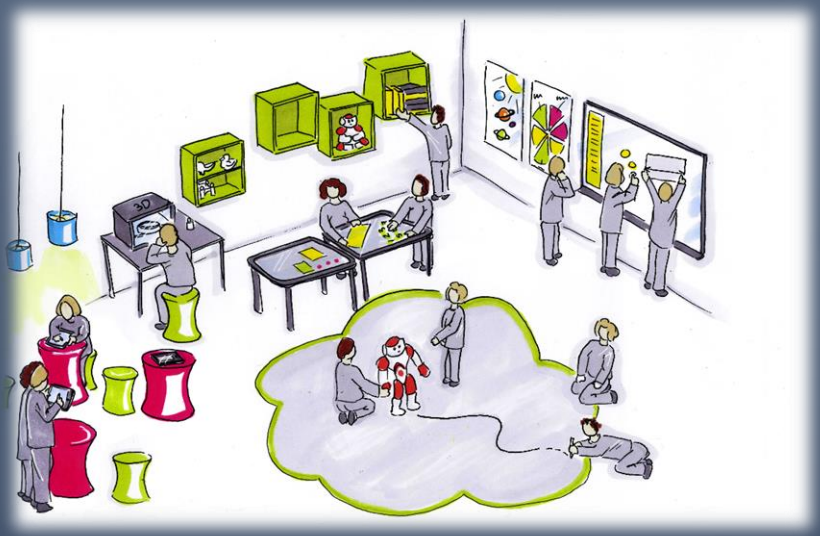
2014
June 2nd



Accustoming to the New Danish School Reform:

A Design-Led Evaluation of a Didactic Mindset Model through Ethnographic Study and Reversal Theory

Niels Vandel Svendsen
Human Centred Informatics, 10th semester
Aalborg University

Title Page

Title:

Accustoming to the New Danish School Reform: A Design-Led Evaluation of a Didactic Mindset Model through Ethnographic Study and Reversal Theory

Aalborg University, June 2nd, 2014
10th semester, Human Centred Informatics

Niels Vandel Svendsen: 

Supervisor: Marianne Lykke

Total number of pages: 79,5 (Characters with spacing: 190,783)

Abstract

At the Danish municipal primary and lower secondary school "Antvorskov School", a development project called "EduTechLab" has been established. EduTechLab is inspired by OECD's project on Innovative Learning Environments, and seeks to develop all students' talents by developing didatic through the interplay between research, practice and education. This is done from the believe that the key to developing educational practice is to interact more with the school's surroundings – making it open to change but also a provider of change. It is the school's claim that by developing a broad pedagogic understanding of use-relations with technology, they are enticing re-thinking of educational practice. To help them achieve this, the school has hired a consultant as project manager of the EduTechLab. The project manager has co-developed a didactic mindset model which is guiding the teachers in their efforts to plan and teach product oriented with interactive digital technologies (IDT). Together with 21 other Danish municipal primary and lower secondary schools, Antvorskov School has been chosen by the Danish government to participate in an IT demonstrational school project. The purpose is to gather knowledge about student learning and motivation with increased use of IT in the teachings. As such, Antvorskov School is studying the students' own production and student involvement.

This report introduces a supplementary study that took place across three weeks in the beginning of 2014. The Danish government called for an evaluation of the new Danish school reform in action, thus providing a unique opportunity to test the EduTech Mindset Model and the product oriented teachings full scale. The study is guided by the principles of Design Based Research and seeks to uncover the students' affective experiences with product oriented teaching and use these to draw implications for further design of the EduTech Mindset model. The study is conducted through an ethnographic approach that combines quantitative and qualitative methods of respectively participant observation, interviews and semantic differential questionnaires.

The findings reveal that the product oriented teachings have generally been well received by the students, who report they feel more delighted, stimulated, exercised, safe, lively and interested compared to traditional classroom teachings. As a result, the merging of the qualitative and quantitative methods reveal the implications for design that affects key aspects of product oriented teaching. The concluding implications for design are as follows:

- The short and concise form of the courses is received positively by the students, however, some topics may be too knowledge-heavy to sufficiently inspire the students.

- We need to rethink how the logbooks can provide the students with instant gratification, in order for them to immediately realise the purpose behind them. Otherwise we risk the students view them strictly as a tool for the teacher.

- The milestones may be more powerful if they are connected to a case with a real world problem. They should be concrete and concise and can preferably be adjusted in volume and scope to fit the skills of each respective group of students.

- We need to find a better way to merge individual training with product oriented teachings so that it makes sense, bears meaning and serves a purpose. Otherwise, we risk that the students experience individual training as a sort of punishment or extra-curricular activity.

- The students' understanding of what it means to be a team needs some serious attention. They are prone to adapt a mindset of "me" and "the others" and will most likely engage in group work from their own perspective. This can make it difficult to improve inclusion. We therefore need to ensure that the students become more socially aware, perhaps by training their group working skills through courses that focus on the dynamics of group work.

Preface

This report marks the conclusion of my education in Human Centred Informatics. It has been five great years with many exciting events that has truly transformed me and opened my eyes towards the field of educational research. I hope you will enjoy my work!

Acknowledgements

First, I would like to thank my supervisor, Marianne Lykke, for all her support and guidance. It has truly been a pleasure to work with you, Marianne. You are and will continue to be a great source of inspiration to me, as I continue to engage in educational research. Thank you!

Next, I would like to thank the school management at Antvorskov School: Søren Ranthe, Britta Thomsen, and Peter Brandt. Thank you for a very pleasant and exciting collaboration. It has been great to work with such passionate people. I wish you all the best in your endeavour to further develop on learning research through EduTechLab. Who knows, maybe our collaboration will continue in the very near future!

Next, but not least, I would like to thank the project manager of EduTechLab, Peter Eduard. It has been a great privilege to work with you and to learn about product oriented teachings. Also, I wish I had your drive! You are insanely enthusiastic and knowledgeable about technology. I really admire that. Here is hoping we will get to collaborate again!

Next, I would like to thank all of the teachers for showing your interests and taking good care of me during my stay at Antvorskov. I would especially like to thank Iben, Helle, Laura, Helen and Malou for allowing my participant observations and for all the interviews. Your contributions have been of great value to this study – thank you very much!

Also a thank you to Dorte Kamstrup for keeping me company and for all the interesting conversations we had in the office. Good times!

Finally, I would like to thank all of the students across the 7th and the 8th grade for their participation – it was truly fascinating to follow your progress!

Regarding the Appendix

The appendix is divided into two parts. Parts A-F2 can be found in the back of the report, whilst parts G-R can be found on the enclosed DVD or on the following link, where it will be available until September 1st, 2014:

- http://1drv.ms/1rewwhT

Throughout the report I use the short term "appx." to refer to the appendix.

Readers Notice

Throughout the report, I use the term "students" instead of "pupils". On occasions where there is a direct referral to one or several student-names I have applied censuring by replacing them with "xxxxx".

Table of Contents

1. Introduction 1
   Case Description 3
   Antvorskov School 3
   EduTechLab 4
   The EduTech Mindset Model 16
   The UVM Project 20
2. Thesis Statement 21
   Thematic Frame 22
3. Reversal Theory 23
   Domains and Motivational States 27
   Reversals 33
4. Method 37
   Design-Based Research 37
   Ethnography 44
   Participant Observation 47
   Interviews 52
   Questionnaires 54
   Evaluation Meetings 60
   A General Inductive Approach 60
5. Data Processing 63
6. Analysis 73
7. Discussion 111
8. Conclusion 117
9. Process Description 121
10. References 123
11. Appendix A-F2 128

1. Introduction

The Danish municipal primary and lower-secondary school has been through a transition in which Interactive Digital Technology (IDT) has become accepted as part of the classroom ecology. Despite of the openness towards IDT, the focus on implementing it has happened through a tool-centric view that has treated innovation as something that would automatically give rise to itself (appx. F2). However, the difference between using IDT for consumption and using IDT for teaching is very significant. IDT always adds a layer of abstraction to our actions, but it also enables us to perform tasks that would otherwise require certain knowledge and skill. Therefore, the use possibilities of IDT are intriguing, but when put into an educational context, they theoretically require certain types of intertwining knowledge in order to be used effectively. Otherwise, as I have observed in previous studies, there is a good chance that the complexity of teaching will rise (appx. F2). Additionally, IDT is governed by a new teaching aid culture that enables students to become didactical co-designers, but also challenges teachers to re-think their teachings and to encompass the complexity of resources (appx. F2).

In order to deal with all these aspects, the Danish government has launched an initiative that will re-establish the foundation of the Scandinavian educational tradition. Amongst the core principles is the education of individuals who are socially, personally, and academically aware, which is achieved through application oriented teachings in broad subject knowledge. Additionally, the body is viewed as a whole learning organ, and must be stimulated as such (appx. F2).

Finally, the Danish government has passed a new school reform that focus on enabling all students to realise their full potential. The reform acknowledges the difficulties of integrating IT in education and funds have therefore been granted to train teachers, pedagogues and school managements to become

better at using IT from an integrated instead of an isolated perspective. An online web portal will be made available to teachers and school management to allow teachers to share knowledge and experience, and to develop a decentralised evaluation culture. Additionally, demonstrational schools have been appointed to test ways of achieving integrated use of IT through product oriented teachings that will motivate and include the students (appx. F2). The schools must become more open towards the surrounding society by basing part of the teachings on relations with businesses that need help with real world problems (appx. F2).

This project takes its outset in one of these demonstrational schools, which I will now present in the case description.

Case Description

At the end of the 9th semester of Human Centred Informatics, I was sitting on a hot porch in Costa Rica and researching schools in Denmark. I was looking for schools that were using IDT in their teachings. It did not take long before I stumbled upon Antvorskov School - a municipal primary and lower secondary school situated in the Danish city Slagelse.

Antvorskov School

Antvorskov School is a large school with more than 1000 students and more than 70 teachers (Undervisnings…, 2013b). The schools long-standing effort on being a successful school through effective classroom management is partly the reason why 97 percent of the children in the local district goes to school at Antvorskov (Undervisnings…, 2013b). Concerning classroom management, the school's focus is on elements that sustain the individual student's behaviour. One of the key principles is for example to talk decently. The schools deputy head, Britta Thomsen, elaborates:

"Everyone has to be together in the classroom, also pupils with diagnoses and those with difficulties at home. This requires us to keep decency on our agenda. For this reason, we focus a lot on everyone addressing each other properly." - (Undervisnings…, 2013b, l. 31-33)

Like every other Danish municipal primary and lower-secondary school, Antvorskov is preparing for the new school reform to take effect. Britta Thomsen has the following remarks concerning the changes the reform will have on classroom management:

"The teachers have to find a role in a school where there is greater focus on the children's learning than on the teaching. The pupils must among other things, learn through their own creations, which results in more noise. The teacher's must develop a kind of "Classroom Management 2.0". - (Undervisnings…, 2013b, l. 40-43)

…

"It is a new paradigm, which they must get used to. Fundamentally, the pupils must not become little adapted soldiers who are not allowed to speak their minds. They must be given the tools to succeed in this new type of teaching. It is first and foremost about the pupils learning to see themselves as learners." - (Undervisnings…, 2013b, l. 45-48)

As a vital part of the schools effort to further understand and develop "Classroom Management 2.0", and to provide both teachers and students with the necessary tools, the school have created a creative learning space called EduTechLab.

EduTechLab

The EduTechLab can best be described as a pedagogical workshop of the future. Its purpose is to expand ways of teaching and to engage more students. The idea is to let this happen through an inquiring approach that inspires practice (Antvorskov Skole, 2013; Appx. O1).

The goals of EduTechLab are the following:

- To develop all students' talents.
- To develop didactic through the interplay between research, practice, and education.
- Future oriented competency development.

At Antvorskov School, they firmly believe the key to developing educational practice is to interact more with the school's surroundings – making it open to change but also a provider of change. They want to be the world's first and leading primary and lower-secondary school that develops new ways of learning with technology – i.e. students who develop solutions to real world problems by experimenting with and combining technologies. The school claims that by developing a broad pedagogic understanding of use-relations with technology, they are enticing re-thinking of educational practice (Antvorskov Skole, 2013). Especially the aspect of inclusion is something the school believes can be supported with EduTechLab. Through their successful experiences with the FIRST LEGO League tournaments (Antvorskov Skole, 2014; Center for rummelighed, 2014; Appx. O1), the school has witnessed how the binding fellowship of group work can entice all involved to view themselves as contributing participants – and it is this kind of mindset they wish to explore and enhance through EduTechLab. However, EduTechLab must be understood as complimentary to traditional classroom teaching; as a creative learning space that is governed by the following values:

- Learning is central. The students must be enticed to engage themselves by their own understanding of themselves as learners.
- It is central that learning is social and collaborative.
- Learning goals must be set for the individual students.
- Continual evaluation of learning goals is practiced through formative feedback.
- Expansion of the classroom happens through activities and projects inside or outside of school in an effort to open the school to the surrounding society.
- Inclusion of technology promotes equal dialogues between teachers and students as well as students and external collaborators, effectively ensuring polyphony in the classroom (Antvorskov Skole, 2013).

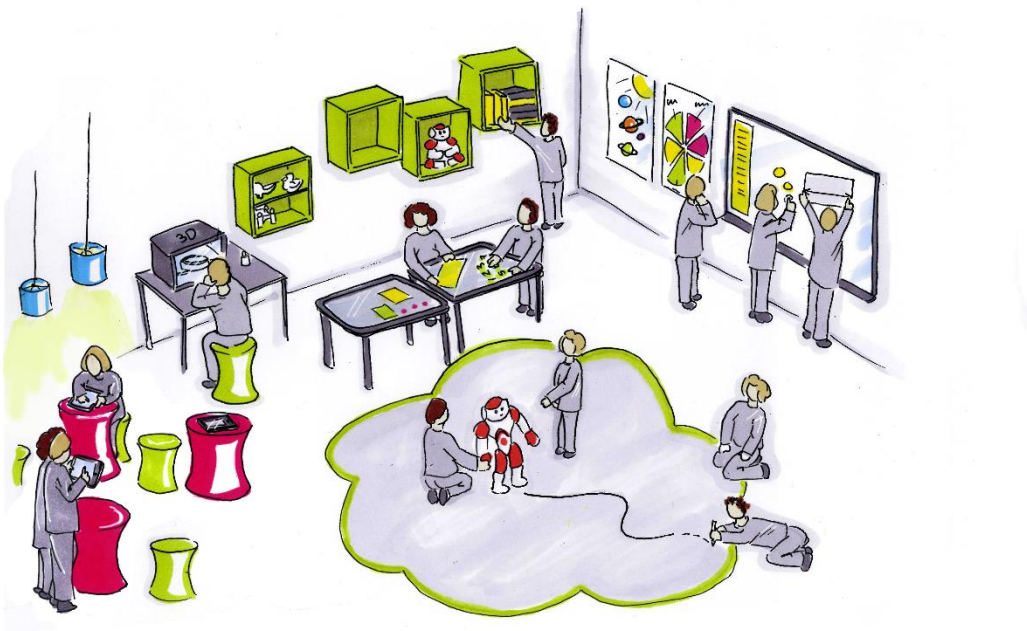


Figure 1: A concept drawing of EduTechLab.

As of now, EduTechLab is a room in the school's natural sciences building. A room filled with modern IDT. Below is a small (but not complete) list of IDT currently found in the EduTechLab:

- NAO robots (Aldebaran Robotics, 2014).
- Hummingbird Robotics Kits (BirdBrain Technologies LCC, 2014).
- Makey Makey's (Joylabs, 2014).
- GoPro cameras (GoPro, 2014).
- LEGO Mindstorms NXT 2.0 (LEGO, 2014).
- Makerbot Replicator 2X 3D Printers (MakerBot, 2014).

For the purpose of this report, I have made very short descriptions of the technologies that have been used during the study. These can be found in appx. R1.

The Project Manager of EduTechLab

To run the implementation and develop the mindset behind EduTechLab, Antvorskov School has hired a project manager named Peter Eduard.

Peter has an independent consultancy firm in which he works part time. He is an educated marine biologist, senior consultant at the Danish Technological Institute (DTI), and regional head of the Danish National Centre of Teachings in Nature, Technics and Health (NTS). Peter has a long history of engagement in various development projects within education, including projects with the Danish Ministry of Education. Currently he is part of an EU project, which is also the reason why he is working part time at Antvorskov (Eduard, 2014b).

On a recently developed website about EduTechLab, Peter describes three main competencies that the teacher's work on in EduTechLab:

1. Pedagogy – to work with and understand children's needs and development.
2. Didactic – insights on the academic presentation of subjects and the learning content of subject areas.
3. Technology – the understanding and use of the tools our society has developed.

In his elaboration of these competencies, Peter describes that the interplay between pedagogy and technology is experienced differently from individual to individual. He mentions that, to some, the mere experience of working with a robot is rewarding and motivating in itself. For instance, the robot is not going to judge you and it does not care how long time you need to understand and solve a task. Furthermore, the coupling between didactic and technology is especially helpful in rectifying inabilities, thus expanding on differentiated teaching. For instance, students with reading difficulties experience a lift in their academic performance when teachings and evaluations become concrete and

physical, as is the idea with the product orientation of working with technologies in the EduTechLab (Eduard, 2014a).

Relevance of Science Education

The research project "Relevance of Science Education" (ROSE) has highlighted some intriguing results concerning the affective dimension of young learners' feelings towards science and technology. These results, which I will describe momentarily, serve as an important source of inspiration to EduTechLab. As described earlier, the new Danish school reform addresses the issue of Danish students scoring averagely in the PISA tests. It also stresses the importance of implementing practical and use-oriented lessons that spark entrepreneurship, creativity, innovation, and nurtures social competencies, motivation and well-being (Undervisnings…, 2013a). The reason for this is the government's focus on innovation and knowledge - more specifically; how we can sustain our welfare society in the future (Østergaard, 2012). The argument is that the Danish society increasingly needs to compete by transforming knowledge into new solutions and products, and this aspect naturally has to be reflected in our educational system (Østergaard, 2012). However, the results of the ROSE project may prove to be a thorn in the flesh on this political endeavour, let alone the teachers who are going to secure it.

The ROSE project includes nearly 40 countries and presents affective perspectives towards science and technology as seen by 15-year-old learners. The focus of the affective perspectives is on attitudes towards- and motivation to learn science and technology (Sjøberg & Schreiner, 2010). Generally, the results show that the attitudes towards science and technology are positive, but especially the young learners in the rich Nordic countries, such as Denmark, are more sceptical and prone to problematize science and technology's effects on society (Sjøberg & Schreiner, 2010). When it comes to learning science in school, the rich Nordic countries generally show little interest compared to developing countries, cf. figure 2 & 3.

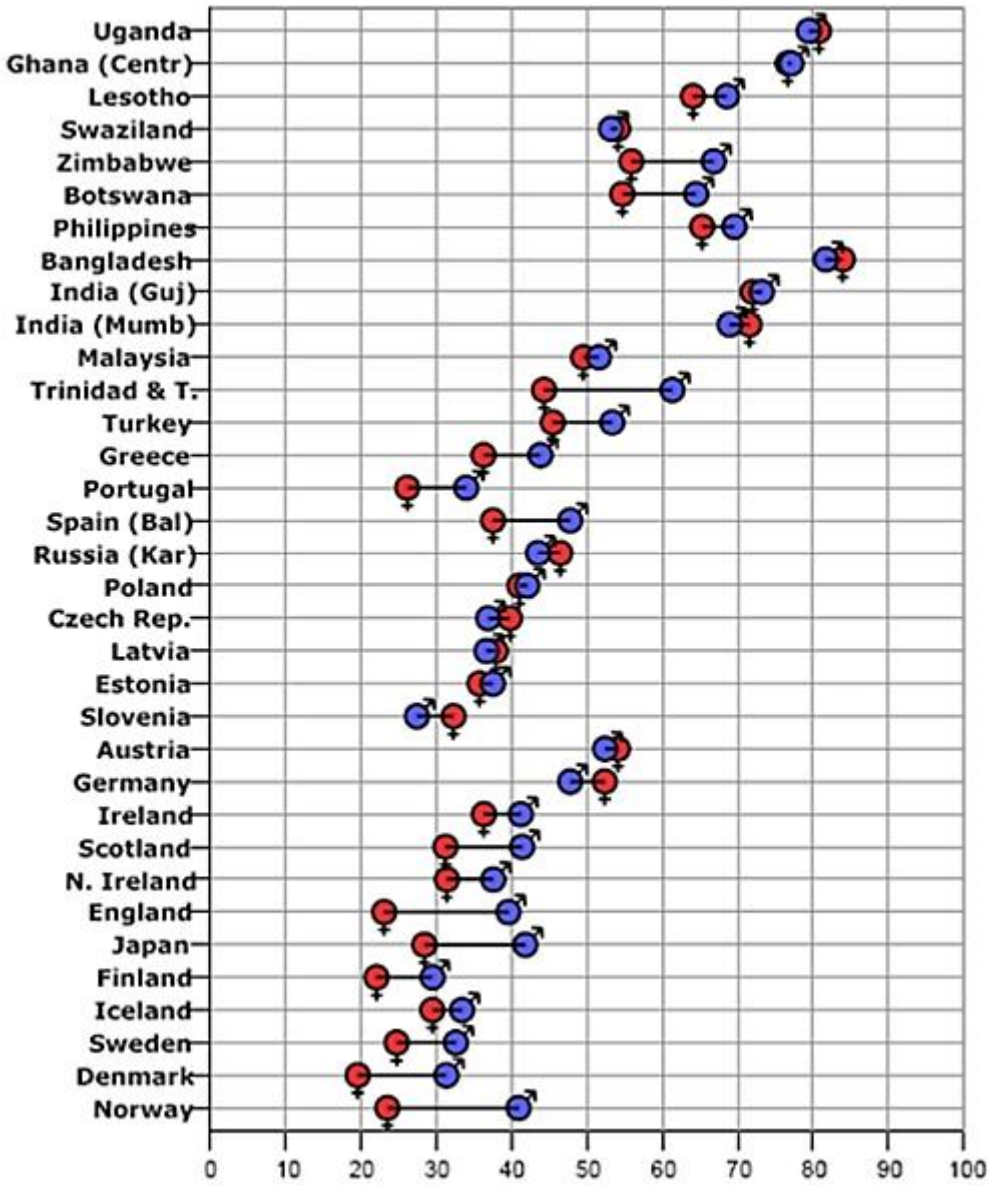


Figure 2: **"I like school science better than most other subjects".** These mean values clearly show that young Danish students are not very fond of school science, compared to poorer countries, when asked to evaluate the above statement (Sjøberg & Schreiner, 2010).

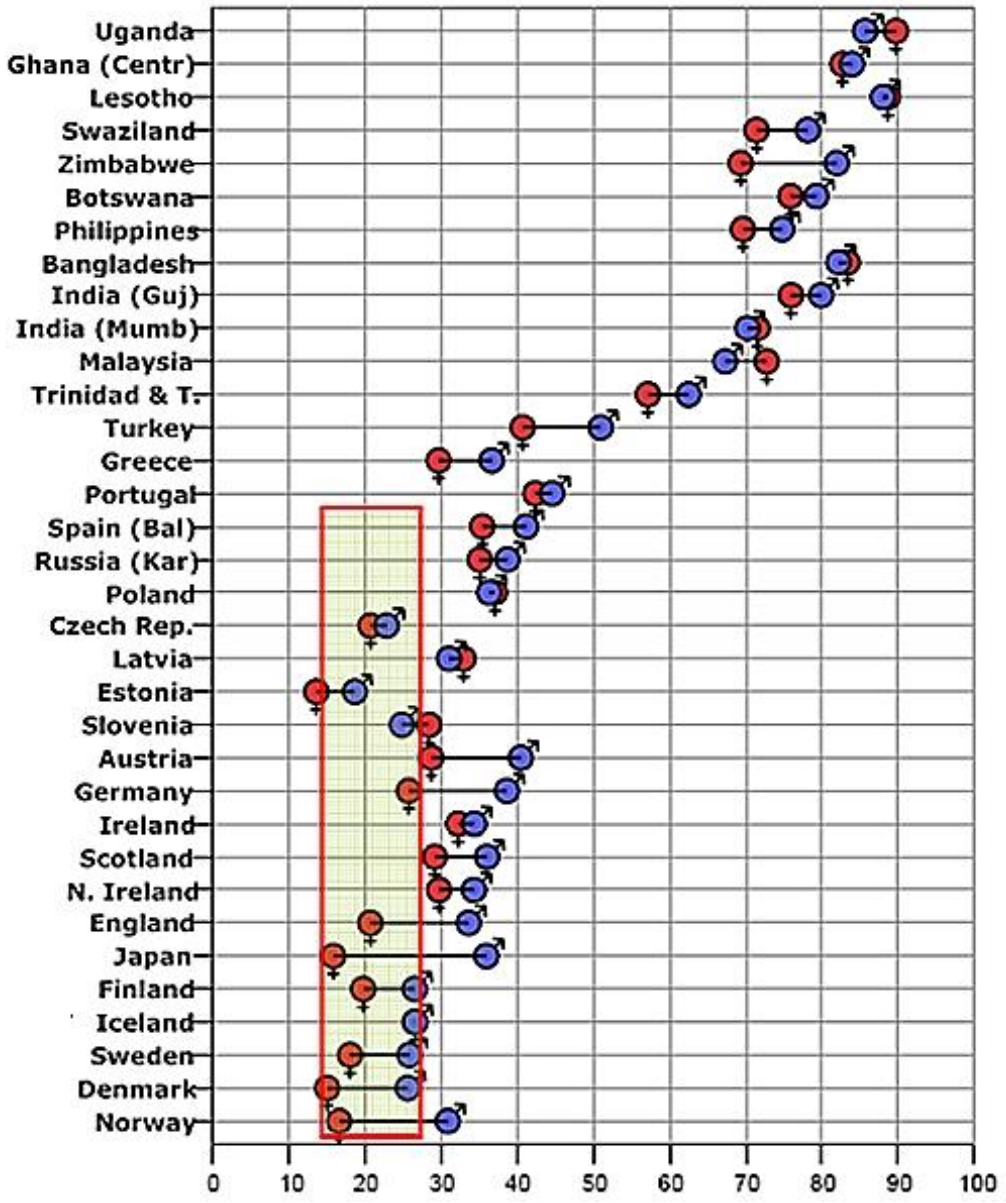


Figure 3: **"I would like to have as much science as possible at school".** The results are even more striking when asked to evaluate the above statement. Here you clearly see that young students in Denmark do not like the idea of science classes taking up as much of the curriculum as possible (Sjøberg & Schreiner, 2010).

The results seem to suggest that the more developed a country is the less interest the young learners have in science in general, however, the study emphasises that this may be too bold an assertion. Instead, the results may be due to young learners in rich countries viewing schooling as a duty or an obligation, rather than as a privilege. In this respect, the young learners in the rich Nordic countries are not just going to be happy to learn everything, as would presumably be the case in the very poor countries. Instead, the young learners in the rich Nordic countries expect school to be fun and entertaining, thus making them more selective in their interests and more prone to make their opinions about the learning content heard (Sjøberg & Schreiner, 2010). For this reason, it would seem that motivating the young Danish students requires an effort in contextualising the educational content so that it bears meaning to them. The ROSE project especially points to *interest* as an important determinant of the student's future educational path, pointing to the following implication for education:

"In particular, there seems a need to "humanize" school science, to show that science is part of human history and culture, and that is is a corner-stone in our present, modern world-view. The learners should also learn to see that science and technology form the basis of our current way of life as well as a basic element of many jobs and occupations, also for those who do not choose to work in what is perceived to be the science and technology sector". - (Sjøberg & Schreiner, 2010, pp. 30, l. 7-11)

Although the new Danish school reform uses the PISA results as argumentation for educational change, the success criteria should not rest on these results alone. The PISA results mainly concern the cognitive aspects, but fails to address the affective factors (Sjøberg & Schreiner, 2010). The ROSE project reveals that if teaching material and practices are not engaging and meaningful to the learners, rote memory learning based on duty is likely to occur and bad learning experiences could then make students "give up" on science and disregard it as too difficult (Sjøberg & Schreiner, 2010). The big question is therefore how EduTechLab is going to ensure this "humanisation" of school

science, in its effort to meet the demands of the new Danish school reform, cf. appx. F2.

Innovative Learning Environments

At its core, EduTechLab is inspired by OECD's research on Innovative Learning Environments (ILE) (Antvorskov Skole, 2013). ILE comprise a holistic approach to learning environments in which technologies are only part of the solution of how to design future education. The research on ILE supports the claim that implementation of IDT from a tool-centric perspective does not innovate education, because the desired changes highly depends on the combination of what goes on in the shaping of the learning environment and the use-purpose of such technologies (Instance & Kools, 2013). A good analogy is that of educational books:

"It is easy to grasp that it is not books per se that need to be evaluated, but their contents, how available and used, by whom, for what purposes, with which methods, and in combination with what other technologies. That is the status that the more digitalised technologies have now acquired." - (Instance & Kools, 2013, pp. 56, l. 23-27)

Despite being only a part of the solution, it is indisputable that technology holds great importance in understanding and developing future educational practice, since the basic reasoning behind the pursuit of technology-rich learning environments is that we do live in a digitised world (Instance & Kools, 2013). In that respect, it makes good sense that Antvorskov School buys all the latest IDT, but how does all this technology actually fit the frame of EduTechLab? To answer this question, let us briefly look at the main principles of ILE that EduTechLab draws upon.

Figuratively speaking, ILE introduces three sets of circles that together form a framework for analysing either traditional or innovative learning environments. Even though it is not the aim of this report to analyse the learning environment on Antvorskov School as such, I believe these sets of circles illustrate the form of education EduTechLab is aspiring towards.

The first is The Pedagogical Core. Traditionally speaking, pedagogic principles are adapted to certain structures, such as classrooms, standardised timetables, and the single teacher on the floor. In ILE, the focus is on sources of change between the pedagogic elements: *learners*, *teachers*, *content*, and *resources*.

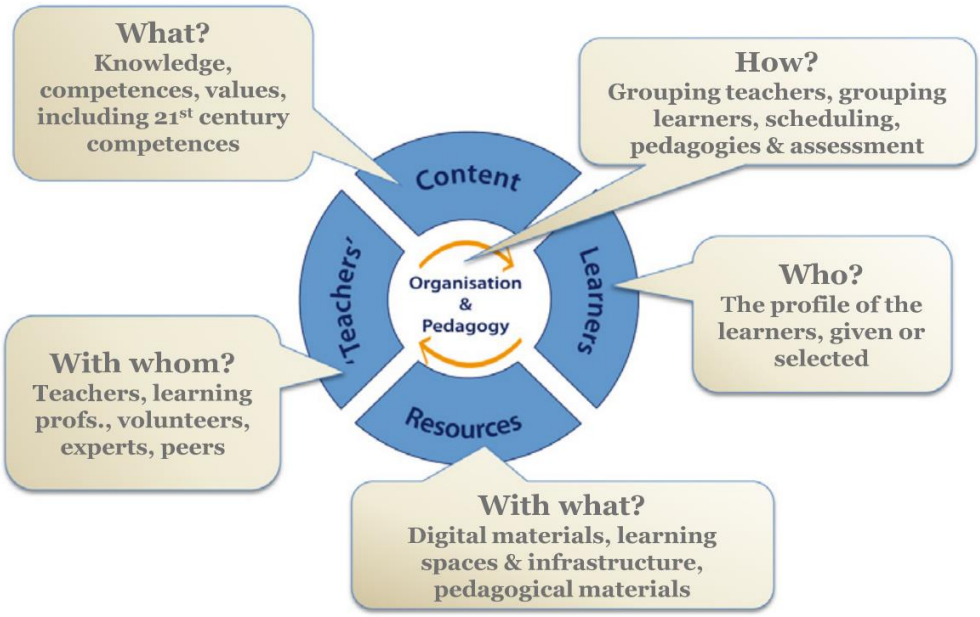


Figure 4: The elements and dynamics of The Pedagogic Core (Instance & Kools, 2013)

By following this example, EduTechLab should become a place that is shaped over the course of time. The pedagogical core shows how the different elements are contextualised and requires a certain degree of movement in the organisational and pedagogical approaches – is it e.g. always a good idea to let the teacher do the teaching?

Of course, The Pedagogical Core does not comprise the entire learning environment, since there also needs to be some kind of leadership that is capable of digesting and acting upon the learning that is taking place in The Pedagogical Core. Otherwise, the aforementioned shaping of the EduTechLab will be

without direction. There needs to be strong visions of learning objectives and a richness of information from The Pedagogical Core in order to enable "learning leadership" that can produce revised strategies for learning and innovation, and effectively design and re-design the learning arrangements (Instance & Kools, 2013). Hence, The Design / Re-design Leadership Circle:

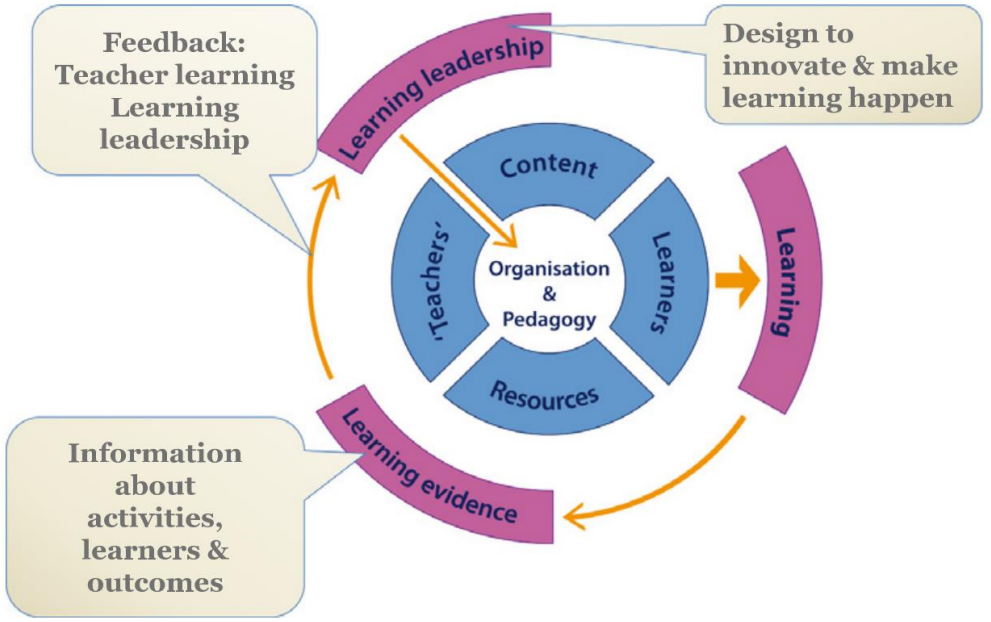


Figure 5: The Design / Re-design Leadership Circle shows how a learning leadership digests and acts upon the learning that is taking place in The Pedagogical Core, effectively providing revised strategies for learning and innovation, which is then tested in The Pedagogical Core (Instance & Kools, 2013).

Instead of being closed and secluded the learning environment should be open towards the outside world. There should be well-established connections with families, businesses, universities, and so on. This could insure an expansion of the learning environment's resources and influence The Pedagogic Core with a wider array of content and expertise, which would then also be subject to revised strategies from The Design / Re-Design Leadership Circle (Instance & Kools, 2013).

This brings us to The Full Learning Environment Framework, in which the third circle, The Wider Partnership Circle, is also depicted.

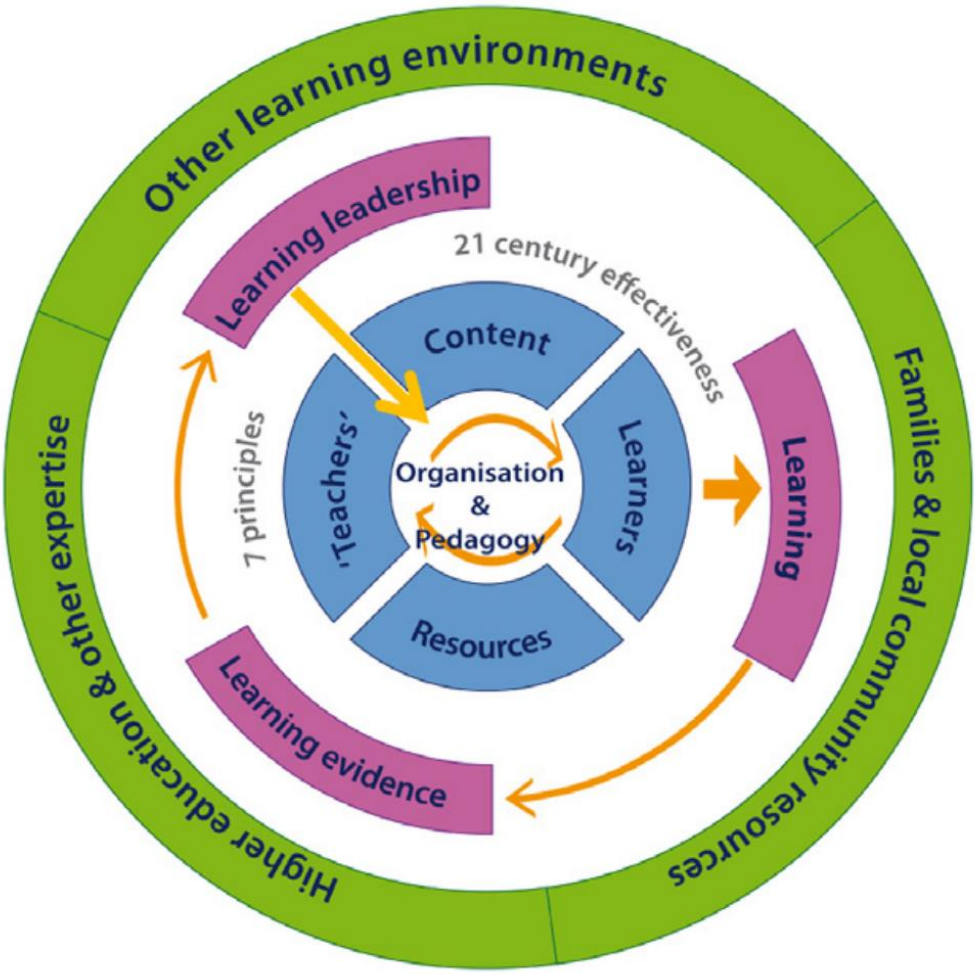


Figure 6: The Full Learning Environment Framework shows the combination of structures and processes that resides within but also revolves around and influences The Pedagogical Core (Instance & Kools, 2013).

By following the ILE example, EduTechLab views IDT as a resource in the learning environment. IDT plays an important role, but is equally considered in relation to all elements within the learning environment. It becomes contextualised and activated as an aid to human learning (Instance & Kools,

2013). At EduTechLab, this happens through *product oriented teaching*. As it will also be presented in details later in the report, the students work in teams to research and concretise a problem that preferably takes point in a real case with an external collaborator. They use IDT to aid them in designing and demonstrating a solution; a product that enables the students to effectively visualise their learning process, creativity and innovation. This form of teaching requires the teachers to take on a new mindset. For this very purpose, Peter Eduard has co-created a didactic mindset model to help the teachers plan product oriented teaching that intrigues and motivates the students.

The EduTech Mindset Model

The EduTech Mindset Model (EMM) is designed to help the teachers plan product oriented teachings that makes the students take ownership of what they are doing by enticing them to work ethically and aesthetically with their products. The process always ends with some form of presentation that highlights the learning process of the students (appx. L1).

The EMM is essentially a questionnaire that, when answered, provides a teaching description that can theoretically be used by anyone to teach product oriented. It contains two parts – BIP and FFF (appx. L1).

BIP is short for the Danish words "Description", "Innovation", and "Product". FFF is short for the Danish words "Astonishment", "Immersion", and "Presentation".

BIP

First, the teachers need to agree on a subject area. It could be anything, but the EMM needs some kind of overall subject area. When the teachers have found a subject, they begin describing the content goals of the subject area. They reflect on the knowledge they have on the subject area and describe the academic goals the students must acquire. They also reflect on the students – who are they? How old are they? What are their strengths and weaknesses, and so on. Finally, they

describe the milestones the students should achieve during their process. The sum of milestones is meant to equal the final product, cf. appx. F1.

Next is a description of the Innovation. The teachers must try to think about how different aspects in the subject area could be changed or used in a new way. Whilst doing this, they should also try to envision what ideas the students might come up with. The point of this manoeuvre is basically to discuss whether the subject area is substantial enough. If not, they might want to consider a new subject area (appx. L1). If they find the subject area to be fitting, they continue by describing what knowledge and skills their particular students have. Maybe the students already have experience working with LEGO Mindstorms or Robotto 2.0, or maybe some of them know a lot about the subject area due to leisure time pursuits. The teachers should have these considerations in order to understand the kind of proficiency available and the kind of competencies and skills they want the students to acquire or improve during the project work. Finally, the teachers should reflect on how they expect the students to highlight the innovation, e.g. through displaying a concrete mechanic and technical solution (appx. F1).

In conclusion of the BIP part, the teachers need to consider how the end products could showcase acquisition or improvement of the listed competencies and skills. How should the students for example present their product? Would it be enough to prepare a sales-pitch or should they also create a poster to highlight their process? Should the students write an essay upon completion? Once the teachers have debated and agreed upon these considerations, they continue to the FFF part of the EMM.

FFF

In this part, the teachers begin by describing the various aspects that are meant to astonish and ignite the students' interest in the subject area. These aspects include academic activities, ethical problems, aesthetical challenges, local challenges and global challenges. The teachers could for example plan a field trip to let the students get a sense of the problem(s). Or maybe the students should search for information on the Internet or in the library. Or maybe they

should interview someone. Or maybe a combination of all these things. The point is, that the teachers think about ways in which they can spark the students' interest in the various aspects of the subject area (appx. F1).

Next is the teacher's description of how the different aspects of the project period should allow for immersion. The teachers should describe what the students should work with and how. What academic activities and subjects should the students engage in? How should the overall process be organised? (appx. F1).

Finally, the teachers should describe what elements could be included in the students' product presentation. What could the form be like? How could it be organised? Who could the presentations be aimed at? And finally - how could the students be evaluated? (appx. F1).

Understanding The EduTech Mindset Model

In an interview I conducted with Peter Eduard, he elaborated on the thoughts behind the EMM. I will now give an account of the most essential insights from the interview, which can be accessed in appx. L1.

The EMM is not static. It is meant to have plasticity – as something that can be developed upon iteratively to fit the given institutional needs (appx. L1). It is a model that does not require pre-existing knowledge about how to plan product oriented teaching. The strength of the model is that essentially a team of teachers only need to answer the questions on the sheets and then they will end up with a common vision of a product oriented project. That is, of course, if they are completely open and honest with each other whilst doing so (appx. L1). On the other hand, the weakness of the EMM is that the teacher becomes more visible. Teachers might find themselves in a situation where they are not able to answer the questions of the students, which may be challenging (appx. L1). Another big challenge of teaching product oriented is to be able to relate to the challenges of the individual student and simultaneously be able to identify the learning that is happening. This is why it is essential in product oriented

teaching that the students are enticed to describe their own competencies by creating an academic presentation and a useful product that works (appx. L1).

At the same time, the demand that it should be possible to assess the learning outcome on the basis of a student made product is a new challenge for the teachers, and this is what the EMM is supposed to mitigate. Once the teachers have agreed on all the elements of the EMM, they are essentially done planning - the rest is pure practice. It should be noted though, that thinking interdisciplinary when working with the EMM makes it easier for the teachers to imagine product requirement specifications, and it makes it easier for the students to pursue their ideas, because they will have multiple professions to draw from. Furthermore, the EMM is meant to be an everyday tool, so the teachers should not create such lofty goals that it becomes hard for them to administer when teaching. Additionally, the regular use of the EMM potentially allows the school to build a knowledge-bank of complete and evaluated product oriented projects, which fit their plans for didactic development and teacher training, essentially helping them being a learning organisation (appx. L1).

Another aspect is that the school and the teachers plans for success. It may just happen that some student's ends up creating a product that is truly innovative, and in such a case, it is important to support them in their endeavour. At Antvorskov School, they have previously dealt with such situations by signing the students up for national competitions, which has also turned out to be highly motivating for the teachers (appx L1).

Regarding the motivational aspects, Peter Eduard states that he believes the whole aspect of working product oriented is motivating the students. To him it is the idea of creating something that you end up being really proud of. This is also the reason why IDT plays such a big part in the EduTechLab. It helps to enable the students in realising their ideas. Exactly because the students are so young, they are not skilled artisans. They are, however, perfectly able to envision something and then create it with the aid of IDT. This is also true for students with various handicaps. Of course, the teachers need to know the right didactics and pedagogical tools, as well as what kind of IDT that would be beneficial for the students to use in order for them to realise their projects, cf. appx F2.

The UVM Project

As I mention in appx. F2, 500 million DKK has partially been earmarked educational experiments with digital demonstrational schools. Antvorskov School is one of the 21 appointed schools who are systematically testing ways of using IT in teachings. The purpose is to gather knowledge about how the different ways of using IT influences the students' motivation and learning. The schools are divided into different focus areas, and Antvorskov School is engaged in *"The students own production and student involvement"* (Nielsen, 2013). The project began in January 2014 and will end in the summer of 2015.

During the month of January, however, Antvorskov School and two other schools in the municipality of Slagelse, was granted a total of 300.000 DKK to test-run the new Danish school reform and in particular the longer and more varied school-day (appx. O2). This project was named *the UVM Project*, and was slated to begin in week 8 of February and end in week 10 of March. As I was already following some of the teachings in January in order to become acquainted with the EduTechLab and the product oriented teachings, the UVM Project fit my time-frame perfectly and presented a unique opportunity to study the EMM in action.

Since Antvorskov School was already working on *the students own production and student involvement*, primarily supported through product oriented teachings and the use of IDT in the EduTechLab, the UVM Project adopted the same strategy. Furthermore, the school only had weeks to plan the whole process.

It was decided that all 7th and 8th graders, comprising more than 200 students, would be working product oriented with the theme: "The House of the Future". Both the 7th graders and the 8th graders would be working in teams to research, design, and produce innovative and useful products that would showcase elements of a future house. The teachers would use the EMM to aid them in their planning of the project period. For the vast majority of the teachers, it was their first time using the EMM. The UVM project was therefore the first real large-scale test of the EMM and product oriented teachings.

2. Thesis Statement

Based on the presented problematics concerning implementation and use of IDT in educational contexts (appx F2), as well as the aims presented in the new Danish school reform (appx. F2), the purpose of this project is to study how the product oriented teachings are perceived by the students in the 7th and 8th grade at Antvorskov School. More specifically, this study seeks to evaluate the EduTech Mindset Model and help the school identify implications for further design, by focusing on the affective aspects of the students' experience of product oriented teachings with IDT. Therefore, this study seeks to answer the following thesis statement:

How do the students of the 7th and 8th grade at Antvorskov School experience product oriented teaching and what implications for further design of the EduTech Mindset Model can be drawn from these experiences?

In order to answer my thesis statement I have conducted an ethnographic study of the teachings that took place during the UVM Project. I have been a participant observer, taking field notes and pictures, and I have had conversations with the students whilst they were working. I have conducted several interviews with the teachers involved, and I have participated in two evaluation meetings between the teachers and a member of the schools management. Furthermore, I have gathered quantitative pre and post data from more than 240 students, utilising a semantic differential questionnaire, as well as a questionnaire for the teachers about their use of the EduTech Mindset Model.

It is my belief that the combination of these qualitative and quantitative measures will enable me to thoroughly answer my thesis statement.

Thematic Frame

This report is subject to the study programme of the 10th semester of Human Centred Informatics at Aalborg University. In section 17 of the study programme it is stated that the thesis may be conducted as either a theoretical and analytical project or a design and implementation project (Faculty of Humanities, 2008). Even though the major part of this study is analytical in its approach, the end purpose is to identify implications for further design of the EduTech Mindset Model. I therefore view this thesis as a design and implementation project.

Furthermore, the aim of this report is to demonstrate that I master the following aspects of my study, as is stated in subsection 10 of section 19 in the study programme.

I must demonstrate that I…

- Have gained insight into the implications of research work (or research ethics).
- Am able to independently, systematically, and critically formulate and analyse scientific problems through the application of scientific theories and methods.
- Am able to reflect on and evaluate design, and to organize and integrate ICT with emphasis on the implications for learning and knowledge processes (Faculty of Humanities, 2008).

3.Reversal Theory

For the analysis of the data I have gathered during this study, I have chosen to use Reversal Theory (RT). Before I present the framework that comprise the core principles of RT, I believe it would be purposeful to describe the underlying methodological couplings that RT derives from.

RT is a general theory that seeks to show how experience and behaviour may be explained through the reversals that happen between certain motivational states (Reversal Theory Society, 2013). The theory was created by psychiatrist Dr. Ken Smith and psychologist Dr. Michael J. Apter in the early 1970s and has been extensively developed ever since, primarily by Apter (Reversal Theory Society, 2013).

According to Apter, the theory breaks with a tendency within psychological theory to be increasingly concerned with specific cognitive aspects of human behaviour, stating that one of the aims of RT is to put the study of *motivation* back in the "driver's seat" (Apter, 2007). The theory derives from "structural phenomenology", which Apter describes as the stance that human behaviour cannot be explained without referring to experience, because human experience has structure. More specifically, he explains that aspects of subjectivity systematically relate to each other:

"Experience is not so much a bag of beans – it is more a finely spun web. If we think of the totality of an individual's experience at a given time as constituting his "phenomenal field" – the way he sees the world and himself in it, including his perceptions, thoughts, feelings, and emotions – then structural phenomenology can be defined as the study of the structure of the phenomenal field." - (Apter, 2007, pp. 3, l. 19-24)

Apter further explains that the range of meanings within psychological phenomenology has long been controversial, ranging from very specific ideas

derived from the German philosopher Edmond Husserl, to broader psychological approaches that are all mainly concerned with subjective experience. Apter views structural phenomenology as a reflection of these broader psychological approaches, arguing that the implication is that there is no rejection towards objectively observable behaviour, per se:

"So conceived, there is no implications that this type of psychology rejects any interest in objectively observable behaviour; indeed, the relationship between experience and behaviour will often be a significant concern. But it does imply a rejection of any approach which attempts to explain human behaviour without any reference to experience, or which sees experience as no more than a by-product or side issue." - (Apter, 2007, pp. 2, l. 21-27)

In my interpretation, what this basically means is that the study of the structure of the phenomenal field is open enough to accept the "objective" descriptions of human behaviour, as seen from a third person perspective from either a real third person or from within. However, these descriptions hold no meaning if they are sought to be separated from one of the primary principles of phenomenology; namely that our being in the world and experience of phenomena as they appear before us, always happens from a first person perspective (Zahavi, 2003). For example, Apter emphasises that structural phenomenology is concerned with expressed behaviour and mental events, stating that part of the phenomenal field is the individual's own actions, which may lead to interesting discussions about the relationship between subjective and objective views of these actions (Apter, 2007). However, there is an important distinction between the words "action" and "behaviour", more specifically, as Apter states it:

"*The concept of action, which also has a long history in psychology, contrasts with that of behaviour precisely in that an action is behaviour plus subjective meaning. To describe someone as stamping his feet would be to describe a piece of behaviour; to describe him as stamping the dirt of his shoes, stamping out a fire, or doing Irish dancing,*

would be to describe an action because it implies something about what the actor saw himself to be doing." - (Apter, 2007, pp. 4, l. 5-11)

With that little, but important distinction out of the way, the question remains as to how the "structural" part of structural phenomenology must be understood. According to Apter, it is reminiscent of the contemporary structuralism of the French anthropologist Lévi Strauss and the American linguist and philosopher Noam Chomsky. Albeit immersed in slightly different fields, they are both representatives of structuralism as abstract structures that pertains to and creates specific surface phenomena (Apter, 2007; Lübcke, 2010). However, unlike Chomsky and Strauss, RT does not focus as much on products of the human mind – it is more concerned with the human mind itself. In RT, human consciousness is the complex surface phenomenon under which organising structures are present. In that sense, structural phenomenology concerns how experience itself is structured (Apter, 2007). To give a few examples, Apter describes that conscious experience is recognised as having a *focus* and a *fringe*; we momentarily concern ourselves with something whilst all else that make up the experience is peripheral:

"If I am playing chess, then the focus of my attention is the chessboard and the pieces on it, but I am also marginally aware of other aspects of my situation: the fact that the board is on a round table, that my chair is a little uncomfortable, that I have an itch on my left shin, that I can hear it raining outside, and so on. It seems to be intrinsic to normal experience that we concentrate on something and relegate the rest to the background – although it is always possible that what is in the background will suddenly come into the foreground, for example if the itch on my shin gets worse." - (Apter, 2007, pp. 5, l. 21-30)

Furthermore, conscious experience also regards that which is contained within the individual's self-boundary and everything that is external to it – respectively the *self* and *not-self* parts of experience. In the above quote, everything but the itch on his shin belongs to the not-self part of his experience. In that sense, both the focus/fringe and self/not-self aspects exemplify what is

understood by "the structure of experience" (Apter, 2007). These structures can be identified and registered over time and thereby provide a temporal structure-map of qualitative changes. Apter describes how that effectively makes the phenomenal field grow broader or narrower, kind of like a pupil of the eye dilating and constricting over the course of time. This notion also leaves Apter to give structural phenomenology a deeper but more precise definition:

"It is the study of the different ways in which the phenomenal field may be structured and the dynamics of transition from one type of structure to another over time. It thus deals systematically with the nature of experience itself at a given time and the changes it undergoes over time." - (Apter, 2007, pp. 7, l. 1-4)

Now you may be thinking to yourself that this kind of sounds like systems theory, especially considering the study of dynamic transitions between structures, and Apter also recognises that systems theory has been very influential to the development of RT, stating that the combination of systems theory and structuralism plays an important part in understanding RT. In fact, he even suggests that this coupling may bring alive phenomenology:

"By relating systems theory to phenomenology, it can be shown how phenomenology need not be restricted to those arid and static descriptions which form such an unfortunately large part of the phenomenological literature, but can, as it were, be "brought alive"." - (Apter, 2007, pp. 7, l. 30-34)

Finally, the view of structural phenomenology could be used to examine many aspects of experience, but according to RT, the one aspect that overrides all others when it comes to understanding human experience, is *motivation.* RT is a theory of motivation, but this essentially also makes it concern emotions (Apter, 2007). To illustrate this, I will now present you with the basic principles of RT, which I will use in the analysis of the data I have gathered during this study.

Domains and Motivational States

Feeling emotions is a natural part of being human – they help us define who we are. In RT, emotions are viewed as the result of your motives being fulfilled or not. These motives are bound to sets of binary and opposing motivational states that are divided into four domains of experience (Apter, 2007; Tucker & Rutledge, 2007). The core concept is that we reverse between these motivational states depending on situation(s) and the meaning we attribute to them (Otto Kroeger Associates, 2013b). This can happen at any time, but only one motivational state within each domain can be active at a time. However, one or two of these states will be more intense than the others will. Effectively, two kinds of movements can happen: reversal within a pair of motivational states or reversal across. Additionally, there are two possible tendencies: dominance and salience. Dominance is when you tend to be in a specific state in each domain, and salience is when you tend to focus on specific domains more than others (Apter, 2007).

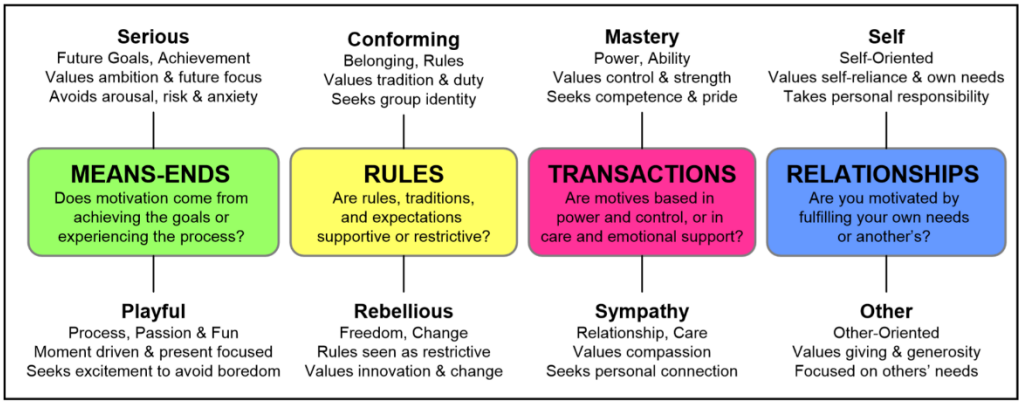


Figure 7: The RT framework. There are four domains: Means-Ends, Rules, Transactions, and Relationships. They each have two binary opposing motivational states (Tucker & Rutledge, 2007).

The best way to describe the framework is to describe the four domains and their respective motivational states one at a time.

Means-Ends

In this domain, the individual may be either serious or playful. It all depends on the significance and intent of the experience the individual is having. The governing question of this domain is then if the individual's motivation stems from the desire to achieve goals (Serious) or the sensation of *being-in-the-moment* for the sake of enjoying the experience, regardless of the outcome (Playful).

Table 1 lists the characteristics of the two motivational states within this domain:

	SERIOUS STATE	PLAYFUL STATE
MOTIVE:	Goal achievement.	Fun and arousal.
VALUES:	Setting and achieving milestones, engaging in planning and avoiding threats and disruptions.	Alleviating boredom, passion, fun, experimentation, risk and excitement.
CONTRIBUTION:	Sets, drives and accomplishes goals and tasks, maintains responsibility and endures.	Enjoys the moment, passion, generating enthusiasm, initiating change through experimentation, sense of humour.
EMOTIONS:	Thrives with low arousal, relaxation and calmness. Disruption can lead to anxiety, stress and fear.	Thrives on immersion in the moment, high arousal yields excitement. Low arousal yields boredom.
KEYWORDS:	➢ Avoids risk and anxiety ➢ Goal driven ➢ Future focus ➢ Complete activity ➢ Plan ahead ➢ Delayed gratification	➢ Seeks arousal and risk ➢ Moment driven ➢ Present focus ➢ Enjoy activity ➢ Spontaneously act ➢ Immediate gratification

Table 1: The differences between the serious state and the playful state in the Means-Ends domain (Otto Kroeger Associates, 2013a).

Rules

In this domain, the individual may be either conforming or rebellious. It depends on the individual's stance towards rules of engagement; is the individual motivated to act according to the rules, norms, roles and expectations? If yes, then the individual is in a conforming state. If not, the individual's motivation is to act against or outside the rules of engagement and will therefore be in the rebellious state.

Table 2 lists the characteristics of the two motivational states within this domain:

	CONFORMING STATE	REBELLIOUS STATE
MOTIVE:	Belonging and fitting in.	Freedom from rules and restrictions.
VALUES:	Acceptance, membership, clear roles and obligations.	Autonomy, innovation, challenging the rules and being seen as a rebel or maverick.
CONTRIBUTION:	Procedure, rules, traditions, stability, group identity and appropriateness.	Innovates and reaches beyond the status quo.
EMOTIONS:	Movement within the structure of rules, roles and expectations, yields identity, connection and belonging. Acting outside and detached of the structure of rules yields embarrassment or isolation.	Moving outside or against the structure of rules, roles and expectations yields freedom. Being held inside the structure of rules yields frustration and anger.
KEYWORDS:	➢ Comply with rules ➢ Agreeable, accepting ➢ Duty and belonging ➢ Authority dependent ➢ Supportive of tradition ➢ Continuity	➢ Challenge rules ➢ Critical, rejecting ➢ Difference ➢ Authority independent ➢ Innovative ➢ Change

Table 2: The differences between the conforming state and the rebellious state in the Rules domain (Otto Kroeger Associates, 2013a).

Transactions

In this domain, the individual may be either mastering or sympathetic. It depends on the interactions with other individuals; is the individual motivated by control and power? If yes, then the individual is in a state of mastery. If not, the individual is motivated by care, connection and emotional support, thus being in a state of sympathy.

Table 3 lists the characteristics of the two motivational states within this domain:

	MASTERY STATE	SYMPATHY STATE
MOTIVE:	Power and control.	Care and personal connection.
VALUES:	Toughness, control, competence, winning and reputation.	Tenderness, caring, friendship, personal relationships, intimacy.
CONTRIBUTION:	Skills, solutions, competition, knowledge and abilities.	Collaboration, loyalty, teamwork, encouragement and relationship sensitivity.
EMOTIONS:	Depends on the active states (Self or Other) in the fourth domain: Relationships.	Depends on the active states (Self or Other) in the fourth domain: Relationships.
KEYWORDS:	➢ Compete ➢ Competency ➢ Domination ➢ Ability ➢ Control ➢ Assertive ➢ Knows no intimacy	➢ Cooperate ➢ Compassion ➢ Devotion ➢ Empathy ➢ Care ➢ Affectionate ➢ Knows no pride

Table 3: The differences between the mastery state and the sympathy state in the Transactions domain (Otto Kroeger Associates, 2013a).

Relationships

In this domain, the individual may be focused on fulfilling his own needs or fulfilling the needs of others. The relationships domain is closely tied with the transactions domain because whichever state is active in the relationships domain influences the emotions in the active states of the transactions domain.

Table 4 lists the characteristics of the two motivational states within this domain:

	SELF STATE	OTHER STATE
MOTIVE:	You, your interests and perspectives.	Others, their interests and perspectives.
VALUES:	Self, personal discovery and development, and feeling appreciated and respected as an individual.	Transcending self, self-sacrifice and opportunities to control, help, develop or relate to others.
CONTRIBUTION:	Personal ambition, responsibility, accountability and initiative.	Community, team spirit, transcendence of self and spiritual connection.
EMOTIONS:	Mastery and Self want to be competent, skilled and powerful. Sympathy and Self want to be cared for, affirmed and supported.	Mastery and Other want someone other than self (another person, a group, a cause, an organisation) to be competent, skilled and powerful. Sympathy and Other want to connect with and care for someone or something other than self.
KEYWORDS:	➢ How does this affect me? ➢ How do I feel? ➢ Individuality ➢ Self-oriented ➢ Desire to gain. Suffering loss is unpleasant ➢ Egoistic	➢ How does this affect others? ➢ How do others feel? ➢ Transcendence ➢ Identification with others ➢ Desire to give. Suffering loss is pleasant if another receives. ➢ Altruistic

Table 4: The differences between the Self state and the Other state in the Relationships domain (Otto Kroeger Associates, 2013a).

Being in a Motivational State

One apparent aspect that must be addressed in order to fully understand motivational states, is the meaning of only being able to be in one at a time. Why is it e.g. not possible to have a simultaneous serious and playful experience? The short answer is that each of the motivational states within all of the four domains are each other's binary opposites (Apter, 2007). In the case of being in a serious state, the key identifier is that seriousness happens because of some or several consequences that goes beyond the immediate activity (Apter, 2008). For instance, I am in a serious state as I write this because I need to meet my project deadline of handing in this report on time, otherwise, there will be consequences. I could also state it like this: *something* depends on my activity of writing this report, namely that I will not graduate on time if I miss my deadline. Now suppose my writing of this report was just a pet project of mine. No one depended on it and no one was expecting something from it. It was just something I was doing in my spare-time and for my own enjoyment, not being aware of any particular consequence that it might give rise to. Would I then be in a serious state? As it is described here, no, because I was doing it for the pure reason of enjoying myself – I was in it for the sake of the experience.

Now you might be wondering about subjectivity. RT is not trying to deal in absolutes - of course - it makes perfect sense that something you might be serious about, e.g. watching your favourite soccer team play an important match, could just be a playful experience to others. It all depends on how you experience things, and this is where the phenomenological part of RT kicks in. When watching soccer, you might be in a serious state because you bet money on the match, whilst your friend is in a playful state because he did not, and so there is no consequences for him beyond the activity of watching the match. You might risk losing your bet, and so your focus is on goal achievement. If your team does not win the match, you do not achieve your goal and you will most likely feel some negative emotions. However, since watching soccer is presumably an activity that most people would perceive as a playful experience, to the outsider observing the two friends, it may be difficult to tell that they are not both in a playful state (Apter, 2008).

Returning to the question about why it is not possible to have a simultaneous serious and playful experience, Apter uses the example of a surgeon performing surgery on a patient. Is it conceivable that the surgeon would perform the surgery in a state of playfulness, when we know that there is a quite serious consequence beyond his activity of performing surgery, namely the well-being or maybe even survival of the patient who is being operated on? The answer is yes, because the surgeon might become interested in the challenge of performing the surgery and temporarily forget the consequences, maybe even treating some of the challenges in the surgery as a game. However, from the outside perspective, what looks like seriousness might just be (if at least momentarily) experienced as playful by the surgeon (Apter, 2008). In that sense, reversals are the reason why you cannot be in both motivational states at the same time. The motivational states connote a way of being; the serious state is about being oriented towards future goals, whilst the playful state is about enjoying the moment, cf. table 1. Realistically speaking, the surgeon is probably in a serious state and focused on completing the surgery with success, during most of the operation, but as described, there may be times where he reverses into a playful state of mind, enjoying the moment and the experience of performing surgery, and then something might make him reverse into the serious state again. In that sense, we dynamically change our orientation or state of mind as we experience everyday life, but only one motivational state is allowed to organise our experience at any given moment (Apter, 2008). Therefore, our next question is then; what makes these reversals happen?

Reversals

RT lists three factors that induce reversals:

- A change of situation.
- Frustration.
- Satiation (Apter, 2007).

Imagine yourself as a child, sitting in the classroom and writing an essay. There is total silence and the teacher makes sure to hush at anyone who speaks loudly or in other ways disturbs the class. You are in a serious state of mind because you want to finish the essay in class in order to avoid having to do it at home. Suddenly the bell rings, and you, along with everyone else, hurry out the door, screaming and yelling whilst rushing to the playgrounds. Clearly, you have just reverted from a serious to a playful state of mind, but why did this happen? The answer is straightforward – there was a change of situations. The ringing of the bell instantly told you that now it was legitimate or perhaps even expected of you to do whatever you pleased. Class was over and you were free!

Now let us consider the same situation again, only this time you are one of the children who are disturbing the class. Why is that? There could be two reasons: either because you have become frustrated or satiated with the whole situation. Imagine that you are struggling to write the essay. You are really having a hard time, because you think the topic of the essay is difficult, so you have writer's block. You begin to feel frustrated, and nothing you try seems to help. Eventually you become so frustrated that you change you orientation towards something else. You begin to crumple pieces of paper into small balls and discretely throw them at some of the other children. You have become so frustrated that you somehow need to blow off some steam, so you revert to a playful state of mind due to frustration.

Now imagine that you have homework. You need to make a book-report, and it obviously requires you to read the book, so you begin to read. After some time you suddenly realise you cannot remember the last two pages you just read. What has happened? For no particular reason your mind has become saturated with the activity of reading. Your mind has wandered elsewhere all by itself. You were aware that you were reading, but the focus of your attention was actually on something completely different. You were thinking about your future vacation to Spain, so you reversed from a serious state of mind to a playful state of mind for no particular reason. All of a sudden you snapped out of it, realised what had happened, which quite honestly made you a bit frustrated and effectively made you revert back to a serious state of mind, because you needed to read that book so you could complete your book-report.

With these three examples, I have just described the factors that induce reversals back and forth between motivational states. Situational change is the deepest and most varied reason for reversal. Frustration is not as varied, but together, these two form the most frequent reasons for reversal, whilst satiation does not occur very often. This is because satiation is something that occurs when no reversals happen due to situational change or frustration (Apter, 2008). In that sense, RT argues that we are always on the move, dynamically reversing between states – but if there is nothing that inflicts these reversals, we eventually reverse anyway, as if our minds needs to be shaken up from time to time. A good analogy is that of sleep. When you have slept long enough, you automatically wake up, unless someone or something wakes you up. The body follows its own internal rhythms, and when you have been in a motivational state long enough, you may simply reverse for no particular reason (Apter, 2008). However, is it not true that some people seem to spend more time in a state of seriousness compared to others, and vice-versa? Yes it is. As I mentioned earlier, RT describes tendencies of this: State Dominance and Salience. I will now briefly describe State Dominance.

State Dominance

Basically, people who seem to be more serious than playful is referred to as *serious dominant* and people who seem to be more playful than serious is referred to as *playful dominant*. RT refers to time as the indicator; if you spent 90% of your time in the serious state, then you are very serious dominant. If you spent 60% of your time in the playful state, then you are marginally playful dominant. An important point is that state dominance must not be understood as a trait, because a trait is something about you that does not change, e.g. that you are introvert. Therefore, someone who is very serious dominant can sometimes be in a playful state, although it does not happen very often. Furthermore, state dominance can change over time. You may for example change from being very playful dominant to becoming slightly serious dominant (Apter, 2008).

Why Reversal Theory?

I have chosen to use RT as my theoretical frame for this project because I believe it can prove useful in my analysis of how the students at Antvorskov School experience the longer and more varied school day through the practice of product oriented teaching. Furthermore, I believe the theory of human experience organising itself in relation to certain structures can prove beneficial in identifying which aspects of product oriented teachings work well and which aspects Antvorskov School might want to change as they iterate the EduTech Mindset Model. On that note, I would like to point out that I have only included the core principles of RT, which I believe will be sufficient for the purpose of this study.

Before I present you with the method I have used to conduct this study, let me give you a final example of how these motivational structures in RT may prove useful. I will use myself as example. Right now, as I write this, I am in a serious state because I am oriented towards finishing this report on time. I am conforming because I want to stay within the code of practice described in the study programme – otherwise my report may be rejected. I am also in a state of mastery, oriented towards myself, because I want to improve my skills and because I essentially am writing this report for my own sake – otherwise I will not get my degree.

Because of this short description, you are now able to get an insight into the reasoning behind my motivation in this exact moment of me experiencing how it is to write this report. I believe a similar kind of insight will be valuable to Antvorskov School as they further develop product oriented teachings that support and motivate their students in the best possible way.

4. Method

The overall methodical frame for this study is Design-Based Research (DBR). I have chosen this approach because I view this study as part of the design and implementation project that is EduTechLab. As I described earlier, EduTechLab is inspired by the principles of the Innovative Learning Environments (ILE). I find these principles to seemingly fit well with the approach of DBR, however, before I elaborate on this, let me briefly describe the magnitude of this study.

This study is based on approximately 90 hours of participant observation across three weeks with field-notes, pictures, and video footage. A little more than 3 hours of interviewing (187 minutes) with the teachers and the project manager of EduTechLab, as well as nearly 2 hours of evaluation meetings (108 minutes) between the school's management and the teachers. Furthermore, more than 240 students answered a pre and post questionnaire about their experience with traditional classroom teaching and product oriented teaching, respectively. Additionally, nine teachers answered a questionnaire about their use of the EduTech Mindset Model, however I did not end up using the results derived from this particular questionnaire, cf. process description.

I will now describe the reasoning behind my methodical approach of conducting this study.

Design-Based Research

In DBR, *understanding* and *change* is like a double-edged sword. True understanding comes from your experience of changing something; however, changing something requires understanding of that which you wish to change. Therefore, one of the main premises of DBR is not just to test and develop

designs, but also to understand and develop the practice in which those designs must function (Christensen et al., 2012). It is a simultaneous movement, which is both enquiring and intervening in relation to practice. Ethnographic method is often used as a way to achieve this kind of double-manoeuvre, but without the intend of changing or improving practice in the actual moment of study. The changes should instead happen through iterations of problem identification, design proposals, testing and evaluation, as well as documentation of results (Christensen et al., 2012).

DBR entices to include practitioners and to regard them as partners. This is because practitioners possess inherent cultural and practical knowledge about the context, which makes it a good idea to let their voices constitute a certain volume in the project. As such, DBR is collaborative, iterative, theory-driven, as well as pragmatic and use-oriented (Christensen et al., 2012). The pragmatism is due to DBR not following any strict rules or guidelines – it is a broad and flexible research method that can be practiced in many ways. In relation to this, *theory-driven* is not typically understood as driven by *large theories* such as RT. It is understood as domain-specific and descriptive – it exclusively deals with and derives from the subject matter of the study in a similar fashion as is known in grounded theory. Through thorough descriptions of the context in which the design is developed and tested, it aims to identify generalisations of use and understand the complexity of practice. It must address the problems the practitioners are experiencing, thus making its value depend on its ability to inform and improve practice. The ultimate purpose of this is to develop a design that is use-oriented and flexible enough to be used in other contexts (Christensen et al., 2012).

To illustrate how I view this project within the frame of DBR, let us look at an innovation model that was used in the Danish DBR project ELYK. This model was inspired by a four phased DBR-model, which was developed by professors Tomas C. Reeves and Tel Amiel (Christensen et al., 2012; Reeves, 2006):

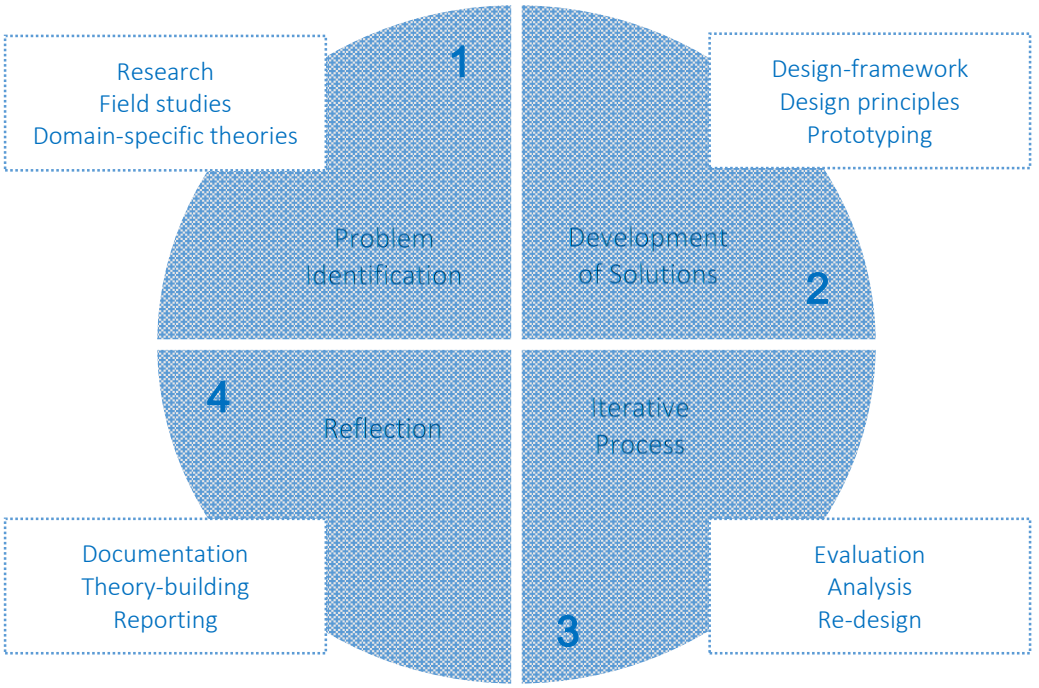


Figure 8: The ELYK innovation model. It is based on the four phased DBR model, which was developed by professors Tomas C. Reeves and Tel Amiel (Christensen et al., 2012).

The first phase in a DBR project is about problem identification. The usual approach is to research other studies to shed light on what known problems exist within the field of application. These results can then be compared with the local context through field studies. In doing this, the results should be shared with the practitioners to debate and question whether they coincide with the local practice or not. It should duly be noted, however, that the term *problem* has been found to be rather unfortunate within the practice of DBR, and that other terms may prove more motivating for the practitioners (Christensen et al., 2012). I therefore use the term *focus area* instead.

In the second phase, practitioners are included in the development of the first iteration of the design, based on the focus areas identified in the first phase.

This phase is as much a validation of the identified focus areas as it is idea generation (Christensen et al., 2012).

In phase three the design is tested in a real context - this is where the design is subject to the complexity of practice and all the variables that it includes. In the first iteration, phase three is viewed as an adaptation phase in which the practitioners learn to use the design and all that it involves, e.g. technologies and teaching principles (Christensen et al., 2012).

Finally, phase four is where the researchers report on their experiences and presents the robustness of the design. At first this phase is about creating formative evaluations, however, several iterations later, when the project reaches a certain point, this phase should also include an evaluation of whether the design can be scaled up and used in other contexts (Christensen et al., 2012).

Now, considering Antvorskov School, we know that the school is subject to the aims listed in the new Danish school reform, i.e. through the creation of a longer and more varied school day that challenges all students to become as skilled as possible (Undervisnings…, 2013a). Furthermore, we know that the reasoning behind the new Danish school reform is the sustainment and future improvement of the Danish nation's competitiveness and ability to transform knowledge into new solutions and products (Østergaard, 2012). Thereby, the reform points to development of new ways of teaching that integrates the use of IT, includes more students, entices creativity and innovation, and opens up the school to the outside world (Undervisnings…, 2013a). However, the ROSE project has revealed that the affective perspectives of learning science and technology are generally not very positive. Danish 15-year olds show little interest compared to developing countries (Sjøberg & Schreiner, 2010). It would therefore seem like one of the focus areas in the creation of a longer and more varied school day should be on how to motivate the students. However, the impression I got from my initial field study in January, albeit purely subjective, slightly contradicts this claim, cf. process description.

Furthermore, the aspects I present you with in appx F2, such as the tool-centric view on IDT, the complexity of resources, the two teaching aid cultures and TPACK, are general aspects that vary in scope from institution to institution. Nevertheless, they all represent research that explains why IDT can be

challenging to integrate into teachings, and as such, they could comprise important focus areas. In essence, this is exactly the reason why conducting field studies is an important aspect of the problem identification, because it can further strengthen your understanding of whether any known problems are present in your own context or not (Christensen et al., 2012). In my case, the results presented in the ROSE project peaked my interest and led me to focus on how the students experienced the product oriented teachings, cf. process description. However, before I illustrate the different DBR phases in relation to this study, I believe it would be beneficial to clarify some things.

First and foremost, before this study was initiated, the guiding principles of EduTechLab had already been established, a didactic design had already been created in the form of the EduTech Mindset Model, and select teachers and students on the school were already experimenting with the product oriented teachings, cf. process description. Therefore, if viewed through the lens of DBR, phases 1 and 2 in figure 8 had already been completed when I arrived, and phase 3 was in progress. In ILE terminology, this was the Pedagogical Core and the Design / Re-design Leadership Circle in action. I was the external component, depicted in the Wider Partnership Circle in figure 6. In other words, the school was already well underway in what I perceive as a DBR project, inspired by the principles of ILE.

Fortunately, as I have briefly mentioned, ILE seems to fit very well within the frame of DBR. I believe this is because ILE is proposing a holistic approach; a kind of meta-structure or depiction of how information is gathered, shared, evaluated, iterated and distributed through three layers of organisation, whereas DBR concretises the process in the four phased model.

Now, you may be thinking about why I viewed the school's progression at the time to equal phase 3. This is due to the fact that the school was working on the aforementioned digital demonstrational school project, or more specifically, *the students own production and student involvement* (Nielsen, 2013). However, when the UVM project was revealed a couple of weeks after my arrival, I began to see my study as supplementary to the digital demonstrational school project, cf. process description. The three weeks of product oriented teachings in which the majority of the teachers would use the EMM for the first

time made it broader in scope, thus allowing for a more valid evaluation of the EMM. For this reason, I viewed phase 3 as re-initiated during the UVM project, whilst phase 2 was completed and phase 1 was refurbished by the knowledge I brought in as a part of the Wider Partnership Circle, but also in terms of my initial field study in January. As a result, this study fits the four phased DBR model as depicted in the following tables:

	PHASE 1: PROBLEM IDENTIFICATION
Research:	➢ Relevance of Science Education (ROSE) ➢ PISA tests ➢ TPACK framework ➢ The complexity of resources ➢ The two Teaching aid cultures ➢ The new Danish school reform
Field study:	➢ My preliminary observations in January
Domain-specific theories:	➢ The school claims that product oriented teachings motivates the students. My preliminary observations confirms this, but are limited by my subjective experience. ➢ Hard to tell from preliminary observations if TPACK, complexity of resources and two teaching aid cultures respectively pose any problems in this institution.

Table 5: The elements included in the problem identification of this study.

Phase 1 was kind of a mixed phase because the school had already moved beyond this point when I arrived in the beginning of January. As described in the process description, I spent the month of January becoming acquainted with the residing culture on the school. During this period, I followed some of the teachings in which select teachers and students were working product oriented as part of the digital demonstrational school project. The school was inspired by the results of the ROSE project, as well as the demands of the new Danish school reform. I used the knowledge I had from previous studies (Marchev et al., 2012, 2013) to see if I could identify any obvious practical problems that could be

related to TPACK, the complexity of resources and the two teaching aid cultures. However, I did not observe any such issues in my preliminary observations. Instead, I felt the same atmosphere as the school management and some of the teachers had told me about; generally, the product oriented teachings were highly motivating for the students. This was my impression as well, and when the UVM project was announced, I saw an excellent opportunity to study this subject further. My reasoning was, that if we were going to make a thorough evaluation of the EMM in action, with the purpose of identifying implications for design, we should focus on the students' experience of the product oriented teachings and the teachers' experience of using the EMM.

	PHASE 2: DEVELOPMENT OF SOLUTIONS
Design-framework:	➢ Innovative Learning Environments (ILE)
Design principles:	➢ Description, Innovation, Product (BIP) ➢ Astonishment, Immersion, Presentation (FFF)
Prototyping:	➢ EduTech Mindset Model (EMM)

Table 6: The elements included in phase 2, which was completed by the school prior to my arrival.

As mentioned, this phase had already been completed by the school. More specifically, Peter Eduard had been responsible for the development of the first iteration of the EMM. The teachers and the school management had been involved through courses and meetings. The next iteration of the design will happen on behalf of their work during the UVM project and the results presented in this report.

	PHASE 3: ITERATIVE PROCESS
Evaluation:	➢ Ethnographic study
Analysis:	➢ Reversal Theory
Re-design:	➢ Implications for design

Table 7: The contents of phase 3 of this study.

This phase is the UVM period. This is where the EMM was tested full-scale and I conducted the ethnographic study. In the analysis of the data I will apply

the principles of RT, which will help identify implications for design. It should be noted that this phase is normally iterated a couple of times, but due to the UVM project being a one-time event, and due to my time restriction of one semester, I instead view the entirety of the four DBR phases as one iteration.

	PHASE 4: REFLECTION
Documentation:	➢ Field-notes ➢ Pictures ➢ Video footage ➢ Interviews ➢ Meetings ➢ Inquiries ➢ Questionnaires
Theory Building:	➢ Not likely in the first iteration
Reporting:	➢ Master thesis report

Table 8: The elements included in phase 4 of this study.

The final phase concerns the processing and analysis of the gathered data, and the documentation of the study through the creation of this report. Antvorskov School will be given a copy of the report, effectively bringing new knowledge from The Wider Partnership Circle into The Design / Re-Design Leadership Circle, which will then turn the knowledge into revised strategies for The Pedagogic Core, where it will be put to the test, initiating the four phased DBR process anew and commencing the second iteration.

I have now described the overall methodical structure, and will therefore continue by describing the ethnographic method that comprise the core of this study.

Ethnography

Within educational research, ethnographic study is one of the most frequently used methods. I believe the reason for this is ethnography's aim of accounting for subjective reality in natural settings (Pole & Morrison, 2003).

However, there are many interpretations of what exactly ethnography is and what kind of knowledge it produces. Some researchers refer to ethnography as a synonym of various qualitative approaches within social research, such as "case study", "participant observation", and so on. It has also been proposed that ethnography can be split into two domains; a theoretical and philosophical orientation and a collection of research methods. Additionally, some researchers refer to *ethnography* as something they do and *ethnographies* as the product of their research (Pole & Morrison, 2003). In that sense, there is no official definition of what ethnography encompasses, nor is there a golden rule of how to conduct ethnographic study. In my view, ethnography is the art of accounting for subjective experience or reality through a range of qualitative and quantitative methods. In doing so, I believe the following characteristics of ethnography, which has been defined by professors Christopher Pole and Marlene Morrison, serve as a good guideline. I will now described how these characteristics fit the scope of this study, in the following table:

ETHNOGRAPHY CAN BE CHARACTERISED AS:	HOW IT FITS WITH THIS STUDY:
A focus on a discrete location, event(s) or setting.	In this study, the focus is mainly on an event. The UVM project is the first encounter of product oriented teachings for most of the involved students as well as teachers. It takes place in different settings on the school, e.g. different classrooms, the EduTechLab, the hallways, and so on. However, none of these settings are unfamiliar for any of the participants, albeit the purpose of the activities that goes on in these settings are new.
A concern with the full range of social behaviour within the location, even or setting.	In this study, the aim is to study how the students experience the product oriented teachings, which effectively means that I will tend to focus on observed behaviours of the students, but also how these connect to the teachers' effort of teaching product oriented.

The use of a range of different research methods which may combine qualitative and quantitative approaches but where the emphasis is upon understanding social behaviour from inside the discrete location, event or setting.	This main qualitative component of this study is participant observation. It includes field-notes, pictures, video-footage, and conversations with the students. In addition, a range of semi-structured interviews have been conducted with the teachers, as well as two evaluation meetings between the teachers and the school management. A semi-structured interview with the project manager of EduTechLab has also been conducted. Furthermore, the qualitative data is supported by two semantic differential questionnaires with more than 240 student replies on each. A small questionnaire about the EMM has also been answered by 9 teachers.
An emphasis on data and analysis which moves from detailed description to the identification of concepts and theories which are grounded in the data collected within the location, event or setting.	A general inductive approach is used to process the qualitative data through open coding, categorisation and abstraction.
An emphasis on rigorous or thorough research, where the complexities of the discrete event, location or setting are of greater importance than overarching trends or generalisations.	The data will be presented through an ethnographic write-up that focus on specific situations identified in the general inductive approach. These situations will then be analysed with the principles of Reversal Theory.

Table 9: An overview of how I perceive this study to be fitting with the characteristics of ethnography, as defined by Pole & Morrison (Pole & Morrison, 2003).

I should emphasise that Pole and Morrison does not view these characteristics as exhausting the scope of ethnographic study, but they do signify what it may be comprised of (Pole & Morrison, 2003). On that note, I will now describe the qualitative and quantitative methods used in this study.

Participant Observation

As mentioned in table 9, participant observation was the main qualitative approach I used to conduct this study. At its core, the aim of participant observation is to get as close to the perceived experience of those who you are studying. This entails observing in the natural settings where these experiences happen. It also means that you try to blend in with your research subjects by adopting elements of their social behaviour. There is a certain form of duality in your effort to understand the residing culture through 'participation' whilst simultaneously 'observing', which is very reminiscent of anthropological studies in which the researcher takes part in the daily life and activities of e.g. tribesmen, learning their cultural ways first hand, whilst maintaining his ability to relate these to his own cultural background (Pole & Morrison, 2003). Although this study does not reach such immersive levels, the aim of reaching a kind of 'first hand' understanding of the 7th and 8th graders' experience of working product oriented remains.

Now, as a first step, I needed to gather consent from the students and their parents in order to be able to observe the teachings during the UVM project. Since Antvorskov School has a long-standing tradition of obtaining written consent by posting declarations on the school's intranet (appx. A), I adopted the same strategy, cf. process description. Furthermore, I made sure to address all the students directly before beginning my observations. I told them about the purpose of my study and how I was going to conduct it. I especially emphasised that it was not in any way a test of their working effort, and that they should try and act as they normally would, without paying too much attention to me. If they for any particular reason did not want to be photographed or video-recorded, they should just let me know and then I would avoid doing so.

During the entire UVM project, I only had one request from a girl who did not want to be photographed. I reckon the reason why there were not more students who had objections is because the students at Antvorskov School are used to the school management occasionally taking pictures for newspaper articles and the school's website.

By being open towards the students about who I was, as well as my purpose of being there, I ensured a level of participation equalling what Pole and Morrison describe as *participation as observer.* I could freely follow the students without having to worry about them questioning what I was up to, because my identity and purpose was open to everyone involved (Pole & Morrison, 2003). Unavoidably, some students did show interest for the notes I was taking, but on the few occasions where this happened, I would once again emphasise that I was not testing them, and then go on to tell them that I was writing my interpretation of how they were working in their groups. No one had any further questions beyond receiving this explanation. I reckon they were just curious and needed some kind of answer to go with. In fact, most of the students could not help but keep an eye out for me in the beginning of the observation period, which naturally led me to be extra cautious when taking pictures. However, a couple of days into the observations it was clear that they began to feel safe with my presence, as they gradually became more open towards conversation and took less notice of me when I was taking pictures.

Being a sole researcher meant that I could not cover everything that went on within the setting. I therefore developed a work routine that I would use every day. First, I would sit at my neutral spot and observe the class. The neutral spot was at a table in the back of the classroom, where I could sit and write my observations without being "present" in the setting. It was a kind of free zone where I could blend in, allowing me to make general observations without anyone taking notice or without anyone sensing my presence. Of course, they all knew that I was sitting in the back taking notes, but the distance allowed me to stay out of sight, making me less interesting. During the first days of the observation period, I would use the neutral spot a lot, and then gradually begin to stray from it as the students began to feel safe with my presence. However, in regards to the work routine, the neutral spot would always be the first place I would go when the day began. I would sit and make general observations as the teacher presented the tasks for the day. Once the students began working in their groups, I would begin to take rounds in the classroom, observing all of the groups, one at a time. When I had observed a group, I would return to the neutral spot to write notes. Once I had observed all of the groups, I would sit for

a while and take general notes, and then I would begin taking rounds again, however, the second time I would seek conversation with the students. My questions would derive from the given activity in the class and my interpretation of what the respective groups were doing. I would try to make the students externalise their interpretations of what was going on, e.g. where they were in their process, how they were feeling about their work, what they were trying to do, and how they were organising the work in their groups. When I was done with the second rounds, I would return to the neutral spot. From there on, I would select some groups that I was going to pay a bit more attention to for the rest of the day. Occasionally, I would then check in on the progress of the rest of the groups. I selected the groups on behalf of what I had learned during the conversational rounds. I would try to select groups that were either progressing with ease or were experiencing difficulties. Whilst paying more attention to selected groups, I would also have small conversations with the teachers about how they felt the students were progressing.

Sometimes, entire groups would leave the classroom to go elsewhere to work. They would either go to the EduTechLab, the hallway or the school's cafeteria. Once I had finished the conversational rounds, I would go to these locations to observe what was going on. On these occasions, I did not have any neutral spot and would therefore seek conversation – even casual conversation about computer-games or any other favourite student topic. When this happened, the students would also ask me questions, e.g. about my education and how it was like to be a student at the university. I reckon these casual conversations helped make the students more open and elaborate towards my inquiries, albeit not contributing with anything in particular to my study in the moment of conversation, however, I deemed them necessary in order for me to adopt elements of student behaviour and become better able to understand their social reality.

Field Notes, Pictures and Video

My primary documentation tool was field notes. At my neutral spot, I had set up my laptop so I could write notes of what I observed. My field notes

comprised a simple system. I would usually draw a crude map of the setting that highlighted the position of the groups and their respective names. This would help me to quickly refer to the groups in my notes, but it also had the pleasant side effect of helping me to remember the different ideas that each of the groups were working on.

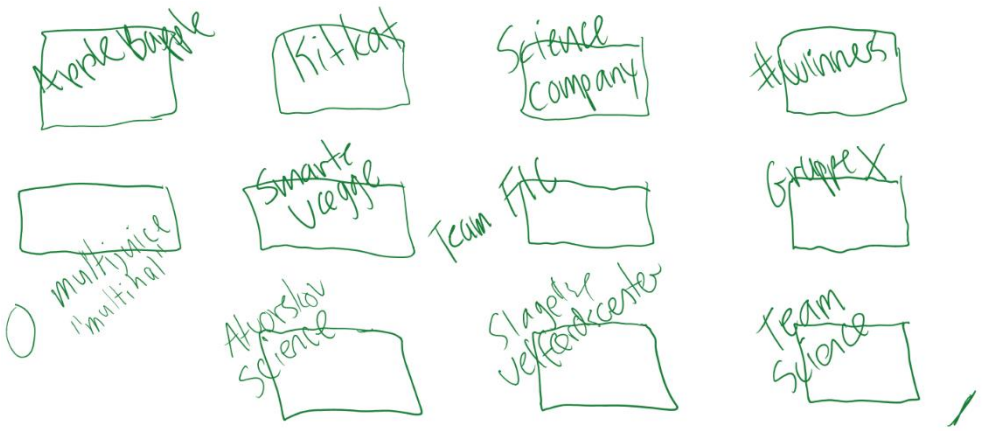


Figure 9: The crude map I drew of the classroom setup in the 7th grade. There were 11 groups, each with their own idea for a product. The circle in the lower left corner is what I refer to as my neutral spot in this setting.

When I was writing notes, I would put a timestamp on the left and the writing on the right. I deliberately put timestamps on every entry in order for me to be able to refer back to specific situations. Every time I had observed a group, I would go back to my neutral spot, put in a timestamp, and begin to write what I had just observed. I chose to do it in this way because I know from experience that I am not good at simultaneously observing and taking notes on a small block. This is mainly because it requires a good personalised note-taking system, where you write cues that are telling enough for you to be able to write an elaborate description at a later point. Instead of ending up with a block filled with cues, I prefer making semi-elaborate entries, but the catch is that I will have to devote some time "away" from the action. Whether one of these approaches is better than the other is hard to tell, however, knowing that I am better at writing semi-extensive entries during observation makes me confident that I

chose the right approach. It also helped when I "filled in the blanks" at the end of each day, as suggested by Pole and Morrison, because the semi-extensive entries made it easy to recall what had happened during the day (Pole & Morrison, 2003).

Occasionally I would take photos of the students. I primarily did this to support my field notes. Every time I took a photo, I would position it directly in the correspondent entry of the field note. In that way, my notes were enriched by the depiction of situations I had been describing, e.g. the students writing post-its or drawing conceptual drawings. Needless to say, the photos show an aspect of reality, but they do so on behalf of my decision of when to close the shutter, as well as the writings I combine them with. In that sense, what is depicted in the photos is subject to my interpretation and presentation of what happened during my observations (Pole & Morrison, 2003). The same can be said about the occasional video-recordings. I would make these to highlight aspects of the observation that I thought would be hard to justify in writing, e.g. if there was a high noise level in the classroom or to showcase the working mechanics of the student-made products.

My intention of using both field notes, photos and video-footage, was to obtain a broad dataset to aid me in the analysis and presentation of the data. As such, I view the photos and the video-footage as secondary to my field notes (Pole & Morrison, 2003).

When I was writing entries in my field notes, I would sometimes refer to student conversations I had overheard or conversations I was part of. Since these conversations could potentially reveal personal information, I chose to anonymise the students in my field notes by replacing their name with xxxxx. I also did my best to avoid portraying the students in any embarrassing moments in both photos and video-footage, however, if I chose to use a potentially discriminating picture to highlight a certain situation, I made sure to censor their faces.

To review the fieldnotes used in this report, you can find them in appx. H. Likewise, all used video footage can be found in appx. K.

Interviews

I conducted seven semi-structured interviews with the teachers that were teaching the 7th A+B and Team Orange on the 8th grade. I chose a semi-structured approach for several reasons. First, I wanted the interviews to be conducted when the respective school day was over, in order to have the events of the day fresh in our memories. Secondly, I wanted the interview to be informal, like a normal conversation between colleagues. Thirdly, a semi-structured approach would allow the interview to progress in many different directions, due to a wider scope (Kvale & Brinkmann, 2009).

The purpose was to get the teachers to externalise their interpretation of how the teachings were progressing. Therefore, I would usually begin the interview by asking how they generally thought the teachings were progressing. Whilst the teacher was speaking I would listen for cues that I could use to make follow-up questions. The cues could e.g. happen when the teacher was using strong intonation on certain words, or if she was continually using a specific term (Kvale & Brinkmann, 2009). I would then either repeat the word or ask directly if she could be more specific, often resulting in a more elaborate and detailed description of a situation. At other times, I would openly interpret the teacher's statements by reformulating them. I did this to test if I had understood her statements correctly. If not, she would be enticed to elaborate. Sometimes, when it made sense, I would remain silent even though the teacher had finished her statement, making the subtle enticement of further reflection (Kvale & Brinkmann, 2009). It was not something I had planned to do. It was something that happened once or twice due to the nature of the conversation; if the teacher stated something that was philosophically profound – something that called for a moment of reflection.

As I conducted the interviews, I wanted the teachers to reflect on their use of the EMM. At times, I would therefore ask direct questions about their experience of planning the teachings, as well as their use of the EMM whilst teaching. This also became the bearing theme in the two final interviews, in which the three teachers from classes A+B in the 7th grade and two teachers from Team Orange in the 8th grade participated. Because these interviews were

conclusive, I put a stronger focus on the aspects of working with the EMM. For these interviews, I had prepared the main questions I wanted to ask in advance, albeit the form was still highly semi-structured. In fact, these two interviews were reminiscent of focus group interviewing, because I let the main questions facilitate the discussion of the participants. The exact purpose was to get different viewpoints about the use of the EMM in play – or at the least to make my data more nuanced (Kvale & Brinkmann, 2009).

Besides the seven interviews with the teachers, I also conducted a structured interview with Peter Eduard, the project manager of EduTechLab. The purpose of this interview was to get more insight into the thoughts behind the design of the EMM. In a similar fashion as with the two last teacher interviews, I had written the questions I wanted to ask on beforehand. I offered Peter Eduard to read the questions in advance, in order for him to prepare, but he respectfully declined due to a busy schedule. Nonetheless, the interview took place at the Mærsk McKinney Møller Videncenter at Sorø Academy, and was a bit more formal in its approach. I began the interview by addressing the results of the ROSE project in correlation with the approaches in the new Danish school reform. I did this to set the scene for the interview and to effectively present the first question (Kvale & Brinkmann, 2009). Thereafter, I would ask follow-up questions to test if I had understood his statements correctly, and then move on with the main questions, cf. appx. E.

A core aspect of conducting a successful interview is to know how to approach the person you are interviewing. You have to realise what areas of expertise the person yields, and prepare your questions accordingly, in order to avoid an asymmetrical balance of power. If you do not show the interview person that you are knowledgeable about his or hers area of expertise, you might risk a loss of interest and experience disregard towards your questions. This primarily happens if the interview person senses that you do not know what you are talking about (Kvale & Brinkmann, 2009). In my interviews, the atmosphere was pleasant and laid back, and I did not sense any such issues whilst doing the interviews, but I did take this aspect of interviewing into consideration by being as honest and open about my knowledge as possible.

Simply put – if there was something I was unsure about, I would say so, instead of pretending to be knowledgeable.

Questionnaires

In order to strengthen the qualitative data that was obtained through the participant observation and the interviews, I created three questionnaires with combined quantitative and qualitative elements. Two of the questionnaires were created for the students and the third one was created for the teachers. The two questionnaires for the students were shared respectively at the beginning of the UVM project and at the end. I therefore refer to these as the PRE and POST questionnaires. The questionnaire for the teachers was shared after the UVM project had been completed, and I refer to this as the teacher questionnaire. The PRE and POST questionnaires can be found in appx. B & C, and the teacher questionnaire can be found in appx. D.

The PRE and POST Questionnaires

These questionnaires were divided into two parts. The first part was the same in both questionnaires – it consisted of a semantic differential questionnaire. However, the second part was different in both. In the PRE questionnaire, the second part consisted of four instances with various statements to be considered. In the POST questionnaire, the second part consisted of three optional questions that enticed to elaborate replies.

The semantic differential part is based on ten criteria of positive experiences, as proposed by (Jantzen et al., 2011):

CRITERIA	KEY QUESTIONS
INTERACTIVE	Informants' comments on whether they feel interactive. Do they feel that they are invited as co-player, co-producer, or co-creator?
NEARNESS	Informants' comments on whether they find that the design "talks to them" – is it close to their situation, their interests, their problems?
INTIMATE	Informants' comments on whether they feel obliged to participate. Do they feel related, do they feel that they should participate, be active, take responsibility?
AUTHENTIC	Informants' comments on whether they find the design authentic, original, true?
UNIQUE	Informants' comments on whether they find the design unique, original, something that they have not experienced before?
INVOLVING	Informants' comments on whether they feel emotionally involved. Is it exciting, relaxing, or reassuring to experience?
LIVELINESS	Informants' comments on whether they find that the design allow them to be spontaneous. Do they feel that the design encourage them to dig into the design?
LEARNING	Informants' comments on whether they find that the installation is supporting their learning and creation of experience. Does it change what they already know? Does the design encourage them to follow up and get to know more?
UNDERSTANDING	Informants' comments on whether they obtain understanding?
INTERESTING	Informants' comments on whether they find the design interesting. Is it providing something new? Does it have their interest? Does it surprise?
RELEVANT	Informants' comments on whether they find the design relevant. Is it something that they can relate to?

Table 10: The ten experience criteria (Jantzen et al., 2011; Lykke et al., 2014)

This exact setup of questions that relate to the ten experience criteria was used to guide and create the semantic differential questionnaire in another study, which I was part of during my research internship in Costa Rica on the 9th semester of Human Centred Informatics (Lykke et al., 2014). In that particular study, these questions were used to guide the observations that were made of Costa Rican university students in three different learning designs. I have not adopted the same strategy in this study, however, the questions nonetheless depict the different aspects of experience in overall terms. The criteria of learning, understanding, nearness and relevance aims to discover if the students experience learning relevancy when working with real world problems. The criteria of uniqueness, authenticity, involvement and liveliness aims to discover if the students feel motivated. The criteria of intimacy and relevance aims to discover the students' responsibility of own learning. The criteria of interactivity aims to discover the students' experience of collaboration and interaction (Lykke et al., 2014). However, because I have not used the questions listed in table 10 to aid my participant observation, I will not be able to analyse the results in quite the same manner as we did in Costa Rica. Of course, the reason for this is that this study uses RT as its theoretical outset. In that sense, the semantic differential questionnaire will provide a quantitative overview of the students' feelings towards traditional classroom teaching and product oriented teaching respectively. My intention is that this overview can be analysed in relation to the qualitative data by relating it to the principles of RT.

The semantic differential questionnaire consists of 12 pairs of adjectives. In each pair is a positive value laden adjective and a negative value laden adjective, e.g. Sad/Happy, Dissatisfied/Satisfied, and so on. The negative laden adjectives are all placed at the left side and the positive at the right side. Between each pair are nine values represented by numbers. The students of the 7th and 8th grade were told to put a mark at one of these values for each of the 12 pairs of adjectives. The closer they put the mark to a respective adjective, the stronger they would connote this type of emotion to the topic in question. In the PRE questionnaire, I asked them to think about how they would most often feel during traditional classroom teachings. In the POST questionnaire, I asked them how they had most often been feeling during the UVM project, cf. appx. B & C.

In the PRE questionnaire, the second part consisted of four instances with various statements to be considered. I created these statements from the principle of state dominance in RT. My idea of getting the students to consider these statements was to obtain a general overview of state dominance. This table shows the logic behind the statements I created:

MEAN/ENDS	
Statement:	Equals:
When I work I mostly concentrate on achieving my goals and getting the job done.	Serious Dominant
When I work I am not thinking about the end result. I am focusing on the experience itself and on having fun with what I am doing.	Playful Dominant
RULES	
Statement:	Equals:
When I work I mostly feel confident if I have clear rules, procedures and guidelines to aid me.	Conforming Dominant
When I work I mostly feel the best if I do not have to conform to a certain set of rules or procedures.	Rebellious Dominant

TRANSACTIONS/RELATIONSHIPS	
Statement:	Equals:
When I work in a group, I am mostly focusing on improving my own competencies and I mostly view things from my own perspective.	Mastery-Self Dominant
When I work in a group, I am mostly focusing on improving the other group members' competencies and I mostly view things from the other group members' perspectives.	Mastery-Other Dominant
When I work in a group, I am mostly focusing on the other group members backing me up, helping me and valuing my contributions.	Sympathy-Self Dominant
When I work in a group, I am mostly focusing on the prosperity of the other group members and I feel bad if I receive help instead of others.	Sympathy-Other Dominant

Table 11: Inspired by the principles of state dominance in Reversal Theory, I created eight statements across four instances, in which I asked the students to pick the statement that was most reminiscent of themselves in working relations.

In all four instances, I asked the students to pick the statement that was most reminiscent of themselves. I purposefully created these statements to fit the characteristics of the four domains and their respective motivational states, as I presented previously in table 1-4.

In the POST questionnaire, the second part consisted of three questions to which I enticed the students to provide elaborate answers. The questions

concerned the working process and group work in general, cf. appx. C. Since the POST questionnaire was the last data I would get from the students, I figured it would be beneficial to end with some open questions. This was of course an effort to "squeeze" any last bit of insight out of the students.

248 students across the entire 7th and 8th grade replied to the PRE questionnaire and 241 to the POST questionnaire. Both questionnaires were accessed and answered via the Internet. I ensured that all students knew that it was anonymous, both in the introduction to the questionnaire and as a common message that I gave to all classes in their classroom, cf. process description.

The Teacher Questionnaire

This questionnaire was shared with the teachers after the UVM project was completed. In the questionnaire I asked the teachers how it was to fill out the BIP and FFF part of the EMM. For each part I gave them four choices: "predominantly easy", "some was easy, some was difficult", "predominantly difficult", and "other". If they replied either of the first three options, they would be taken to a new screen where they were asked to elaborate on their reply. Once they were past the questions regarding the BIP and the FFF, the teachers would be faced with another multiple choice question, in which I asked them if they used the EMM "actively" during the UVM project. For this question they had five choices: "no", "I looked at it once", "I looked at it a couple of times", "I looked at it continuously", and "other". Just as with the two preceding questions, all other replies than "other" would prompt the teachers with a new screen, asking them to elaborate on their reply. Finally, the teachers were faced with two concluding questions in which I asked them which issues concerning motivating the students were the most dominant, and which challenges they thought were the most conspicuous in relation to teaching product oriented. These questions enticed to elaborate replies as well.

The teacher questionnaire was answered by nine teachers. It was shared with all teachers across the 7th and 8th grade. The questionnaire was not anonymous – the teachers were required to state their full name as well as the class or team they taught during the UVM project. I made the questionnaire

onymous on purpose, because I wanted the teachers to provide feedback that they could stand by. On that note, my purpose was not to insinuate that I did not trust the teachers to be sincere, however, at the time I reckoned that total transparency would provide the best feedback. Alas, in retrospect I reckon I would have received more replies if the questionnaire had been anonymous. Adding to this is of course the fact that the questionnaire was completely optional – it was up to the teachers to decide it they wanted to participate or not, cf. appx. D.

Evaluation Meetings

Two evaluation meetings were held between the school management and the teachers from respectively the 7th grade and the 8th grade. Both meetings lasted approximately an hour and concerned various aspects of using the EMM and teaching product oriented, as a part of the longer and more varied school day that was tested in the UVM project. I attended both meetings as a fly-on-the-wall, not participating in the debate, but instead taking notes and recording the meetings for later transcription, cf. appx. J 8ab-9ab. This was a good example of The Pedagogical Core providing feedback for the learning leadership, as presented in figure 6 of ILE. As part of The Wider Partnership Circle, I viewed these meetings as valuable empirical data that could be included in my study.

A General Inductive Approach

For the processing of the data I had gathered in the participant observations, as well as the seven teacher interviews and the two evaluation meetings, I used a general inductive approach. The approach comprises three steps in which you perform open coding, creation of categories and abstraction (Elo & Kyngäs, 2008; Thomas, 2006). The first step was to read through the raw data of my field notes and transcriptions and apply labels to sections of text. The purpose of labelling sections of text was to achieve a very short description of the content. Once I finished labelling the raw data, I organised the labels in

categories in a separate coding sheet. Through this organisation into categories the combination of labels that represented sections of text in the raw data made it possible to describe what each category signified, which is what the final step of abstraction is about (Elo & Kyngäs, 2008).

The inductive part of this approach derives from the descriptions of the categories in the abstraction step. By referring back to the raw data, so-called "theory" can emerge on its own terms (Thomas, 2006). The "theory" that will emerge from my data will be the implications for design. If I were to use a deductive approach, I would seek to compare my data with established theory in an effort to determine the validity of said theory. Since my aim is not to question the validity of RT, but to use the principles of RT to analyse implications for design, I have chosen to process my data in this manner.

5. Data Processing

In this chapter I will briefly describe how I processed the data I obtained during the study. First, I will describe how I handled the questionnaire data. Then I will describe how I transcribed the interviews, and finally, I will describe how I processed the data through the general inductive approach and present the generic categories.

The Questionnaire Data

I used Microsoft Excel to organise and process the quantitative data. I listed all of the values from the semantic differential questionnaire in a column for each pair of adjectives, with the anonymous student replies in rows beneath. I then used Excel's functions to calculate a series of values, most importantly the mean and standard deviation values for each pair of adjectives, cf. appx. M1.

	A	B	C	D	E	F	G	H	I	J	K	
1	Participant	Q1: Sad/Ha	Q1: Annoye	Q1: Dissati	Q1: Melanc	Q1: Dispair	Q1: Bored/S	Q1: Stresse	Q1: Calm/E	Q1: Slow/H	Q1: Nervou	Q1
245	4. marts 2014	1	1	1	1	1		1	9	1	1	
246	4. marts 2014	8	7	7	6	7	7	7	6	9	8	
247	4. marts 2014	7	7	7	6	6	6	6	5	8	7	
248	7. marts 2014	9	9	9	9	9	9	9	9	9	9	
249	9. marts 2014	8	8	8	8	8	8	7	7	7	8	
250												
251	**Results Q1:**											
252	1	3	8	7	8	3	30	6	20	8	24	
253	2	4	3	5	5	3	12	10	25	5	14	
254	3	7	21	12	12	11	35	13	28	9	19	
255	4	13	22	18	17	16	29	26	27	23	33	
256	5	46	52	39	65	62	46	39	51	38	53	
257	6	34	43	54	61	43	38	39	38	37	41	
258	7	66	49	54	47	54	37	59	25	50	32	
259	8	37	32	29	19	31	14	33	21	40	17	
260	9	38	15	27	10	18	4	23	12	37	13	
261												
262	Blanks	0	3	3	4	7	3	0	1	1	2	
263	N=	248	245	245	244	241	245	248	247	247	246	
264	Mean	6,524193548	5,783673469	6,110204082	5,672131148	6,066390041	4,653061224	5,975806452	4,842105263	6,28340081	4,995934959	4,
265	Median	7	6	6	6	6	5	6	5	7	5	
266	Mode	7	5	6	5	5	5	7	5	7	5	
267	Variance	3,189695703	3,596453663	3,623051188	2,912635769	2,862240664	4,522582804	3,918440643	4,86521181	4,122609526	4,689779326	3,
268	Standard Deviation	1,785971921	1,896431824	1,903431424	1,706644594	1,691815789	2,1266365	1,979505151	2,205722514	2,030421022	2,165589833	1,
269	Minimum	1	1	1	1	1	1	1	1	1	1	

... Results 8th graders | PRE Questionnaire Data | Results pre Q1^ | PRE 7th graders | PRE 8th graders | POST Questionnaire Data | Results post Q1^ | Resul ...

Figure 10: I calculated the mean and standard deviation values by organising the data in rows and columns in Microsoft Excel, cf. appx. M1.

For the replies in which the students had made elaborate texts I categorised these under similar headlines that more or less described the essence of what the students were stating, e.g. “something was boring” or “something about inclusion”, and so on. I was then able to count the number of similar replies in each headline and generate graphs to highlight what the students were most keen on elaborating on, cf. appendix M1.

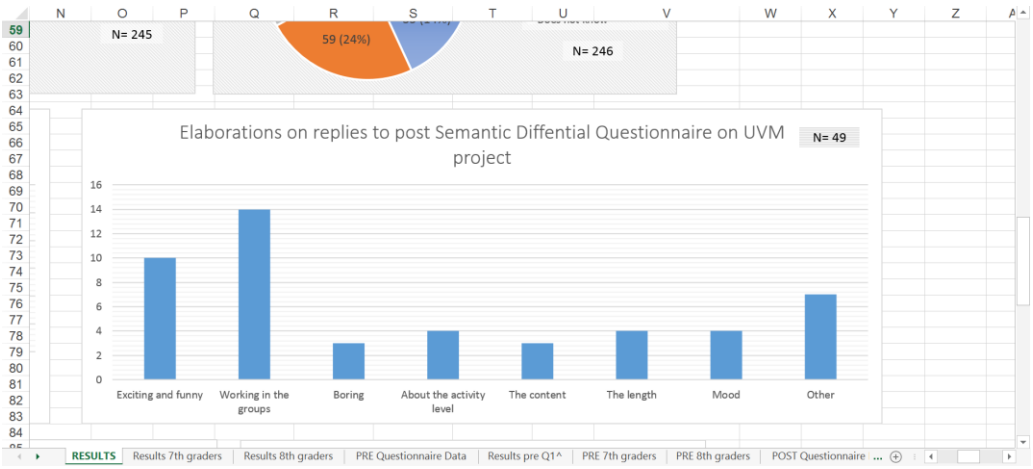


Figure 11: By categorising the elaborate replies under headlines it was possible to generate graphs to highlight the most elaborate topics, cf. appx. M1.

Transcriptions

There are many ways to do transcriptions. I focused on keeping the writing as close to the spoken word as possible. Therefore, I included utterances like “ermm” and “ahh” to let the reader get a good sense of the inherent meaning such utterances may apply to whole sentences (Kvale & Brinkmann, 2009). Every time there was a slight break in the spoken sentence, I would add two full stops. Furthermore, I decided to anonymise all references to students in which they were addressed directly by name. When this occurred I put “xxxxx” instead, cf. all transcriptions and interview recordings in appx. J.

Open Coding

The first step in the general inductive approach was to label sections of text in the field notes and the transcriptions. This involved reading through the data several times and meticulously *code* the sections of text by continuous assessment of the labels I was creating, cf. appx. I1-24. One apparent challenge was to come to terms with the meaning of the labels I created. Why would a certain label fit another section of text? How broad could the respective labels be interpreted? In order to answer these questions, I created a list of the labels in which I began to scribble the meaning of every single one of them. As such, the labelling of the data and the writing of their meaning became the core activity in the open coding step. I continued to revise the meaning of the labels as I read through the data. This process continued until I had read through all of the data a couple of times, and I finally ended with 120 labels, which can be seen and read in appx. G1.

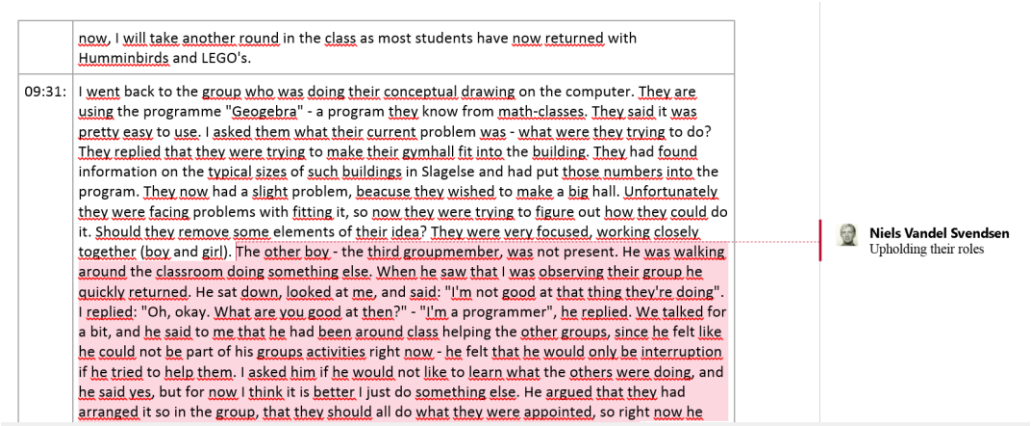


Figure 12: The process of labelling sections of text.

Categorising the Labels

Even though this is supposed to be the next step, I could not help but begin the categorisation process whilst I was creating the labels. This is because I

gradually increased my overview of the data as I read through it again and again. I was therefore slowly becoming aware of some generic categories under which I could group labels. In that sense, the grouping of labels meant that they referred to the same category because they had something in common. For instance, the labels "Division of roles" and "Upholding their roles" fit into the generic category "Roles". In this way, all 120 labels were categorised under generic categories, and the generic categories were then categorised under main categories. For instance, the generic category "Roles" was categorised under the main category "Working in groups", because the labels in the generic category "Roles" all referred to situations that had something to do with the students' relation to their individual roles when working in their groups. An example of the categorisation system can be seen in this figure:

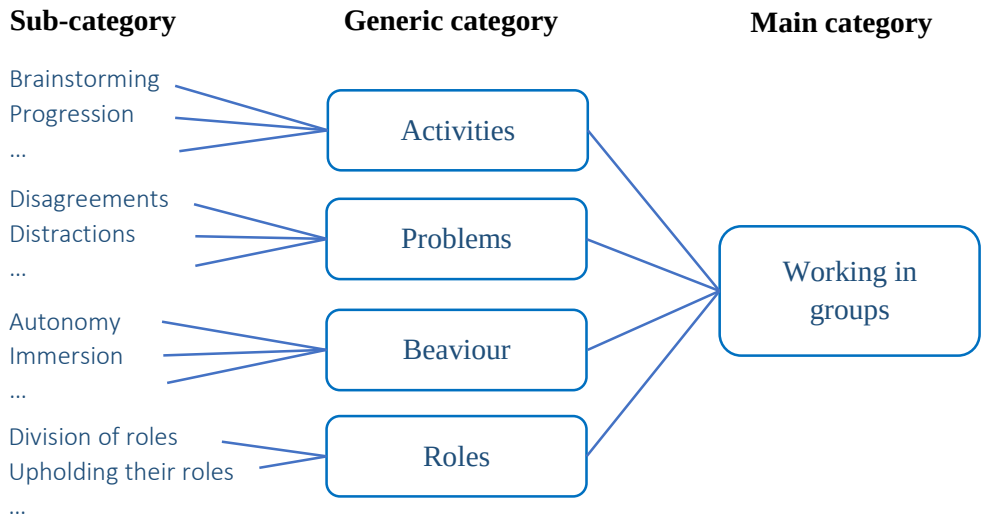
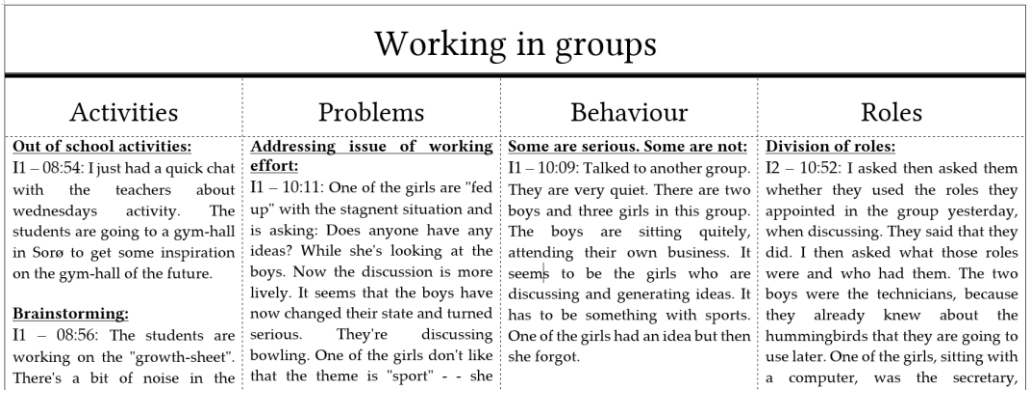


Figure 13: An example of the categorisations of labels into generic categories and generic categories into a main category (Elo & Kyngäs, 2008).

Since the key feature of the general inductive approach is to be able to refer back to the raw data I created documents for each main category, in which I listed all the labels along with the coded text under their respective generic categories (Elo & Kyngäs, 2008; Thomas, 2006). An example of this can be viewed in the following figure:



Working in groups

Activities	Problems	Behaviour	Roles
Out of school activities: I1 – 08:54: I just had a quick chat with the teachers about wednesdays activity. The students are going to a gym-hall in Sorø to get some inspiration on the gym-hall of the future. **Brainstorming:** I1 – 08:56: The students are working on the "growth-sheet". There's a bit of noise in the	**Addressing issue of working effort:** I1 – 10:11: One of the girls are "fed up" with the stagnent situation and is asking: Does anyone have any ideas? While she's looking at the boys. Now the discussion is more lively. It seems that the boys have now changed their state and turned serious. They're discussing bowling. One of the girls don't like that the theme is "sport" - - she	**Some are serious. Some are not:** I1 – 10:09: Talked to another group. They are very quiet. There are two boys and three girls in this group. The boys are sitting quitely, attending their own business. It seems to be the girls who are discussing and generating ideas. It has to be something with sports. One of the girls had an idea but then she forgot.	**Division of roles:** I2 – 10:52: I asked then asked them whether they used the roles they appointed in the group yesterday, when discussing. They said that they did. I then asked what those roles were and who had them. The two boys were the technicians, because they already knew about the hummingbirds that they are going to use later. One of the girls, sitting with a computer, was the secretary,

Figure 14: The document for the main category "Working in groups". It has four generic categories: "Activities", "Problems", "Behaviour" and "Roles". In each of these generic categories are the respective labels along with text and code identifier to refer back to the raw data.

In these main category documents, which can be found in appx. G2-5, the respective generic categories are listed along with the labels that belong to them. Under each label I have put a code that refers back to the exact segment in the raw data. For instance, "I1 – 08:56" means that you can find that particular text segment in appx. I1 next to the timestamp 08:56. In this way, by referring to the main category documents it is possible to move further down the layer of abstraction.

Upon completing the general inductive approach I ended up with 120 labels across 16 generic categories and 4 main categories, which are as follows:

- Working in the groups
- The teacher's practice
- The project
- Evaluation

To get a complete overview of all the labels, generic categories and main categories, I have created a document that shows their relations in appx. G6.

Since the generic categories will serve as content providers for the analysis, I believe it would be beneficial to provide a brief overview of the meaning of these, before I begin to analyse the data through the ethnographic write-up. What do the generic categories contain?

The Generic Categories

Category:	Meaning:
Activities	Contains observations of a range of different activities that the students engage in during their group work. It is mostly activities that happens within the groups, but observations of class activities are also included. Examples of observed activities: *Brainstorming*, *Fruitfull dialogue*, *Using 3d printers*, etc. (appx. G2) [Working in groups > Activities > ...]
Behaviour	Contains observations of a range of different student behaviours that occurred during group work. Includes both general observations of behaviour within the different settings and within the groups themselves. Examples of observed behaviour: *Fooling around*, *Restlessness*, *Working quietly*, etc. (appx. G2) [Working in groups > Behaviour > ...]

Control	Contains observations of the teacher's effort to maintain control and presence within the given setting. Also contains general observations of the atmosphere. Examples of observed control: *Presence, Retention of tasks, Loose atmosphere,* etc. (appx. G3) [The teacher's practice > Control > ...]
Courses	Contains general observations of the content of the various courses the students attended during the UVM project. Examples of observed courses: *Course in Stop Motion*, *Course in 3d printing*, *Course on writing a report*, ect. (appx. G4) [The project > Courses > ...]
Facilitation	Contains observations of how the teachers would facilitate the students during their group work. Examples of observed facilitation: *Corrections*, *Explaining purpose*, *Suggestions*, etc. (appx. G3) [The teacher's practice > Facilitation > ...]
Goals	Contains teacher's insight on the importance of realistic expectations towards the students' work. (appx. G5) [Evaluation > Goals > Realism]

Insights	Contains the teachers' insights about various aspects of teaching product oriented. The insights derive from interviews and evaluation meetings. Examples of teacher insights: *Motivation*, *Roles in the groups*, *Students behaviour*, etc. (appx. G5) [Evaluation > Insights > ...]
Milestones	Contains few observations relating to the students work on achieving milestones during their group work. Examples of milestones: *Milestones* & *Interview* (appx. G4) [The project > Milestones > ...]
Preparation	Contains teachers' insights on how it is to teach when you do not have all the answers. (appx. G3) [The teacher's practice > Preparation > ...]
Presentation	Contains observations of how the teacher would present the tasks of the day and provide overview for the students. Examples of presentation: *Asking questions*, *Emphasising*, *Changing tasks on the class* (appx G3) [The teacher's practice > Presentation > ...]

Problems	Contains observations of various problems the students were facing in their group work. Also contains general observations of problems within the classroom setting. Examples of problems: *Disagreements*, *Distractions*, *Division of Labour* (appx. G2) [Working in groups > Problems > ...]
Process	Contains the teachers' insights on the various aspects of using the EMM to prepare the product oriented teachings. Examples of process: *BIP*, *Ease of use*, *FFF*, etc. (appx G5) [Evaluation > Process > ...]
Products	Contains observations and inquiries that relate to the student-made products. Examples of products: *Descriptions*, *Innovation*, *Preliminary ideas*, etc. (appx G4) [The project > Products > ...]
Roles	Contains observations of the group dynamic within the groups – especially how the students coped with the different roles in the groups. Examples of Roles: *Division of roles*, *Upholding their roles*, *Serious or playful* (appx. G2) [Working in groups > Roles > ...]

Room & Space	Contains observations of the different aspects of the settings in which the students were working. Examples of Room & Space: *The noise level*, *Workspace*, *Quantity of tools*, etc. (appx G4) [The project > Room & Space > ...]
Visions	Contains the teachers' visions about the future with product oriented teachings. Examples of Visions: *Mixing the classes*, *The school*, *About milestones*, etc. (appx. G5) [Evaluation > Visions > ...]

6. Analysis

The analysis of the qualitative and quantitative data will be conducted through a write-up of the data (Pole & Morrison, 2003). The write-up will refer back to the categorisations of the general inductive approach, and I will simultaneously seek to apply the principles of RT where possible. The analysis will concern selected situations from the four main categories. The analysis will then end with the quantitative results of the questionnaires, which will be discussed in relation to the write-up in the following chapter.

The Project

The students in the 7th and the 8th grade had two weeks to envision and create products that made sense in relation to the overall theme, which the teachers had planned. The overall theme was "The House of the Future", however, in the 7th grade, the focus was on creating a futuristic gym, and in the 8th grade, the focus was on creating a house on Mars. All students had to work in teams of 3-4 persons. During the two weeks, the students attended a variety of small courses. In the A+B class of the 7th grade, which were the class in which two thirds of my observations took place, most of the courses were held in the beginning of the first week. Between the courses, the students would continue working on their products. The A+B class attended a total of nine courses and had one day in the first week in which they went on an inspirational trip to an advanced gym in the city of Sorø. The courses introduced the students to various aspects that held relevance to their group work (appx. G4). It was a mix between IDT tools and principles of process and documentation. Some of the courses were meant as inspiration whilst others concerned aspects that were mandatory to their process. For instance, the courses on how to write log books and how to

write a report was meant to teach the students about the importance of reflecting on- and documenting their process (Appx. G4). In the logbook course, the students were told to think about their learning process; what had they learned during the day? What was difficult? What were they going to do the next day? (appx. I1 – 12:03) The teacher told them that it was important for them to keep a log book because it would help them in their process, and because it would help the teachers get an overview of their progress (appx. I1 – 12:14). In continuation of the logbook course, the students received a course on Google Docs, which was the platform they were going to use to write their log books and share them with their teachers (appx. I1 - 12:10).

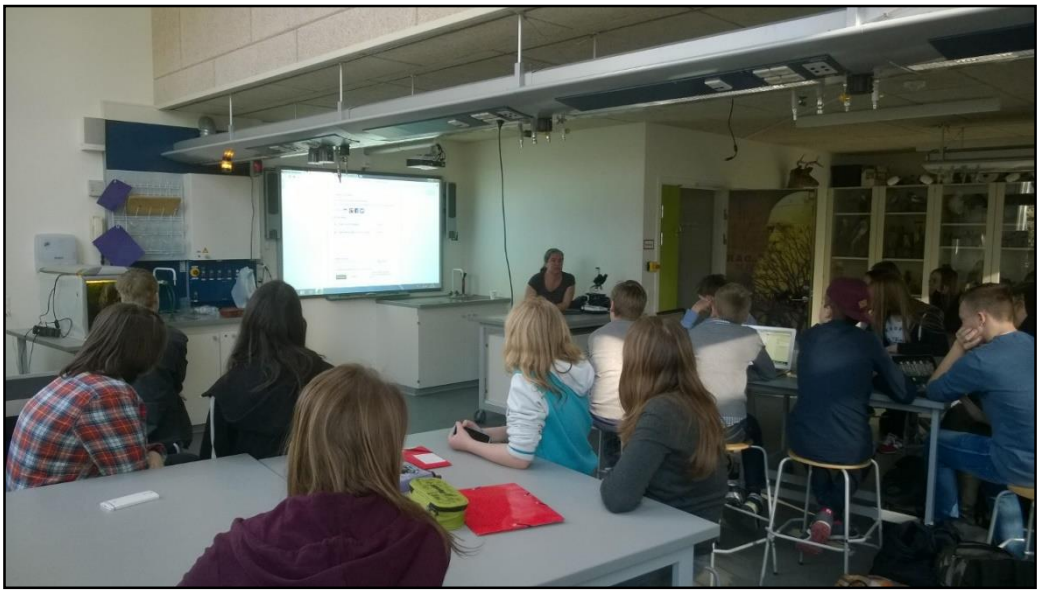


Image 1: The A+B class is being presented to Google Docs.

During the course on how to write a report the students were told that they were expected to write 3-5 pages in total. In the report, the students were expected to use process pictures of their model in order to document how they had created it. They were also expected to conclude on their process and include references to author and title, if they had used any literature (appx. I5 - 09:55).

The students also attended a course in communication. This course taught the students what is meant by engaging in a dialogue. The students were

introduced to principles such as: "Do not interrupt others", "Do not judge", "Make sure to announce that you have heard what the other person has said", and so on (appx. I1 – 13:01).

The rest of the courses all related to the creation of the products. In the design course, the students learned about colours, fonts, aesthetics and functionality, and they were given the task of considering these aspects in relation to their creation of a classroom sign (appx. I2 – 09:32). In the architecture

Image 2: The group 'Science Company' working on the task of creating a classroom sign, using the presented principles of colours and fonts.

/ modelling course, the students learned about building materials, scaling and blueprints, sketching perspectives, and sustainability. They were given a sheet of paper with some small tasks that guided them through the different aspects of the course, e.g.: "Write the materials on the house that you would use for the different parts" and "Choose a material that fits the scaling – little patterns and textures = 1:100/1:200, large patterns and textures = 1:50/1:20 (appx. I5 – 08:51; 09:07; K11). In the Hummingbird course, the students learned about the different parts of the Hummingbird kit, such as the servo motors, the LED lights, the motherboard, and cables. On this course, the students had time to practice

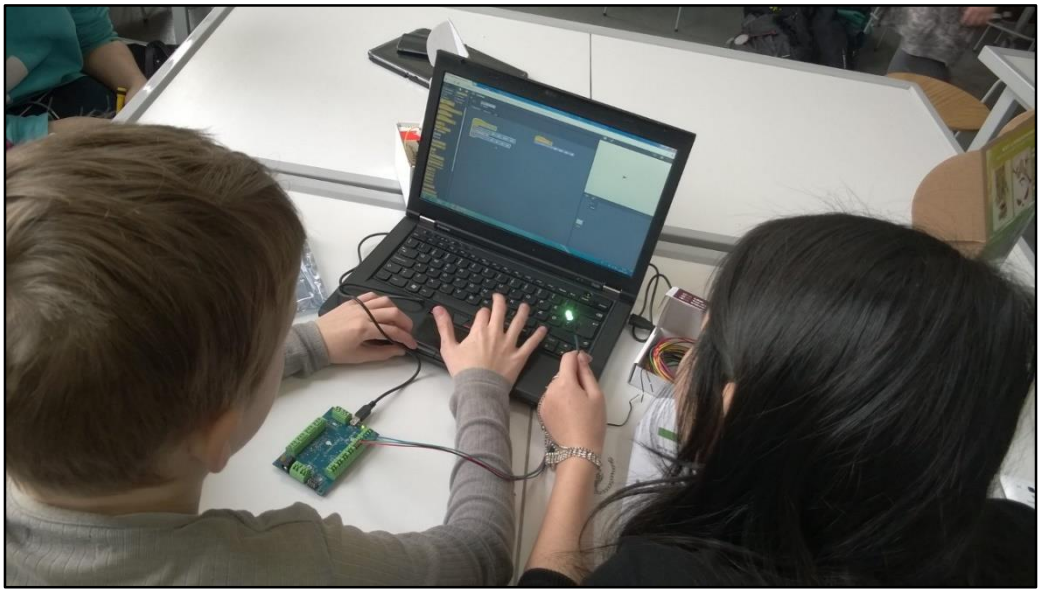


Image 3: Two students has just connected the Hummingbird Kit to a laptop and programmed the little LED-light to illuminate green colour at the press of a button.

connecting the Hummingbird kit to the computer and begin programming (appx. I2 – 12:12). On the course in 3d printing the students were introduced to the basics of the 3d printers, e.g. how the printers print the plastic pieces in layers from bottom to top. The students also got a short introduction and time to fiddle around with the design program TinkerCat, which is used to generate small templates or design 3d models from scratch (appx. I5 – 10:30). The students also attended a course on how to create stop-motion movies with a small app on their phones. On the course, the students saw some examples of stop-motion movies, whilst the teacher explained the concept of connecting slightly different photos to create the motion effect (appx. I2 – 08:36; K4). The students also had time to create small examples of stop-motion movies with the app (appx. I2 – 08:29; K5; K6).

On Wednesday the 19th of February, during the first week of the UVM project, the A+B class went on an inspirational trip to an advanced gym in the city of Sorø. The purpose of this trip was partly to have physical exercise lessons

Image 4: The 'Antvorskov Science' group is using post-its to create a short stop-motion movie.

and to get inspiration to the student products. The students were introduced to all the various functions of the gym and had a short Q&A with a gym teacher about how the gym was used and for what purposes (appx. I3 – 14:38; K8).

In general, the students seemed focused and paid attention during the courses (appx. I1 – 12:03; 12:33). The courses were very short and concentrated. They were clearly designed to provide the students with overall knowledge that was immediate applicable (appx. I1 – 13:05; I5 – 09:03). During the span of the UVM project it was clear that the students were using what they had learned during the courses. For instance, I saw several examples of interactive posters that were created to help present the respective products, in which students had put thought into the selection of colours and fonts, like they were taught in the design-course. Likewise, I saw numerous of products that included details about the scale of the model, the materials used, and so on (I7 – 12:24; 14:25).

Image 5: The A+B class at the advanced gym in Sorø. In this image the gym teacher is illustrating an exercise.

Besides the 9 courses and the inspirational trip to the advanced gym, the core component of the UVM project was the achievement of milestones. Whilst working in the groups, the students were working on achieving milestones that led them through different "steps" on their way towards creating a product. These steps included the gathering of data, choosing technologies, continuous documentation, building the product and presenting it for family and friends at a concluding exhibition on the final day of the UVM project. For instance, the gathering of data required the students to find a knowledgeable person to interview about their product idea (I6 – 08:41; 09:18; 09:59). The continuous documentation required all groups to write logbooks, create an interactive poster and write a report. A fitting technology also had to be chosen – the students had to reflect on what technology or combination of technologies would sufficiently enable them to build and showcase their idea. Most groups ended up using Hummingbirds or LEGO Mindstorms, combined with 3d printed objects and a special type of cardboard to build the models. On the final day, the students presented their products, which consisted of a model to showcase the principle behind their problem-solving solution, the interactive

poster and report to document the process, as well as their personal attendance to give a presentation to the visitors and answer questions.

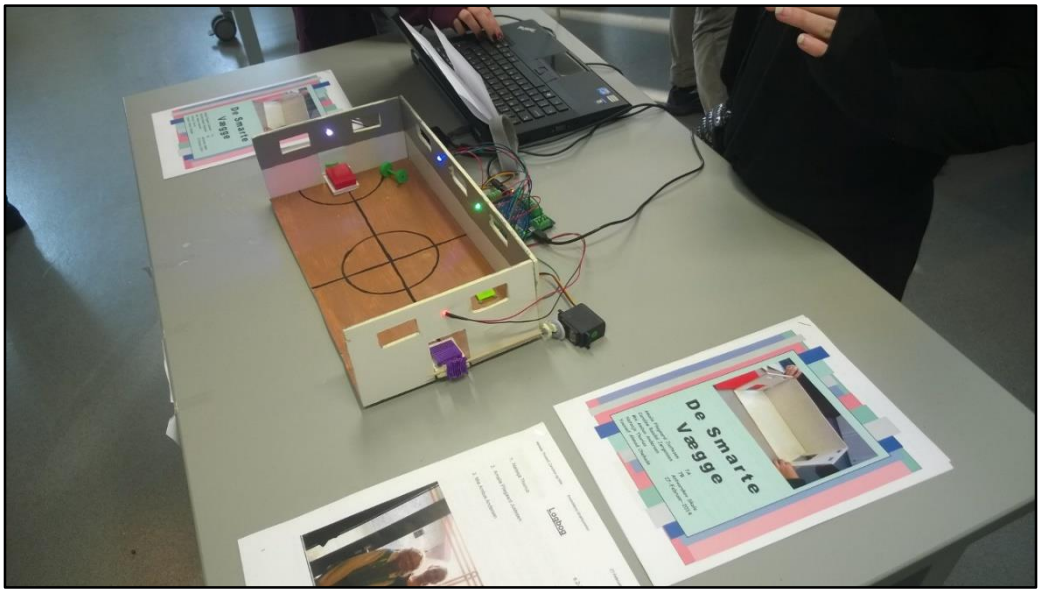


Image 6: The finished product of the 'Smarte Vægge' group. Their idea was to incorporate mattresses that could be raised and lowered from the walls.

Image 7: The exhibition day for all of the 7th graders. Family and friends came to see the products the students had created and to hear their presentations.

Working in Groups

In the A+B class in the 7th grade, the students were told to form groups by writing their competencies on a piece of paper and talk to the others to find out who could be a good match. During this activity, I noted a loose atmosphere and a sense of playfulness (appx. I1 – 09:10; K1). Prior to this, the teachers had given the students a "growth-sheet" (appx. O4) to help them generate product ideas. Whilst the students were working on the growth sheet, I noticed the noise level was quite high – the students seemed energetic and playful, maybe because they had to use their imagination during this activity, or maybe because there were 46 students present in the classroom (appx. I1 – 08:56).

Image 6: The students are talking two each other about their competencies in order to form groups. They were very energetic and seemed playful.

Once the groups were formed, the teachers made the students aware that they had just begun completing their first milestone (appx. I1 – 09:55). The teachers had briefly introduced the students to the idea of working with milestones at the very beginning of class. Now they were making the students aware that the activity of forming groups and working on the growth-sheet was actually milestones. The teachers then told the students that their deadline was

at 10:15 and that they should use their "work-voices", going forward. Upon receiving this message I immediately noticed how the students were working much more quietly and generally seemed to be serious and focused (appx. I1 09:55; 09:57).

As part of working with the growth-sheet, the students were supposed to assign roles to each other in the groups. As the days passed by, it did however seem like some students were interpreting their role a little too literally. For instance, a group of two boys and two girls were having problems because the boys were convinced that their respective roles as 'technician' and 'journalist' meant that they were not obliged to take part in any work outside of these roles (appx. I5 – 08:03). This effectively left the two girls, who had been appointed the roles of 'secretary' and 'designer', to be responsible for the majority of the work in the group. This ignited problems in the group, because one of the boys, albeit serious in his pursuit, ended up spending too much time preparing the interview (appx. I5 – 12:31; I22 – 29:31), whilst the other boy was busy helping all other groups than his own (appx. I7 – 14:13; I8 – 09:12; 09:21). The girls tried different solutions to include the boys – one of which was to make small to-do lists, which did in fact seem to work for a short while (appx. I4 – 10:47). However, despite all their efforts, the girls ended up doing most of the work. When I spoke to the girls about these issues, they both agreed that it was annoying and obstructive to their overall progress to have to spent time trying to make the boys take responsibility (appx. I3 – 09:38; 14:45; I5 – 13:44). When I spoke to the boys, one of them claimed that the others did not value his efforts (appx. I8 – 09:21), and the other did not really have much to say. It left me with the impression that there was a power-struggle within this group: the girls were trying to reverse the boys' state of rebelliousness, but was unable to. In the following table I have highlighted my interpretation of the state dominance for each of these group members:

	Girl 1 (designer)	Girl 2 (secretary)	Boy 1 (journalist)	Boy 2 (technician)
Serious/Playful	Serious	Serious	Serious	Playful
Conforming/Rebellious	Conforming	Conforming	Rebellious	Rebellious
Mastery-self/Mastery-other	Mastery-other	Mastery-other	Mastery-self	Mastery-self
Sympathy-self/sympathy-other	Sympathy-Self	Sympathy-Self	Sympathy-self	Sympathy-self

Table 12: My interpretation of state dominance for this particular group.

The girls were mostly serious and comforming dominant. They were serious because they actively tried to take responsibility for the progress of the group, and because they were very focused on achieving the milestones and planning ahead. They were conforming because they were seeking stability and wanted all group members to contribute equally. They were focused on the group as a whole, and wanted the group to succeed, but in order to do so, they had to spend a lot of time trying to activate and help the boys, which made them active in the mastery-other state (appx. I8 – 09:26). However, whilst doing this, they were sympathetic towards themselves, because they felt a loss every time their efforts to revert the boys failed; they would blame the boys for the groups' slow progress and their feelings of despair (appx. I7 – 12:24; I8 – 08:55). The boys were a bit different. The journalist boy seemed to be serious most of the time, but his habit of making excuses for the slow progress of the interview planning was one of the main drivers of frustration for the girls (appx. I6 – 14:01; I8 – 08:28). To me, it seemed like he would not accept the leadership of the girls and refrained from conforming to their ways by being rebellious. He did this by being very reserved with his role as journalist, as if his appointment of the role of journalist meant that he held special knowledge that the others did not understand. As a result, when the girls would ask him how his work was progressing, he would give unclear answers in an effort not to lose face, instead of admitting that he was struggling (appx. I5 – 13:44). I believe he wanted it to seem like he had everything under control – a showing of power – and that the girls would have to trust his way of doing things. Concerning the other boy, the technician, he was clearly having a hard time working in the group. Like the journalist boy, he was very specific about his role. He felt inadequate and like

he was only able to contribute with one specific part of the whole product oriented process – to program the model. Since this was one of the final things the group would be doing, he felt like he could not take part in any of the other activities, such as gathering knowledge, finding materials, as well as writing the logbook and the report. Instead, he spend most of his time either fooling around or helping other groups with their programming (appx. I8 – 08:55; 09:26).

I suppose that all of the group members were sympathetic towards themselves. They all seemed frustrated that "the others" could not understand how they felt. For the boys, I believe their rebellious behaviour was fuelled by the girls trying to make them revert - maybe they felt the girls were too bossy.

None of the other groups experienced similar problems, but I did observe how the division of labour could pose a bit of a problem for some of the students. In one group, a boy had become a kind of "errand boy". In one instance, he had been sent to the library to do individual training, because there was nothing he could help his group with due to time constraints (appx. I5 – 12:53). When I got there to talk with him, it turned out he was actually working on the report. He then expressed that he felt like he was always being sent around to do stuff, and that the girls in his group were very controlling (appx. I5 – 13:05).

In other groups it seemed a bit problematic that the programming of the LEGO Mindstorms and the Hummingbirds would often be done by one person. This person often had previous experience with programming and was therefore appointed the role as programmer. Since the act of programming was crucial for these groups to highlight the idea behind their product, this person held a lot of responsibility. In one group, this person showed a similar understanding towards his role as programmer, as the technician boy in the other group, albeit he was not spending his time fooling around or helping other groups. Instead, he was sitting idle until the others had completed the model, because he could not begin programming until then (appx. I7 – 10:08). Once he did begin programming he finished rather quickly and then began to "wander around" (appx. I7 – 12:55; I8 – 10:09). However, I did not observe any issues in this group – maybe because they all understood their roles as secluded and work-specific.

On team orange in the 8th grade, the students were not focusing as much on the different roles in the groups. They all stated that they had found their respective roles naturally, without the need to discuss them with each other (appx. I13 – 08:42; 09:28; 10:47; I14 – 08:29). When I asked them, they all seemed to agree who was the leader in their respective group, however, one group stated that they did not have any leader. They argued that because they were not complete strangers to each other, and because they all thought alike, they were able to discuss and agree without problems. If they had been complete strangers to each other, they would probably have discussed their roles (appx. I13 – 09:28).

From time to time, some students in both the 7th and the 8th grade would be doing individual training. The purpose of individual training was basically for the students to do small math-tasks or grammar assignments in areas where they needed to improve themselves. It was mainly used whenever the students had finished their work for the day or whenever the students had nothing to do. When I asked a couple of groups on team orange in the 8th grade what they thought about doing individual training, they replied that they felt it was irrelevant and that it was mainly used as a way to kill time. One girl was very specific when I asked her if she felt like she could make good use of the individual training in relation to what they were doing in their project. She replied:

"No, I don't think so. I think it is irrelevant and kind of used as a sort of 'punishment' for completing your tasks. So just because you finished your tasks and cannot progress any further, you're told to do some curricular tasks that have no relevance to this. It just makes me annoyed. I don't feel like doing such work when I have just spent a lot of energy completing project work" – (appx. I13 – 08:42, l. 3-8)

Although it was not implemented in the same way as the individual training, the students held somewhat similar opinions towards writing logbooks. This activity was mandatory on both team orange in the 8th grade and in class A+B in the 7th grade, and as such, the day would always end with the students writing their logbooks. In the A+B class they had been given a set of questions that they needed to answer, e.g. what they had done during the day

and if there was anything in particular that was difficult. When the students were writing in their logbooks, I observed how the class would calm down and everyone would seem focused (appx. I1 – 12:18; I2 – 14:30; I13 – 14:29). However, it seemed like the boys were prone to writing very short answers, whilst the girls were more elaborate (appx. I3 – 09:10). When I asked the students about their experience of writing the logbooks, many would state that the logbook was really just for the teachers' sake, and that they found it weird that they had to write what had happened during the day, because they already knew (appx. I3 – 09:36; I8 – 12:23; I11 – 09:11; 13:07). Only few stated that they liked writing the logbooks, because it made them reflect on what had happened during the course of the day (appx. I11 – 12:44; I14 – 08:29). Another telling sign of the unpopularity of the logbooks, was when I overheard a group contemplating to write the logbook at the beginning of the day, just to get it over with, because they already knew what they were going to do (appx. I12 – 08:39).

In general, I got the impression that the students were enjoying working in the groups, however, the aspects of having to write the logbooks and occasionally doing the individual training did not make sense to them. To some, the deliberate focus on the roles in the groups also became more of an obstacle than an advantage. I also found it quite interesting that most groups in the A+B class chose to use LEGO Mindstorms instead of Hummingbirds to help them build and show-case their products, since they had not been introduced to the LEGO Mindstorms during the courses (appx. I2 – 12:44; 12:59; 13:13). However, a teacher mentioned that they had previous experience with LEGO Mindstorms, so in retrospect, the short course on how to use Hummingbirds might not have been sufficiently astonishing the students (appx. I2 – 12:53).

The Teacher's Practice

In the A+B class in the 7th grade, three teachers were taking shifts teaching the students during the UVM project. There would usually be a least two teachers present at all times. On the orange team in the 8th grade, I mainly observed one teacher.

One of the aspects the teachers were experiencing as different during the UVM project was the fact that they did not have all the answers and were not all-knowing. At one point I observed how a teacher tackled this situation by openly admitting to the students that she was no expert in Hummingbirds. She could teach them the overall purpose for using Hummingbirds, but due to her scarce knowledge, it would be better if the students tried to help each other and share their knowledge, so that everyone could learn (I2 – 12:09). On several occasions I did in fact observe the students reaching out to each other and helping each other, e.g. with Google Docs and TinkerCat (appx. I1 – 12:37; I5 – 10:55; I9 – 10:32). The teacher on team orange in the 8th grade, elaborated further on the aspect of not having all the answers, by stating that maybe it was actually good for the students to see their teacher being in unfamiliar territory:

"[…] that they also experience an adult being just as much in unfamiliar territory, and that they see how we manage, because we usually say to them: "Then do it! Try it!" – but they never really see us trying, because we know what it is we need to do. We enter the classroom and have all the answers. We know it all. It is never us who gets caught on a shaky leg. Now they have nothing but a teacher with shaky legs." – (appx. I21 – 26:23, l. 3-8)

In her experience, the teacher's shaky leg has enticed the students to begin validating their projects on their own. She has been able to make the students relate to open questions such as "Why is this the direction you want to take?" and "Do you think this is feasible?"

Because she has been open about her lack of knowledge in certain areas, the students have been accepting towards the fact that they would need to do some research in order to answer those questions. Even more so, they have done so without becoming frustrated at the lack of a straight answer, since that is usually what happens if the teacher cannot answer their questions (appx. I21 – 03:26). Instead, what she has been able to do, is to brainstorm with the students:

"[…] I don't hold all the answers. But I can find out.. you know.. we can find out. After the first day we had created a long list of things we were wondering about. Then

we had to go and find a physics teacher and say: Why is that? Why is that? Why is that? Where do I find out about stuff like this?" – (appx. I21 – 27:14, l. 3-6)

In addition to this, I observed many situations in which the students were progressing without the teachers help. The use of the Internet seemed to be a good way of finding inspiration and knowledge. For instance, one group used the internet to research plants, because they needed to find out which type of plants that would support a house on Mars (appx. I11 – 11:17). Another group would have 10 minutes meetings at the beginning and the end of each day. On these meetings, they would discuss their status and their course of action (appx. I5 – 12:40). Also, programming and testing the models fuelled discussions in some groups – especially when there was some sort of problem. For instance, I observed one group in which two boys were trying to fix a problem of connecting a motor to a special part of their LEGO model. They were eagerly discussing whether they should use a traditional cog or an odd one (appx. I7 – 14:18). However, in another group, the students were not able to discuss their way to a solution. They were simply stuck, and could not figure out how to build and programme the LEGO Mindstorms. As a result, they were all doing individual training whilst waiting for some of their fellow students to come to their aid. I tried asking them about using Hummingbirds, but they seemed very persistent on using the LEGO Mindstorms:

"[…] I asked them if they could not make their product with Hummingbirds, and they replied that they did not know. They said that they needed knowledge on LEGO and that they felt they did not know enough. I then asked if they would have liked a course in LEGO, and they replied "Yes – very much, because we are sure we cannot use anything else but LEGO for our project."" – (appx. I4 – 10:54)

The following day I went to speak with them again, and it turns out they had to change their direction and go to a plan B. No one could help them with the LEGO, so instead they had decided to make a stop-motion movie (appx. I5 – 13:22).

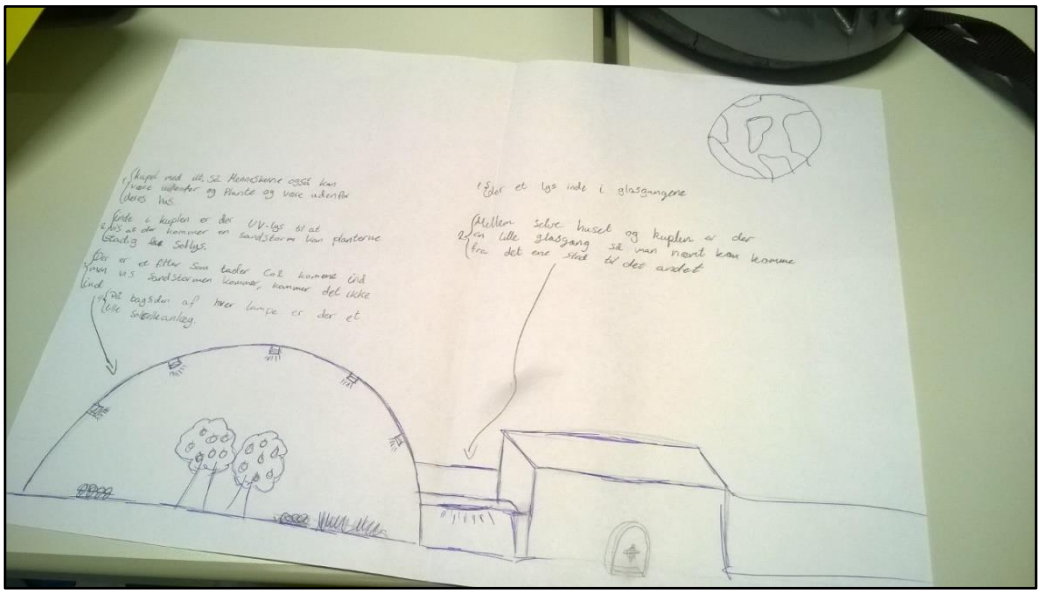


Image 7: The concept drawing for a house on Mars. The group needed to research what types of plants could adapt to- and sustain the environment needed for human settling.

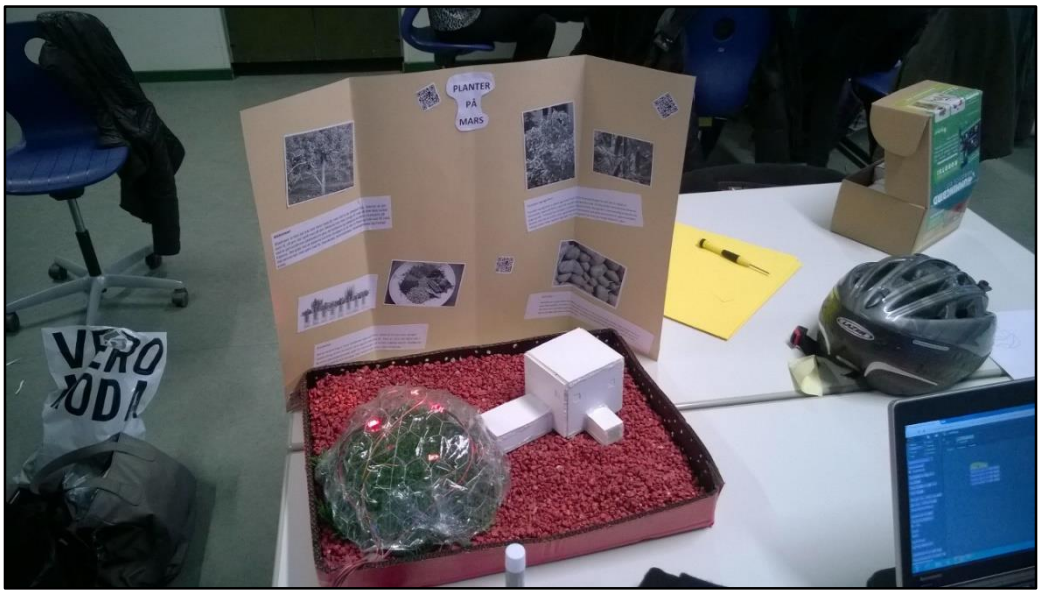


Image 8: The finished product. The interactive poster with the QR codes contain the descriptions of the plants that the group had been researching.

During the observation period, I was noticing what the teachers would do to control the learning environment. How would the teachers make sure that the students were progressing, that all students were challenged, and that everyone enjoyed working product oriented?

In the A+B class, the teachers would use various teaching aids to help them sustain the students to the tasks or activities they were supposed to engage in. During the courses, it was just like traditional classroom teaching, albeit very brief and to-the-point. The teachers would use the IWB to present the curriculum - working sheets would be handed out - and open questions would be asked to engage the students in the presentation (appx. I2 – 09:18; 09:20; 12:04; I5 – 09:11).

When it was time to work in the groups, the teachers would be doing many things simultaneously. Due to the nature of group work, the students would alter the classroom layout and position themselves in small clusters around the classroom (appx. I1 – 09:50). The students would also leave the classroom from time to time, either to work in the EduTechLab or to find a place that was more quiet (appx. I12 – 12:25; I13 – 12:59; I4 – 08:34; I7 – 12:10). Naturally, the open scope of such a setting meant that sustaining a controlled atmosphere became much more challenging for the teachers, compared to traditional classroom teaching. However, the aspect of working in groups also enticed to discussion and movement, for which reason a noisier and looser atmosphere was more tolerable. Nevertheless, the main activity of the teachers became to facilitate the students as they were working in their groups, whilst simultaneously trying to sustain their presence in the environment as a whole. Sometimes, this involved addressing the entire class when the atmosphere got too loose or whenever the teacher sensed that it was time to do a status update. These status updates would normally consist of reminders, such as how much time the students had left to complete certain milestones, however, many times the status updates would also include corrections (appx. I1 – 10:34; I3 – 08:06; I8 – 08:06). For instance, the state of the logbooks was a recurring topic. The teachers in class A+B were not satisfied with the students' effort of writing the logbooks, and therefore they made sure to address the entire class about their expectations in the middle of the first week of the UVM project (appx. I4 – 13:37; 14:41; K10). The video-footage in appx. K10 sums up the main issues perfectly.

First and foremost, there was a "logistical problem" of sharing the logbooks with me and the teachers. I reckon many students simply forgot to do it, but it made it difficult to follow their thoughts on how they were progressing. Secondly, those who did share their logbooks did not provide elaborate answers. One problem addressed by the teachers was "freestyling", in which the students would refrain from using the template of questions the teachers had made for them. However, even though some would use the template, the result was still very short answers like: "We did not learn anything" or "We have no plans for tomorrow" or "It was fine", cf. logbooks in appx. N. This is also the reason why I did not include the logbooks as part of my data, cf. process description.

As the days went by it became clear to me that the teachers in class A+B were struggling to get their messages through to the students. I got the impression that the students might have been fed with more information than they could handle. On the other hand, I reckon it was necessary to sustain the students by doing continuous status updates, since neither teachers nor students were used to working product oriented. The big difference between the 7th graders and the 8th graders, as I shall describe in detail momentarily, was that the 7th graders needed more guidance; they were not as autonomous as the 8th graders. Therefore, the teachers in class A+B did a lot to convey the idea behind the milestones and the logbooks, but somehow the logbooks did not catch on. The video-footage in appx. K12 stand out as a good example of the kind of information the teachers had to convey to the students. In the video, the teacher reminds the students where they should be in their process, according to the overall plan. The students are told that they should soon have their model ready, the interviews needs to be done, the parents needs to give their consent, the interactive poster needs to be done, the verbal presentation of the product needs to be done, the report needs to be written – and they are running short on time. The students are then told to read through their milestones to review what they are expected to do – maybe they even needed to assign themselves with homework.

On team orange in the 8th grade, the atmosphere was not nearly as controlled as in class A+B in the 7th grade. Here, there was most often only one teacher present, however, there were also only 21 students, compared to the 46

students in class A+B. One very apparent feature of the learning environment on team orange was that they had been allowed to listen to music whilst they were working in their groups. I observed how the students would pick their favourite tunes on the IWB and work quietly in their groups. It seemed like the students were perfectly capable of working seriously with the music playing, and I also noticed how the music actually evened out the noisiness that is prone to occur from all the talking during group work (appx. I11 – 08:53; 09:11; 09:28; K14). When I asked the students about the music, they stated that they liked having the music in the background, and some even claimed it made them more productive (appx. I11 – 09:11; 09:50; 11:17). On one occasion, the teacher was not present and I observed how the atmosphere turned from controlled to loose. Suddenly, the IWB and the music fuelled the playfulness and even the most concentrated students could not help but revert from serious to playful (appx. I11 – 13:59). For instance, some students joined in a long row in front of the IWB, turned up the music whilst singing along (appx. I11 – 13:53). The music was continuously turned up and down by different students passing by, and at some point the IWB was also used to play games on (appx. I11 – 13:57; 13:59; 14:02). A boy also began to play football in front of the IWB, fending off anyone who tried to turn down the music (appx. I11 – 14:05). Finally, a teacher came by and got the situation under control by telling the students to turn down the music, clean up the room and begin writing in their logbooks (appx. I11 – 14:09).

As the above situation illustrates, the physical presence of the teacher was necessary, even though the students on team orange in the 8th grade were much more autonomous than the students in the A+B class in the 7th grade. In general, there were many small occasions in which the teachers would address the students directly in order to control the environment. Most often, I observed how the teachers would effectively revert the students behaviour from playful to serious, by reminding them of the task at hand (appx. I6 – 12:15; I12 – 12:47; I11 – 14:25).

Evaluation

The teachers seemed to agree that the UVM project had generally been a success, however, several pointed out that they thought the weak students were losing out. It was difficult to balance the teams so that both the strong and the weak students became motivated, although the mixing of students from different classes probably did result in more even product results, as opposed to if the teams had strictly been formed within each class (appx. I24 – 05:27; I22 – 32:32). One teacher had come to the realisation that some of the weak students were actually motivated and immersed – it just happened on their own terms. They would do something that was related to the expectations set up by the teachers, and they would be captivated by it, but she was unsure how much they would actually learn from it (appx. I19 – 13:40). According to another teacher, the act of working in groups was in itself an aspect the students had to come to terms with. To her it seemed like some of the students had misunderstood what it means to be a team, and as such, they were sometimes very quick to give up on the inclusion (appx. I22 – 28:16). My impression is that some students did not know what to do about incompetent or unmotivated group members. For instance, I observed a boy on team orange in the 8th grade, who was sitting on his chair and glaring into the air for the majority of the project period (appx. I14 – 09:01). He seemed like everything was insignificant to him, and when I had the chance to talk with him, he more or less confirmed my impression:

"While we talked, the boy from the group was sitting and cutting sporadically / aimlessly into a cardboard. He looked like he didn't want to participate at all. Before I left the group, I asked him what he thought about the project period. He replied with few words: "It's boring". "How come? Are you not interested in any of this?". "No". "Then what about normal classroom teaching? Do you like that better?". "No, because then you get homework". He then looked away as if he didn't want to talk anymore. I returned to my seat." – (appx. I12 – 10:57, l. 11-14)

I believe the group that this boy was a part of had "given up" on including him, or maybe they just did not know what to do about him. However, I believe

this might have been one of the rare situations in which it was difficult to find out how to motivate the particular person. For instance, I observed another situation in which all that was needed was a little "push" from the teacher. In this situation, the teacher came into the classroom with the student and addressed his group directly:

"xxxxx would really like to get a task in this group. Something that can get him out of his comfort-zone, so that he can get challenged a bit" – (appx. I12 – 09:20, l. 3-8)

This was a good example of a boy who had been sitting in the periphery of the group without anything to do, but also without the motivation to do something about it. He needed help to become activated. The teacher saw this an interfered. I believe he actually wanted to do something, because he did not seem to be in a playful state. He was just sitting quietly and following along with the work. When the teacher brought this to the attention of the others in the group, and a boy suggested a task they could do together, he lid up and smiled (appx. I12 – 09:20).

With such an example, the point is not only that the teacher can influence the inclusion. It is just as much that some students may want to participate more actively but instead end up being in the periphery, because they are either afraid they are going to say or do something wrong or because they are having trouble externalising their thoughts. The teachers' hope was that by mixing up the students, some of the weaker students would flourish by engaging in new relations, but instead, the weaker students struggled to keep up. One teacher importantly noted that it was not necessarily because they were academically weak, but because they lacked the social competencies (appx. I24 – 15:39; 05:49; I23 – 54:46; 55:25).

In relation to the teachers' use of the EMM, some teachers mentioned that they found the BIP-part to be a good way to create an overall structure of the project, and that they had been able to plan within a reasonable timeframe (appx. I16 – 00:47; I20 – 07:39; 07:55). It had made them reflect on the abilities of their students and create a plan that fit accordingly (appx. I20 – 08:30; 08:40; 08:52). However, the teachers also raised concern that the BIP-part was difficult

to make their own. One teacher even stated that she found the model to be too "thought out". Of course, the BIP was also a tool that they needed to get used to, but they felt like it was not practice oriented enough. It was more like a "must-do" paper. They felt like they needed to make smaller plans on the side that were more oriented towards the immediate situation (appx. I22 – 04:05; 04:46; 08:12; 08:16; 09:18; 09:47; I23 – 02:47). One teacher also stated that it was possible that it could become a tool if the teachers sat down and discussed it from time to time throughout the project period (appx. I22 – 08:33).

Concerning the logbooks, the teachers stated that the purpose of introducing logbooks was to get the students to reflect on their own learning process – what did they need to learn? What could they do to ensure that they learned it? (appx. I17 – 07:16) Those who did write elaborate logbooks gave the teachers a unique insight into their experience of the project – as one teacher stated:

"Because it seems like.. yeah it seems like they forget that we are reading along." – (appx. I23 – 14:47)

Unfortunately, most of the students had trouble externalising their thoughts, however, those who were capable used the logbook to address problems in their group work (appx. I23 – 14:54; 15:38).

The use of milestones had a good effect on the students. It was new and different and some teachers even stated that they could see the potential of using the concept of milestones in other projects (appx. I23 – 03:47; I20 – 09:21; 09:35). The reason why the milestones worked was that they were like a roadmap in which the students could see what was required of them before they could achieve the ultimate goal of creating and presenting their products. In this respect, one teacher emphasised the importance of being very concrete when writing the milestones – instead of the milestone being "Create the product" it should be divided into several smaller milestones, like "Find materials" or "Do a brainstorm". In that way, it was easy for both students and teachers to use the milestones as reference points; how far have you come? What should you complete for the next time we meet? (appx. I23 – 05:26; 08:14). Otherwise, the

students would have trouble figuring out how to go from point A to point Z (appx. I16 – 03:21). A teacher also pointed out the difficulty of evaluating aspects such as aesthetics. For instance, she mentioned a group that all the teachers had told to aesthetically assess their product, however, they never understood what that meant. Their end product ended up having visible chords lying around. If the teachers had instead made it a specific milestone to "hide the chords", then the outcome would probably have been different (appx. I20 – 13:09). Another reason why the milestones worked was, according to another teacher, that the students quickly realised that the teachers would follow up on the milestones in all groups. The teachers were able to determine if the students had really completed the milestones or not and if they had skipped along (appx. I16 – 04:05; I17 – 02:23). For instance, it could have been beneficial to create more milestones for some groups, depending on their progress and skill (appx. I20 – 10:12; 11:20).

Quantitative Results

248 students across the 7th and the 8th grade filled out the PRE questionnaire and 241 students the POST questionnaire. If we look at the mean values across both the 7th and the 8th grade, the results amounts to the following:

Traditional Classroom Teaching (PRE)			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,52	1,78	248
Annoyed/Comfortable	5,78	1,89	245
Dissatisfied/Satisfied	6,11	1,90	245
Melancholy/Delighted	5,67	1,70	244
Despaired/Optimistic	6,06	1,69	241
Bored/Stimulated	4,65	2,12	245
Stressed/Relaxed	5,97	1,97	248
Calm/Exercised	4,84	2,20	247
Slow/Hectic	6,28	2,03	247
Nervous/Safe	4,99	2,16	246
Sleepy/Lively	4,28	1,93	246
Insignificant/Interested	5,44	1,87	248

The UVM Project (POST)			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,40	1,94	240
Annoyed/Comfortable	5,67	1,99	240
Dissatisfied/Satisfied	6,04	2,05	241
Melancholy/Delighted	5,95	1,78	240
Despaired/Optimistic	6,12	1,83	239
Bored/Stimulated	5,31	2,28	240
Stressed/Relaxed	5,80	2,12	238
Calm/Exercised	5,53	2,00	238
Slow/Hectic	6,42	1,88	240
Nervous/Safe	5,57	2,32	240
Sleepy/Lively	5,07	2,26	241
Insignificant/Interested	5,50	2,41	240

Table 13: Mean values across the 7th and 8th grade in PRE and POST questionnaires (appx. M)

When visualised in a graph, these mean values reveal that the UVM project was a success, cf. figure 15. Across all sets of adjectives, the mean values for the UVM project is either almost on par or above the mean value for traditional classroom teaching. Especially interesting are the values for the adjectives "Melancholy/Delighted", "Bored/Stimulated", "Calm/Exercised", "Nervous/Safe", and "Sleepy/Lively". In all of these pairs, the UVM project scores above the neutral mean value of 5,0. This means the students replied that they felt delighted, stimulated, exercised, safe, and just a tiny bit lively – and more so than during traditional classroom teachings. In fact, the values for traditional classroom teaching are below the neutral score for the adjectives "Sleepy/Lively", "Calm/Exercised", and "Bored/Stimulated", meaning that the students feel sleepy, bored and calm during traditional classroom teachings.

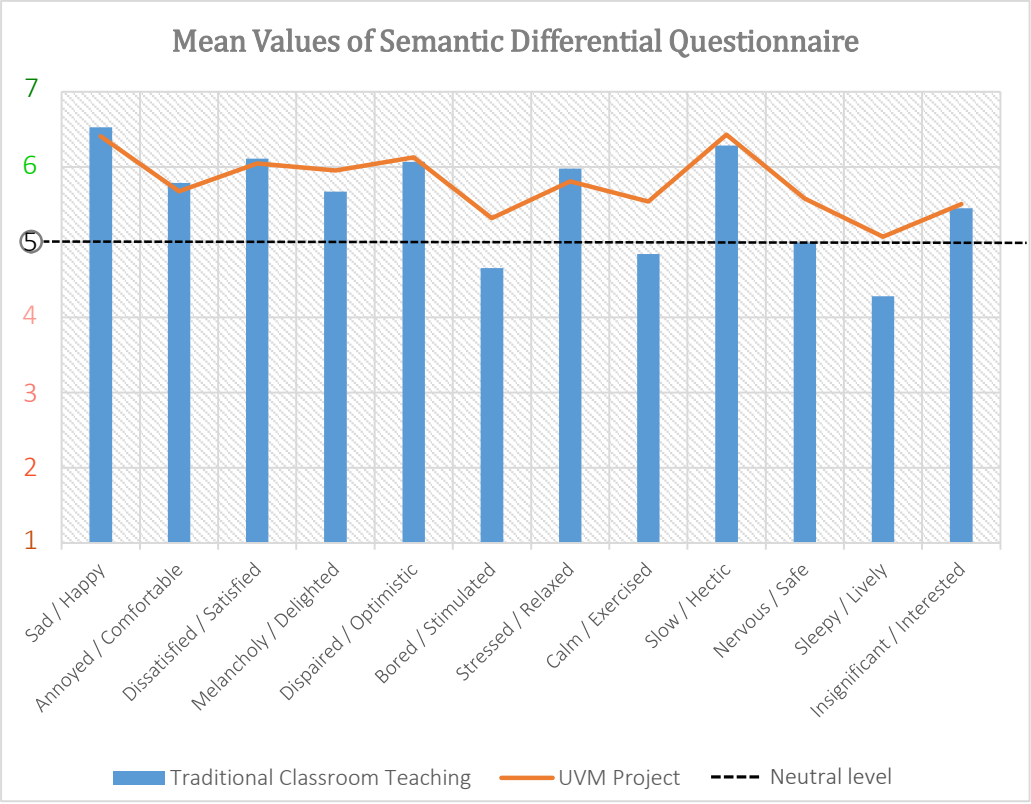


Figure 15: Mean values of PRE and POST Semantic Differential Questionnaires (appx. M)

Now, if we divide these results by the 7th and the 8th grade respectively, the results look a bit different. First, let us look at the mean values for the 7th grade:

Traditional Classroom Teaching (PRE) divided by 7TH Grade			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,59	1,72	136
Annoyed/Comfortable	5,82	1,80	133
Dissatisfied/Satisfied	6,23	1,83	134
Melancholy/Delighted	5,82	1,58	133
Despaired/Optimistic	6,00	1,66	132
Bored/Stimulated	4,69	2,10	135

Stressed/Relaxed	5,83	1,81	136
Calm/Exercised	5,17	1,98	135
Slow/Hectic	6,21	2,03	136
Nervous/Safe	5,01	2,07	134
Sleepy/Lively	4,38	1,87	134
Insignificant/Interested	5,63	1,77	136
The UVM Project (POST) divided by 7TH Grade			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,71	1,76	128
Annoyed/Comfortable	5,66	1,93	127
Dissatisfied/Satisfied	6,45	1,86	128
Melancholy/Delighted	6,15	1,62	128
Despaired/Optimistic	6,33	1,62	128
Bored/Stimulated	5,72	2,09	127
Stressed/Relaxed	5,53	2,03	127
Calm/Exercised	5,76	1,85	126
Slow/Hectic	6,37	1,83	127
Nervous/Safe	5,83	2,22	128
Sleepy/Lively	5,59	2,07	128
Insignificant/Interested	6,08	2,09	127

Table 14: Mean values for the 7th grade in PRE and POST questionnaires (appx M).

In figure 16, the values are almost consistent with the overall mean values depicted in figure 15. The 7th graders felt just a bit more positive. Especially interesting are the values for the adjectives "Sad/Happy", "Dissatisfied/Satisfied", "Despaired/Optimistic", and "Calm/Exercised". The 7th graders felt slightly more happy during the UVM project, whereas the opposite is the case if you consider the overall mean values, in which traditional classroom teaching scores a bit higher. The same can be said about the 7th graders' experience of satisfaction. The 7th graders also felt more optimistic during the UVM project, however, when looking at the overall mean values, the level of optimism is almost the same between the UVM project and traditional classroom teaching. Finally, it is interesting that the 7th graders reply they feel slightly exercised during traditional classroom teaching, cf. figure 16.

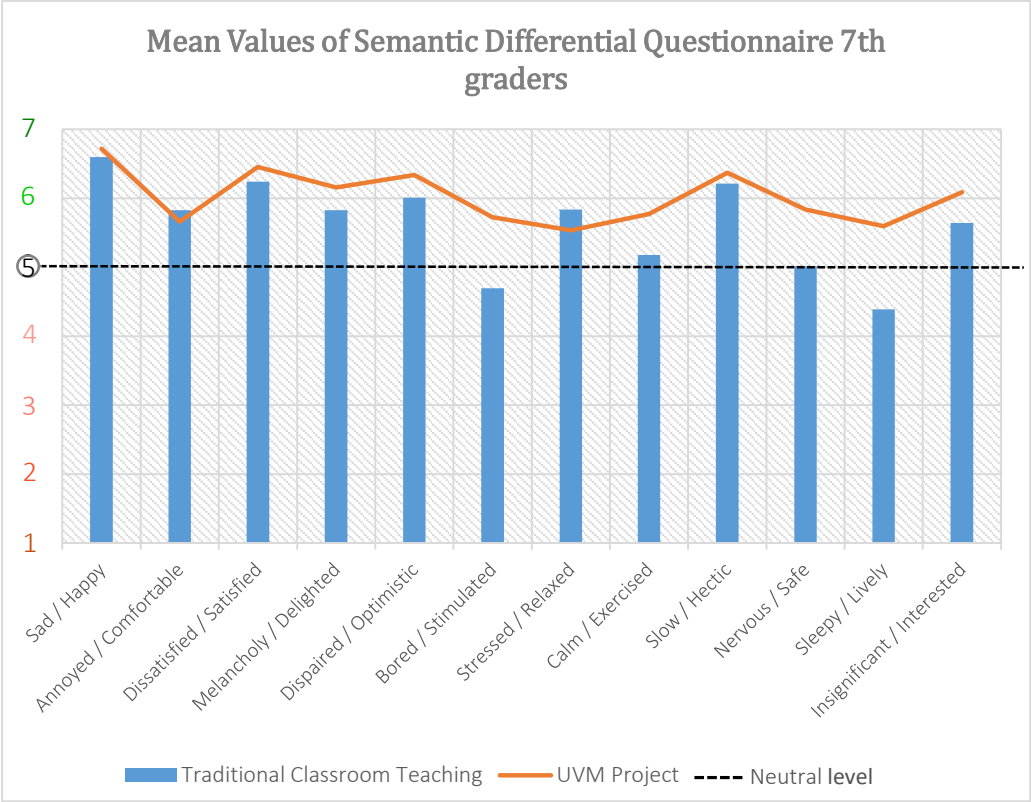


Figure 16: Mean values for the 7th grade in PRE and POST questionnaires. (appx. M)

Now, let us consider the mean values for the 8th grade:

Traditional Classroom Teaching (PRE) divided by 8TH Grade			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,43	1,85	112
Annoyed/Comfortable	5,73	2,00	112
Dissatisfied/Satisfied	5,95	1,98	111
Melancholy/Delighted	5,48	1,83	111
Despaired/Optimistic	6,13	1,73	109
Bored/Stimulated	4,60	2,15	110
Stressed/Relaxed	6,14	2,15	112
Calm/Exercised	4,43	2,39	112
Slow/Hectic	6,36	2,03	111

Nervous/Safe	4,97	2,28	112
Sleepy/Lively	4,15	2,01	112
Insignificant/Interested	5,21	1,97	112
The UVM Project (POST) divided by 8TH Grade			
Adjective	Mean Value	Standard Deviation	N=
Sad/Happy	6,05	2,07	112
Annoyed/Comfortable	5,69	2,06	113
Dissatisfied/Satisfied	5,58	2,17	113
Melancholy/Delighted	5,71	1,92	112
Despaired/Optimistic	5,88	2,03	111
Bored/Stimulated	4,85	2,39	113
Stressed/Relaxed	6,11	2,20	111
Calm/Exercised	5,27	2,13	112
Slow/Hectic	6,49	1,95	113
Nervous/Safe	5,28	2,41	112
Sleepy/Lively	4,47	2,33	113
Insignificant/Interested	4,84	2,58	113

Table 15: Mean values for the 8th grade in PRE and POST questionnaires (appx M).

In figure 17 it is quite clear that the 8th graders felt differently about the UVM project than the 7th graders. While the responses are mainly positive, there as some significant differences that requires attention. Especially the values for the adjectives "Insignificant/Interested", "Sleepy/Lively", "Nervous/Safe", "Calm/Exercised", "Bored/Stimulated", "Despaired/Optimistic", "Dissatisfied/Satisfied", and "Sad/Happy" are interesting. The 8th graders felt slightly insignificant towards the UVM project, contrasting that they found traditional classroom teaching to be slightly interesting. During the UVM project, they felt a bit sleepy and slightly bored as well. Furthermore, the 8th graders did not feel as safe as the 7th graders, and they felt less optimistic, less satisfied, and less happy during the UVM project in comparison to traditional classroom teaching. Clearly, the 8th graders felt less positive during the UVM project than the 7th graders, cf. figure 17.

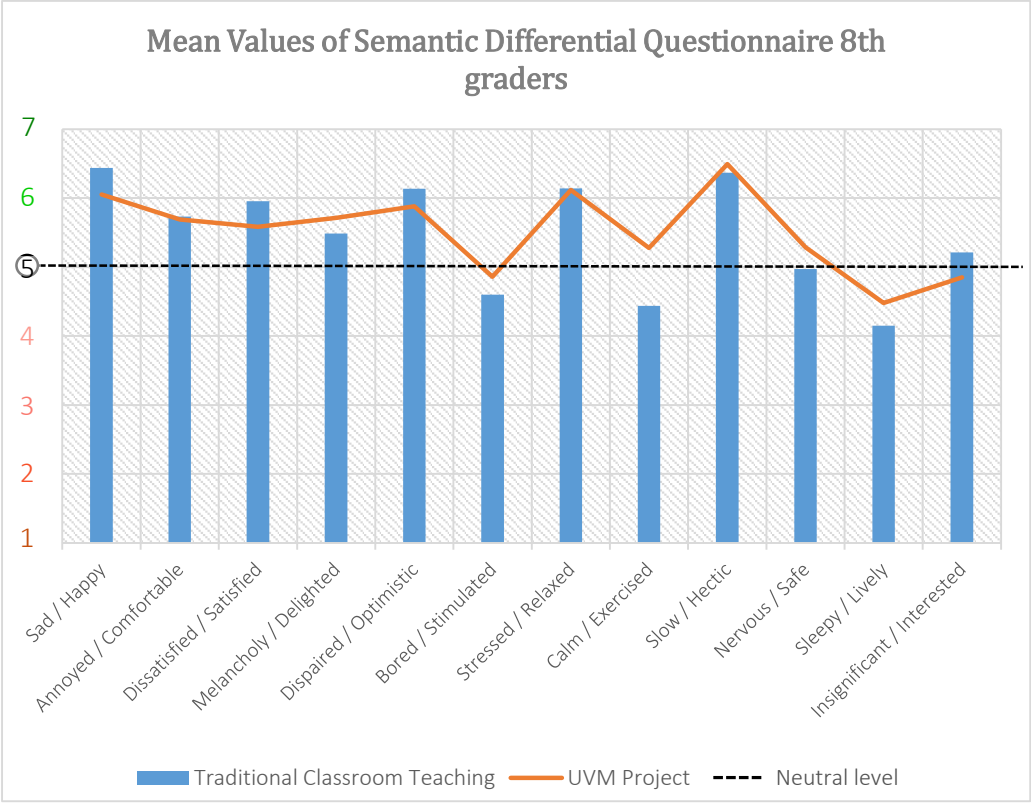


Figure 17: Mean values for the 8th grade in PRE and POST questionnaires. (appx. M)

48 students across the 7th and the 8th grade made elaborate replies to the PRE semantic differential questionnaire and 49 to the POST. The majority of the replies in the PRE concerned boredom and the activities of traditional classroom teaching themselves, as well as remarks that did not fit with any particular category, cf. figure 18. In their replies, the students i.a. state that it is boring just to sit and listen to the teacher talking, that nothing happens, that they are doing many of the same activities, and that the lessons are lengthy (appx. M1). One student even states the he or she would like to have more physical activity during the lessons, preferably whilst solving the curriculum, instead of sitting on a chair all day (appx. M1).

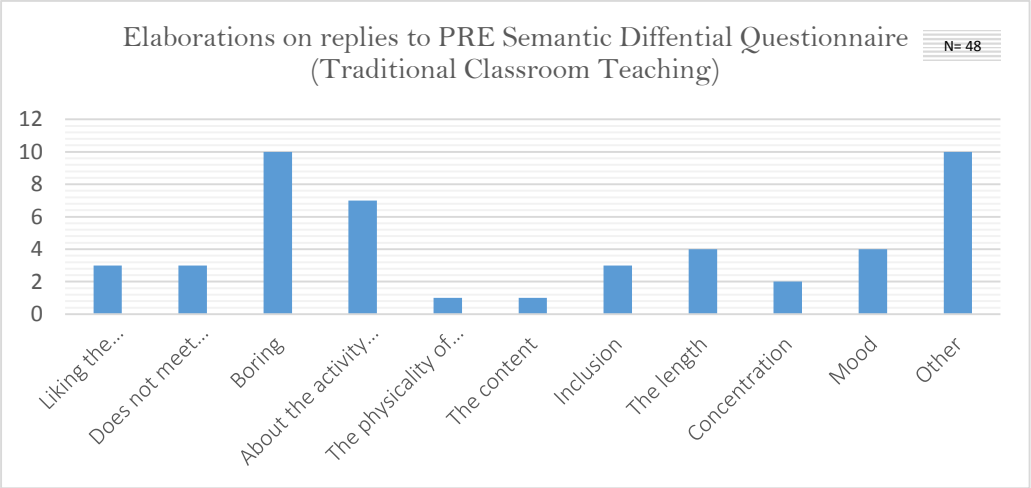


Figure 18: Categories of the elaborate PRE replies (appx. M)

The majority of the replies in the POST concerned working in the groups and the feeling of excitement and enjoyment. There were also some interesting comments on the content, the length, and the activity level. In regards to working in the groups, the students i.a. replied that they would become very tired by 1:30 pm, that their groups were not good, that some group members would either not be working or be too bossy, causing a lot of stress (appx. M1). However, some students also replied that they had been having fun, and that it was exciting and interesting to work with the project (appx. M1). Other students replied that they felt it had been boring and that they did not really feel like they had gained anything from it. These comments especially raised concern with the learning outcome and the physical activities, which these students thought were lacking (appx. M1).

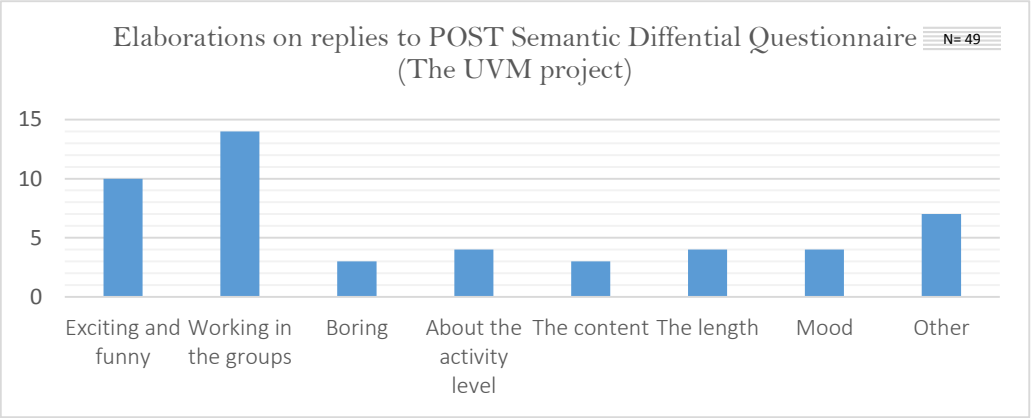


Figure 19: Categories of the elaborate POST replies (appx. M)

207 students replied to the question: "Were there any group activities that you found difficult?" In 85 of these replies, the students stated that it had not been difficult. 34 replies related to the process of working product oriented. 32 replied that there was difficulties of working in groups, and 26 replied that the use of Hummingbirds had been difficult. The remaining replies concerned the use of other technologies, practical issues, the writing of the report, and statements that could not be categorised, cf. figure 20.

The replies that stated it was not difficult, were generally not elaborative, but those that did elaborate, stated that it had been easy because they could ask their friends for advice if they were stuck. Some stated that although it had not been difficult, some group members had been making too many of the decisions (appx. M1).

The students who commented on the process replied that they found it difficult to build the product and to come up with a good idea. Some also mentioned that finding the technical solution was difficult. And some mentioned that it was difficult to meet the time-limits (appx. M1).

The replies concerning working in the groups are somewhat similar to the replies that were given as an elaboration to the semantic differential questionnaire. These students stated that it was difficult to reach a common understanding in the group, that it was sometimes difficult to stay concentrated, and that the working effort of "the others" was not good enough (appx. M1).

Those who replied they found the use of Hummingbirds to be difficult mainly stated that it was because it did not work as it should or because it was hard to connect and program. One student found it difficult because one of his or hers group members had been doing all the work with the Hummingbird, and he or she had therefore not gotten to work with the Hummingbird (appx. M1).

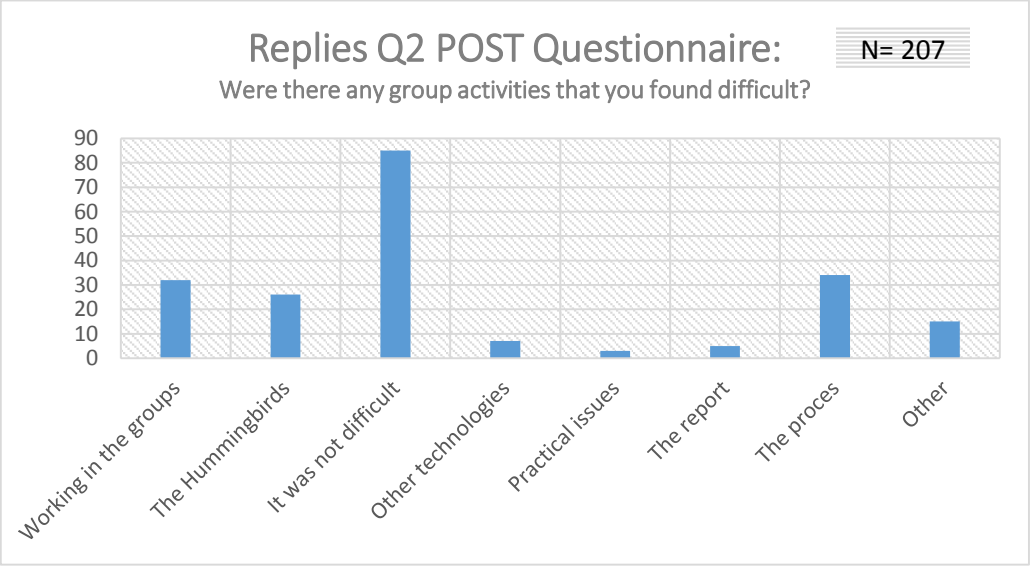


Figure 20: Most students did not find any group activities to be difficult.

223 students replied to the question: "Do you feel like you gained anything by keeping a log book?" 98 replied "No" and 24 replied "Yes" without elaborating further. 6 replied "It helped" and 11 replied "It did not help me" with a short elaboration. 42 gave elaborate replies of why it made sense to them and 13 of why it did not make sense to them. The remaining replies was about the logbooks being annoying or boring, and that they were a waste of time. 21 replies were not categorised, cf. figure 21.

Those who replied that it made sense to them to write logbooks, mainly stated that they felt it gave them a good overview of the tasks at hand, but also of what they had completed / achieved so far. Some stated that they found it helpful that they could use the logbook to go back and review information they

might have forgotten about. Some also stated that it was helpful when they wrote their report. One even stated that it was nice that he or she was able to describe how the work in the group was progressing without the other group members knowing. Some also stated that it felt good to go home and know what you were supposed to do the next day, thanks to the logbook (appx. M1).

Those who replied that it did not make sense to them, mainly stated that they could not see any reason to write the logbook, because they already knew what had happened during the day and could perfectly remember it. Most argued that it was more of a tool for the teachers than it was to them. They found it insignificant and annoying to have to write logbooks (appx. M1).

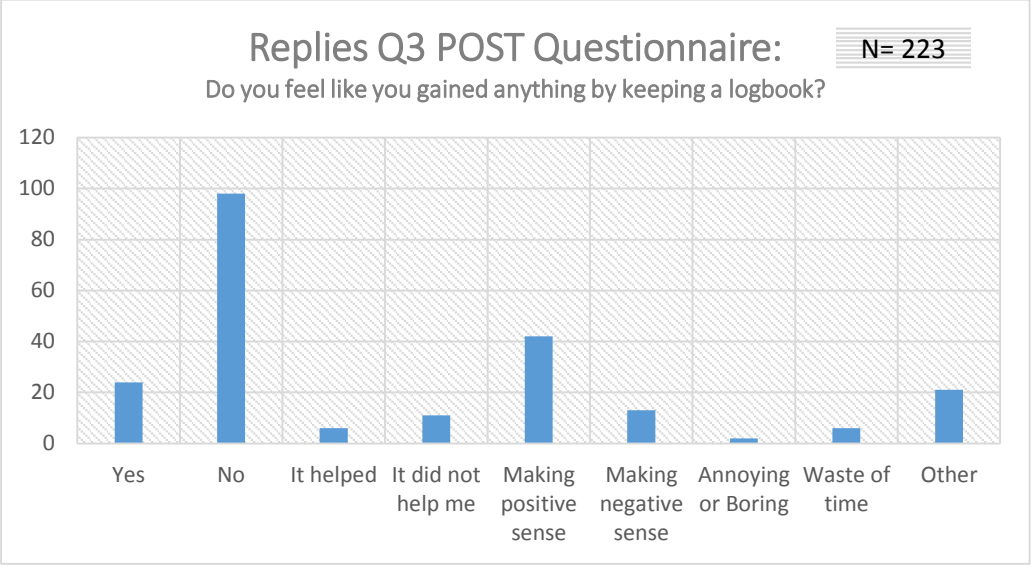


Figure 21: Most students did not feel like they gained anything by writing a logbook.

208 students replied to the question: "Is there anything in the way you worked in your group that you would have liked to be different?" 88 replied "No" and 5 replied "Yes" without elaborating further. 36 made elaborate replies about "The working effort". 17 made elaborate replies about the "Work process". 12 made elaborate replies about "Division of labour". The remaining replies were about "Roles", "Ambition", "Disagreements", "Unity", and "Dialogue" – and some replies were not categorised, cf. figure 22.

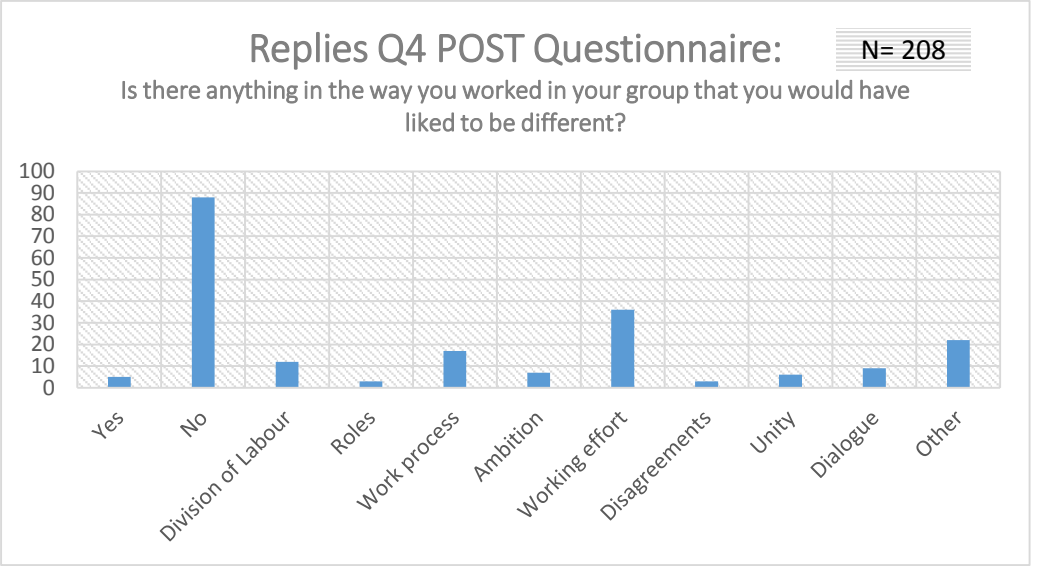


Figure 22: Most students did not think there was anything that should have been different in regards to the way they worked in their groups.

Those who made elaborate replies about the working effort in their groups were mostly stating that there were one or two persons in their respective group who were not doing anything. Apparently, these persons would sit with their mobile phones instead of participating (appx. M1).

The replies concerning the working process were mostly about how these students would wish they had been able to concentrate more in their group, and that everybody was able to participate. One students also suggests to use smaller groups the next time (appx. M1).

The students who made elaborate replies about the division of labour mainly stated that it was hard to divide the work so that everyone had something to do. Some also stated that they wished that they had not been alone with all the work in their group (appx. M1).

The results from the statements I asked the students to consider in the PRE questionnaire (cf. page 57-58) shows the following:

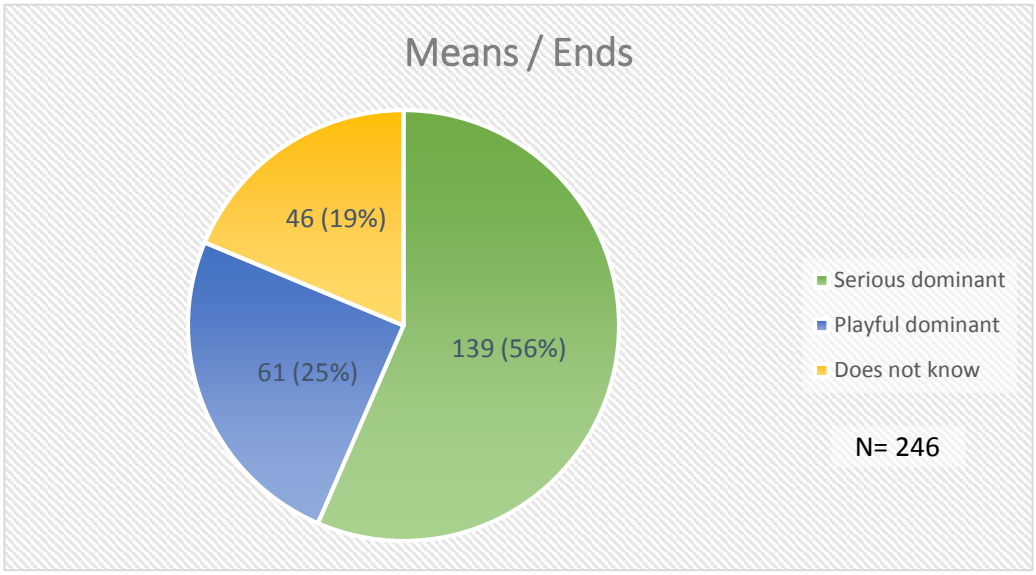


Figure 23: The majority of the students across the 7th and 8th grade view themselves as serious dominant (appx. M1).

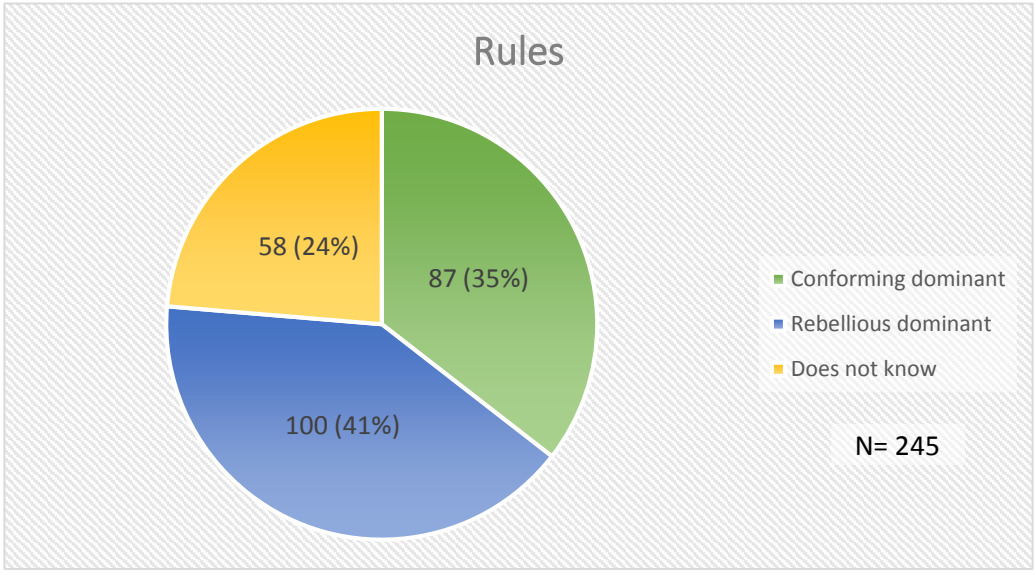


Figure 24: The majority of the students across the 7th and the 8th grade view themselves as rebellious dominant (appx M1).

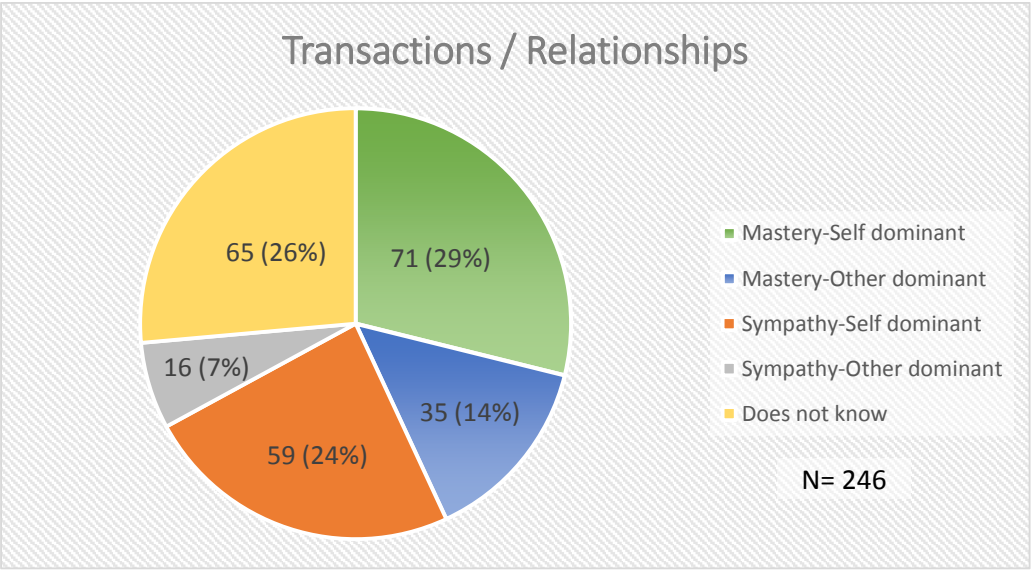


Figure 25: The majority of the students across the 7th and the 8th grade view themselves as Mastery-Self dominant and Sympathy-Self dominant (appx M1).

The results show that the students, when asked to assess the statements they deem to be most reminiscent of themselves in a working situation, reply that they are mostly in a serious motivational state, concentrating on achieving goals and getting the job done, cf. figure 23. However, the majority also views themselves as rebellious dominant, meaning that they do not thrive with too many rules and procedures, cf. figure 24. Finally, as depicted in figure 25, the majority focus on improving their own competencies and tend to view things from their own perspective, whilst they simultaneously want the other group members to aid them and value their contributions (appx. M1).

Now, let us look at the data divided by the 7th and the 8th grade respectively:

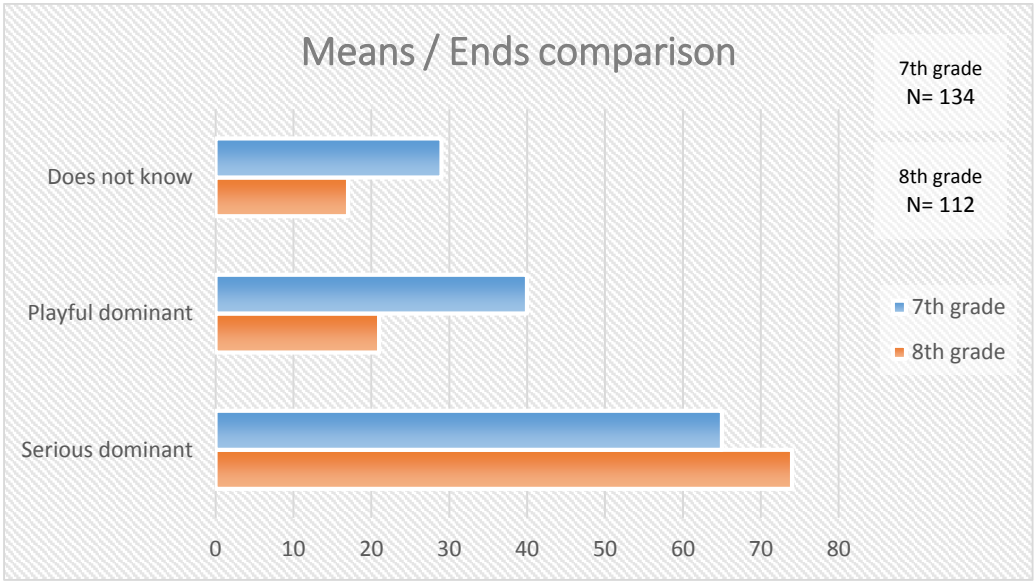


Figure 26: The majority in both the 7th and the 8th grade view themselves as serious dominant (appx M1).

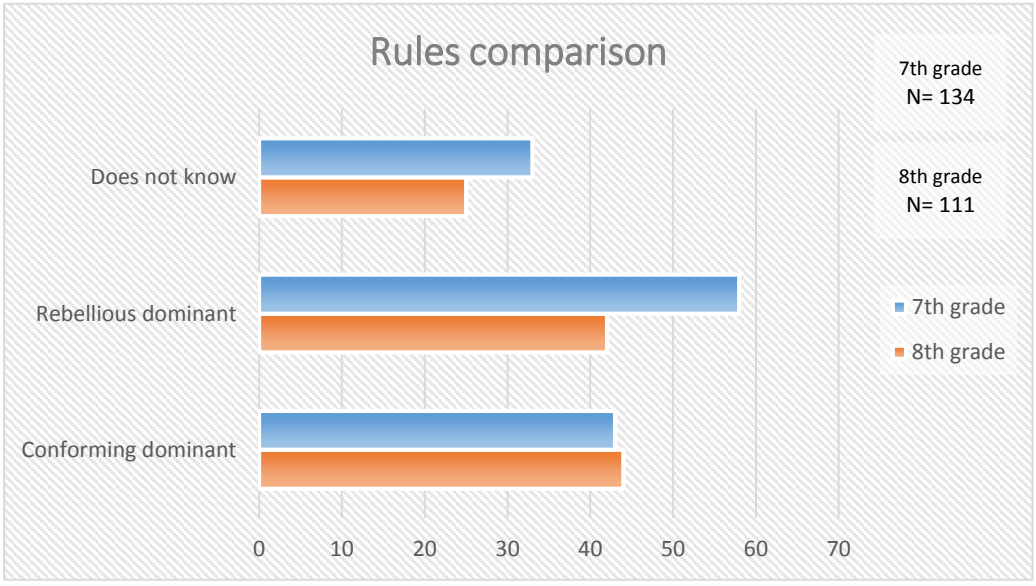


Figure 27: The majority in the 7th grade view themselves as rebellious dominant and the majority in the 8th grade view themselves as conforming dominant(appx M1).

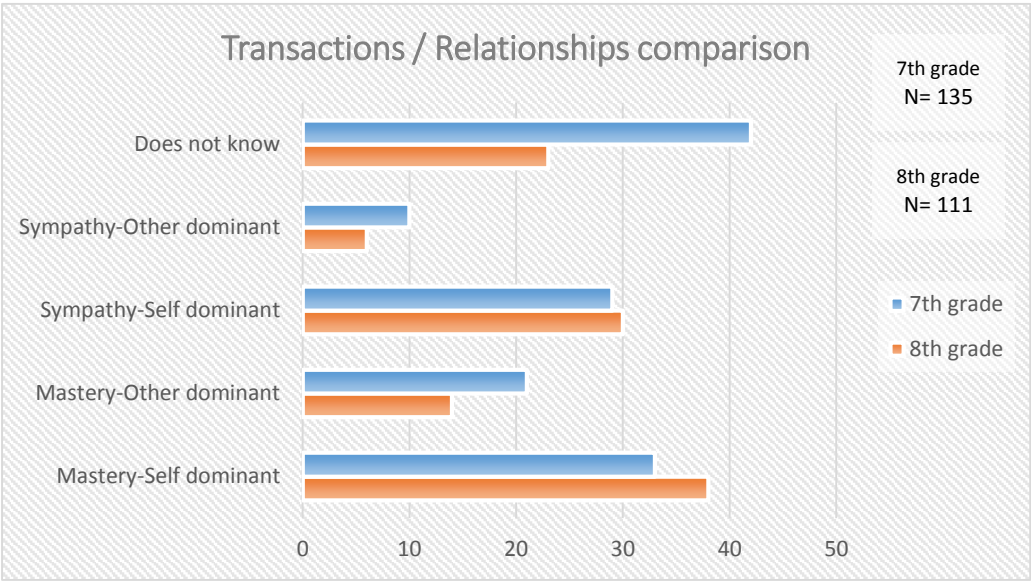


Figure 28: The majority in the 7th grade does not know where their focus generally lies when working in groups. Those who do seem to know, reply that they are mastery-self dominant and sympathy-self dominant across both the 7th and the 8th grade (appx. M1).

When divided by the 7th and the 8th grade respectively, the data shows that both the 7th and the 8th graders see themselves as generally concentrating on achieving goals when working. Also, about twice as many 7th graders as 8th graders view themselves as playful dominant, focusing on the experience itself instead of focusing on the goals, cf. figure 26. It is also the 7th graders who seems to view themselves as the most rebellious, whereas just as many across both the 7th and the 8th grade generally work best with procedures and rules of protocol, cf. figure 27. Furthermore, the majority of the 7th graders does not know where their focus generally lies when working in groups, however, both the 7th and the 8th grade mostly concentrate on improving their own skills, and want their group members to aid them and value their contributions when working in groups, cf. figure 28.

7. Discussion

As presented in the analysis, the UVM project was generally a success. The students reported emotional values that were either nearly on par or above the level of traditional classroom teaching. Furthermore, the data suggested that the 7th graders were generally more positive towards the UVM project than the 8th graders. The teachers had managed to successfully use the EMM to plan product oriented teachings, but which aspects were received well by the students and which were not? More specifically, how did the students experience the courses, the logbooks, the milestones, the individual training, and working in the groups?

The Courses

On a general level, I believe the courses were a big success. Even though some students already possessed knowledge about e.g. Google Docs, my observations revealed that the students were paying attention and seemed to be in a serious state during the courses. I deem the conciseness of the courses the real reason why the students responded well to the courses. As the quantitative data reveals, the students generally experience traditional classroom teaching as somewhat boring and sleep-inducing, and as some students elaborated, this was especially linked to the length of lessons, repetitive activities and physical inactivity. In that sense, I believe the immediate applicable nature of the courses meant that the students were able to maintain their concentration, because they knew they were going to try out the knowledge they were being presented with momentarily. I suppose the idea of presenting the students with general and basic knowledge and then letting them put it to use, made the them quickly able

to determine if it was relevant in relation to the creation of their products. Of course, the content of all of the courses did share a strong connection with the many aspects the students were expected to work with, as part of their projects, e.g. writing the logbooks, measuring scale, and so on. In that sense, I believe it would have been beneficial to put greater emphasis on what was mandatory and what was strictly for inspirational purposes. For instance, it seems like many of the 7th graders chose a technology they already knew and were already comfortable with, namely the LEGO Mindstorms, despite the fact that LEGO Mindstorms were not a subject of any of the courses. Did the students perhaps not feel influenced enough or were e.g. Hummingbirds too complicated to comprehend in 1½ hours?

The Logbooks

The majority of the students did not see the need for a logbook. Although the activity of writing the logbooks seemed like a good way to end the day, the students generally disliked it. In my observations I took notice of the controlled atmosphere induced by the activity of writing the logbooks, however, what might have seemed like students immersed in an activity from an outside perspective, was in reality students who must have been anxious to get the day over with. The many short replies in the logbooks bears witness to a failed attempt to make the students reflect on their learning process. Alas, those who did make elaborate replies found it useful to provide an overview and be able to go back and review information, however, I believe both the qualitative and quantitative data reveals that many students perceived the logbooks strictly as a tool for the teachers. Many students also seemed to not fully understand the meaning of recapping the events of the day, because they were perfectly able to remember what had happened. I think such statements are very telling that the whole benefit of evaluating yourself as a learner in a learning situation, as well as how such reflections could be beneficial to the process of working product oriented, did simply not shine through with the students. Furthermore, I think

the sheer amount of status updates in which the teachers had to emphasise the logbooks made the situation worse. I believe the students downgraded the significance of writing logbooks because they had so much other information they needed to deal with, and as such, they experienced the logbook writing as an annoyance and as something they just needed to finish quickly. But how could you then make the logbooks seem relevant to the students? Since the students find it insignificant and view it strictly as a tool for the teachers, I believe it should be considered how the logbooks could provide the students with some sort of instant gratification. Maybe through competitive measure or by making a series of short logbook courses, instead of just having one.

The Milestones

The students quickly latched on to the concept of completing milestones to progress with their work. Although student insights on the experience of working with milestones are scarce in the data, the fact that milestones comprised the main propelling component of the UVM project means that the overall positive response in the semantic differential questionnaire serve as a good indicator as to how they experienced it. Few elaborative replies state that some found it difficult to come up with a good product idea, as well as finding a technical solution and meeting the time-limits. I believe the students' ability to come up with good ideas could have been excelled, at least in the A+B class on the 7th grade, if they had been presented to a real problem, instead of "just" an inspirational trip to an advanced gym. However, given the short time there was to plan the UVM project, it is understandable that cases with real world problems were hard to find. Besides, all students got the experience of going from idea phase to finished product, which must be the most important achievement, considering this was the first full-scale attempt at product oriented teachings at Antvorskov School.

One important take-away from the evaluation meetings is definitely the teachers' insights on the use of milestones, in which it is proposed that concrete

and concise milestones works the best, and that milestones should be adjusted in volume and scope depending on the individual groups.

The Individual Training

The implementation of individual training was not successful. Even though I did not observe many students who did individual training, the ones I spoke with who had been doing it, replied that it was just a way to kill time. I believe the underlying idea of having the students train their competencies in various topics is good, because some students did in fact raise concerns in regards to their learning outcome during the UVM project. I believe this serves as a reminder that certain basic qualifications are better trained through traditional means than through product oriented teachings and group work. The challenge of merging individual training with product oriented teaching is to make it purposeful to the students, or else it may be experienced as a sort of punishment or extra-curricular activity, as revealed in the analysis.

Working in the Groups

If there is one thing the data has revealed it is that the students could benefit from learning what it means to be part of a team. Throughout both the qualitative and the quantitative data it is apparent that the students are very busy blaming everybody else but themselves for whatever lacklustre experiences they might have had. It seems to me that this is the biggest challenge Antvorskov School is facing in their further development of product oriented teachings. If the students' assessment of their own motivational orientation serve as any indication, then it seems there is good reason for such a mindset to be present. Across all motivational states, the students believe the ones that are most reminiscent of themselves are the ones that concern their own well-being. This is not to say that the students are selfish or ego-centred, but they are very

focused on improving their own competencies, without having to conform to certain codes of conduct. They mostly see things from their own perspective and they expect others to aid and acknowledged their contributions. Furthermore, they view themselves as serious and driven by goal achievement.

If this holds true, then I am not surprised they are so quick to give up on including their fellow group members, nor does it seem surprising that some are simply unable to solve their quarrels, as highlighted in the example where two male students take their appointed roles a little too literal. The teachers are right in their impression of the weak students losing out; if you find yourself in a group of people who fits the aforementioned motivational structures, it may prove difficult to break the ice and show your worth if you are not socially competent. Of course, the revealed landscape of state dominance should not be taken as static, since reversals back and forth between the opposite motivational states will inevitably happen to all. However, what seems to be a residing mindset of "me" and "the others" should be taken seriously and should somehow be addressed to allow for a better experience of working product oriented for all. Maybe a form of course in "group work" could be considered, with implemented milestones and physical exercises to activate and train the students' sense of each other's different qualifications and competencies.

8. Conclusion

The thesis statement for this study was the following:

How do the students of the 7th and 8th grade at Antvorskov School experience product oriented teaching and what implications for further design of the EduTech Mindset Model can be drawn from these experiences?

In order to answer the thesis statement, this study sought to combine qualitative and quantitative method and apply Reversal Theory as a vocabulary to describe the motivational aspects connected with the students' experience of working product oriented. The study was conducted through the optics of Design Based Research and in collaboration with the municipal primary and lower secondary school "Anvorskov School". The development project "EduTechLab" at Antvorskov School comprised the overall frame of this study, which was interpreted as The Wider Partnership Circle in the framework of the Innovative Learning Environments. As such, the knowledge obtained in this study is meant to aid the further development of the EduTechLab, and more specifically, the EduTech Mindset Model. The aim has been to become able to point towards implications for further design as the EduTech Mindset Model and the guideline it encompasses for product oriented teachings has been tested in the full scale, and three week long UVM project. The frame for the overall methodical approach was ethnographic study, with participant observation as the bearing component. A range of interviews with both the involved teachers and the school management, as well as a couple of evaluation meetings between the school management and the teachers from the 7th and the 8th grade,

supported the empirical data from the participant observation. Furthermore, two student questionnaires that focused on the emotional experience of respectively traditional classroom teaching and product oriented teaching, as well as a short teacher questionnaire about their use of the EduTech Mindset Model, supported the qualitative data.

The processing of the qualitative data through a general inductive approach made it possible to segment the data into a system of labels, generic categories and main categories. The descriptions of each label and each generic category made it possible to present the main categories through an ethnographic write-up in the analysis. Where possible, the principles of Reversal Theory was applied in conjunction with the write-up. The results of the quantitative components were presented in the final segment of the analysis, and then discussed in relation to the presented ethnographic write-up. The discussion sought to identify implications for design by questioning the success of the major components of the UVM project: the courses, the logbooks, the milestones, the individual training, and the group work.

The courses turned out to be a real success. The students paid attention and were serious throughout all the courses. The quantitative data showed a general feeling of boredom and sleepiness towards traditional classroom teaching with statements revealing that physical inactivity, repetitiveness and length of lessons were contributing factors. However, the concise and use applicable nature of the courses secured that they were the exact opposite of what the students did not like about traditional classroom teaching, effectively making it safe to conclude that the students experienced this form of teaching as anything but boring and sleep-inducing. However, it would seem that some topics might have been too knowledge-heavy for these short bursts of classroom teaching, which I suspect is one of the reasons why most of the 7th graders in class A+B chose to use that which they were already familiar with: LEGO Mindstorms.

The logbooks never caught on as intended. The students could not see the purpose of reflecting on their everyday activities during the UVM project. The many short replies and the teachers' need to continually address the lack of elaborations, says it all. The students did not like writing the logbooks because

they could not see the purpose – only for the teachers. It can therefore be concluded that we need to rethink how the logbooks can provide the students with instant gratification, in order for them to immediately realise the purpose.

The milestones worked according to plan. Some students reported difficulties with coming up with a good idea, which I believe is the result of a lack of a real case with a real world problem to consider – it might have limited their imagination. However, what can be concluded, on behalf of the teachers' experience of facilitating the students is, that the milestones should be concrete and concise, and they should preferably be adjusted in volume and scope according to the skills of the individual groups.

Honing ones skills through individual training is a good idea on paper, and according to some students also a necessary evil, since some raised concern that they did not learn enough during the UVM project. However, the way the individual training was implemented did simply not work. The students experienced it as a sort of punishment or extra-curricular activity, because it was difficult for them to see the connection between individual training and the content of what they were doing in the product oriented teachings. It can therefore be concluded, that we need to find a better way to merge individual training into product oriented teachings, so that it makes sense, bears meaning and serves a purpose.

The biggest part of the UVM project was the act of working in groups. Although the majority of the students came through with a more positive experience compared to traditional classroom teaching, their understanding of what it means to be a team needs some serious attention. This especially holds true if inclusion is to be improved. The students seem prone to adapt a mindset of "me" and "the others" and will mostly engaging in group work from their own perspective, sometimes making it difficult for them to solve quarrels and include the weaker students. It can therefore be concluded that we need to make the students more socially aware, perhaps by training their group working skills through courses that focus on the dynamics of groups work.

To sum up, we can conclude that the UVM project has generally been a success, however, the product oriented teachings and the EduTech Mindset

Model should be considered in relation to the following implications for design, when iteration the concept further:

- The short and concise form of the courses is received positively by the students, however, some topics may be too knowledge-heavy to sufficiently inspire the students.

- We need to rethink how the logbooks can provide the students with instant gratification, in order for them to immediately realise the purpose behind them. Otherwise we risk the students view them strictly as a tool for the teacher.

- The milestones may be more powerful if they are connected to a case with a real world problem. They should be concrete and concise and can preferably be adjusted in volume and scope to fit the skills of each respective group of students.

- We need to find a better way to merge individual training with product oriented teachings so that it makes sense, bears meaning and serves a purpose. Otherwise, we risk that the students experience individual training as a sort of punishment or extra-curricular activity.

- The students' understanding of what it means to be a team needs some serious attention. They are prone to adapt a mindset of "me" and "the others" and will most likely engage in group work from their own perspective. This can make it difficult to improve inclusion. We therefore need to ensure that the students become more socially aware, perhaps by training their group working skills through courses that focus on the dynamics of group work.

9. Process Description

When I arrived at Antvorskov School in the beginning of January, I was immediately introduced to the EduTechLab and the school management. Upon engaging in two introductory meetings with respectively the schools deputy head and the schools learning consultant I had received thorough descriptions of the various projects the school was involved in (appx. P1-2). I was then handed the keys to the office so I could come and go as I pleased.

During January I spent time getting to know the school. I figured that it was important for me to get to know the residing culture on the school, if I were to conduct an ethnographic study. At this point I was not really sure what the aim of the study should be, and this was also the reason why I was primarily focusing on getting to know the school. As I moved around the school and observed some of the teachings that went on in the EduTechLab, I got the impression that the students were very motivated. I had several conversations with some of them, in which I tried to make them elaborate why they would e.g. stay after school to continue working on their projects. It turns out that some of them was participating in a competition called "The Young Scientists", but they also stated that they generally liked figuring out how they could solve problems by using technology. I later learned about the results of the ROSE project, which essentially led me to Reversal Theory, and from there I began thinking about how come these particular students seemed to be so motivated about working product oriented. It was also around this time I began to realise the full extend of the IT demonstrational school project that Antvorskov School was already engaged in. Shortly thereafter, the UVM project was announced and I began to view my study as supplementary to the digital demonstrational school project.

Before I could begin my study, one of the most important activities was to gather consent from both students and parents. Besides addressing the students directly and telling them about my purpose, a lot of time was spent on informing the students on the schools intranet.

ANGÅENDE SKOLEREFORMSPROJEKT I UGE 8-10: FI

Kære forældre,

Jeg arbejder i øjeblikket på mit speciale i samarbejde med Antvorskov Skole. Jeg kommer fra Aalborg Universitet og studerer Informationsvidenskab. I forbindelse med skolereformsprojektet, som afvikles i uge 8-10, skal jeg følge tre læreres undervisning. Dette indebærer bl.a. at jeg kigger på hvordan eleverne arbejder i deres grupper. For at dokumentere min undersøgelse, vil jeg primært tage noter af de situationer jeg observerer. Som yderligere dokumentation, vil jeg tage billeder og / eller korte videoklip af eleverne i arbejdssituationen. Jeg har i forvejen snakket med mange af eleverne, og gjort det klart overfor dem, at hvis de ikke ønsker at jeg tager billeder, uanset årsag, så skal de bare sige til, og så respekterer jeg dette. Ligeledes skriver jeg til jer her på intra, for at informere om, at hvis i har nogle forbehold eller ønsker mere information, så kan i kontakte mig via intra, personlig e-mail eller telefon.

I min specialerapport vil jeg inkludere enkelte billeder og videoklip til at hjælpe mig med at dokumentere processen. Selve rapporten vil blive gjort offentligt tilgængelig i Aalborg Universitets projektdatabase. Forløbet er på ingen måde en test af jeres børn. Undersøgelsen tjener udelukkende det formål at hjælpe lærerne og Antvorskov Skole med at evaluere og forbedre undervisningen.

Kontaktoplysninger:
e-mail: nsvend09@student.aau.dk
telefon: 4059 2874

Mange hilsner

Niels Vandel Svendsen
Informationsvidenskab, 10. semester
e-Learning Lab, Center For Brugerdreven Innovation, Læring og Design
Aalborg Universitet
Skrevet af Niels Vandel Svendsen den 06-02-2014

Image 9: The message I sent to all the parents via the schools intranet (appx. Q).

I especially made sure to emphasise what my study involved, e.g. taking pictures and video-footage, as well as the right to opt out at any given time. All of the messages I posted on the intranet can be reviewed in appx. Q.

During the observation period the students in the A+B class on the 7th grade would share their logbooks with me via Google Docs. I did review these from time to time during the study, but since most of these logbooks only contained very short replies, I chose not to include them in the data processing, cf. appx N1-2. Had the replies been elaborate, they would have provided me with a unique insight into the students' thoughts that was simply not possible to achieve by any other means.

Finally, I never actually used the results I got from the teacher questionnaire in the analysis. It was a small questionnaire that only nine teachers had answered, cf. appx N3. Despite of some few elaborate answers, the questionnaire did not end up serving any purpose in respect to the content that was treated in the analysis. As such, it remained in the appendix.

10. References

Aisinger, P. (2010, oktober). Elever præsenterer fremtiden med it i folkeskolen. *Folkeskolen.dk*. Retrieved December 4, 2012, from http://www.folkeskolen.dk/64869/elever-praesenterer-fremtiden-med-it-i-folkeskolen

Aldebaran Robotics. (2014). Who is NAO? *Aldebaran Robotics*. Retrieved April 29, 2014, from http://www.aldebaran.com/en/humanoid-robot/nao-robot

Andersen, P. B. (2003). Acting Machines. In *Digital Media Revisited: Theoretical and Conceptual Innovation in Digital Domains*. Cambridge, MA: MIT Press.

Antvorskov Skole. (2013). EduTechLab. *Antvorskov Skole*. Retrieved October 1, 2013, from http://www.antvorskovskole.skoleintra.dk/Infoweb/Designskabelon_Slagelse/Rammeside.asp?Action=&Side=&Klasse=&Id=&Startside=&ForumID=

Antvorskov Skole. (2014). First LEGO League - turneringen. *Antvorskov Skole*. Retrieved April 29, 2014, from http://www.antvorskovskole.skoleintra.dk/Infoweb/Designskabelon_Slagelse/Rammeside.asp?Action=&Side=&Klasse=&Id=&Startside=&ForumID=

Apter, M. J. (2007). *Reversal Theory: The Dynamics of Motivation, Emotion, and Personality* (2nd ed.). Oxford: Oneworld Publications.

Apter, M. J. (2008). Understanding Reversal Theory: A Programmed Tutorial. *Reversal Theory Training Site*. Retrieved February 10, 2014, from http://www.reversaltheory.net/files/RT_Apter/player.html

BirdBrain Technologies LCC. (2014). About Hummingbird. *Hummingbird Robotics Kit*. Retrieved April 29, 2014, from http://www.hummingbirdkit.com/about

CAHE. (2010, November 1). Teknologien forstyrrer undervisningen. *Institut for uddannelse og pædagogik*. Retrieved April 21, 2014, from http://edu.au.dk/aktuelt/nyhed/artikel/teknologien-forstyrrer-undervisningen/

Center for rummelighed. (2014). *Project-based learning at its best. A FIRST LEGO League documentary. Part one: The project*. Retrieved from http://www.youtube.com/watch?v=4hGc0orcG5g

Christensen, O., Gynther, K., & Petersen, T. B. (2012). Design-Based Research - introduktion til en forskningsmetode i udvikling af nye E-læringskoncepter og didaktisk design medieret af digitale teknologier. *Læring & Medier*, (9).

Eduard, P. (2014a). EduTechLab. *EduTechLab*. Retrieved April 20, 2014, from http://edutechlab.dk/

Eduard, P. (2014b). Peter Eduard. *Peter Eduard*. Retrieved April 20, 2014, from http://eduard.dk/

Egelund, N. (2012). Hvad kan vi lære af de nordiske lande - set med PISA-brillerne på? *Kognition & Pædagogik: Tidsskrift om gode læringsmiljøer*, (85), 38–45.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115.

Faculty of Humanities. (2008). Curriculum For The Master's Programme In Human Centred Informatics. Aalborg University. Retrieved from http://www.fak.hum.aau.dk/digitalAssets/66/66795_studieordning_informationsvidenskab_ka_eng_2008.pdf

Frank, L. (2011). Helsingør Kommune har smidt kridttavlerne ud. *Folkeskolen.dk*. Retrieved April 10, 2013, from http://www.folkeskolen.dk/68621/helsingoer-kommune-har-smidt-kridttavlerne-ud

GoPro. (2014). About Us. *GoPro*. Retrieved April 29, 2014, from http://gopro.com/about-us

Gruba, P., & Hinkelman, D. (2012). *Blending Technologies in Second Language Classrooms*. Basingstoke [u.a.]: Palgrave.

Gynther, K. (2010). *Didaktik 2.0: Læremiddelkultur mellem tradition og innovation* (1st ed., Vol. 2010). Akademisk Forlag.

Henderson, S., & Yeow, J. (2012). IPad in Education: A case study of iPad adoption and use in a primary school. *HICSS IEEE Computer Society*, 78–87.

Henriksen, L. (2011, July 16). Ny teknologi skal hjælpe skoletrætte drenge. *Kristeligt Dagblad*. Retrieved from http://www.kristeligt-dagblad.dk/artikel/425738:Danmark--Ny-teknologi-skal-hjaelpe-skoletraette-drenge

Instance, D., & Kools, M. (2013). OECD Work on Technology and Education: innovative learning environments as an integrating framework. *European Journal of Education*, *48*(1), 43–57.

Jantzen, C., Vetner, M., & Bouchet, J. (2011). *Oplevelsesdesign: Tilrettelæggelse af unikke oplevelseskoncepter*. Frederiksberg: Samfundslitteratur.

Jelved, M. (2012). Ny Nordisk Skole. *Kognition & Pædagogik: Tidsskrift om gode læringsmiljøer*, (85), 32–37.

Joylabs. (2014). An Invention Kit for Everyone. *Makey Makey*. Retrieved April 29, 2014, from http://makeymakey.com/

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60–70.

Kvale, S., & Brinkmann, S. (2009). *InterView: introduktion til et håndværk* (2nd ed.). Kbh.: Hans Reitzel.

Lauritsen, H. (2013, maj). Elever: Mobiltelefoner forstyrrer undervisningen. *Folkeskolen.dk*. Retrieved April 22, 2014, from http://www.folkeskolen.dk/530484/elever-mobiltelefoner-forstyrrer-undervisningen

Laursen, P. F. (2012). Fortællingen om ny nordisk skole. *Kognition & Pædagogik: Tidsskrift om gode læringsmiljøer*, (85), 24–31.

LEGO. (2014). History of LEGO Robotics. *LEGO*. Retrieved April 29, 2014, from http://www.lego.com/en-us/mindstorms/gettingstarted/historypage/

Lübcke, P. (2010). *Politikens filosofi leksikon* (2nd ed.). Kbh.: Politikens Forlag.

Lykke, M., Coto, M., Mora, S., Vandel, N., & Jantzen, C. (2014). Proceedings of the 2014 IEEE Global Engineering Education Conference (EDUCON). *Motivating Programming Students by Problem Based Learning and LEGO Robots*, 12.

MakerBot. (2014). Join the next industrial revolution. *MakerBot*. Retrieved April 29, 2014, from http://www.makerbot.com/products/

Marchev, G., Rønn, L., Johansen, S., Nielsen, T., & Svendsen, N. (2012). *Designing for Participation: A Social Approach to Technology Enhanced Learning in the Classroom* (Semester project) (p.

72). Aalborg University. Retrieved from http://projekter.aau.dk/projekter/da/studentthesis/designing-for-participation(0c09df93-0ad2-4867-bb9e-185b09d84755).html

Marchev, G., Rønn, L., Johansen, S., Nielsen, T., & Svendsen, N. (2013). *Designing for Participation Part 2: Studying the use of iPads by observing a classroom ecology* (Semester project) (p. 88). Aalborg University.

Ministeriet for Børn og Undervisning. (2012a). Initiativer til at øge anvendelsen af it i folkeskolen. Retrieved December 4, 2012, from http://www.uvm.dk/Uddannelser-og-dagtilbud/Folkeskolen/I-fokus/Oeget-anvendelse-af-it-i-folkeskolen/Initiativer-til-at-oege-brugen-af-it-i-folkeskolen

Ministeriet for Børn og Undervisning. (2012b). *Velkommen til Ny Nordisk Skole* (2nd ed.). Denmark: Gyldendal.

Ministeriet for Børn og Undervisning. (2013). Mål, Manifest og Dogmer for Ny Nordisk Skole. *Ny Nordisk Skole*. Retrieved April 21, 2013, from http://nynordiskskole.dk/Om-Ny-Nordisk-Skole/Hvad-er-Ny-Nordisk-Skole/Maal-Manifest-og-Dogmer-for-Ny-Nordisk-Skole

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record*, *108*(6), 1017–1054.

Nielsen, S. (2013, September 2). 21 folkeskoler skal være digitale demonstrationsskoler. *Kommunernes Landsforening*. Retrieved April 21, 2014, from http://kl.dk/Folkeskolen/21-folkeskoler-skal-vare-digitale-demonstrationsskoler-id137034/?n=1

Ny Nordisk Skole. (2013, January 3). 352 institutioner kickstarter sammen med børne- og undervisningsministeren arbejdet med Ny Nordisk Skole. *Ny Nordisk Skole*. Retrieved April 4, 2013, from http://nynordiskskole.dk/Nyheder-og-web-tv/~/Ny-Nordisk-Skole/Content/News/2013/130301-352-institutioner-kickstarter-sammen-med-boerne-og-undervisningsministeren

Østergaard, M. (2012, September 7). Vi skal konkurrere på viden. *Uddannelses- og Forskningsministeriet*. Retrieved from http://ufm.dk/minister-og-ministerium/ministeren/taler/tidligere-minister-morten-ostergaards-taler/2012/vi-skal-konkurrere-pa-viden#cookieoptin

Otto Kroeger Associates. (2013a). Domains and States. *Reversal Theory Training Site*. Retrieved February 10, 2014, from http://reversaltheory.net/RT/learn-the-theory/audio-slideshow-the-states/

Otto Kroeger Associates. (2013b). Reversal Theory: An Overview. OKA. Retrieved from http://www.reversaltheory.net/files/Reversal-Theory-Fact-Sheet.pdf

Pole, C., & Morrison, M. (2003). *Ethnography For Education*. England: Open University Press.

Pontoppidan, H., Amstrup, P., Olsen, F., Christensen, A. B., Pedersen, H., & Pedersen, H. (2012). Web-tv: Indspark fra interessenterne. *Ny Nordisk Skole*. Retrieved December 4, 2012, from http://nynordiskskole.dk/Om-Ny-Nordisk-Skole/Hvad-er-Ny-Nordisk-Skole/Web-tv-Indspark-fra-interessenterne

Qvortrup, L. (2001). Skolen i et hyperkomplekst samfund. *Uddannelse "Fremtidens folkeskole"*, *2001*(2). Retrieved from http://udd.uvm.dk/200102/udd02-8.htm?menuid=4515

Reeves, T. C. (2006). Design Research from a Technology perspective. In J. V. D. Akker, K. Gravemeijer, S. McKenney, & N. Nieveen, *Educational Design Research* (pp. 86–109). London & New York: Routledge.

Reversal Theory Society. (2013). Theory Overview. *Reversal Theory Society*. Retrieved April 21, 2014, from http://reversaltheory.net/org/

Ritzau. (1996, January 4). Mobiltelefoner forbudt på skole. *Ritzaus Bureau*. Retrieved from http://apps.infomedia.dk.zorac.aub.aau.dk/Ms3E/ShowArticle.aspx?outputFormat=Full&Duid=Z0038280

Ritzau. (1997, April 30). Riv klasselokalerne ned. *Ritzaus Bureau*. Retrieved from http://apps.infomedia.dk.zorac.aub.aau.dk/Ms3E/ShowArticle.aspx?outputFormat=Full&Duid=Z1682710

Ritzau. (2004a, maj). Skole låser mobiltelefoner inde. *Ritzaus Bureau*. Retrieved from http://apps.infomedia.dk.zorac.aub.aau.dk/Ms3E/ShowArticle.aspx?outputFormat=Full&Duid=e01f9bc3

Ritzau. (2004b, January 31). DF: Forbyd mobiltelefon i skolerne. *Ritzaus Bureau*. Retrieved from http://apps.infomedia.dk.zorac.aub.aau.dk/Ms3E/ShowArticle.aspx?outputFormat=Full&Duid=e015f9f3

Ritzau. (2005, maj). Forbud mod mobiltelefoner og sodavand i mange skoler. *Ritzaus Bureau*. Retrieved from http://apps.infomedia.dk.zorac.aub.aau.dk/Ms3E/ShowArticle.aspx?outputFormat=Full&Duid=e03af6dc

Ritzau. (2011, September 13). Odder Kommune giver alle elever og lærere iPad. *Århus Stiftstidende*. Retrieved from http://stiften.dk/odder/odder-kommune-giver-alle-elever-og-laerere-ipad#!

Rogers, Y. (2011). *Interaction design: beyond human-computer interaction* (3rd ed.). Chichester, West Sussex, U.K: Wiley.

Rutenbeck, J. (2006). Bit by Bit by Bit: Hypercomplexity and Digital Media Studies. Retrieved from http://www.units.muohio.edu/codeconference/papers/papers/rutenbeck%20-%20bit%20by%20bit%20[final].pdf

Schmidt, E., & Jensen, T. L. (2012, October 22). It i folkeskolen er ikke pengene værd. *Politiken.dk*. Web-avis. Retrieved April 10, 2013, from http://politiken.dk/debat/kroniken/ECE1788533/it-i-folkeskolen-er-ikke-pengene-vaerd/

Sjøberg, S., & Schreiner, C. (2010, March). The ROSE project - An overview and key findings. University of Oslo. Retrieved from http://roseproject.no/network/countries/norway/eng/nor-Sjoberg-Schreiner-overview-2010.pdf

Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. *American Journal of Evaluation*, *27*, 237–246.

Tucker, J., & Rutledge, H. (2007, November). CrossTalk: The Journal of Defense Software Engineering. *Shaping Motivation and Emotion in Technology Teams*, *20*(11), 10–13.

Undervisningsministeriet. (2013a, June 7). Aftale mellem regeringen (Socialdemokraterne, Radikale Venstre og Socialistisk Folkeparti), Venstre og Dansk Folkeparti om et fagligt løft af folkeskolen. Retrieved from http://uvm.dk/~/media/UVM/Filer/Udd/Folke/PDF13/130607%20Aftaleteksten.ashx

Undervisningsministeriet. (2013b, December). Klasserumsledelse giver plads i fællesskabet. *Undervisningsministeriet*. Retrieved April 29, 2014, from http://uvm.dk/Den-nye-

folkeskole/Udvikling-af-undervisning-og-laering/Ro-og-klasseledelse/Klasserumsledelse-giver-plads-i-faellesskabet

Zahavi, D. (2003). Fænomenologi. In *Humanistisk videnskabsteori* (2nd ed., Vol. 5/2008, pp. 121–138). [Søborg]: DR Multimedie.

Zankel, S. (2012, January 5). Skole deler iPads ud til elever. *Tv2 Nyhederne*. Retrieved from http://nyhederne.tv2.dk/article.php/id-47213492:skole-deler-ipads-ud-til-elever.html

11. Appendix A-F2

Appendix A

Declaration of Consent

I hereby confirm that it is normal practice on Antvorskov School to gather written form of consent, respectively with both students and parents through the school's intranet system. There is a long-lasting agreement between the parents, the students, and the school, that any posted declarations on the school's intranet must be considered by both parents and students as they occur. If parents or students should have any objections they are obliged to make their voices heard, if not, written form of consent is considered to be attained. This type of written form of consent does not exclude the possibillity of any participants, be it either students or parents, refusing to take part for whatever reason, at any given moment within the concerned period, as depicted by a declaration.

I can confirm that Niels Vandel Svendsen has used this way of reaching consent with all parents and students involved in the UVM project. He has done so with the knowledge and approval of the school management.

Peter Brandt
Head of Department
Antvorskov School

ANTVORSKOV SKOLE
TAG EN BID AF FREMTIDEN

Appendix B

SPØRGESKEMA

Hej!

Du vil i dette spørgeskema blive bedt om at tage stilling til nogle udsagn. Det er vigtigt at du forholder dig til udsagnende og svarer så ærligt som muligt. Det er ikke muligt at svare forkert og dette spørgeskema er ikke en test. Formålet med spørgeskemaet er at opnå nyttig baggrundsviden om hvordan du og dine klassekammerater føler jer motiverede, når i har undervisning.

Spørgeskemaet tager ca. 10 minutter at udfylde, og alle dine svar vil være anonyme - på forhånd tak for din indsats!

Din oplevelse af traditional klasseundervisning:

Du skal nu tænke på hvordan du oftest oplever den traditionelle klasseundervisning - altså den slags undervisning hvor i sidder på jeres pladser og arbejder med opgaver hver især.

Du vil på næste side blive præsenteret for en række ord-par. For hvert ord-par, fx "trist / glad" og "irriteret / komfortabel", skal du angive hvilket af ordene i hvert ord-par, der bedst beskriver dine følelser i forbindelse med traditionel klasseundervisning. Jo tættere på ordet du sætter markeringen, desto stærkere følelsen.

Du bedes tage stilling til alle ord-par i listen.

Under almindelig klasseundervisning føler jeg mig oftest:

	1	2	3	4	5	6	7	8	9	
Trist										Glad
Irriteret										Konfortabel
Utilfreds										Tilfreds
Melankolsk										Begejstret
Modløs										Optimistisk
Kedsommelig										Stimuleret
Stresset										Afslappet
Rolig										Fysisk aktiv
Nervøs										Tryg

Søvnig										Livlig
Jeg føler oftest at traditionel klasseundervisning er:										
Langsommelig										Hektisk
Ubetydelig										Interessant

Uddyb gerne dine svar:

Hvad kendetegner dig?

Du vil på de følgende sider blive præsenteret for nogle grupper af udsagn. I hver gruppe skal du vælge, hvilket udsagn der generelt set passer bedst på dig. Husk at ingen af udsagnene er bedre end andre!

Hvilket udsagn kendetegner bedst dig?

Mål / Middel

◯ Når jeg arbejder, er jeg for det meste koncentreret om at nå mine mål og fyldestgøre arbejdet.

◯ Når jeg arbejder, tænker jeg ikke så meget på slutresultatet – jeg fokuserer for det meste på selve oplevelsen og på at have det sjovt med det jeg laver.

◯ Ved ikke.

Hvilket udsagn kendetegner bedst dig?

Regler

◯ Når jeg arbejder, har jeg det for det meste bedst med at have klare regler, procedure og retningslinjer at gå ud fra.

◯ Når jeg arbejder, har jeg det for det meste bedst hvis jeg ikke skal indordne mig efter et bestemt regelsæt eller en bestemt procedure.

◯ Ved ikke.

Hvilket udsagn kendetegner bedst dig?

Transaktion / Forhold

◯ Når jeg arbejder I en gruppe, er jeg for det meste fokuseret på at forbedre mine egne færdigheder og jeg ser for det meste tingene ud fra mit eget perspektiv

◯ Når jeg arbejder I en gruppe, er jeg for det meste fokuseret på at forbedre de andre gruppemedlemmers færdigheder, og jeg ser for det meste tingene ud fra de andre gruppemedlemmers synspunkter.

◯ Når jeg arbejder I en gruppe, er jeg for det meste fokuseret på at de andre gruppemedlemmer bakker mig op, hjælper mig, og værdsætter min indsats.

◯ Når jeg arbejder I en gruppe, er jeg for det meste fokuseret på de andre gruppemedlemmers ve og vel, og jeg får dårlig samvittighed hvis jeg modtager hjælp, frem for de andre.

◯ Ved ikke.

<u>Afsluttende oplysninger:</u>
(husk at trykke 'send')

Hvilken klasse går du i?

☐

Hvad er dit gruppenummer?
(udfyldes kun hvis I har fået gruppenumre)

☐

Appendix C

SPØRGESKEMA 2

Hej!

Du er nu færdig med projektforløbet, og vil nu igen blive bedt om at tage stilling til nogle udsagn. Ligesom sidst er det vigtigt, at du forholder dig til udsagnende, og svarer så ærligt som muligt. Det er ikke muligt at svare forkert og dette spørgeskema er ikke en test.

Spørgeskemaet tager ca. 10 minutter at udfylde, og alle dine svar vil være anonyme - på forhånd tak for din indsats!

<u>Din oplevelse af projektforløbet:</u>

På næste side vil du blive præsenteret for de samme ord-par som du blev præsenteret for i det forrige spørgeskema. Ligesom sidst gælder det, at jo tættere på ordet du sætter markeringen, desto stærkere følelsen.

Jeg vil nu bede dig om at tænke på det projektforløb som du netop har været igennem. Hvordan har du oplevet det?

Husk at tage stilling til alle ord-par i listen.

Under projektforløbet har jeg oftest følt mig:

	1	2	3	4	5	6	7	8	9	
Trist										Glad
Irriteret										Konfortabel
Utilfreds										Tilfreds
Melankolsk										Begejstret
Modløs										Optimistisk
Kedsommelig										Stimuleret
Stresset										Afslappet
Rolig										Fysisk aktiv
Nervøs										Tryg
Søvnig										Livlig

Jeg følte oftest at projektforløbet var:

Langsommelig										Hektisk
Ubetydelig										Interessant

Uddyb gerne dine svar:

Dine bemærkninger

Du vil på de følgende sider blive stillet nogle afsluttende spørgsmål. Prøv om du kan besvare dem så fyldestgørende som muligt. Husk at alt hvad du skriver vil blive behandlet anonymt, så vær ikke bange for at skrive din ærlige mening.

Arbejdsprocessen

Var der noget af det i lavede i din gruppe, som du syntes var svært?

Arbejdsprocessen

Føler du, at du fik noget ud af at skrive logbog?

Gruppearbejdet

Er der noget ved den måde i arbejdede på i din gruppe, som du godt kunne tænke dig havde været anderledes?

Afsluttende oplysninger:
(husk at trykke 'send')

Hvilken klasse går du i?

Hvad er dit gruppenummer eller gruppenavn?

Appendix D

Spørgeskema om UVM-forløbet og Model for Mindset

Kære lærere fra 7. og 8. klassetrin,

I er nu færdige med UVM-forløbet, og jeg er derfor interesseret i at høre om jeres oplevelser med henholdsvis at planlægge og at afholde forløbet. Spørgeskemaet vil være overvejende kvalitativt, så mit håb er at få nogle fyldige besvarelser.

Jeres besvarelser vil indgå som en del af data-analysen i min projektrapport, og formålet er at nå så bredt ud som muligt på tværs af jer der har været involveret på 7. og 8. klassetrin. En del af årsagen er ligeledes, at det ikke har været muligt for mig at snakke med jer allesammen og / eller følge alle klasser eller hold, imens forløbet blev afviklet.

Jeg vil gerne opfordre til, at så mange af jer som muligt får besvaret spørgeskemaet, men hvis i af hvilken som helst årsag ikke ønsker at deltage, er i naturligvis fri til at melde fra.

Spørgeskemaet er ikke anonymt.

Praktiske oplysninger

Dit fulde navn

Hvilke(n) klasse(r) eller hold underviste du I UVM-forløbet?

Beskrivelse, Innovation, Produkt (BIP)

Hvordan var det at udfylde BIP-modellen?

◯ Overvejende nemt

◯ Noget var nemt, andet var svært

◯ Overvejende svært

◯ Andet: [ ]

Du svarede "Overvejende nemt"

Beskriv hvorfor det var overvejende nemt for dig at udfylde BIP-modellen:

[ ]

Du svarede "Noget var nemt, andet var svært"

Beskriv hvad du syntes var nemt og hvad du syntes var svært:

[ ]

Du svarede "Overvejende svært"

Beskriv hvorfor det var overvejende svært for dig at udfylde BIP-modellen:

[ ]

Forundring, Fordybelse, Formidling (FFF)

Hvordan var det at udfylde FFF-modellen?

◯ Overvejende nemt

◯ Noget var nemt, andet var svært

◯ Overvejende svært

◯ Andet: [ ]

Du svarede "Overvejende nemt"

Beskriv hvorfor det var overvejende nemt for dig at udfylde FFF-modellen:

Du svarede "Noget var nemt, andet var svært"

Beskriv hvad du syntes var nemt og hvad du syntes var svært

Du svarede "Overvejende svært"

Beskriv hvorfor det var overvejende svært for dig at udfylde FFF-modellen:

Brugte du Model for Mindset "aktivt" under projektforløbet?

- ◯ Nej
- ◯ Jeg kiggede på den en enkelt gang
- ◯ Jeg kiggede på den et par gange
- ◯ Jeg kiggede på den løbende
- ◯ Andet:

Du svarede "Nej"

Beskriv hvorfor du ikke kiggede på Model for Mindset under projektforløbet:

Du svarede "Jeg kiggede på den en enkelt gang"

Beskriv hvorfor du valgte at kigge på Model for Mindset en enkelt gang under projektforløbet:

Du svarede "Jeg kiggede på den et par gange"

Beskriv hvorfor du valgte at kigge på Model for Mindset et par gange under projektforløbet:

Du svarede "Jeg kiggede på den løbende"

Beskriv hvorfor du kiggede på Model for Mindset løbende under projektforløbet:

Hvilke problemstillinger synes du var særligt fremtrædende med hensyn til at motivere eleverne?

Hvad tænker du er de mest iøjnefaldende udfordringer ifm. at afholde den slags produktorienterede forløb som Model for Mindset ligger op til?

Appendix E

Interview-guide

Vedrørende 'Model for Mindset' | Peter Eduard | Niels Vandel Svendsen | Ca. 30 min

Oslo Universitets ROSE projekt har vist os, at Skandinaviske unge er interesserede i at bruge teknologien, men at de ikke interesserer sig for videnskaben bag. Især i de velhavende lande viser de unge lav interesse for videnskabelig praksis. Vores nye skolereform fordrer større brug af teknologi i undervisningen, længere skoledage og mere tid afsat til projektarbejdsformen. Med denne omstrukturering, kommer der praktiske udfordringer, men også didaktiske prøvelser for lærerne. Mange taler endda om at lærerens rolle i disse år ændres i takt med udvikling af praksis.

1) Kan du prøve overordnet at beskrive hvad det er Model for Mindset skal gøre lærerne bedre til?

2) Skal modellen ses som et planlægningsværktøj eller som et procesværktøj?

3) Er målet at lærerne indbyrdes planlægger aktiviteter på tværs af fagene, som passer ind i en samlet helhed / proces?

4) Hvad er det for tanker BIP-modellen skal fremprovokere hos lærerene?

5) Hvad er det for tanker FFF-modellen skal fremprovokere hos lærerene?

6) Hvilke dele af den produktorienterede undervisning, som Model for Mindset ligger op til, vil du sige er særligt motiverende for eleverne?

7) Hvordan passer Model for Mindset ind i forhold til målsætningerne for EduTechLab?
    a. Er den skelettet der skal bære det hele?

8) Kan du med få ord beskrive modellens henholdsvis stærke og svage sider?

Appendix F1 – Edutech Mindset Model

Om dokumentet:

Projektforløbet er færdig, når dokumentet er udfyldt. Dokumentet består af to hoveddele: 1) Lærerens faglige forberedelse i processen; BIP (Beskrivelse, Innovation, Produkt). 2) Elevernes motivation, faglig træning og redegørelse for læring; FFF (Forundring, Fordybelse, Formidling). Efter 1 og 2 er der en checkliste. Her er det meningen at man går de udfyldte igennem og går tilbage og retter til. Det tager typisk en to-tre gennemgange inden hele checklisten kan opfyldes.

Paraply –

Overskrift – overordnet emne, tid (uger) og timer til rådighed. Skriv 6 ord (tags) der dækker emnet. Tænk på dine kollegaer såvel som eleverne !:

BIP-modellen - hvad læreren skal overveje:

Beskrivelse -

Faglige mål og indhold -
Hvad er den kendte viden, færdigheder og værktøjer på området før, nu og i fremtiden?

1) Eleverne skal tilegne sig viden om følgende emner (faglige mål):
   a)
   b)
   c)
   d)

2) Beskrivelse af elever.
   a) Klasse (trin/hold/alder etc.):
   b) Erfaring med projektarbejde (lav/høj):
   c) Særlige styrker:
   d) særlige udfordringer:

3) Milepæle. Milepælene (delmål) viser eleverne at de er på vej imod opfyldelse af læringsmålene. Milepæle skal sættes med et 'passende' mellemrum. For nogle elever vil det være hvert 5. minut, for andre vil det være en pr. afholdt undervisning. For eleverne vil milepælene ofte ligne en alm. udleveret opgave med en fast deadline. Summen af milepæle (opgaver) giver det endelige produkt. Husk dog at det er normalt at gå tilbage til tidligere milepæle og opdatere 'afleveringen' så det passer med senere erkendelser!

a) Tanker om milepæle (tilpasning til skema, undervisningsform etc. - fri tekst):
b) Afstand mellem milepæle:
c) Liste over milepæle - vedlægges som bilag - se 'Fordybelse'.
d) Planlæg en oversigt og præsentation af milepælene for eleverne

Innovation -

Idé, innovation … Læringsmål – kompetencer, færdigheder
Hvad kan elevernes nytænkning/idé evt. bestå i ?

Beskrivelse af de færdigheder projektet hviler på (viden og færdigheder, som benyttes under løsning af opgaven - som eleverne har tilegnet sig tidligere):

a)
b)
c)
d)

Læringsmål: Beskrivelse af de nye færdigheder og kompetencer, eleverne skal tilegne sig under projektarbejdet.
Eleverne skal ved forløbets afslutning kunne demonstrere følgende:

a)
b)
c)
d)

Hvad kan vores nytænkning evt. bestå i?
Eleverne forventes at nyudvikle på:

a)
b)
c)

d)

Produkt -

Formidling, Fremlæggelse, Event …
Forsøg, model, prototype, tekst …

a) Hvilke elementer kan indgå i vores afsluttende event?
b) Hvad er det afsluttende produkt?
c) Hvordan skal det afsluttende produkt formidles til andre?
d) Hvordan viser produktet, at eleverner har tilegnet sig de opstillede mål?

Checkliste	Kryds af
Rumme mulighed for forskellige faglige indfaldsvinkler (videnskabssyn)	
Rumme mulighed for såvel praktisk som teoretisk arbejde	
Pirre elevernes etiske sans	
Appellere til elevernes æstetiske sans	
Have aktualitet og relevans i forhold til elevernes hverdag	
Rumme mulighed for inddragelse af lokale aktører	

FFF-modellen - hvad eleverne skal opleve:

Forundring

Overordnet krog (betragtninger over hvad der skal tænde eleverne). :

Beskriv:

a) Faglige aktiviteter og problemstillinger

b) Etiske problemstillinger:

c) Æstetiske udfordringer:

d) Lokale udfordringer:

e) Globale udfordringer:

Fordybelse

Proces og indhold (betragtninger over med hvad og hvordan eleverne skal arbejde):

Beskriv:

a) Faglige aktiviteter og procestræning:

b) Arbejdsdeling og organisering

b) Videnssøgning og forarbejdning:

c) Milepæle i processen:

Formidling

Hvilke elementer kan indgå i elevernes afsluttende formidling

a) Form (demonstrationer, happenings, foredrag, posters, online (film, hjemmeside):

b) Organisering (hvor):

c) Modtagere (Hvem og hvormange):

d) Evaluering:

Forberedelseschecklist - grejkassen:

Værktøjer i 'Kassen' - Pædagogisk rum	Listeform eller henvisning.
Skriftligt materiale (bøger, avisartikler, tidsskrifter, brochurer, links m.v.)	
Konkret materiale (kendt teknologi, materialeprøver, laboratorieudstyr m.v.)	
Audiovisuelt materiale (video- og filmklip, DVD og Internet, Radio og TV)	
Gæstelærere (fagfolk og lægfolk, konsulenter og specialister, private og offentlige)	
Ud af huset aktiviteter (ekskursioner, virksomhedsbesøg, feltarbejde, praktikforløb m.v.)	
Samarbejdspartnere (offentlige og private virksomheder og institutioner, sponsorer m.v.)	

Appendix F2

In today's Danish municipal primary and lower-secondary schools, interactive digital technology (IDT) is present in almost all classrooms. Whether it is in the form of interactive whiteboards (IWB), tablets, or smartphones, IDT is influencing the daily teachings (CAHE, 2010; Gynther, 2010).

The mere acceptance of IDT as part of the classroom ecology has not always been at the level we see it at today. In the late nineties, when cell phones became common property, IDT intrusively found its way into the Danish classrooms; the students would bring their cell phones with them to class. Inevitably, this would spur disturbances when the cell phones would suddenly ring (Ritzau, 1996). Many schools reacted by banning the use of cell phones or by making strict rule-enforcements. This tendency continued throughout the following decade (Ritzau, 2004a, 2005). Even politicians debated prohibition of cell phones (Ritzau, 2004b).

As time went on IDT evolved. Cell phones became smartphones, desktops became laptops, and tablets entered the market. In tandem with the increasing ubiquity of IDT, the Danish municipal primary and lower-secondary schools underwent a period of transition in which there was a thawing towards the banning and the rule enforcing, cf. figure 29.

Concurrently, IDT became more advanced and the use possibilities increased. Many schools began to see the potentialities of integrating IDT in classroom teachings. For instance, in late 2011, the Danish municipality of Odder invested in iPads for all teachers and students in its primary and lower-

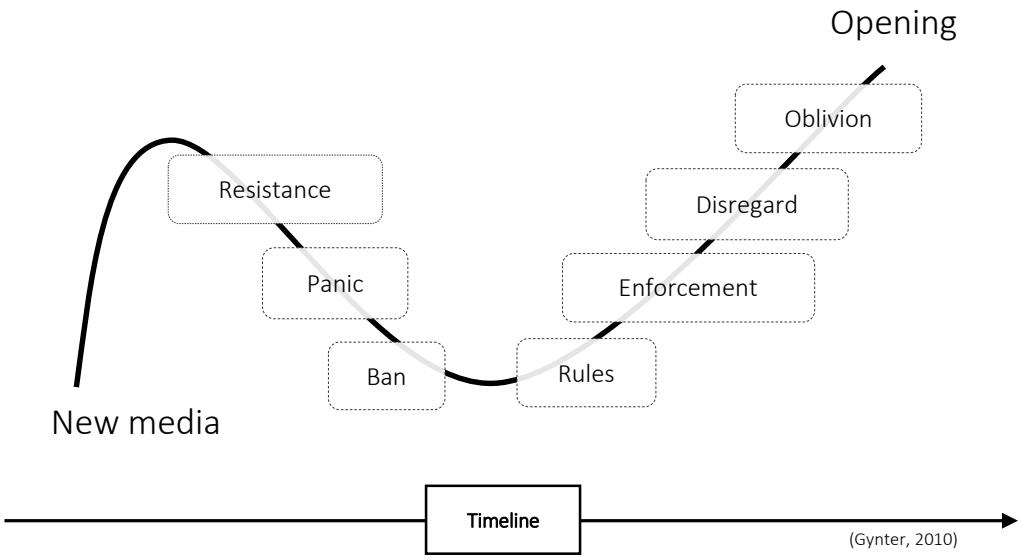


Figure 29: A generalisation of how intrusive IDT would initially be dealt with through banning and rule-enforcing, and later become "accepted" as something that exists in the classroom ecology.

secondary schools (Ritzau, 2011; Zankel, 2012). Many schools also invested in IWB's (Frank, 2011; Henriksen, 2011).

As a result, the era in which teachings with IDT would only take place in the school's computer lab, is coming to an end (Henderson & Yeow, 2012). However, the increased focus on utilising IDT in teachings points towards a re-thinking of educational practice. There are several aspects that I believe serve as valuable background knowledge as to why this is the case – and I will now present the most important ones.

A Tool-Centric View on IDT

First, let us look at a system theoretical argument of why we have not yet been able to re-think education with IDT.

The Danish professor, Lars Qvortrup, argues that we Danes live in a hyper-complex knowledge society (Qvortrup, 2001). That society is hyper-complex means that social systems like the Danish municipal primary and lower-secondary school are polycentric (decentralised), constitute their own order, and varies in their code of self-observation (Lübcke, 2010).

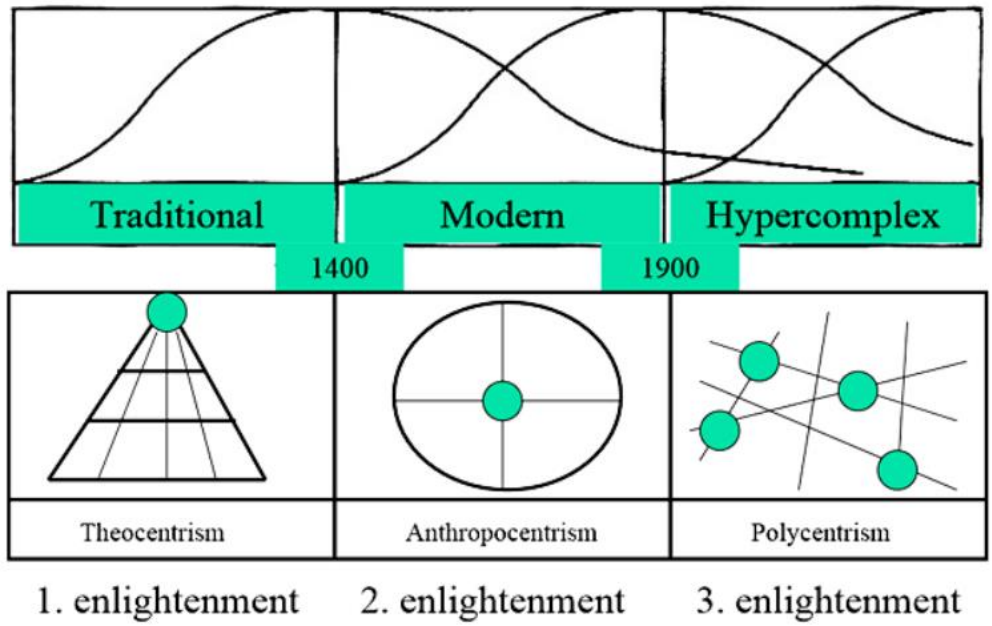


Figure 30: A visualisation of how access and delivery of knowledge has changed throughout the history of the Danish society (Qvortrup, 2003).

In relation to the Danish municipal primary and lower-secondary school, Qvortrup argues that it, as an institution, has been unable to address a cultural inconsistency that is happening due to Danish society's view on culture as something that stays constant (Qvortrup, 2001). For this reason, the difference between the decisions that are being made and the results these decisions are

believed to provide, is unclear. Qvortrup uses the schools rapid and nationwide investments in IDT as a prime example of how IDT has been thought of as something that would automatically and successfully become integrated without the need to reassess the cultural traditions. In other words; that you could be part of the change process without doing anything differently (Qvortrup, 2001).

I believe this stance has meant that the Danish municipal primary and lower-secondary schools (as well as the Danish politicians) have had a tool-centric view on IDT – like it was something that you could just put in the classrooms and then innovation would give rise to itself (Gruba & Hinkelman, 2012). However, to my knowledge, no one has yet been able to argue just how IDT in itself does anything better for the learning outcome. If anything, I would say it has made the teacher's practice more complex, which is quite ironic, if you consider the general believe that technology is here to make our lives easier.

Now, the next couple of examples will further clarify why IDT in teachings points towards a re-thinking of educational practice.

Two Teaching Aid Cultures

The presence of IDT in the classrooms has affected the teachers practice through the advent of a new teaching aid culture (Gynther, 2010). The integrated capability of most devices being able to connect to the Internet means that access to knowledge is greater than ever. In fact, the access to knowledge has risen so much that the evaluation of knowledge is not able to keep up. This has effectively created a complexity of resources that has never been greater than it is today, cf. figure 31.

Because accessing knowledge has become so easy, the teacher's role as the sole conveyer of knowledge is changing. Students can quickly find the answers they are looking for by searching on the Internet. However, much of the knowledge that is found on the Internet has not been evaluated through the

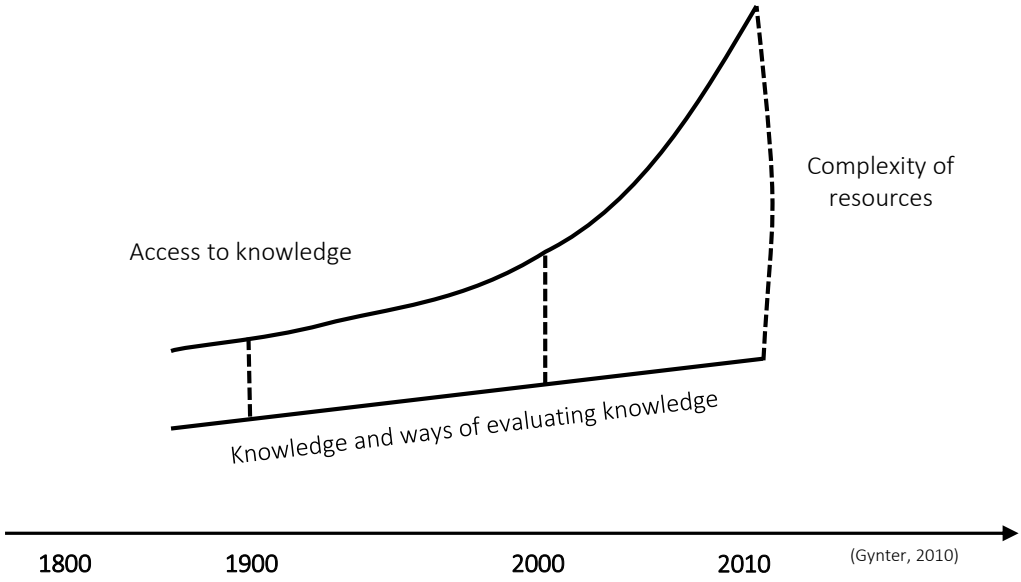


Figure 31: Thanks to the spreading of IDT and the Internet, the complexity of resources has never been greater than it is today.

same means as e.g. the knowledge you find in books. For this reason, educating the students in source criticism is more important than ever, cf. table 16.

Since there is no reason to believe that IDT and the Internet will go away, the presence of a new teaching aid culture means that teachers are now dealing with two teaching aid cultures that are interwoven and supplement each other (Gynther, 2010). For instance, an intriguing thought is that students are becoming didactical co-designers because IDT enables them to test the knowledge they are taught in a teaching situation, thus influencing and maybe even deepening the learning outcome (Gynther, 2010).

Traditional Teaching Aid Culture	New Teaching Aid Culture
Chain of teaching aids that are influenced by line of profession and professional adults who produce, evaluate and distribute teaching aids for children	Chains of teaching aids with a random line of professions, functions, relations, roles, production age and choice of teaching aids
Publisher produced (primarily books)	Internet based
Commercial	Public, user generated (web 2.0), open source, freeware
Heavy budget	Free
Influenced by habits and gatekeepers like librarians and IT-managers	Easily accessible teaching aids – the gatekeepers are avoided
Controlled by a tradition of teaching aids – from an institutional perspective	Controlled by contributors (teachers and pupils)
Reliable	The reliability is uncertain and context-sensitive (Internet availability, amount of PC's, e.g.)
The content is academic and pedagogically legitimized (in the primary school e.g. through The Agreement of Joint Goals)	The relevance of the content depends on the information-seeking and source critical competencies of the user (the teacher or the student)
High level of validation	Uncertain level of validation (user-generated content and user-generated validation)
Offers securement and control through 'extern didactic'	The pupils also become didactical co-designers and the teacher must take this into consideration in his didactical design
Example: The educational books	Example: Wikipedia

Table 16: The two teaching aid cultures and their differences (Gynther, 2010).

Using IDT

IDT may make many aspects of everyday life easier for us. Essentially, it is meant to either replace or enhance the actions we perform when we engage in activities. In doing so, it blurs the line between actions and skills that used to

be required in certain schools of thought or professions (Andersen, 2003). Through IDT, anyone can suddenly become the "artist" and create remarkable photos without having the slightest idea about composition, lighting, saturation, and so on. Of course, this does not make such knowledge obsolete. It certainly still helps to know about e.g. composition, but the point is that IDT enables us to do things that was previously only possible if you possessed certain knowledge and skill.

When using IDT, individuals draw on their multimodal and semiotic understanding, but always in terms of IDT's organisation of processes according to its own structure (Rutenbeck, 2006). This means that you need to have a basic understanding of how to interact with IDT, because every piece of IDT has its own set of rules for interaction (Rogers, 2011).

Let us think of the good old blackboard as an example. When the teacher uses a piece of chalk to draw on the blackboard, the response is immediate. The sound and the feeling is distinct, and the line he draws will turn out exactly as he draws it. Now, imagine the same teacher drawing a line on an IWB. In this case, there are certain rules of interaction that needs to be fulfilled. First, he needs to open a program that allows him to draw. When this is done, he may pick up an IWB marker or use his finger to draw a line, however, something will be different. The line does not appear on the IWB exactly in the moment he draws it – there is a slight delay.

Even though this is a simple example, the subtle difference in experience illustrates that using IDT is not completely analogous to the kind of actions we perform with everyday non-digital objects. There will always be a layer of abstraction because IDT needs to interpret our input in order to provide an output (Rogers, 2011).

Technological Pedagogical Content Knowledge

Knowing how to use IDT is one thing, however, knowing how to use IDT for teaching is an entirely different matter. The TPACK framework shows what types of knowledge the teacher needs to have in order to teach effectively with IDT. In this report I will not go into great detail about the framework itself. I merely wish to use it to illustrate how the different types of knowledge intertwine.

First and foremost, the framework shows that teachers need Pedagogical Knowledge, Content Knowledge, and Technological Knowledge, in order to teach. That is, they need to know how to teach effectively, and they need to know what they are teaching. They also need to know what technologies to use and how to operate them for the purpose of teaching (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Now, the interesting part is where the different types of knowledge intertwine. Technological Content Knowledge is the knowledge of choosing the technology that best fits the content of what it is you are trying to teach. Pedagogical Technological Knowledge is the knowledge of how to teach effectively with technology. Pedagogical Content Knowledge is the knowledge of how you teach the curriculum content most efficiently (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

The combination of the three intertwined types of knowledge becomes Technological Pedagogical Content Knowledge (TPACK), which is the type of knowledge a teacher needs to effectively plan and teach curriculum in which technology is utilised. Furthermore, the stippled line in the framework depicts how the teacher also needs to be aware of the different contexts in which these teachings take place (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

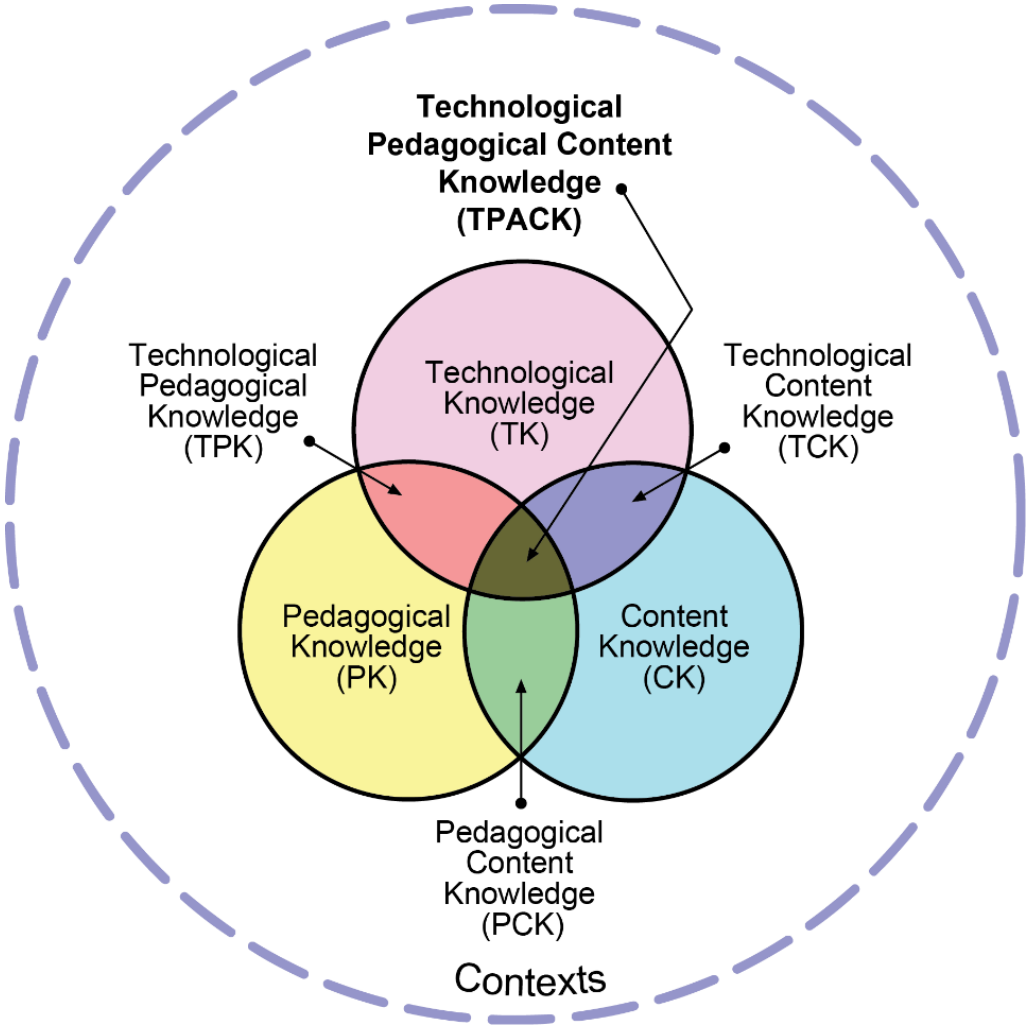


Figure 32: The TPACK framework. Reproduced by permission of the publisher © 2012 by TPACK.ORG

A New Approach

You may be wondering why I just presented all of this. The answer is that I believe this background knowledge provides a general overview of why IDT is not just something that you simply put in a classroom – it is a complicated matter.

First, it is the story of how the Danish school system transitioned its mindset towards the presence of IDT in the classrooms. Secondly, it is the story about how the school system handled IDT from a tool-centric view due to its inability or unwillingness to change cultural traditions. Thirdly, it is the story about how the presence of IDT has created a new teaching aid culture. Fourthly, it is the story about how the utilisation of IDT requires a basic understanding of interactional means. Finally, it is the story about the different types of knowledge that are theoretically required to teach effectively with IDT.

All these aspects relate to each other. They are the reason why the Danish school system is still coming to grasps with how to successfully implement IDT in teachings (Schmidt & Jensen, 2012). However, it seems like we are coming close to a common understanding of how to approach these aspects and better utilise the possibilities that IDT affords (Ministeriet…, 2012). Incredibly, some voices have been arguing for a change of educational praxis as far back as 1997, foreseeing many of the aspects I have just presented you with (Qvortrup, 2001; Ritzau, 1997). I myself have also conducted study's that reveal a rise in complexity when the use of IDT is not properly supported by the entire organisation (Marchev et al., 2012, 2013). Also, students are arguing for an increased understanding of the different use-potentialities of IDT, in a recent example stating they find smartphones to be disturbing the teachings and that codes of practice should not be out of the question (Aisinger, 2010; Lauritsen, 2013).

Fortunately, the Danish government is now taking a new approach in order to accommodate these aspects. Hence, the initiative "New Nordic School" was created in 2012 and launched with 352 institutions in early 2013 (Ny Nordisk…, 2013).

The New Nordic School

The New Nordic School is about re-establishing the core principles of the Scandinavian educational tradition. It is about educating our young people through broad subject knowledge that sparks personal, social and academic awareness through application-oriented lessons (Laursen, 2012; Ministeriet…, 2012b). One of the key points of the New Nordic School is that the human body is viewed as a fully connected and learning organ, and that education should therefore encompass stimulation of the entire body, instead of just "the head". Furthermore, playing and learning is treated as each other's requisites (Laursen, 2012; Ministeriet…, 2012b).

The New Nordic School also entices more and better knowledge-sharing between teachers and institutions, and the main premise of achieving good knowledge-sharing is to trust in the teachers' professionalism - development of didactic should come from the teachers and not from political top down management (Egelund, 2012; Jelved, 2012; Laursen, 2012; Ministeriet…, 2013; Pontoppidan et al., 2012).

In continuation of the principles behind the New Nordic School is the new Danish school reform, which details the different steps needed to meet the vision for the future Danish municipal primary and lower-secondary school.

I will now present the most relevant steps described in the reform.

The New Danish School Reform

The new Danish school reform aims to decrease the amount of students who complete the primary and lower-secondary school without adequate reading and math skills. In OECD's PISA tests, the Danish students score averagely in native language, math, and science. Many students are also placed in special needs education. The central goal of the reform is therefore to enable all students to realise their full potential in order for the Danish society to be able to compete with the increasing international competition (Undervisnings…, 2013).

The reform introduces three general goals:

1) The municipal primary and lower-secondary school must challenge all students in order to make them as skilled as they can possibly become.
2) The municipal primary and lower-secondary school must reduce the impact of social inheritance concerning academic results.
3) Trust and welfare must be strengthened through respect of professional knowledge and practice.

These goals are meant to insure a high level of ambition and a clear direction of continuous and systematic evaluation (Undervisnings…, 2013). The reform also takes point in three general and intertwining focus areas that may ensure improvement of the students' academic level:

- A longer and more varied school day with more and better teaching and learning.
- A competence boost of teachers, pedagogues and school management.
- Few clear goals and rule-simplifications.

The longer school days are meant to make possible the practice of varied and differentiated ways of learning that challenge both strong and weak students. The reform mentions practical and use-oriented lessons that opens the school to the outside world, e.g. by teaching students how to research and be entrepreneurial with focus on innovation and creativity, effectively enabling them to create products that hold value and makes sense to others. In relation to this, the purpose of the learning activities should be to nurture social competencies, motivation and well-being (Undervisnings…, 2013).

Furthermore, the reform reveals that 500 million DKK has been especially earmarked an increase of information technology (IT) in teachings and

development of new digital teaching aids. The funds are also covering experiments with digital demonstrational schools. These schools are going to contribute with generalizable and practical knowledge that can help teachers become better at integrating IT in their teachings and shed light on how IT can help strengthen student academic performance (Nielsen, 2013; Undervisnings…, 2013). The reasoning behind the funding is as follows:

"An increased and qualified use of IT in teachings demands that IT is not viewed isolated, but as an integrated part of teachings and as a pedagogic and didactic tool to increase the outcome of teachings. As part of the reform a series of initiatives are therefore launched to increase the use of IT in the school." – (Undervisnings…, 2013, pp. 11, l. 4-8)

In the reform it is also mentioned that final examinations are subject to change based on ongoing experiments with other examination forms. The final examinations should motivate and support a modern form of teaching that is targeted at the world outside of the municipal primary and lower-secondary school. The examinations should test the students' competencies in relation to concrete tasks that are rooted in partnerships between schools and local businesses respectively (Undervisnings…, 2013).

Another important step regards better inclusion of weak students in everyday teachings. The amount of students that are placed in special needs education is increasing. They make up 30 percent of the total expenses of the municipal primary and lower-secondary school. On top of that, there is no scientific evidence that show that weak students fair better in special needs education as opposed to normal teachings. The reform therefore aims to include more weak students in the normal teachings through a large range of initiatives, e.g. new laws, a national counselling team, a national resource centre for inclusion, information and awareness campaigns, and so on (Undervisnings…, 2013).

The reform also mentions an aim to reduce noise-levels and to improve classroom management. The government acknowledges that noisy classroom environments are problematic. Therefore, a national effort to establish routines,

rules and norms that support a healthy learning environment will be initiated. An expert group consisting of practitioners from schools and academic staff from institutions within higher education will be formed to collect and describe existing and new knowledge about classroom management (Undervisnings…, 2013).

Furthermore, 1 billion DKK has been earmarked the aforementioned competence-boost of teachers and pedagogues. The goal is that teachers should be able to teach all of their subjects as efficiently as they do their main subject. The reasoning is that teachers who are academically immersed in their subjects will ensure that students are met by teachings of higher pedagogic and academic quality. In the year 2020 the schools must have achieved what is referred to as "full competence coverage" – and this demand is upheld by law. The aim of full competence coverage is additionally to support the use of IT in teachings, to improve class management, and to improve inclusion (Undervisnings…, 2013).

Finally, a web portal will be created to inform teachers, pedagogues and school managements in an appropriate and application oriented manner about the latest research that has been collected by the aforementioned resource centre. The goal of the web portal is to support the teachers' development of a nationwide decentralised evaluation-culture (Undervisnings…, 2013).