some of the steps of a typical process. With this, creative thinking processes may be better fostered at schools in the future. The aim of designing at school, is to further engage the children in the design of their own learning. The next chapters will look at designing processes in school contexts.

3.3.2 Design Processes in School Contexts

A Chinese proverb goes as follows: *Tell me, I will forget. Show me, I may remember. Involve me and I will understand.*

Designing is precisely about involving its participants in each step of the learning process. In a school context, designing usually happens on *two levels*: On one level, teachers are the designers of the learning scenarios and learning environments of their students, and on another level, the students are the designers of their projects. According to the empirical data, teachers usually start a design process by assessing the curriculum and determining which themes and subjects they wish to integrate to be a part of their next project:

“I like to always teach so that I have a larger theme, that lasts a bit longer, on the background. Then we’ll have a chance to really study that one theme from many perspectives instead of trying to grasp many topics all at once... And I think the current [Finnish] curriculum already enables it; you can easily connect subject matters to build up a larger theme.” T5

“You really need to know the curriculum well in order to be able to connect the dots... Pick which topics you’ll take from science, mother tongue, history, arts, and so on, to make a bigger entity. It requires a lot of work and planning, but on the other hand, it’s really creative work, and quite fun too.” T3

Often, teachers may also wish to collaborate with other teachers and their classes to broaden their project even further. Collaboration among teachers was practiced in the case of all of the interviewed teachers (in cooperation with different subject teachers, as well as with primary level teachers teaching both the same age level or different aged students). All five teachers found collaboration to be productive in their profession. One of the teachers described close collaboration with colleagues in these words:

“Working on the same task with innovative and competent people – what a flow!” T3

As can be seen, designing for teachers is largely based on carefully planning and designing the outlines of projects; mapping the time frame, deciding the structures of collaboration and assessing possible resources in and outside of school. Another important element, described by the teachers, was how they chose to start off the next unit and introduce the leading theme to their students:

“There is great importance in how we present the things we are about to engage in. How we get them excited. Cause once we get them excited, we’re doing pretty well.” T5

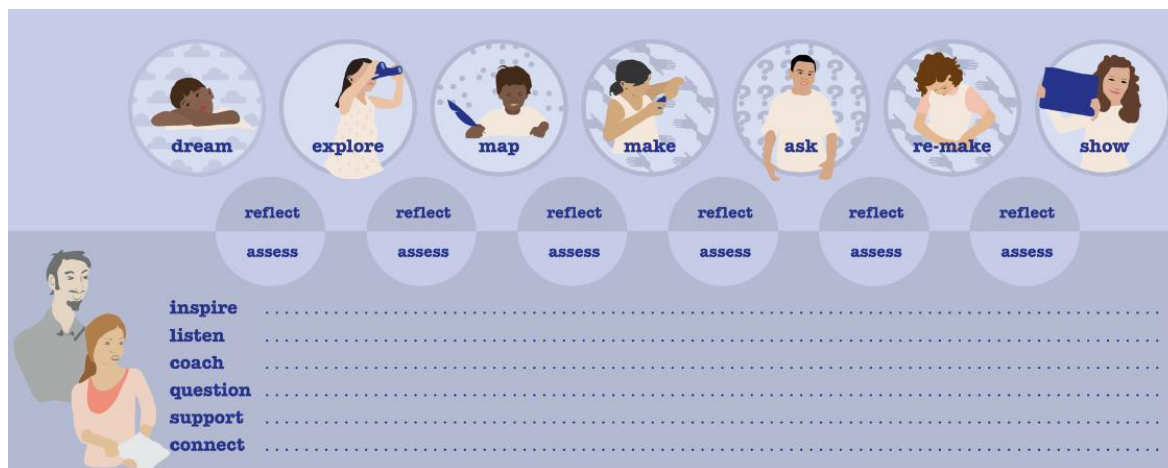
“It’s all about knowing your students and what they are into... and group dynamics – that’s important too.” T1

Based on these comments, a successful project seems to partly rely on how the teachers stimulate their students in the beginning in introducing their next assignments – as the later steps of the project, including the actual outcome, are conducted by the students. The teachers plan the learning environments, introduce the theme, and guide the students along the process to best ensure development.

Much like a creative process, designing for students begins by defining and constructing the design problem. According to Kurttila and Lang (2014b), the goal and outcome of a design problem is usually concrete. It is related to the nature of designing; the goal is to develop a concrete, visually apparent outcome which already in itself reflects the success of the process quite well. Often, when the outcome of a project is successful, the process behind it has been successful as well. At other times, the process may show great promise but the outcome does not turn out to be such a success. Even then, the evolving stages of the process are easier to reflect upon, once there is a visual prototype to look at. Section **3.3.4, Examples of Design Tasks**, will further explain the purpose of concrete design outputs.

As explained before, after the design problem has been defined, the students as designers identify the need and audience for their task, collect data, discuss alternative solutions, ‘incubate’ on the different solutions, and come up with the most purposeful solution to their task. After this, the designers will start to develop and design their prototype, simultaneously assessing the process and asking for feedback from their peers, teachers and other expertise. Once the prototype is finished, the designer team will evaluate the project by both looking at the finished prototype and by reflecting upon the whole process. Furthermore, each student will assess his/her participation in the project, as objective self-reflection is one of the most important elements in fruitful collaboration. (Doppelt, 2007: 57 ; Hakkarainen, 2003.) Image 6, a model by Anna Keune, a researcher at Aalto University, represents the steps of a creative design process at school.

Image 6: Design Processes in School Contexts



iTEC Cycle 4: Learning stories and activities, www.itec.eun.org

As the image shows, the students go through a process of; dreaming, exploring, mapping, making a prototype, asking for feedback, re-making, and showing their final output. The teachers examine the students' inquiries and support them by listening to their solutions and coaching them through difficult phases.

This model represents one possible way of looking at a design process. As Kurttila and Lang (2014b) explain, finding completely novel ways of processing information is rare nowadays, but what is novel and significant, are the new ways of learning to construct information and make it visible to others. Formerly, creative thinkers where often unable to explain the process behind their successful creation, but models such as Doppelt's or Keune's make creative design processes easier to follow (Cross, 2007: 37 – 38). Kurttila and Lang (2014b) further explain, that in order to foster designing in the field of education, terminology and concepts for the steps in the process need to be named. As Kurttila (2014b) describes: *"That is valuable in education – to know how a process evolves and becomes a conscious part of our everyday routines. It can also be subconscious, but maybe it is better that we [as teachers] are conscious of our actions."*

When analysing the empirical data, one of the most interesting findings seemed to be related to the subconscious processes and differing opinions on the topic of design-oriented pedagogy. Once the interviewed teachers had all explained their pedagogical practices (describing them as inquiry-based, student-centred and collaborative among other things), on a sub-question on design-oriented pedagogy, three out of the five teachers showed hesitancy in their comments on using design related practices with their students.

“Design learning isn’t that clear to me, even though I took part in the [iTEC] pilots. Maybe a simpler version of it should be developed so that teachers could practice it more easily. In our everyday teaching, matters that are too complicated have a tendency to not stick for long.” T1

Another teacher bypassed the question on design-oriented pedagogy, also showing hesitation, but continued by describing how beneficial student-led, collaborative inquiries are;

“I always attempt to hand out all my tasks with a lot of room in them, and from there, we’ll start to develop things together. That’s when you’ll need to have faith in the students and trust that the ideas will come... I always try to push them by saying; ‘show me what you’re capable of, what you want to do and what you think would be good ways of learning. Let the learning look like you’.” T2

These comments demonstrate how the ill-defined and wicked nature of designing may be hard to follow in a school context (Seitamaa-Hakkarainen: 2011: 6). Furthermore, one of the five teachers thought that the design model represented in **Image 6**. left little room for independent interpretation;

“I thought it was too structured. I don’t like to follow structured models that much, but rather develop things along the way by examining how the students are doing. -- That’s why I would criticise the fourth cycle [of iTEC]—it was too much of a readymade package, but I really liked the fifth one as it was more free.” T3

This teacher described designing by comparing the iTEC project’s two final cycles. The fourth cycle consisted of choosing a theme from the curriculum and following the design process represented in *Image 6*. Additionally, the teachers chose to execute one from the following learning activities: *Create an object*, *Tell a story (digital storytelling)* or *Create a game*, with additional instructions for each step. The entire process of the fifth cycle, however, was independently chosen by the teachers. (iTEC webpage, 2014.) The next quote shows an interesting undertone in comparison to the former teacher’s statement;

“[the design model of the fourth cycle] was structured by quite excessive guidelines, step by step... But when it was more open in the fifth cycle, many of the same steps seemed to still appear along the way. The process was actually quite similar, but when the strict guidelines disappeared, the process seemed more convenient and fun.” T5

As can be read from the comment, this teacher nicely views the process of subconscious design processes becoming conscious action: first, by following structured guidelines, and once becoming familiarized with the process, using one's own expertise to foster the most fruitful ways of designing.

Moreover, one of the teachers positively commented on design-based learning in the following way:

"I thought it was quite close to an idealistic learning process... The way it formed an entity – and how assessment was naturally involved in each step. The students were goal-oriented, cooperative and interactive... and motivated. -- I'd like more of that to support all the factual content that the students need to learn, so that they would want to create novel things, train their memory in new ways, and learn different ways of constructing information." T4

When analysing these five statements, it seems that the teachers experienced mixed feelings in regards of practicing designing with their students. The novelty and little experience in designing left some of the teachers hesitant, questioning the design model. However, before the sub-question on design-oriented pedagogy, all of the five teachers spontaneously described their pedagogy with ways that were all relatable with the philosophy of design education (their comments can be found throughout this thesis). Therefore it could be argued, that even with some uncertainty, all of the teachers, consciously or subconsciously, practice design-related pedagogy on some level. Exposure to such a design model may have awoken thoughts on how designing had become purposeful and goal-oriented action.

On another note, it could be argued that the word *design* seemed to distract some of the teachers, as well as possible other users in fostering design. However, according to Hakkarainen et al. (2003), the definition for designing is quite straight forward: to design means to *give form* to an idea in a conceptual and/or physical manner. Designing always calls for careful planning and consideration, with conscious efforts to solve a problem by using the most convenient methods. The aim of designing is to develop socially, psychologically and culturally relevant products or platforms to service the society. Therefore it could be argued, that the aim of designing at school, would be to practice designing with the students on a more simple level, as after such practice, students may develop further

competence in designing, useful for their future professional lives. In the next section, the benefits of designing for students will be further discussed.

3.3.3 Purpose and Benefits

Beginning from the very basis of the evolution, Nelson and Stolterman (2003: 11 – 13) explain the purpose of designing to relate to the basic instinct of human survival. Throughout history, people have designed artefacts to improve, develop, thrive and evolve in the society. Furthermore, different designs have been developed to serve the society by creating something of a real consequence and lasting quality. Throughout our evolution, designers have wanted to participate in the never-ending genesis of the environment leading up to today.

The purpose of practicing designing at school, also relates to practicing these evolutionary skills – practicing the kind of skills each student will individually need to help forward their learning process, as depending on the individual, different skills are found beneficial. Therefore, activities at school cannot only examine content from a singular perspective (usually the perspective of the teacher) but rather from multiple perspectives simultaneously. Design-based learning allows this, as it emphasises learning from different real-world phenomena, examining the various standpoints and interesting aspects they relate to. According to the design paradigm, each study topic should always relate to a larger context or entity, making the study process more multidimensional and holistic. (Enkenberg, 2012: 8 – 12.) As Enkenberg explains, design processes also withhold the following elements:

1. Design processes are anchored to suit the students' own way of handling information: their designs mirror their ideas, perceptions and interpretations of the phenomena.
2. Engaging the students in a design task happens through examining the phenomena as a whole, not through detail. The process begins and evolves through the teacher's use of motivating and interesting questions, *driven questions*, from which inquiries are formed.
3. Knowledge-construction and understanding is practiced through communicating and working with the surrounding community, making the process greater in meaning for students.

4. The ‘bring your own device’, BYOD principal, (meaning the utilization of students own tools and technology) is practiced in designing to allow and ensure convenience. The personal tools of students are seen as the mediators of the learning process.
5. Finally, the purpose of the teachers and other adults is to offer their help along the process; in looking for possible resources, while also showing support and guidance. (Enkenberg, 2012: 8.)

As Pirita Seitamaa-Hakkarainen (2011: 5) further explains, design problems require integration of knowledge across domains to find solutions to such problems – so called *design-thinking skills*. Due to the nature of the design process, students learn to solve problems in more creative and unconventional ways, using their expertise and individual strategies to come up with solutions

“I argue, that the projects will turn out to be a whole lot better, when the ideas have emerged from the students and continued to grow from their efforts.” T1

“Usually the less I speak, the better it turns out to be!” T3

Student-driven projects often make the process more authentic and the students learn useful skills – for them especially. In other words, the process is anchored for each group individually, leaving the dynamics of the group members as the dominant effecting factor. The process is automatically differentiated to the extent that the group members allow it to be – the learning is deeply interdependent with social interaction; teaching the students various important life skills, such as communication, self-expression, and negotiation skills. Therefore, it could be argued that design-based learning does not teach the students direct modelling, but rather *competence* in interaction as well as in personal study tactics. The designerly ways of thinking and solving problems are constructive and solution-focused, valuable in the children’s education. (Cross, 2007: 19 – 29.)

3.3.4 Examples of Design Tasks

To summarise, good and appropriate design tasks are: **executable**, meaning that the students in question are able to manage any inquiries related to solving the task; **worthwhile** with rich content and relation to real professional practices; **contextualised** representing real-world phenomena and concepts; as well as **meaningful** in that the phenomena is inter-

esting and existing to the students. Through design-based, holistic learning methods, students learn to view the same information from many different viewpoints, and are able to represent various solutions to design problems in alternative forms of presentation. (Seitamaa-Hakkarainen, 2011: 7 – 10.) The aspect of concrete, materialized outcomes is an important element of the design paradigm. The next statement summarises the purposefulness of concrete outputs especially well:

Latour (1999; 2005) argues that all artefacts are hybrids in nature because they contain both conceptual (objectified intentions, purposes, and signification) and material aspects; creation, development, and sharing of artefacts requires that those be given an externalized form at some stages of the process. It is clear that designing cannot be reduced to mere play with ideas; in order to understand and improve the ideas in question, those have to be given a material form by means of practical exploration, prototyping, and making. Designing these objects is an active, distributed meaning-making process (Cole, 1996; Wertsch, 1998). (Seitamaa-Hakkarainen, 2011: 5.)

As Seitamaa-Hakkarainen (2011: 5 – 6) further explains, the materialisation of ideas is the process in which meaning and conceptual ideas are negotiated. Furthermore, Doppelt (2007: 57) states that the experience of conducting a concrete output assists the students in realising the complexity of a real design process of a real prototype – “*in this learning process, the learner is required to consider real factors involved in such a design*”. Whether in the form of material, digital or representational displays, the used tools and artefacts further mediate the meaning of the process for students. Through the externalisation, the visions become visible and improvable, and by this, embody the students’ “*thoughts and intentions in shareable cultural artefacts*”. (Vartiainen, 2014: 19.)

To conclude, fruitful design tasks often withhold both personal meaning and relevance as well as the process of making something concrete. As stated earlier, designing is a natural, innate way of handling the information around us; we naturally tend to start a design process and continue to develop it until it is finished in our eyes. In contrast to studying subject matters “separately”, handling information this way makes each aspect of the process relevant in regards of the outcome – the process forms an entity. (Nelson, Stolterman, 2003: 1 – 6.) To further exemplify fruitful design tasks, the following table represents the design processes executed by the five interviewed teachers.

Table 2: Designs Executed by the Interviewed Teachers during the iTEC –pilots

Project Title	The Idea	Execution	Tools
T5 : Ten Sticks on the Tablet <i>(suom. kymmenen tikkua tabletilla)</i>	<p>The students learn to interact and collaborate with community members representing another generation.</p> <p>Students gain confidence in using the tablets.</p> <p>Practicing peer- and self-assessment</p>	<p>The students make a mind map of their favourite in and outdoor games.</p> <p>Then, the class visits a senior home nearby and both parties exchange thoughts / try out their favourite games. The visit is also videoed by the students.</p> <p>Back at school, the students try out the games explained by the seniors, write digital directions of them and describe their experiences onto a blog. As the final result, videos are edited of the whole process and shown to the seniors, parents and other students.</p>	<p>Popplet</p> <p>iMovie</p> <p>Wordpress Blog</p>
T4: What Else Flows?	<p>Phenomena-based learning</p> <p>Theme: Fluid Systems / Currents</p> <p>Integrated with art and biology</p>	<p>Together, the class thinks of different things that constantly flow, e.g. streams and rivers, the circulatory system, the photosynthesis cycle, traffic congestions, et cetera.</p> <p>In groups, students study each phenomena and make digital presentations.</p> <p>After this, students paint an artwork of the phenomena and use the Aurasma application to embed the presentations behind their art.</p> <p>The project is finished by having an exhibition of the artworks and of the embedded presentations. Students peer- and self-assess each other's work.</p>	<p>Aurasma</p> <p>Augmented Reality App</p> <p>Google Drive</p> <p>Puppet Pals App</p> <p>Morfo Booth 3D Face App</p> <p>Tellagami Animated Video App</p>
T3: My Roots on the	<p>Familiarizing with one's ancestors and the</p>	<p>The students interview a relative about their family tree, geological</p>	<p>BOYD (bring your own device)</p>

Map	<p>geographical background</p> <p>Learn about the geography & history of Finland</p> <p>Make digital books</p>	<p>background, former livelihood, culture, food, et cetera, and execute further research on the area of interest independently.</p> <p>As a final product, each student makes a digital story out of their findings; with pictures, narrated facts and video. Together, the stories form a digital book of the class members' ancestry. The book is viewed at a parents evening and sent to the interviewed relatives as well.</p>	<p>Google Earth</p> <p>Popplet</p> <p>Book Creator App</p> <p>Drop Box</p>
T2: Parsing Games	<p>Practicing the parsing of Mother Tongue</p> <p>Computer programming</p> <p>Making a game</p> <p>Peer-assessment</p>	<p>Students execute learning games for their peers by using the Scratch application.</p> <p>The students come up with an idea for a learning game and think of the key elements behind successful games. Their prototype is assessed by peers as well as an outside of school expert invited to visit the class.</p> <p>The students develop their games according to the feedback. During the entire process, students document their findings onto a blog, self-assessing their work. As the outcome, the students play the final versions together for further practice.</p>	<p>Scratch</p> <p>Mindjet</p> <p>Wordpress Blog</p>
T1: Finland: Past and Present	<p>Familiarizing with the history and common traditions of Finland.</p> <p>Trying out novel applications together</p>	<p>In groups, students research elements of the Finnish culture; history, celebrations, nature, food, etc., and examine how matters have evolved throughout history. Posters are created to represent their findings. Then, by using QR-codes and augmented reality applications, the students prepare written documents and embed the information into the posters.</p>	<p>BYOD</p> <p>Word</p> <p>Notebook XC</p> <p>QR-codes</p> <p>Aurasma</p>

		As the school is a Comenius school, the presentations are also made in English, and as the final outcome, an exhibition for foreign visitors is held.	Morfo Booth 3D Face App
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The above designs are merely examples of design tasks, nevertheless representing the execution of designing in a school context rather well. By engaging in different open-ended tasks, students find the most convenient ways of searching for information and are able to expand their learning environments both by using their personal expertise to find answers as well as by using contemporary tools. Each project is finished with a finale (whether in the form of an exhibition, premiere or actually using the designs), letting the students reflect on their work and also know that the project is finished. What the students hopefully learn from these projects, are some useful techniques and executions, as well as the ability to adapt the learned information into future projects and other settings.

In the next section, the role of teachers as educators will be examined. First, thoughts on the value and purposes of education will be discussed, followed by discussion on the role of teachers in specifically design processes. The aim of the upcoming chapter is to provide answers for the third research question, and discuss how student-centred collaborative working methods, as well as the powerfully increasing status of digital learning methods through ICT-tools, affect the role of teachers in the classroom.

3.4 CHANGES IN PEDAGOGY

Before further examining the role and pedagogy of teachers as educators, larger questions on the purposes of education need to first be addressed. What is actually the purpose of education, and what are we trying to teach?

Often, answers to such questions consist of abilities and the idea of “surviving” and “making it” in the society. The purpose of education is to educate students to provide for themselves in the future. According to sociologist Aaron Antonovsky (1996: 11 – 17) our survival and coping methods are based on the *sense of coherence*; control of one’s life, and on *generalised resistance resources*: the understanding of one’s abilities and the utilization of

them to cope through different events in life. According to Antonovsky, the sense of coherence of individuals mainly relies on the following three elements:

1. *Meaningfulness*: People who frequently deal with meaningful stimuli often believe that even challenging endeavours are meaningful and worthwhile their efforts. These people have confidence in facing challenges and are often determined to find solutions to problems.
2. *Comprehensibility*, on the other hand, refers to the ways in which individuals comprehend different inner and external stimuli. A person with high comprehensibility is able to grasp and handle even the most difficult situations in productive ways and assess them from more fruitful perspectives.
3. Finally, *manageability* refers to a person's confidence and beliefs in knowing how to handle situations. A person with high manageability is able to control their *generalised resistance resources* and adapt them to best suit different situations. (Antonovsky, 1996: 15 – 17.)

In other words, a person with a strong sense of coherence sees the world as a meaningful, manageable environment and encounters situations with confidence in oneself. According to Ebina and Yamazaki (2008: 8) the sense of coherence develops and is largely based on the experiences experienced throughout childhood and adolescence. Repeated experiences of successful endeavours strengthen the sense of coherence, and therefore make such experiences an important element in education. Schools as educational facilities should create scenarios which allow the sense of coherence of each student to individually grow and develop. The empirical study suggested likewise:

“Even more so, we need to have the ability to face different learners... To know how to support each learner on their learning path... Have the skills to guide and have a vision of where we are headed. Every teacher should be capable of reflecting what the school represents for children and what we should be doing there together. -- One of the most important roles of schools is to allow the students to be a part of a community, have their voices heard, and have a chance to affect in matters.” T2

Antonovsky's theory (1996: 15) further supports this statement as he explains the sense of coherence to also be affected by: the consistency of engaging in meaningful practices; balance in the underload-overload events in life; as well as by the participation of individuals in socially valued decision making. Furthermore, the other teachers stated:

"[A good teacher] genuinely cares about the children and their future, and wants for them to succeed in life." T4

"Overall well-being – it holds great meaning for both adults and children. I have to have a good feeling to come to work every day, but most of all, the children need that. If they don't feel good, or if they don't think we're waiting to see them every day... If they don't feel like they matter, they won't be learning much. But if they know that they are respected and feel important, they will want to take part in the activities. They will know that they have a place in the class physically, mentally and socially." T5

Interestingly, all five teachers expressed their thoughts on how to support differentiated learning – not to control or lead learning in any way. The emphasis of the conversations was more on student awareness (emotional intelligence, pedagogical love, and the idea of *raising* and educating students to be ready for the future) than it was on any specific teaching content or subject. Teachers rather experienced the subject –related matters as secondary elements in learning: a tool with which self-regulatory, collaborative activities could be practiced:

"...but we do still need different contents as well; the times tables, national anthems, Lord's Prayers, and so on. They are our cultural capital and work as the tools for learning how to think and learning how to learn as well – learning how to learn new things." T4

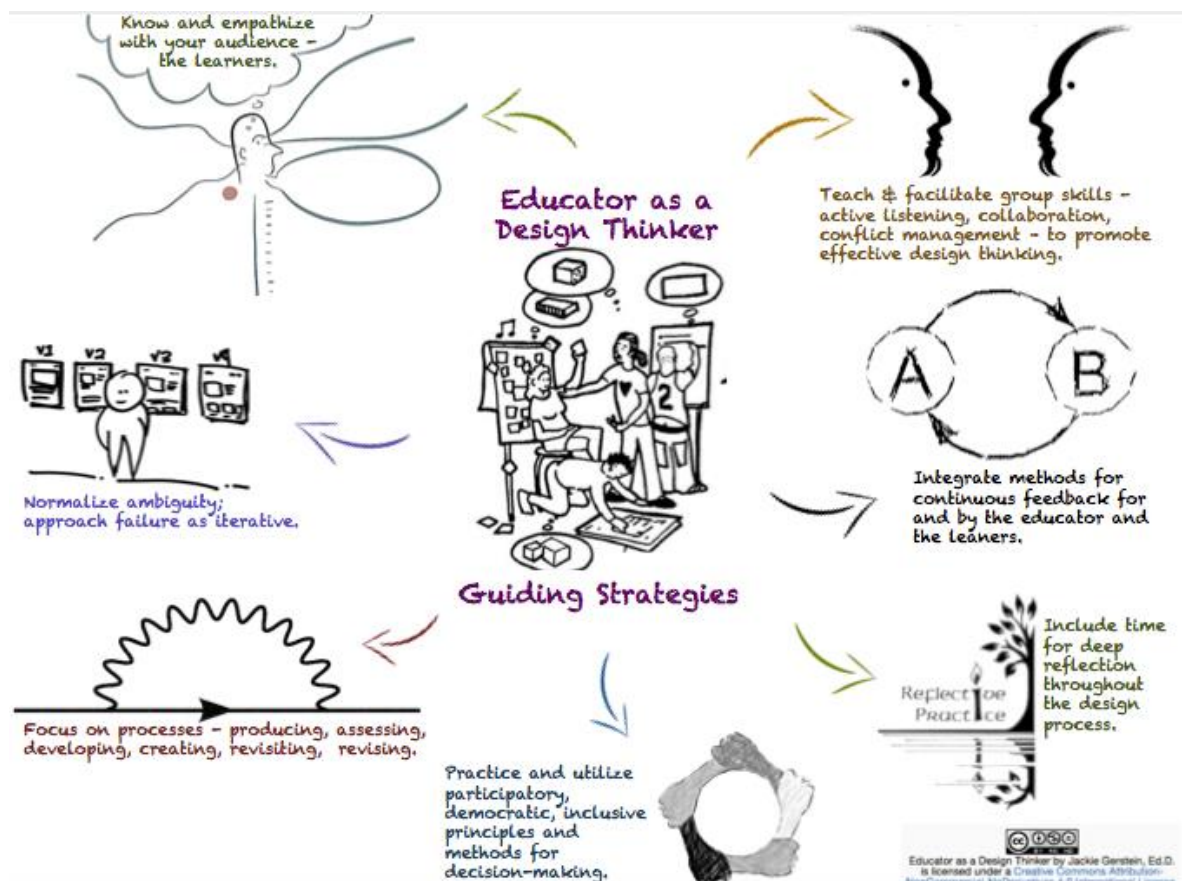
"I see myself as a coach – or something along those lines. Teaching has changed and is changing all the time. Now, teaching is rather enabling matters and making yourself uncalled for in different student-centred activities. As educators, we need to have the courage to take a few steps back and let the kids figure it out, when we notice that things seem to start rolling. Nowadays, the emphasis is on pair work, group work, and overall, ability to interact with others." T1

According to the design education paradigm, teachers are seen as stimulators, enablers and guiders in the learning process. The students are encouraged to find solutions independently, while the teachers view the process on the background and provide mentoring in different stages. Throughout the lessons, students pick up from where they previously left off, and the project evolves through their efforts. (Enkenberg et al., 2012.)

“I think it requires more planning and preparations in advance, but I find that I am not as tired after the days as I might normally be; I go around in class and guide the students in the right direction. The workload in advance is bigger, but the actual workdays are slightly lighter as I don’t need to be in constant control all the time.” T5

As this teacher explains, her role is no longer to be the prior source of information for students, but rather an inspirator in the process. A teacher’s aim is rather in finding ways in which the students could become interested and adopt “a thirst” to find information independently. The following image further exemplifies a teacher’s role in a design process:

Image 7: The Educator as a Design Thinker



Gerstein, J. (2014)

As can be seen, an important element in the design paradigm, is the element of constant evaluation. Through different design tasks, students practice objective reflection of themselves and of their peers as well, and through this, learn to view and understand their abilities in more truthful ways. As explained in section 3.2.4, **Self-regulated Learning**, such

practices start from very simple, daily self-regulatory practices and goal-setting, preceding slowly into something more profound (as is presented in the above image). Together with the teacher, students co-develop standards for the evaluation, and with this, both parties; the students and teachers, reflect upon the process. (Gerstein, 2014.)

Furthermore, reasoning behind such strong emphasis on assessment practices in design pedagogy, is mostly based on the uncertainty of the future. According to many different studies, such as OECD reports and future barometric studies executed in Finland, self-regulatory skills in relation to innovative activities should already be practiced at school, because the future will withhold many professions which educators are yet unaware of and unable to teach – there is simply not enough knowledge of their existence yet. Therefore, skills of continuous learning, and skills of adaptation in different contexts should already be practiced. (Ananiadou & Claro, 2009 ; Laitio, Linturi. H, Linturi, J. Rubin, Sirén, 2010.) In a newspaper article, 3rd grade teacher Maarit Korhonen expressed that she would like to exclude half of the current subjects, and in return, study topics that the children would truly be passionate about. Korhonen also stated that due to the uncertainty of any future professions, we now need more teaching of creativity, innovativity, teamwork and skills of continuous learning – in other words, skills that revive from precisely the students through practice, not skills replicated from the teachers. (Sippola, 2014.)

However, on the other hand, the current educational system partly forces teachers to use the more typical teacher-led pedagogy as to prepare their students for future standardised testing situations. As Doctor of Education, Jackie Gerstein (2014) explains:

It is understandable that given today's school climate of accountability, testings, standards, and scripted curriculum, going into a classroom without a plan other than to use design thinking to design the curriculum and learning activities can be a more than a little disconcerting or seem like an impossible endeavour. But for educators who want to prepare their learners for functioning in today's and future worlds, this process can be invaluable. Benefits can occur even if the educator can devote some of the class time to this process (e.g. 20%).

If we look at the current society, teaching such practices is not exactly a question of: ‘*do I want to teach this way?*’, but rather an obligation for teachers. When examining the purpose of education for students, life-management and the practice of useful skills in regards of their future professional lives were considered as one of the most important elements of

education. Even if the increasing role of technology and other contemporary tools would seem appalling for some teachers, the tools' status in our society has increased and will most likely increase in the future – therefore, being an inevitable element in all of our lives. Pedagogy for fostering such practices needs to therefore be developed: consisting of ways to explore the possibilities of the Internet and of other multimedia tools. In comparison to printed study material, the aspect of the World Wide Web as the information source of students pushes teachers to expand the learning environments of their students. The classrooms can no longer be entirely closed learning communities, but rather open playgrounds open for students' exploration. This requires the co-designing and developing from the teachers, and together, thinking of all of the possibilities, resources and challenges that the learning scenarios may withhold. In its most fruitful state, a classroom represents “*a protective environment that provides the space and freedom necessary to foster the process that is both powerful and vulnerable at the same time*” – the process of creative designing (Nelson, Stolterman, 2003: 3). To conclude, teachers should educate themselves to work as mentors, stimulators and guiders, supporting learning processes relevant in the 21st century. The pedagogy of the 21st century will be discussed in the upcoming section, aiming to, once more, address the theme of meaningful pedagogical practices, and voice the opinions of the interviewed teachers on valuable pedagogical topics.

3.5 21st CENTURY SKILLS

According to a large scale barometric study conducted by the Finnish Ministry of Education, by the year 2030, schools as educational institutions will have arguably shaped into more open *learning centres* with different facilities and educational settings; including workshops and themed events, rich in culture, and with resourceful libraries and connections to parties representing different aspects in the society. Schools will no longer be silent or passive institutions, but rather active voices largely involved with the rest of the society, intertwining both formal and informal learning environments. They will be even involved in the decision-making and novel experiences happening in the surrounding community. Furthermore, the barometric study also presented ideas on moving the school buildings from the outskirts of the cities into the centres – literally making them exist in the centre of the development of new ideas, interacting with other organisations. (Laitio et al., 2010: 31 – 32.) Naturally, none of this is for certain, as the study bases on mere assumptions, but such possible changes in our society are beneficial to foresee and discuss.

According to one of the interviewed teachers:

“Future learning is not only associated with knowledge and skills, but also the ability to adapt them to benefit different situations.” T2

To define this in other terms, the future world seems to place greater value in *competence* rather than any specific or singular skill. As explained by Rychen and Salganik (2003):

A competence is more than just knowledge or skills. It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context. For example, the ability to communicate effectively is a competence that may draw on an individual’s knowledge of language, practical IT skills and attitudes towards those with whom he or she is communicating with. (Ananiandou, Claro, 2009: 8.)

When further interviewing the five teachers, they characterised the following abilities to hold value in regards of future learning:

- a) Social skills: the ability to interact, communicate and collaborate with other people in different contexts
- b) Creative and versatile problem-solving skills, as well as meta-cognitive skills essential for learning how to learn
- c) Knowledge construction and critical thinking skills
- d) ICT skills
- e) Everyday skills: related to basic survival in the society
- f) Philosophical and ethical understanding
- g) Self-regulatory skills and skills of truthful self-assessment, as well as
- h) Skills of entrepreneurship, perseverance and inventiveness.

Furthermore, the interviewed teachers thought that such skills were not usually practiced on any particular lessons, but rather through integrating them in a cross-curricular manner, across the subject areas, such as in the form of projects or through inquiry-based learning. Wider studies also suggest the same (see Ananiandou, Claro, 2009: 15 ; Enkenberg, 2012 ; Laitio et al., 2010). However, comments on the relevance of the subjects taught in primary and secondary education were also exchanged with the interviewed teachers. While all of them favoured more holistic, cross-curricular pedagogy, they also expressed the absolute importance of learning certain subjects and skills, such as:

- a) Mathematics and the ability to mathematically and logically solve problems,
- b) Mother tongue and knowledge in Literature,
- c) Ethics and Religion to study both one's own heritage as well as the globalized and multiculturalised world,
- d) Arts and Crafts under which any subject or theme can be discussed, and where self-expression can be learned, and
- e) Sports and Music for alternative ways of self-expression and for ways to balance one's life and lead a healthy lifestyle.

Like Doctor of Education, Jackie Gerstein (2014) expressed, trying to find the balance between the taught school subjects and the cross-curricular, holistic themes, is and will be the goal of present day and future pedagogy for teachers. Without a doubt, students will have to show competence in creativity, collaboration, and novel thinking and problem-solving, as well as to show their diversity, flexibility and designerly competence in any possible tasks. In relation to this, one of the interviewed teachers gave a present day example of the importance of possessing such skills:

“One of my good friends has a company in the metropolitan area, and he just told me that a recently graduated person, with two degrees; in both economy and engineering, was seeking for a job in his company. The applicant described that he could calculate the different costs of the company and provide analysis based on the calculations, after which my friend sadly told him that the company had already bought a software that digitally calculates the same things – and that it only costs 5000 euro per year for the company. This was the only thing this person had to offer... So we are already in the situation that a person with two masters' degrees only knows routines and is soon unable to find any work. So I think that we should educate the students into being these novel designers. We've already made it far enough, so that no matter what kind of destruction we might face, we have the technology that will do the routine procedures for us... But what we will always need, are people who design and create the systems. That we cannot replace with any kind of technology.” T4

This comment summarises the relevance of the so-called 21st century skills rather well. Creative problem-solving, collaboration and self-regulation should be practiced in order to develop competencies that will simultaneously support the growth of the society as well as support the individuals with skills that will become truly useful in their future professional

lives. In a sense, the arrival of the smart, “24/7” technological devises marked the beginning of a new, more global era. Schools as the prior and primary educational facilities should be further developed to match the needs of this new millennia.

4 CONCLUSION

Now, the related educational paradigms, as well as the nature, purpose, and benefits of designing have been described to exemplify the phenomenon's use in the field of educational sciences. The following chapters aim to conclude these findings, followed by further discussion on the phenomenon of designing in a wider sense.

4.1 Summary of the Main Results

To conclude and summarise the main findings of this study, the research questions represented in the beginning must be looked at one last time. The first research question was:

- 1) What kind of pedagogical practices actually hold value in the current society, and moreover, what kind of activities make learning meaningful?

As Professor of Educational Psychology, Kirsti Lonka (2014) explained, currently the school practices and the students' personal interests seem to differ greatly from one another. At schools, the students' natural ways of finding information and integrating that information to benefit them is not taken into account as well as it should be. With their smart technological devices, the students are quick and creative in finding answers to their questions, are able to contact others effortlessly, and are knowledgeable in using applications to mediate their thoughts rather well. These useful skills should be adopted into the school contexts to further add relevance to the school activities, and also to engage the students in tasks at school. According to Lonka's findings, presently the students do not find some of the activities at school stimulating, authentic, or practical enough, and furthermore, feel like they will not benefit from some of the taught skills in their future professional lives.

According to recent studies, there is some truth behind these worries as many professional communities now seek for employees with skills of creative and resourceful problem-solving, and the ability to work with different people, in new contexts, in ways yet unknown to us (Mitra, 2013). An element missing from our current basic education, is precisely the element of being resourceful and using all of the available tools, technology, and expertise in learning new things and developing solutions to problems. In the 21st century, this is what is expected of us. Modelling existing models or copying existing skills is not enough in this digital era. As Doctor of Education, Jackie Gerstein (2014) expresses:

This movement to build a generation of design thinkers could not be more timely or more relevant. We are living in an age of increased complexity, and are facing global challenges at an unprecedented scale. The nature of connectivity, interactivity, and information is changing at lightning speed. We need to enable a generation of leaders who believe they can make a difference in the world around them, because we need this generation to build new systems and rebuild declining ones. We need them to be great collaborators, great communicators, and great innovators.

Of course, this should not only be a task for schools, but rather a way of thinking and continuing learning throughout life. The environment and atmosphere at schools could be uplifted by further involving scenarios from the real world around the students as a part of school activities. Integrating relevant issues into school tasks increases the value of education for students, and hopefully also reduces the “gap” between off and at school interests.

Furthermore, the element of versatile, interactive learning environments also affects student engagement. When discussing about optimal learning environments with the interviewed teachers, all five teachers expressed that students learn in both formal and informal learning settings – everywhere. Therefore, learning should not be linked to a particular environment, such as the classroom. Optimal learning environments should rather be chosen according to the task in question – convenient environments were seen to further stimulate the students’ learning processes.

Furthermore, the teachers believed students’ motivation in school tasks to increase by letting the students be active members in every part of the learning process: from the planning stages to the execution of the inquiries. The stimulation of students would usually begin by introductory lessons in which the teachers’ role was seen as especially important. Three of the interviewed teachers expressed the importance of the first few lessons on each project, as the lessons’ purpose was to especially excite, inspire and motivate the children for the upcoming process. One of the teachers further explained that while some of the students become fascinated by the theme of the project, others need to be excited with the ways in which the theme is presented to them. Moreover, two of the teachers emphasised that it was precisely the right kind of questions, *driven questions*, that would usually stimulate the children, while the others emphasised the importance of giving the children the freedom to choose between different forms of execution.

In relation to all of these comments, the element of subjective, personalized experiences as a part of the learning process of students was mentioned in all of the interviews. All of the five teachers thought that the experiences at school would withhold more value once they were linked with the surrounding social environments of the students. Physically, this meant the integration of everyday technology and versatile, interactive learning spaces. Mentally, this meant the integration of the students' personal history, culture and areas of interest as a part of the activities at school. In order to succeed in this, the five teachers favoured inquiry-based learning methods in their pedagogy; such as learning from phenomena, through different collaborative tasks, and in holistic cross-curricular manners.

Moreover, in regard to student-centred activities, especially the beginnings of the projects were described as somewhat chaotic and hectic by two of the teachers. They expressed that while such student-centred activities may sometimes seem to lack focus, they usually also represent the beginning of fruitful collaboration leading to novel and creative outputs. An important element, voiced by all of the five teachers, was the students' ability to self-regulate and assess their learning. Two of the teachers explained that they had begun the practicing of such abilities from very simple and concrete, daily tasks. Furthermore, one of the teachers further explained, that in only a short period of time, the students' goals for learning had shifted from external motivation (as in getting a high grade) to internal motivation (as in authentically wanting to understand something). Self-regulated, metacognitive skills were seen as one of the most important skills for students to learn.

As a conclusion, pedagogical practices that hold value in the current society are the kind that foster creative problem-solving, innovation, collaboration, self-regulation, and ICT-skills' development. Students find the kind of pedagogical practices meaningful that indeed provide them with these aforementioned skills and know-how – skills that also show relevance and need in the 21st century.

Furthermore, as one of the main findings of this study, designing in education and design-oriented pedagogy were introduced for fostering the aforementioned pedagogical practices. In this study, design practices were considered as mediating tools in addressing the pedagogical issues of the 21st century. For this purpose, the second research question of this study was:

- 2) What is Design Education and how can we benefit from its ideology in our teaching practices?

Designing can be considered as a basic, innate, natural human ability. We constantly design: make inquiries, plan, and create products which will make our lives easier in the environment in which we live. Designing is a common way of constructing information and using the information and learned skills to solve the problems around us in convenient ways. (Enkenberg, 2012.)

At school, designing could be characterized as collaborative project work among the students and other participating members – the students actively contribute in each step of the design process, from planning to execution. Design projects often involve other members in the community, and invite experts from the field to further support the students' designs. Designing withholds elements of producing a real prototype and possibly encountering real-world problems in the making. By practicing designing, students are faced to interact and deal with authentic scenarios, which according to research, increase the motivation and engagement of students. (Lonka, 2014.)

However, when analysing the comments of the interviewed teachers on designing, in relation to any other discussed topics, their remarks on designing varied the most. Three out of the five teachers seemed to have engaged in design-related activities with students rather subconsciously, or alternatively, by using other terminology for the activities – the teachers described their pedagogy as student-centred, inquiry-based and collaborative. Moreover, one of the teachers saw the design process as constructive and well-functioning, and had seemed to realize how subconscious design processes had progressed into conscious action throughout the iTEC –cycles. Furthermore, one of the teachers described design processes as idealistic in regards of learning in school contexts. This teacher liked the fact that the design process formed an entity and naturally involved assessment practices in the learning of students.

With these arguments, it is clear that the second research question aims to address the first: designing has the capacity to make education more valuable and meaningful for students. However, the research also showed importance in the more traditional, teacher-led learning scenarios, and emphasised the balance between subject teaching and the teaching of cross-curricular themes.

Furthermore, the third research question was:

- 3) In relation to the information and communications technology (ICT) becoming one of the most dominant learning tools of the 21st century, how do teachers understand their role as educators?

By examining especially the empirical data, it seems that the interviewed teachers saw great possibility in the integration of ICT-tools. Especially after hearing about the executed iTEC –projects, the integration of the digital tools had seemed to have had positive impacts both in the independent use of students as well as for collaborative purposes. Surprisingly, all teachers stated that they had never come across a student unwilling to use ICT-devices. One of the teachers did emphasise that this was precisely due to the pragmatic use of technology, meaning that the devices were only used when seen as relevant. Another teachers also stated that the question of integrating ITC-tools was not exactly a question of positive or negative experiences, but regardless of them, a necessity and an essential part of the students later lives.

In relation to the theoretical framework, computer-supported collaborative learning shows to present its users with tools and pedagogy which help mediate and support the social action and collaboration among the participants. The purpose is to precisely support interaction, not replace it by only communicating in virtual learning environments. (Stahl et al., 2006.) By integrating technological devices into learning activities at school, the students are kept in contact with the popular and dominant ways of searching for and processing the information around them. With these digital tools, students are able to produce, save, move and undo their work. Furthermore, digital tools show to be efficient mediative tools; a possible way to document self-regulation practices, and an easy way for students to go back and reflect upon what has already been done.

On the contrary, ICT-tools in education also present great pedagogical responsibility. All of the five teachers expressed that practicing the appropriate use of the Internet with the students was one of their most important tasks. The teachers felt, that it was not necessary to integrate ICT-tools, if not for a particular purpose, and with purposeful and relevant tasks, critical thinking skills, and the questioning of the reliability of the found sources could be practiced. However, it was also expressed that schools presented a beneficial platform for conducting precisely such activities; a safe environment where conversations on the appropriate use of ICT-tools could be held. Furthermore, to balance this, schools were

also thought to present a platform for practicing the social skills of students. One of the teachers stated: *“We come to a certain building to practice being with others. I hope that never changes.”* In other words, the balance between digital and face-to-face inquiries was found as an extremely important element in current pedagogical practices.

Furthermore, in addition to integrating ICT-tools as a part of the activities at school, teachers also experienced their roles in the classroom as somewhat different. Because information is now so widely accessible by everyone, the teachers did not feel like their task was to precisely provide the students with the needed information, but rather viewed themselves as stimulators, enablers and mentors in the classrooms. Currently, more focus was put into the planning and preparation of different projects: assessing the possible resources, possibilities and limits the projects might present. Additionally, it was also thought that the teaching of some of the more basic skills (such as mathematically logical problem-solving, understanding of literature and the mother tongue, understanding of ethical issues and religions, as well as the practicing of music, physical education, and arts and crafts) was seen as essential. Furthermore, according to both theoretical and empirical findings, balancing these basic skills and the so-called cross-curricular skills, is what the profession will most likely lead to be in the future (Gerstein, 2014.)

As a conclusion, it could be argued that in relation to the growth of ICT-tools and their increasing status as the dominant tools for accessing information, the role of teachers has changed. Learning at schools has now become rather project and inquiry –oriented, meaning that learning new content is strongly associated with learning from larger entities, phenomena and inquiries. In my opinion, more opportunities for additional teacher training on the mentioned matters should be organized locally and globally, so that teachers could better adapt to the current and upcoming changes in different educational contexts. After all, teachers can be thought to resemble the mentors and mergers of children into young adults, beginning their first attempts to pursue their professional goals and overall well-being in life.

Now, to conclude this study, the reliability, validity, and ethical issues of the study will be discussed.

4.2 Reliability and Validity

This study relies on findings gathered from the five interviews, meaning that the process of analysis is entirely dependent on the researcher herself. According to Cohen et al. (2000: 121), in qualitative research, and especially in using interviews as the method for gathering data, the researcher is prone to many sources of bias, such as; a) personal attitudes, opinions, and expectations; b) tendency for the interviewer to see the respondent in her own image; c) tendency for the interviewer to seek answers that support her preconceived notions; d) misconceptions on the part of the interviewer of what the respondent is saying; and e) misunderstandings on the part of the respondent of what is being asked. All of the mentioned aspects affect the interpretation of the researcher, therefore affecting the reliability and validity of the study. Therefore, in order to analyse the data productively, as the researcher, I must realise my own biases and any presumptions I may have towards the discussed topics. Undoubtedly, my prior work experience and engagement with the teachers prior to the interviews has affected the entire analysis process; from choosing which teachers to interview, in the ways of interacting with each teacher during the interviews, as well as in the ways of analysing and writing the conclusions in this thesis. The conclusions merely represent my understanding of the empirical data.

Furthermore, unlike in quantitative studies, where reliability and validity are often ensured by gathering a much larger data, I was not as interested to gather or interpret data based on the quantity of the found results as I was on voicing and analysing the opinions of individuals with expertise on the topic. In other words, my research was focused on analysing the interesting details and undertones found in the five interviews. In my opinion, this aspect of the study was rather successful as the open structure of the interviews left a lot of room for self-expression and the opportunity of explaining oneself thoroughly. This was also noticeable in the length of the interviews as well, as their duration varied from 20 to 60 minutes in length. Naturally, some of the teachers were more descriptive in their ways of explaining, and some also used humour as a way of self-expression.

In relation to this, my personal conceptions are also visible throughout this study in the form of the translations of the teachers' interviews. I chose to interview the teachers in their mother tongue to avoid possible shortcomings in expressions, instead relying on my personal skills in translation. I do however, realise the causes translating may have had on the interpretation of the teachers' statements. As a translator, I have not translated the

teachers' quotes word for word, but rather focused on ensuring that the tones and messages of the quotes would become clear to the reader.

However, regardless of the mentioned deficiencies, I would consider the findings of this research as valid. In my opinion, the information received from the interviews was extensive enough and supported the theoretical framework sufficiently. The teachers' comments presented fruitful additions to the existing information, discussing the phenomenon and concepts under exploration in depth. Furthermore, the similarities found in the empirical data and the theoretical framework also implicate the truthfulness and reliability of the analysis. (Eskola, Suoranta: 2003: 210 – 218.) Similar results have also been reported from the large scale iTEC –pilots executed across Europe in over 2500 classrooms. Linking the findings of this research with findings from the iTEC –project increases the reliability of this research even further (iTEC: 2014).

4.3 Ethical Issues

As has been mentioned, the empirical data of this research was gathered through five interviews. In the early stages of the research process, the interviewees were gathered by inquiring their willingness to be interviewed either in person or via email. Before their acceptance, the purpose and nature of the study was explained to all five teachers. The interviews were held separately, assisted with a recording device to help the later transcription phase. Once all of the official interview questions were asked, the teachers were given a chance to further express any additional thoughts on the topic. Furthermore, the nature of the interview procedure in itself was also rather open and enabled all kinds of thoughts and interpretations on the topics to be expressed. The interviewees were let to know that all of their given information was shared confidentially with only the researcher. The chance to contact the researcher later on for any additional questions was also given.

In this report, the names of the teachers have been replaced by coding (T1, T2, T3, T4, T5) to ensure their anonymousness. The original interviews have only been analysed and transcribed by the researcher, in the light of the theoretical framework, and for only purposes of educational research. (Eskola, Suoranata, 2003.)

Theoretical and Practical Implications

Theoretically, this thesis represents a useful addition to the existing literature, as the phenomenon of designing in education is still quite a recent discovery in the field of educational sciences. Yet it represents incisive ideas in developing pedagogy-related issues in the 21st century.

On more practical levels, the thesis presents relevant discoveries for educational professionals. The Finnish national curriculum is under development – teachers and other educational parties might find the findings of this thesis useful in regards of the planning of the curriculum, as well as in regards to their everyday practices related to education.

Additional research could also be executed on the lifelong impact of designing from basic education, to high schools and later degrees, all the way through work life. This thesis studied designing from the perspective of teachers attending additional professional training in the form of the iTEC –project. Studies on design-oriented pedagogy in more natural, every-day school environments could also be executed.

In the final section of this thesis, thoughts on the phenomenon of designing will be discussed in a wider sense.

5 DISCUSSION

Designing, whether in relation to arts, architecture, engineering, marketing, or physical designs, seems to be a trendy word, rich with meaning, used in many professional fields. However, the basic idea of designing in all these relations, seems to be somewhat similar; producing outputs to please or benefit the target audience. The word *design* as both a noun (a concrete object) and as a verb (designing as a process) seems to be in wide use all over the world. (Leinonen, 2014). In fact, the word is so profoundly used that it does not even translate to some languages conveniently (i.e. in Finnish), and thus the English word is rather used. Therefore, it could be argued that *designing* as a word, process, or concrete output, is associated with quite a lot of power and positive notions for the time being.

On the contrary, the word *design* may have also suffered from inflation due to its widespread and common use in a variety of different contexts – the value has decreased because there is no specific or singular meaning to it. The designing of different products is also often associated with the current consumer culture, where new and advanced products (designs) are constantly produced to the market. Sometimes this decreases the quality of the designs, whether in means of low endurance or more advanced designs being made. It is often this imagery of designing that partly contradicts with some of the current educational values: such as recycling and sustainable development. Desire for schools to further promote such consumer culture is undoubtedly low. However, it must be remembered that designing *in education* does not only associate designing with material products, but rather with strong emphasis on innovative and evolutionary problem-solving and creating purposeful additions to different existing systems. The pedagogy behind it is constructive and actually supportive of sustainability. (Nelson, Stolterman, 2003.)

Further in relation to pedagogical designing and learning, Hakkarainen, Paavola and Seitamaa-Hakkarainen (2006) explain general notions of learning to be related to: 1) finding information, 2) socially and culturally participating in a learning event, and 3) in notions of creating new information. Designing can be considered as the counterpoint of all of these three, as it is a socio-cultural process in which novel understanding is formed. The process is also deeply involved with collaborative practices, demanding skills of functional interaction from the participants to produce something productive. Furthermore, abilities in doing such require a sense of will and engagement from the participants – attitudes that cannot be

forced by others, but need to exist in the levels of motivation of the participants. This means, that even if the interest rate in a task might not occasionally be very high, skills of self-regulation need to be used to continue successful engagement until the end of the task.

Currently, especially in work life, it is trendy to be talking about self-regulation and self-management. Of course, companies rather hire self-sufficient, proactive workers – in their eyes, “the perfect package”. Yet, however trendy self-management may be, it is a hard and difficult competence to master. Profound learning experiences, which are often the experiences leading to skills or competence, require meta-cognitive, social, and emotional skills and engagement from a person. (Järvelä, 2014b.) Furthermore, self-management usually requires high self-esteem and a high sense of capability. As can be understood, this type of self-regulation is very difficult for many adults – let alone children attending their basic education. However, in regards of this, the purpose of education is precisely seen as the platform for practicing such skills. Even if proven to be difficult, such skills of overall life management, are some of the most important skills to practice – one of the most important tasks of education.

Another frequently formed question, in relation to student-centred self-regulated practices, is related to the diversity of such activities. Oftentimes, when students are given the possibility to freely execute activities among group members, the tasks are divided according to the students’ personal strengths. In some ways, learning should also be uncomfortable for development to occur; students should also be pushed outside of their comfort zones to learn new skills, as after all, lessons are learned through unpleasant endeavours as well. Therefore, questions arise in how to guarantee this in student-driven activities.

In my opinion, this aspect presents one of the most difficult questions in current pedagogy. How are teachers sure to pass on, what is referred to as general education and knowledge, to all of the students? Some of the interviewed teachers explained that a deep sense of student awareness helps in this; for each task, teachers mix up the groups to introduce new dynamics and stimulation for students. Furthermore, the constant assessment practices help teachers in observing the learning process of each student. In other aspects, the responsibility of learning is actually in the hands of the students themselves. They need to self-assess their learning. However, when further thinking this, how are teachers to guarantee learning in the teacher-led activities either? Even though the same skills are introduced to all students, there is no guarantee of actual learning to occur, and trust in the students’ own re-

sponsibility plays a major role there as well. Even though teachers might feel that there is more control in teacher-led activities, that is not necessarily always the case.

In conclusion, it could be argued that the process of profound learning is dependent on an individual's interests and will. Fortunately, a sense of exploration is usually a part of the characteristics of every human being, and that inner curiosity often leads us to explore the unknown. Trust in the students will to explore, develop, and create is an element that should be further fostered in pedagogy.

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APPENDIX 1

THE INTERVIEW QUESTIONS IN ENGLISH:**1. Background information**

- Age
- Work experience
- Current school and taught age levels

2. iTEC

- In how many iTEC cycles have you taken part in?
- What kind of projects did you execute during those cycles?
- Did you experience anything pedagogically new during the projects?
- Could you describe some of the things that you experienced as positive? Negative?

(The first two questions functioned as warm up questions)

3. In what kind of learning environments does learning usually occur in?

- How can teachers support the learning processes?

4. What kind stimuli or learning scenarios make learning meaningful?**5. How big a part should students have in the designing and implementing of their own learning processes?**

- Can we expect self-regulation and the responsibility of one's learning from students attending their basic education?

6. What kind of competencies will students need after their school years?

- In relation to our current society, the expanding role of technology, or skills needed in future professional practices.

7. What will the role of teachers be like in the future?

- What kind of skills should be taught?
- What will the role of information and communications technology be?

(The next questions were aimed to function as 'cool off' –questions. I wanted to see how, in the teachers' professional opinions, the educational system might develop in the future)

8. In what kind of learning environments would education be its most fruitful?**9. What might schools be like in fifty years from now?**

- Will we come to school?

10. Do you have any additional thoughts on the topic?

The interview questions in Finnish

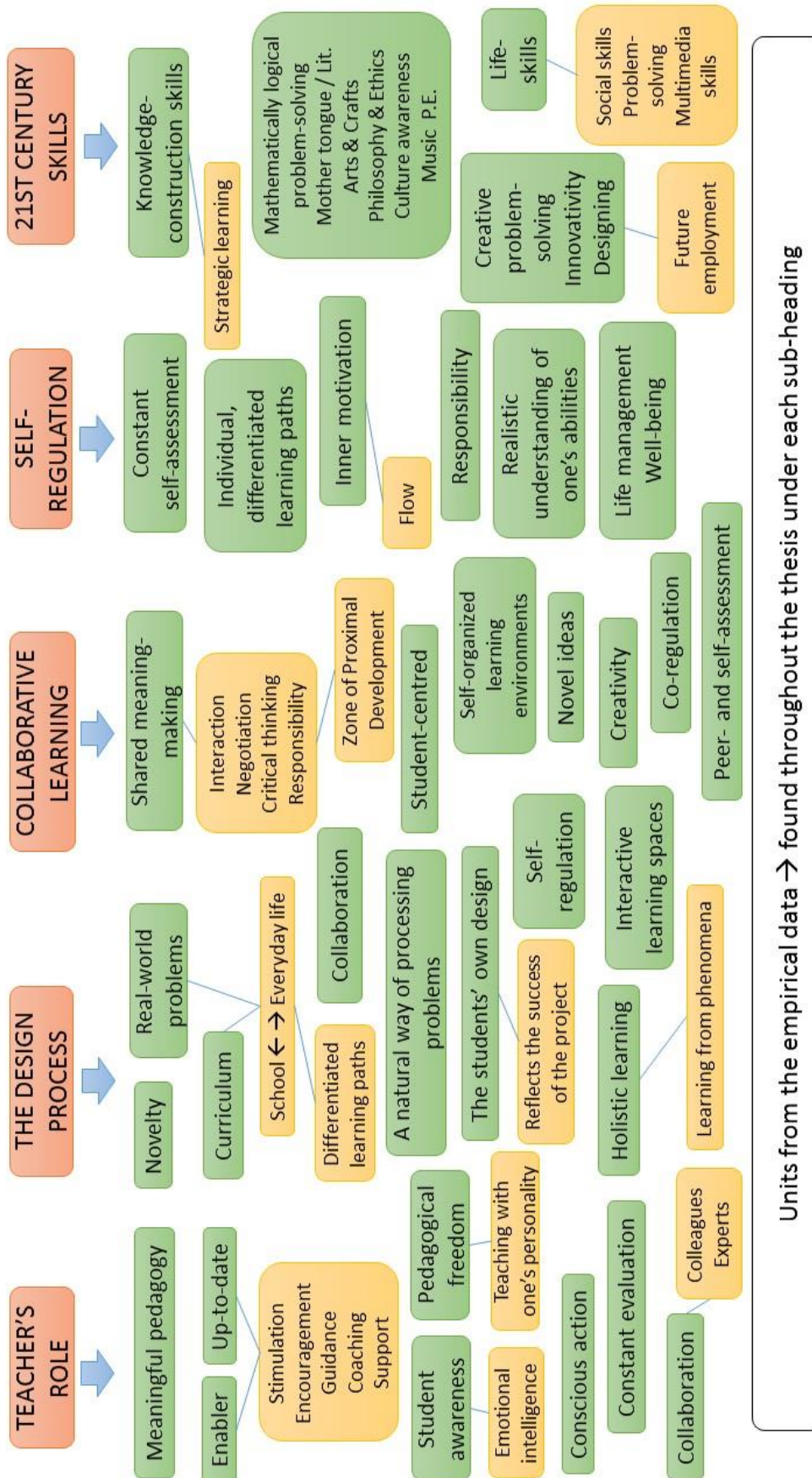
HAASTATTELUKYSYMYKSET:

1. Haastateltavan
 - syntymävuosi
 - työkokemus
 - nykyinen koulu, opetettava luokka
2. **Kuinka monessa iTEC-syklissä olette olleet mukana?**
 - Minkälaisia projekteja toteutitte kokeiluiden aikana?
 - Koitteko projektien aikana opetuksellisesti jotakin uutta?
 - Mikä oli positiivista/negatiivista?
3. **Minkälaisissa oppimisympäristöissä ja opetustilanteissa nykypäivän oppiminen tyypillisesti tapahtuu? Miten opettaja voi tukea näitä prosesseja?**
4. **Minkälaiset ärsykkeet tekevät oppimisesta mielekästä?**
5. **Kuinka suuri rooli oppilailla tulisi olla oman oppimisensa suunnittelussa?**
 - Voidaanko alakouluikäisiltä oppilailta vaatia itsesääätelytaitoja ja vastuuta omasta oppimisestaan?
6. **Minkälaisia taitoja oppilaat tarvitsisivat mielestäsi tulevaisuudessa?**
 - Jos ajatellaan nyky-yhteiskuntaa, teknologian kasvavaa merkitystä ja tulevaisuuden työelämässä tarvittavia taitoja?
7. **Millainen on tulevaisuuden opettajan rooli?**
 - Minkälaisia taitoja/kompetensseja tulisi osata opettaa?
 - Millainen rooli TVT:llä on tulevaisuuden kouluissa?
8. **Minkälaisissa oppimisympäristöissä oppiminen ja opettaminen olisi kaikkein hedelmällisintä?**

9. Minkälainen koulu on noin viidenkymmenen vuoden päästä?

10. Herääkö teillä muita ajatuksia aiheesta?

APPENDIX 2



6 ACKNOWLEDGEMENTS

I would like to thank Pasi Kurttila and Markku Lang for including me in their projects with such trust and kindness. Involvement in these projects have revolutionized my thoughts and changed the way I now view education. Their guidance and partnership has been invaluable to me.

I would also like to thank my mentor at the university, Essi Vuopala, for guiding me, and in moments of hesitation, making me see things clearly again.