Innovative Pedagogical Processes Involving Educational Technology

Creating Motivating Learning Through Game Design and Teacher Competence Development in a Hybrid Synchronous Video-Mediated Learning Environment

Weitze, Charlotte Lærke

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

INNOVATIVE PEDAGOGICAL PROCESSES INVOLVING EDUCATIONAL TECHNOLOGY

CREATING MOTIVATING LEARNING THROUGH GAME DESIGN AND TEACHER COMPETENCE DEVELOPMENT IN A HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

BY
CHARLOTTE LÆRKE WEITZE

DISSERTATION SUBMITTED 2016

AALBORG UNIVERSITY
DENMARK

INNOVATIVE PEDAGOGICAL PROCESSES INVOLVING EDUCATIONAL TECHNOLOGY

Creating motivating learning through game design and teacher competence development in a hybrid synchronous video-mediated learning environment

by

Charlotte Lærke Weitze

AALBORG UNIVERSITY
DENMARK

Dissertation submitted

.

Dissertation submitted: March 9, 2016.

PhD supervisor: Associate Prof. Rikke Ørngreen
Aalborg University

PhD committee: Professor Morten Misfeldt
Aalborg University

Professor Nicola Whitton
Manchester Metropolitan University

Professor Chris Dede
Harvard Graduate School of Education

PhD Series: Faculty of Humanities, Aalborg University

ISSN (online): 2246-123X
ISBN (online): 978-87-7112-530-6

Published by:
Aalborg University Press
Skjernvej 4A, 2nd floor
DK – 9220 Aalborg Ø
Phone: +45 99407140
aauf@forlag.aau.dk
forlag.aau.dk

Printed in Denmark by Rosendahls, 2016

CV

I was trained as a pianist at The Royal Danish Conservatory of Music, studied abroad in Budapest and London for three years and worked for 15 years as a piano teacher at MGK Helsingør, a music academy preparatory school, and Helsingør Municipal Music School. In 2011, I finished my M.Sc. at the IT University of Copenhagen, focusing on digital design and communication. Since studying at the IT University, I have been interested in the design of motivating and engaging learning games. Teacher competence development in the area of educational technology is also one of my main interests. Since 2013, I have worked as a doctoral student in the IT & Learning Design research laboratory (ILD) of the Department of Learning and Philosophy, Aalborg University, Copenhagen, Denmark. I will continue as an assistant professor in the same department after completing my PhD studies.

ENGLISH SUMMARY

This design-based research study investigated the development of innovative pedagogical competences and practices in and around a hybrid synchronous video-mediated learning environment, the Global Classroom. This took place at VUC Storstrøm, an adult educational institution in Denmark. VUC Storstrøm was interested in gaining new knowledge about how to create motivating and qualified learning experiences for their adult students within the framework of the Global Classroom. The research question was this: "*How should pedagogical innovation be designed in order to contribute to the creation of motivating learning for students and teachers in a hybrid synchronous video-mediated learning environment?*"

An educational institution is a complex learning environment with many involved individuals, communities of practice, technologies, practices, processes and elements (Gravemeijer & Cobb, 2013; Nicolini, 2012). The cross-disciplinary study examined the three actors in the educational institution (students, teachers and administration) individually and relationally. The design-based research project developed knowledge in co-design processes with the three actors, investigating how design and learning processes can support continuous pedagogical innovation and competence development.

Gamified learning designs: The objective of the learning designs was to create motivating learning experiences for the students in the hybrid synchronous video-mediated learning environment; to this end, the project experimented with gamified learning designs. Students designed digital games while implementing learning goals from their curriculum. The findings from these experiments were that activities that involved making, building or programming provided a rich context for learning, as the construction of artefacts, in this case learning games, enabled reflection and new ways of thinking. The students became their own learning designers as well as learning designers for their fellow students, leading their own innovative learning processes with educational technology. Four parallel types of processes for designing and learning supported the gamified learning design: 1) the structured game-design process, 2) concept-building processes in which prototypes served as materials for learning, 3) teaching processes in which the teacher's learning- and game-inspired metaphors were used to support the learning processes in the big and small gamified learning designs, and 4) the students' individual, collaborative and motivational learning processes (Bruner, 1966; Illeris, 2007; Lave & Wenger, 1991; Piaget, [1968] 2006). An increase in socially engaged interactions was observed among the students; these interactions contributed to more complex cognitive learning processes with more collaborative activity.

Motivating learning designs: The study also investigated which learning designs emerged and what potentials and barriers were experienced when designing learning for the Global Classroom. The following seven characteristics were found for equal (for in-class and at-home students), activating and motivating learning designs for the hybrid synchronous video-mediated learning environment: a tendency to use only synchronous learning designs, a need

for a web-based platform for sharing content, the benefit of web-based collaborative construction software, the wise choice of "unequal" learning designs for experiments, the use of collaborative workarounds and technological bricolage, the development of hybrid synchronous mobile learning designs and, finally, the environment's unique potential for learning designs with virtual guest teachers.

Practices for pedagogical innovation: In redesigning their teaching practices, teachers found that the small interventions that typically are a part of a daily teaching practice were insufficient in this new environment (Schøn, 1983, 2001). The hybrid synchronous video-mediated learning environment was so disruptive that teachers experienced a loss of competence when entering this new environment and had to reconsider their learning designs. The change required a new innovation space, time, structure and anchoring as well as new cross-disciplinary practices within the organisation. Such practices entailed changes in responsibilities, communication, collaboration obligations, anchoring and coordination efforts by the administration. The teachers co-designed a new pedagogically innovative practice for teacher teams: the IT-Pedagogical Think Tank. When using this new practice, the teachers became innovative learning designers, developing new knowledge about learning designs, new uses of technology and new ways of sharing knowledge in their educational institution. Combining their professional knowledge and experiences, they created new visions for the educational organisation. The teachers became able to design and create innovative pedagogical processes with collective reflection using relevant tools, theory and methods. They each facilitated common ideation phases for the team, resulting in the creation of a common language and reaching individual as well as team-based goals for innovation. When the teachers found a satisfactory solution (i.e., a new innovation), they could unravel how they arrived there, identifying the learning trajectory to their solution. In this way, the innovation turned into knowledge again, making the new learning design, the new learning process or the new way of sharing knowledge in the organisation possible to repeat. The teachers developed innovative pedagogical competences that they were able to transfer to their teaching practice. This type of competence development differed from more traditional Teacher Professional Development (TPD) courses, which involve learning from more knowledgeable others. The study termed the establishment of this new practice *Teachers' Professional Innovation Development* (**TPID**), as the teachers developed competences in pedagogical innovation. VUC Storstrøm teachers and administration co-developed a four-step organisational learning design in order for pedagogical innovation to be designed into the organisation, enabling knowledge development and sharing.

The demand for change in our working lives is more a premise than an exception, the innovative use of educational technology being one example. It can be challenging for teachers and administrators to meet expectations for continuous change where restructuring, new technology and changing trends are concerned. Teachers and administrators need a continuous and qualified structure/practice that provides the freedom and tranquillity necessary for their organisational learning processes. The students were motivated by the freedom and opportunity to participate from home, but reported that they lost their concentration more easily when listening to presentations from home. The goal for these learning designs for pedagogical innovation was therefore to enable agile, tranquil and motivating innovation and learning processes for all three actors – teachers, administration and students.

This DBR study has contributed new knowledge about how organisational learning designs can support the development of innovative pedagogical competences for continuously creating new learning designs involving the use of educational technology for students, teachers and administration in an educational institution. The project has also provided knowledge about characteristics of activating and motivating learning designs for a hybrid synchronous video-mediated learning environment. Finally, the DBR study has developed new knowledge about how students can learn through acting as digital-learning-game designers and being their own learning designers while reaching curriculum learning goals.

DANSK RESUME

Dette design-based research (DBR) projekt undersøgte, hvordan udviklingen af innovative pædagogiske kompetencer og praksisser foregik i et hybrid synkront video-medieret læringsmiljø, Global Classroom på VUC Storstrøm, et voksen uddannelsescenter i Danmark. VUC Storstrøm ønskede ny viden om, hvordan man kunne skabe motiverende og kvalificerede lærings oplevelser for deres voksne studerende, inden for rammerne af det nye læringsmiljø. Forskningsspørgsmålet var: *Hvordan skal pædagogisk innovation designes, når det skal medvirke til at skabe motiverende læring for elever og lærere i et hybrid synkront video-medieret læringsmiljø*?

En uddannelsesinstitution er et komplekst læringsmiljø med mange involverede individer, praksis fællesskaber, teknologier, metoder, processer og elementer (Gravemeijer & Cobb, 2013; Nicolini, 2012). Det tværfaglige studie undersøgte de tre aktører i uddannelses-institutionen (studerende, lærere og administration) individuelt og relationelt. DBR projektet udviklede viden i co-design processer med de tre aktører for at undersøge, hvordan design- og læreprocesser kan understøtte kontinuerlig pædagogisk innovation og kompetence-udvikling.

Gamificerede læringsdesign: Formålet med læringsdesignene var at skabe motiverende læringsoplevelser for de studerende i det hybrid synkrone video-medieret læringsmiljø. I den forbindelse eksperimenterede projektet med gamificerede læringsdesign. De studerende designede digitale læringsspil og nåede samtidig læringsmålene fra deres pensum. Resultaterne fra disse forsøg var, at aktiviteter, der involverede at skabe, at bygge eller at programmere, skabte en rig kontekst for læring. Desuden bidrog dét at bygge artefakter, i dette tilfælde læringsspil, til refleksion og nye måder at tænke på. De studerende blev deres egne læringsdesignere samt deres med-studerendes læringsdesignere, og styrede de innovative læreprocesser med den anvendte undervisningsteknologi. Fire parallelle former for design og lærings processer understøttede det gamificerede læringsdesign: 1) den strukturerede game-design proces, 2) koncept-bygningsprocesser, hvor prototyperne fungerede som "materials for learning", 3) undervisningsprocesser, hvor lærerene anvendte lærings og spil-inspirerede metaforer til at understøtte de studerendes læreprocesser i store og små gamificerede læringsdesigns, og 4) de studerendes individuelle, samarbejdsmæssige og motiverende læreprocesser (Bruner, 1966; Illeris, 2007; Lave & Wengers, 1991; Piaget, [1968] 2006). Der blev observeret en stigning i socialt engagerede interaktioner blandt de studerende, og disse interaktioner bidrog til mere komplekse kognitive læreprocesser med mere samarbejde.

Motiverende læringsdesign: Studiet undersøgte også, hvilke læringsdesign, der opstod, og hvilke potentialer og barrierer lærerne erfarede, når de designede læring til Global Classroom. Følgende syv karakteristika blev fundet for lige/ens (for studerende i klassen og hjemme), aktiverende og motiverende læringsdesign til det hybrid synkrone video-medierede læringsmiljø: En tendens til kun at anvende synkrone læringsdesign (vs. asynkrone), et behov

for en web-baseret platform til deling af indhold, anvendeligheden af web-baserede samarbejds-konstruktions-software, kloge valg af "ulige" læringsdesign til eksperimenter, omstrukturering af samarbejdsformer og teknologisk bricolage, udvikling af hybrid synkrone mobile læringsdesigns og endelig læringsmiljøets unikke potentiale for læringsdesign med virtuelle gæstelærere.

Praksisser for pædagogisk innovation: I re-designet af den pædagogiske praksis oplevede lærerne, at de små inventioner, der typisk er en del af en daglig undervisningspraksis, var utilstrækkelige i dette nye miljø (Schøn, 1983, 2001). Det hybrid synkrone video-medierede læringsmiljø var så forstyrrende, at lærerne oplevede et tab af kompetence, når de entrerede dette nye miljø, og derfor blev de nødt til at genskabe deres læringsdesigns. Ændringen krævede et nyt innovationsrum, tid, struktur og forankring, samt nye tværgående praksisser i organisationen. Disse nye praksisser afstedkom ændringer i ansvarsområder, og krævede koordination, kommunikation, samarbejdsforpligtelser og forankring i administrationen. Lærerne co-designede en ny pædagogisk innovativ praksis for lærerteams: den IT-Pædagogiske Tænketank. Ved brug af denne nye praksis, blev lærerne innovative læringsdesignere, udviklede ny viden om læringsdesign, ny anvendelse af teknologi, og nye måder at dele viden på i deres uddannelsesinstitution. Ved at kombinere deres fælles faglige viden og erfaringer, skabte de nye visioner for den pædagogiske organisation. Lærerne blev i stand til at designe og skabe innovative pædagogiske processer med fælles refleksioner, inddragelse af relevante værktøjer, teori og metoder. Således arrangerede lærerne fælles ideskabelses-faser for teamet, så de sammen kunne skabe et fælles sprog og opnå individuelle såvel som teambaserede mål for innovation. Når lærerne kom frem til en tilfredsstillende løsning eller nyt koncept (dvs. en ny innovation), kunne de udrede, hvordan de var kommet dertil og identificere læringsforløbet hen til denne løsning. På denne måde, blev innovation forvandlet til viden igen, hvilket gjorde det muligt at gentage det nye læringsdesign, den nye læringsproces, eller den nye måde at dele viden på i organisationen. Lærerne udviklede innovative pædagogiske kompetencer, som de var i stand til at overføre til deres undervisningspraksis. Denne form for kompetenceudvikling adskiller sig fra mere traditionelle lærer kompetenceudviklingskurser, som indebærer at lærerne lærer fra mere vidende andre. Studiet betegnede etableringen af denne nye praksis som *udviklingskurser for innovative kompetencer*, da lærerne udviklede kompetencer i forhold til pædagogisk innovation. VUC Storstrøm lærere og administration co-designede et fire-trins organisatorisk læringsdesign, der muliggjorde at pædagogisk innovation kunne blive designet ind i organisationen, og dermed fremme videns-udvikling og -deling.

Behovet for og kravet om forandring i vores arbejdsliv er mere blevet en præmis end en undtagelse, hvor den innovative brug af undervisningsteknologi er ét eksempel. Det kan være en udfordring for lærere og administration at imødekomme forventningerne om kontinuerlig forandring, hvad angår omstrukturering, ny teknologi og skiftende tendenser. Lærere og administrationen har brug for en kontinuerlig og kvalificeret struktur eller praksis, der kan give den frihed og ro, som er nødvendig for deres organisatoriske læreprocesser. De studerende i Global Classroom blev motiveret af den nye frihed og mulighed for at deltage i undervisningen hjemmefra. Men de studerende erfarede også, at de lettere mistede deres koncentrationen, når der lyttede til oplæg hjemmefra. Målet med disse pædagogisk innovative læringsdesign var derfor at gøre det muligt at skabe agile, rolige og motiverende innovations- og læringsprocesser for alle tre aktører - lærere, administration og studerende.

Dette DBR studie har bidraget med ny viden om, hvordan organisatoriske læringsdesign kan støtte udviklingen af innovative pædagogiske kompetencer, når formålet er kontinuerligt at skabe nye læringsdesign, der involverer anvendelsen af teknologi, til studerende, lærere og administration i en uddannelsesinstitution. Projektet har også givet viden om karakteristika ved aktiverende og motiverende læringsdesign til et hybrid synkront video-medieret læringsmiljø. Endelig har DBR studiet udviklet ny viden om, hvordan de studerende kan lære ved at designe digitale læringsspil i en proces, hvor de er deres egne læringsdesignere.

ACKNOWLEDGEMENTS

First, I would like to thank the administration at VUC Storstrøm for inviting me to look over their shoulders and study their working lives and practices in and around the Global Classroom. Thank you to the brave and engaged teachers who dared to be challenged, and to the students who participated in initially difficult learning-game design experiments – experiments that later turned out to be so engaging that you forgot to take your breaks! Thank you to the welcoming and engaged individuals in the project administration, Kristian and Flemming, for always being positive and coming up with new ideas and answering *any* questions, helping me out in every way to make the experiments possible. Thank you to Niels, Anne, Jannie and John for good and *hyggelige* discussions about learning and IT. Thank you to Henrik, Camilla, Lisa, Susanne, Rasmus, Annette, Sune, Kristine, Michael and Kristen for your engaged and dedicated hard work while co-designing with me to create the IT-Pedagogical Think Tank. Thank you to the administration at VUC Niels, Laila and Ole. Thank you to my supervisor, Rikke, for encouraging support during the PhD study and all the valuable long, long reads and comments, especially here at the end. Thank you to my editor for being so hardworking and thorough in reading and commenting on this long text.

I am grateful that my PhD study was enriched with inspiring meetings, discussions and insights from so many warm and generous people: Educational insights, discussions about educational technology and learning games, and good visits, lunches and dinners with Chris, Karen, Joe, Jim, Tina, Sheri, Shane and Amy (Harvard graduate School of Education). Fascinating talks about distance learning, learning programmes, hybrid synchronous video-mediated learning environments, strange moving iPads, fun experiments with games and nice lunches and dinners with Kathryn, Joe, William, Kristen, Leigh, Michelle, and Carrie (Michigan Virtual Learning Research Institute and Michigan State University). Inspiring game talks with Bob, Brock, Stephen, Lizzy, David and Deborah. Fun trips, crocodile for lunch (!) and interesting talks about virtual guest teachers with Marshall (Direct to Discovery, Georgia Tech). Exiting talks and demonstrations of how it is possible to teach a puppetry class in Alaska over videoconference when you are in Atlanta with Patty (Center for Puppetry Arts, Atlanta). Stimulating insights into distance students' strategies for learning online with Susan (Columbia University). Inspiring and thought-provoking talks about games, game design and student learning through game building with Natalie, Jennifer and Scot (MIT). Fun and interesting talks, lunches and dinners, well-planned workshops and old caveman visits with Gabriella, Rosella, Alessandra (Free University of Bozen-Bolzano) and Donatella (Istituto per le Tecnologie Didattiche, Genova).

It has been an inspiration and a pleasure being a small part of the IGDALEGSIG community and the writing of the *Learning, Education and Games* book. Thank you to Richard, Diana and Eileen (London Knowledge Lab) for stimulating meetings and talks about learning through game design, creation of innovative practices for teachers and learning design patterns. And not least, I am thankful for the many supportive and enjoyable discussions –

academic and fun – with Inge, Anne-Mette, Kristine, Selen, Elvi and Camilla, and for my good talks with the "garden-girls."

Thank you to my very supportive, patiently waiting, constantly listening and encouraging old and new friends – you know who you are. Thank you to both of my parents for support, love and for learning to believe that we matter, that it is important to contribute with good things in life and that we have to dare to be brave. And finally, my biggest thank you to my three knights – my husband and sons, Christoffer, Lucas and Oscar. This project could never have been accomplished without your never-ending support, patience and love.

This work was funded in part by VUC Storstrøm in collaboration with Aalborg University. I am truly grateful for their support.

PUBLICATIONS

During this project, several papers have been produced and published with varying relevance to the core aims of this thesis.

Publications with High Relevance
(Printed in this thesis).

Weitze, C.L. & Ørngreen, R. (2014). The Global Classroom Model Simultaneous Campus-and Home-Based Education using Videoconferencing, *EJEL, The Electronic Journal of e-Learning*, vol. *12*(2), 215-226. (Article A)

Weitze, C.L. (2015c). Pedagogical Innovation in Teacher Teams – An Organisational Learning Design Model for Continuous Competence Development, ECEL 2015. *Proceedings of the 14th European Conference on e-Learning* ECEL-2015. University of Hertfordshire, Hatfield, UK, 29-30 October 2015, 629-638. (Article B)

Weitze, C.L. (2015a). Learning and Motivational Processes When Students Design Curriculum-Based Digital Learning Games, *Proceedings of the 9th European Conference on Games Based Learning* (ECGBL), Nord-Trondelag University College, Steinkjer, Norway, 8–9 October 2015. Academic Conferences and Publishing International Limited (Article C)

Weitze, C.L. (2016). Learning and Design Processes in a Gamified Learning Design in which Students Create Curriculum-Based Digital Learning Games; *Nordgold, Ild-Lab – Nordisk Antologi*, - Submitted 1st September 2015 (Article D)

Publications with Lower Relevance
(E.g. earlier iterations of the DBR sub-projects)

Weitze, C.L. (2015b). Designing for Learning and Play - The Smiley model as framework, CHItaly 2015 - Public, private and community-based interaction, Paper presented at: *PALX – Player And Learner Experience – Can We Design For Both?* Rome, Italy, 28. September 2015. Retrieved from http://palx.inf.unibz.it/papers/Weitze.pdf

Weitze, C.L. (2015d). What is the teachers' role when students learn through design of learning games in a scaffolded gamified learning environment? Abstract from *NERA* Conference 2015, Gothenburg, Sweden.

Weitze, C.L. (2014a). An Experiment on How Adult Students Can Learn by Designing Engaging Learning Games. *Meaningful Play 2014*, 16-18 October 2014: Conference Proceedings. Michigan: University of Michigan Press.

Weitze, C.L. (2014b). Experimenting on How to Create a Sustainable Gamified Learning Design That Supports Adult Students When Learning Through Designing Learning Games. (ECGBL 2014) *Proceedings of the 8th European Conference on Games Based Learning*. Berlin, Germany, 9–10 October 2014. (2) 594–603. Academic Conferences and Publishing International Limited.

Weitze, C.L. (2014c). Developing Goals and Objectives for Gameplay and Learning (Chapter 12). In Shrier, K. (Ed.). *Learning, Education and Games: Volume One: Curricular and Design Considerations*, pp. 225–249. Pittsburgh: Carnegie Mellon University ETC Press.

Weitze, C.L. (2014d). Continuous Competence Development Model for Teacher Teams: The IT-Pedagogical Think Tank for Teacher Teams (ITP4T) in Global Classroom. *Proceedings of the 13th European Conference on e-Learning* ECEL-2014. Copenhagen: Academic Conferences and Publishing International Limited, 2014. p. 578-588.

Weitze, C.L. (2014e). IT-pedagogical Think Tank for Teacher-teams in Global Classroom, A Model for Continuous Competence Development with a Focus on Reflection, Innovation, Motivation and Engagement. *Designs for learning 2014*, 4th International Conference, Expanding the Field, 6-9 May 2014, Stockholm, Sweden: Conference Proceedings. 2014.

Weitze, C.L., Ørngreen, R. & Levinsen, K. (2013). The Global Classroom Video Conferencing Model and First Evaluations in Ciussi, M.; Augier, M. (Ed.). *Proceedings of the 12th European Conference on E-Learning*: SKEMA Business School, Sophia Antipolis France, 30-31 October 2013. Vol. 2, Academic Conferences and Publishing International Limited, pp. 503-510.

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

1.1. CREATING MOTIVATION TO LEARN: A NEED FOR KNOWLEDGE

This PhD thesis presents an explorative, innovative and experimental trip through the Global Classroom PhD project. This project was developed through collaboration with teachers, students, IT-Pedagogical team and management at VUC Storstrøm who have been working on a daily basis in and with the Global Classroom. However, the project did not begin in the Global Classroom. It began with a vision of being able to offer adults a motivating way of studying at VUC Storstrøm.

VUC Storstrøm is an adult educational institution that offers a full-time, two-year upper secondary general education (more about VUC in section 3.2). Attended mainly by young adults, VUC can be described as a *second chance* for many of its students. VUC has a particular role in Danish education as an institution for students who have dropped out of other upper secondary schools (EVA2, 2014). The student population at VUC is diverse. Ages range from 16 to 80; 88% of students are 30 years old or younger, and 50% are between 18 and 21 (Pless & Hansen, 2010). The students' academic, social and personal backgrounds vary widely, which can be challenging for teachers. Sixty percent of the students who do not come directly from secondary school have at least one discontinued education in their past; the reason for this is often a lack of motivation (Pless & Hansen, 2010). VUC Storstrøm's teachers and administrators aim at embracing these motivational issues. VUC teachers use a variety of motivational strategies in their daily teaching practices to create positive learning situations. The VUC administration continuously strives to find new, motivating solutions for future education. As part of these initiatives, VUC offers three types of upper secondary general education to meet the needs of the young adult students who are their customers. The *Global Classroom*, a hybrid synchronous video-mediated learning environment (Figure 1), is one of VUC Storstrøm's initiatives to create an alternative educational offering for students (other initiatives include active classes and eliminating homework). In the Global Classroom, adult students can choose on a daily basis between participating in class on campus or from home via videoconference. This is intended to help accommodate adult students' busy lives, which often include jobs and families. Some students live near the school, and others have up to two hours of commuting every day (in 2014, distances ranged from 8km to 134km). The first incentive to create the hybrid synchronous video-mediated learning environment stemmed from outreach problems in the region, Southern Sealand in Denmark. The areas around each school have a low population density (Stensgaard, 2015), and in many subject areas, too few students are enrolled to make the courses profitable (Nielsen, 2013). With the Global Classroom came the possibility of offering a new way to participate in class by synchronously connecting the classroom, with its teacher and students, to students at home (Figure 1).

Figure 1: Students and teacher in the Global Classroom environment

The teaching and learning experiences from the innovative hybrid synchronous video-mediated learning environment, positive as well as problematic, led to an extended strategy in which VUC Storstrøm aimed not only to reach more students but also to give them a more motivating learning experience for completing their education (Nielsen, 2013). VUC Storstrøm therefore became interested in gaining new knowledge about how to create motivating and qualified learning experiences within the framework of the Global Classroom learning environment.

The need for knowledge about how to motivate students to learn is not new (Bandura, 1997; Schunk, Meece & Pintrich, 2010). However, the problem is highly relevant, as it is becoming increasingly difficult to motivate and engage young people in the Danish education system (Sørensen, Hutters, Katznelson & Juul, 2013). This challenge is also experienced in the United States, where motivation to learn decreases from the beginning of school age (Corpus, Haimovitz & Wormington, 2012; Lepper, Corpus & Lyengar, 2005) and becomes lowest upon entering the work force. In American elementary schools, 76% of the students report feeling engaged. In middle school, this figure falls to 61%; in high school, to 44%. By the time they start working, only 13% of employees report feeling engaged in their jobs (Gallup, 2012; Gallup, 2013). Some researchers consider this a sign of a motivational crisis in the educational system (Sørensen et al., 2013). The motivation to learn has an effect on the quality of students' results in school as well as on their ability to complete their education; this therefore calls for new knowledge about what enables students' motivation to learn.

Many young people lose the motivation to stay in school, and this leads to absence and dropping out. Researchers suggest that we need more knowledge about how the motivation to learn can be enhanced through the educational system (Sørensen et al., 2013). In our knowledge-based society, it becomes gradually more difficult to get a job without a qualifying education; therefore, it has been a political goal in Denmark for many years to raise education levels so that at least 95% of students complete at least one upper secondary course of study (MBUL, 2015; In Denmark, students study in primary school for nine years. In secondary school, they study for two or three years, depending on whether they choose the gymnasium or the Higher Preparatory Examination Course [HF]. These educations will prepare them to continue on to university and other professional education.) Teachers, researchers and politicians thus continuously aim at finding new motivating learning approaches that will help reach this goal. To provide everyone with an equal opportunity to complete their education may call for a variety of educational options for different types of learners. This is one of the aims of the hybrid synchronous video-mediated learning environment of the Global Classroom.

1.2. THE HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

The question is how to make the innovative hybrid synchronous video-mediated learning concept work in the best possible way and give the best possible value for the actor-groups: students, teachers and administration. Development of this learning environment will involve change by all three actor-groups in their daily traditional practices in the educational institution, as well as the development of the pedagogical use of technology in the Global Classroom. The technology in the hybrid synchronous learning environment includes the video equipment that makes it possible to communicate between the school and the students working from home on laptops. But to transform all the different teaching and learning practices that traditionally take place in a brick-and-mortar classroom into the new synchronous hybrid practices, it is necessary to use additional technologies to support the pedagogical aims. This includes, for example, technologies for collaboration, for discussion, for presentation – all various types of communication that take place both in the brick-and-mortar classroom and between the classroom and the students participating from home via videoconference. The development of these new pedagogical-technological practices is not as straightforward as it may seem. But according to the actors, they gained new competences working in the Global Classroom because it is such a pedagogically and technologically complex setting in which to teach and learn. In this hybrid synchronous video-mediated learning environment, they had to experiment, develop new skills and practices and change their conceptions of how to be a teacher, a student or an administrator.

1.3. TECHNOLOGY IN EDUCATION: HOPE, CHALLENGES AND GOALS

VUC Storstrøm's decision to implement educational technology as a means to create motivating learning processes is well in line with the Danish Government's school development strategy. The implementation of educational technology is regarded as a means to increase academic levels and facilitate the completion of education by more people (Regeringen & Regioner, 2011, 2013). Educational technology has been on Denmark's public school agenda for the last 15–25 years (EVA4, 2008). In the Danish Government's digital strategy, digitisation is becoming a requirement and not a choice for public educational institutions. In the period from 2012 to 2015, the Danish state (population 5.65 million people; SD, 2015) planned to spend 500 million Danish kroner (equivalent to $745,000 U.S.) for more extensive use of educational technology in public schools. The effort was part of the eGovernment Strategy 2012–2015 (UVM, 2012). One of the arguments was that the use of educational technology provides better opportunities for differentiated and more flexible forms of learning and evaluation (Collins & Halverson, 2010; Dede, 2008; Laurillard, 2012; TDGME, 2011).

Although the use of technology seems promising, research shows that teachers lack an established practice and support when navigating the many new opportunities for using educational technology (Laurillard, 2011; Riis, 2012; Somekh, 2008). The teachers at VUC Storstrøm had a similar experience as they started teaching in the Global Classroom, in spite of the administration’s plans to provide information and training on how to use the video equipment. When approaching a learning situation involving the use of new technology, where innovation to a certain extent became a requirement for the daily teaching and learning processes, the teachers had to become pedagogical innovators with the ability to incorporate new educational technology and change their learning designs accordingly (Collins & Halverson, 2010). For most of the VUC teachers, this did not happen overnight. Here are a few examples of citations from the teachers’ and students’ experiences in the project:

- Teacher: “The other day, I handed photocopies of an assignment to the students in class as part of my lesson, and then I looked up and saw the students participating from home sitting there on the screen and suddenly remembered... It still isn’t a natural part of teaching yet. And then I had to scan the page and upload it to the LMS after class, but it was still a bit frustrating not to be able to reach out to the student at home right there, in the right moment.”
- Videoconference student: [The teachers] need to ask questions as if I was sitting in class [...]. You feel a little like an alien once you get to say something, because then the teacher looks, like, ‘Oh, was there a sound from out there?’ and then you [think], ‘Oh, then I don’t want to say anything.’ But I don’t think that the way of teaching should be different from when I sit there [in class].”
- Teacher: “If the video equipment breaks down in the middle of a lecture, you, as the teacher, will have to decide if you should continue teaching the students sitting in class or leave the class to find a technician that can help solve the problem. This will sometimes mean leaving the whole class waiting for five to twenty minutes, resulting in losing teaching time. That’s a dilemma.”

These changes may seem easy to adjust to, but the required changes take many forms and have many levels of difficulty, and there are different actors involved in each change, human as well as technological. Many changes are so subtle that they are just felt as small almost unnoticeable and uncomfortable new phenomenon. But these small changes may have big consequences: hindering valuable class discussion, making the option of collaborative teamwork for students less frequent, or making old motivational learning strategies impossible.

Students are the end-users for any knowledge development processes and innovative pedagogical approaches involving technology that take place in the educational organisation. Therefore, the final goal will always be to enhance students' learning process by developing motivating and engaging learning designs. There is a clear need to examine and develop knowledge about how to enable teachers to create motivating and qualified learning designs involving educational technology in the Global Classroom. In addition, knowledge is needed about how to achieve well-functioning communication and decision-making flows taking place in the many practices, intentions, sayings and doings in the organisation (Henriksen, Buhl, Misfeldt & Hanghøj, 2011).

1.4. PROBLEM AREA AND PURPOSE OF THE PHD PROJECT

The following describes relevant issues and focus areas of the PhD project. Despite widespread optimism about the use of technology in education, the actual experience has been that, apart from a few enthusiasts (EVA5, 2009), teachers generally find it difficult to be innovative in their use of educational technology. Teachers often stay with their existing and familiar practices. According to the Danish Evaluation Institute (EVA3, 2011), the consequence can be that teachers do not use the new technology and miss out on the professional possibilities it presents. Therefore, there is a need for new knowledge and experimentation regarding the development of innovative competences in educational technology. Teachers need to learn to work with educational technology and support the process of innovation and the development of innovative thinking (Laurillard, 2011; Law, 2008; Somekh, 2008).

As a result of media development, teachers in our technology-based society need competence not only in instrumental or functional technological skills but also in *technological literacy*, the ability to exercise judgment and sensitivity for how and when to use technology in educational contexts (Hasse & Dupret, 2012). The question is how and in which contexts this is best established in practice. Along with the need for overall pedagogical learning designs for the specific context, there is a need for development and guidance in technology-based disciplinary, or subject-specific, learning designs (Jank & Meyer, 2006; Nielsen, 2012). The education field still lacks experience and research-based knowledge about how best to support learning designs and teaching practices with technology in the relevant subject, at the current level and in the specific context (Henriksen et al., 2011; EVA1, 2008).

Where educational technology is concerned, knowledge is still lacking about the best approach to change and anchoring, both from the administrative side and from the teaching side. This lack of knowledge reverberates further into the educational institution and results in uncertainty about the impact of educational technology on students' learning and motivational processes (Riis, 2012). There is also a lack of knowledge about which strategies, requirements and frameworks are required for the necessary knowledge sharing to take place at all levels within the organisation (student, teacher, administration) (EVA5, 2009).

Finally and perhaps foremost, because this innovative Global Classroom project is a new area of research, it is relevant to investigate what learning designs emerge and how motivating learning processes can be supported in this new environment.

1.5. PROBLEM STATEMENT

The aim of the PhD project is, through design-based research and qualitative analysis on the Global Classroom case at VUC Storstrøm, to form theory and develop guidelines for elements, methods, processes and practices that can contribute to the creation of reflected, innovative and motivating learning designs for teachers and students in a hybrid synchronous video-mediated teaching context, with a focus on how to create motivating learning for the students.

The research was conducted as a practice-oriented study investigating how and by what means pedagogical innovation and competence development can change and anchor IT-based and digital video-mediated educational programs. This was done by examining the educational actors individually and relationally. More specifically, the potentials and barriers in relation to the following research question and sub-questions were explored.

The research question:

How should pedagogical innovation be designed in order to contribute to the creation of motivating learning for students and teachers in a hybrid synchronous video-mediated learning environment?

Sub-questions 1-3 for the research project included the following:

1) **Q 1 – The Teachers:** How can an educational organisation develop a reflective, innovative and competence-developing tool/method or practice for teachers? This tool, based on teachers' subject-specific pedagogical approaches, should enable them to carry out appropriate planning, execution and theorising on their own teaching in IT-based and video-mediated teaching programs. The tool should also enable teachers to make informed and relevant choices in the use of educational technology for their learning designs in a professional academic context.

2) **Q 2 – The Students:** How can an educational organisation create activating and motivating learning designs for adult students when they learn with and through educational technology? To what extent is it possible to measure how learning with and through educational technology affects student learning and motivation? Can students help in further innovative integration of educational technology in their learning processes, and if yes, how can this take place?

3) **Q3 – The Organisation:** What are the educational organisation's opportunities and responsibilities in relation to change, implementation and anchoring of IT-based and digital video-mediated educational programs?

These questions are based on the assumption that the innovative implementation of educational technology in an educational programme happens through an interaction between and among various actors (teachers, students and the surrounding organisation); in this PhD project, innovation must be understood within the framework of learning in public educational institutions. The PhD project was conducted in close cooperation with VUC Storstrøm.

1.6. CONCEPTS AND DEFINITIONS IN THE THESIS

The PhD thesis uses the following concepts throughout the dissertation.

- At-home students
- Global Classroom
- Educational technology and educational IT
- Innovation/innovative
- IT-Pedagogical Think Tank
- Motivation to learn
- Pedagogy
- Think Tank

Please find expanded explanations of these concepts in the section “Concepts” just before the references.

1.7. STRUCTURE OF THE PHD THESIS

The thesis consists of 13 chapters. In this first chapter, I have explained and presented the dissertation’s problem area and purpose. Chapter 2, “State of the Art and Literature Review,” presents an overview of the research conducted in the fields that the dissertation investigates. Chapter 3 provides a more detailed description of VUC Storstrøm, the organisation where the studies took place. Chapter 4, “How can Pragmatism and Design-based Research be Combined?”, presents the dissertation’s philosophy of science and its methodological background. Chapter 5 presents the project’s methods and research design, analytical approaches and theory construction. Chapter 6 describes the general theoretical frameworks of the thesis. Chapters 7–10 present Articles A, B, C and D, and the analytical studies. Chapter 7 and Article A analyse the initial exploratory phase, investigating how the three actor-groups (students, teachers and the surrounding organisation) first experienced the potentials and barriers when working and learning in the hybrid synchronous learning environment. The sub-studies in Chapters 8–10 examine the problem statement in relation to each of the three actor-groups; each of these chapters begins with an introduction to the relevant theoretical backgrounds for these sub-questions. Chapter 8 and Article B describe teachers' innovative work with learning designs for teaching in the Global Classroom. The need for a new working method was examined and identified, and teachers worked to develop innovative pedagogical competences and continuously develop new knowledge about creating learning designs for the Global Classroom, which resulted in the development of the IT-Pedagogical Think Tank for teacher teams. Chapter 9 presents examples of emergent learning designs for the Global Classroom and, in Articles C and D, shows how the students worked as their own learning designers in a gamified learning design. The learning game experiments were done to explore how teachers can create motivating learning for students in a complex video-mediated learning environment. Chapter 10 describes the organisation's development and new responsibilities in the Global Classroom; for example, what actions and ongoing development are needed in the organisation. Brief summaries and conclusions are presented in Chapters 7-10 and Articles A-D. Chapter 11 reflects on the research questions, findings and validity. Chapter 12 summarises all discussions and conclusions, outlines the research contributions and suggests perspectives for future research. The final sections are: Concepts, References, Figures and tables lists, Appendices.

CHAPTER 2. LITERATURE REVIEW

What do we know, and what do we not know, and how can we contribute to filling in those blind spots?

This brief literature review aims to map out the state of the art in order to plot out the field for the research question by investigating what is already known about the PhD project's research area, what empirical findings, concepts and theories have been applied to it and what controversies may exist within it (Bryman, 2012). Because the project adopted an explorative and design-based research approach, the literature study was integral and continuously informed the research and design process (Creswell, 2014; Herrington, McKenney, Reeves & Oliver, 2007). The project started out with a literature review within this cross-disciplinary research area to draft design guidelines for the project in order to inform the design and development of the interventions that would seek to address the identified problems. Initially, the literature review focused on change and anchoring of technology in education, competence development and pedagogical innovation for teachers, and learning and motivation for students and teachers. As the problem area became more specific in the research process, the focus of the literature review changed as well. But the theories and research found relevant in the initial and ongoing literature review became part of the theories and literature used to guide the designs and discuss the empirical findings in the thesis (Chapter 7–10).

The current review seeks to identify conceptual underpinnings of the problem area in order to understand and predict the elements of a potential solution (Herrington et al., 2007). To answer the research question, the three relevant areas of research were pedagogical innovation, learning designs and educational technology. To focus the literature search in this cross-disciplinary study, the following literature review examined earlier research on the areas two at a time. The three areas of the literature search thus were: 1) Designing for learning in the synchronous hybrid classroom (section 2.1); 2a) Pedagogical innovation with educational technology (section 2.2); 2b) Games and other active teaching and learning approaches in video-mediated environments (section 2.3); and 3) Learning designs for pedagogical innovation (section 2.4).

First a systematic review was conducted. Educational databases such as ERIC, Web of Science, ProQuest Research Library, Academic Search Premier and the database for the *Journal of Research on Technology in Education* were searched for relevant articles published between January 2000 and November 2015. Despite experimenting with numerous search words in many combinations (including various search terms for hybrid synchronous video-mediated learning environments, teachers' professional development and other concepts), it became evident that while the research area was comprehensive, the terms in question (*pedagogical innovation*, *learning designs* and *educational technology*) were used in numerous and widely varied educational experiments. Each search yielded a high number of results, but most encompassed very few relevant results. Consequently this final review was therefore based not only on these searches but also on relevant articles found over the course of the project period. The search strategy relied to a great extent on finding specifically relevant articles and examining the reference lists of those articles to discover other relevant articles.

2.1. DESIGNING FOR LEARNING IN THE HYBRID SYNCHRONOUS VIDEO-MEDIATED CLASSROOM: INTEGRATING AT-HOME STUDENTS

Free videoconference services as Skype (2016) and Google Hangout (2016), along with increased Internet speeds allowing for high-quality video and audio transmission, have made videoconferencing part of daily life for many people (Smyth & Zanetis, 2007). Though videoconferencing has been used for education since the early 1990s (Barbour, 2014; Freeman, 1998), educational studies on videoconferencing still call for further investigation into innovative uses in the classroom as well as theoretically-guided and empirically-grounded studies of practice (Friesen, 2009; Lawson, Comber, Gage & Cullum-Hanshaw, 2010). *Blended*[1] or *hybrid learning* can be defined as the thoughtful integration of conventional face-to-face learning with digital methods of teaching and learning (Laurillard, 2014). There are, however, many variations when it comes to hybrid/blended learning designs (iNacol, 2011; Torrisi, 2011). In one hybrid variation, all of the students work together in class, face-to-face, and then go on to work asynchronously in an online debate forum. In most hybrid learning designs, all of the students work in the same environment – the same room or the same mode – simultaneously. However, new types of hybrid learning forms keep evolving. In the hybrid synchronous video-mediated learning environment of the Global Classroom, students are in two different modes at the same time: some are in class and some are at home (Figure 5). This type of hybrid synchronous video-mediated learning environment, with in-class and at-home students participating simultaneously, is a flexible new way to offer education and has just recently become a topic of investigation for educational research. Students use this flexible option for convenience if they live far from the educational institution or are challenged by family or job obligations (McCue & Scales, 2007; Norberg, 2012; Popov, 2009; White, Ramirez, Smith & Plonowski, 2010; Ørngreen, Levinsen, Jelsbak, Møller & Bendsen, 2015). Researchers of hybrid synchronous video-mediated learning environments aim to create new knowledge about how to design effective and motivating video-mediated collaborative online learning experiences that involve the use of additional educational technology and enable in-class and at-home students to participate on equal terms (Roseth, Akcaoglu & Zellner, 2013; Szeto & Cheng, 2014; Weitze & Ørngreen, 2014). The following is a short review of the areas in need of further investigation and the possibilities and challenges presented by the hybrid synchronous video-mediated learning environment.

---

[1] A small passage in this section is rewritten from the following article: Continuous Competence Development Model for Teacher Teams: The IT-Pedagogical Think Tank for Teacher Teams (ITP4T) in Global Classroom. Proceedings of the 13th European Conference on e-Learning. Copenhagen. 578–588. (Weitze, 2014d): After this the article will be cited as: (Weitze, 2014d)

For video-mediated education to be effective, one of the key challenges is to design active and collaborative learning activities, providing opportunities for students to directly interact with one another and with the learning materials (Bower, Dalgarno, Kennedy, Lee & Kenney, 2015; Bower et al. 2012; Friesen, 2009; Greenberg, 2004; Roseth, Akcaoglu & Zellner, 2013; Stewart, Harlow & DeBacco, 2011). It can be difficult for teachers to promote seamless interaction between at-home and in-class students and to activate and give the same attention to both groups (Bower et al., 2015; Stewart et al., 2011; Rogers, Graham, Rasmussen, Campbell & Ure, 2003; White et al., 2010). In certain studies, teachers reported having compromised their own pedagogical aims (Popov, 2009; Rogers et al., 2003). Another emergent theme was the need for grouping strategies and the potentials and barriers involved in choosing a grouping strategy. A number of studies gave teachers the option of grouping in-class students together and remote students together, or blending the two populations of students (Bell, Sawaya & Cain, 2014; Cain, Sawaya & Bell, 2013). Bower et al. (2015) found that grouping at-home students together with in-class students could level the playing field to some extent for the two populations of students (p. 12).

For these new learning environments to be effective, Bower and colleagues found that it was important to develop knowledge about key learning designs, frameworks or pedagogical patterns that could contribute to motivating learning experiences for the students (Bower, Dalgarno, Kennedy, Lee & Kenney, 2014a). Research in hybrid synchronous video-mediated learning environments suggests that “the way in which the technology is used determines the extent to which students perceive a sense of co-presence and of communication and sharing occurring between remote and on-campus participants, but that it is the task design and pedagogy that influence the depth of learning” (Bower, Kenney, Dalgarno, Lee & Kennedy, 2014b). These studies found that teachers needed to alter their pedagogical approaches to develop technological literacy; to become familiar with the affordances of the different technologies involved; and to learn to integrate the complex and continually changing technology in a “thoughtful” way (Cain & Henriksen, 2013; Hasse og Storgaard Brok, 2015; Laurillard, 2014).

Rogers, Bower & collegues emphasised that teachers in hybrid synchronous video-mediated learning environments had to prepare extensively before lessons (Bower et al., 2014a&b; Rogers et al., 2003). Teachers experienced cognitive overload as there were many more points of attention than in a traditional brick-and-mortar classroom (Bower et al., 2014a&b; Popov, 2009). Cain & Henriksen (2013) found that some of the additional considerations included managing video connections, positioning the camera, activating screen sharing and transitioning between different video platforms. Bell, White and colleagues discovered that the use of a “technology navigator,” or facilitator, was a relief for the teachers, since this assistant made it possible for the teachers to concentrate on teaching (Bell, Cain & Sawaya, 2013; White et al., 2010). Several findings emphasised the importance of a facilitator. No matter how well planned a lesson was, both regarding learning design and the technology that supported the learning design, there were often minor equipment breakdowns, students who needed help using the technology or learning designs that demanded alternative technological setups during a lesson. Compared with traditional teaching situations, these additional tasks significantly increased the challenges for teachers who did not have assistance, which could adversely affect the effectiveness of the class for the students (Bell et al, 2013; Hedestig & Kaptelinin, 2005).

The cumulative research suggests that there is a need to learn more about how to design effective technological configurations that use hardware and software to support learning designs in a hybrid synchronous video-mediated environment. There is also a need to investigate how the involved teachers and students can develop the learning designs so they become efficient and motivating (Bell, Sawaya & Cain, 2014; Bower et al., 2014a&b, 2015). At the CEPSE/COE Design Studio at Michigan State University, the technology navigators were PhD students who both studied and assisted in the hybrid synchronous video-mediated learning environments (Bell, Cain & Sawaya, 2013; Cain & Henriksen, 2013). This gave them unique opportunities to collaborate with instructors and to be creative in developing new solutions for the learning environment (W. Cain, personal communication, October 15, 2014). The researchers concluded that "there is no one fixed educational technology arrangement that will meet the demands of every class, or even a single class over time. Differences in content, class make-up, technology, and most importantly, pedagogical strategies make a one-size-fits-all model of [synchronous hybrid learning] an unrealistic expectation" (Cain & Henriksen, 2013, p. 295). The teachers and technology navigators developed "situational creativity" and "a refined sense of what worked for their classes in terms of pedagogy, class composition, and content" (Cain & Henriksen, 2013, p. 295). The teachers had to be flexible and purposeful problem solvers who looked for new and creative solutions to navigate the possible technological solutions for each pedagogical situation (Cain & Henriksen, 2013).

Some of the problems with establishing videoconference-based courses have been regarded as grounded in teachers' resistance, though this resistance may have sound reasons (Somekh, 2008; Knowles, 2014). The resistance towards teaching via videoconference was found to be based in scheduling difficulties, sufficient practice time and, most importantly, a lack of sustained and meaningful professional development and training (Bower et al., 2014a; Lundgren, 2007). It is worth considering whether the challenges teachers face in this new learning environment could inspire and provide a reason for the emergence of new kinds of teacher education and professional development strategies involving theoretical foundations, training and experimenting with innovative pedagogy in the hybrid synchronous video-mediated learning environment (Cain & Henriksen, 2013; Friesen, 2009, p. 9; Weitze, 2014d&e).

Many videoconference studies have investigated and compared videoconference teaching and learning situations with those in brick-and mortar settings (Bower et al., 2015; Greenberg, 2004, 2009). This PhD study has not been a comparative study but has instead investigated which pedagogical and technological considerations were important, how specific learning designs emerged and what possibilities were found in the synchronous video-mediated learning environment. The current PhD study also considered how to establish active and motivating learning environments with deep learning and high levels of cognitive complexity. A potential bias or problem when comparing synchronous video-mediated learning environments with brick-and mortar teaching situations is that many of the investigated cases involved teachers and students who were already interested and determined. Participants often had extended preparation time and were only preparing for part-time courses or a limited number of lessons (Bower, 2014a&b, 2015; Bell, Sawaya & Cain, 2014). The current research project investigated a class of full-time students, and the teachers that taught in the Global Classroom. The teachers had no extended preparation time and no immediately present (in-room/on site) IT-support personnel, and sometimes it was experienced difficult to get immediate help from IT-support personnel. In addition, many of the students were unmotivated learners. This context made teaching in the hybrid synchronous video-mediated learning environment a challenge, but this challenge ultimately enhanced the project and contributed new knowledge to the research area, because it demanded that teachers created active and motivating learning designs for this environment.

2.2. PEDAGOGICAL INNOVATION WITH TECHNOLOGY

The purpose of this study has not been to investigate what could be termed “technologizing education,” that is, what happens when we apply a hybrid synchronous learning environment to replicate the original practice that does not use technology (Laurillard, et al., 2013; Law, 2008). Instead, the purpose has been to investigate the creation of motivating learning designs through innovative practices involving educational technology (Laurillard el al., 2009; Laurillard, 2012). A teacher’s area of expertise is to plan, create, conduct and evaluate learning processes – to be a learning designer (also see section 6.5). The opportunity to apply new technologies in those learning designs can be a powerful driver for change, but a gap has been experienced between technology’s potential to support learning and its actual use in practice (Somekh, 2007, 2008). To overcome this gap, teachers creating innovative learning designs involving technology must have knowledge about which elements, processes and interactions are relevant, as well as which conceptual models incorporating these dimensions may be of help in clarifying ideas, processes and relationships in the learning design process (Webb, 2010). The number of models offering their view of what is of importance when creating new learning designs with technology makes it obvious that this is a complex area, and also that there are no “silver bullets” when choosing the most appropriate learning design model (Conole, 2012; Jahnke, Svendsen, Johansen & Zander, 2014; McKenney, Kali, Mauriskite & Voogt, 2015; Persico, et al., 2013; Webb, 2010). Though common dimensions are present in many studies, variations in theoretical orientation and vocabulary hinder a broader understanding and development of common directions (McKenney et al., 2015). Therefore it can be a challenge to know which learning design model to be inspired by in a specific context and how to develop an individualised version for this context with relevant dimensions and technologies. That being said, many of the learning design models that encompassed technology found the following characteristics relevant.

Relevant elements, processes and interactions when learning with technology

Based on a number of models, frameworks and articles (Beetham & Sharpe, 2013; Conole, 2012; Harasim, 2011; Hiim & Hippe, 1997; Kjær, Christensen, Blok & Petersen, 2010; Laurillard, 2012; Lave & Wenger, 1991; Majid, et al., 2006; Mishra & Koehler, 2006; Persico et al., 2013; Piaget, [1968]2006; Selander & Kress, 2012; Webb, 2010) the following elements and interactions are identified as characteristics of learning design models that incorporate technology. This may clarify important elements when achieving an increased understanding of relevant learning design frameworks for the hybrid synchronous video-mediated learning environment. When teachers design learning, they start with a learning goal and then decide upon the specific content a student must learn in order to reach this goal. Teachers use various theoretical approaches to pedagogy and learning to select specific activities for introducing students to the content and evaluating them afterwards; those activities may involve technology. Based on the learning theory and pedagogical approach adopted, various interactions or communications are planned between student–teacher, student–student and student–content. A variety of technologies may be used: mediating technologies (e.g., videoconference), content technologies (games for learning or electronic books), presentation technologies, search engine technologies or construction technologies (e.g., game-creation tools). It is important that individualised learning designs specify what technologies will be used, as the pedagogical opportunities they support will be very different. Combined with social and contextual factors, the above decribed elements, processes and interactions are all important when designing learning with technology and will therefore to a greater or lesser extent be in focus in learning design frameworks involving technology.

Learning design frameworks involving educational technology

Many scholars have investigated, tested and compared frameworks that could support teachers in developing innovative learning designs with technology (McKenney et al., 2015; Persico et al., 2013; Webb, 2010). Among teachers, however, there has been an underuse of 1) educational research, 2) learning design models involving educational technology, and 3) methods and tools proven effective as digital learning resources for pedagogical change (Cator & Adams, 2013; Cuban, 2001; Halverson & Smith, 2009; Somekh, 2008). In the creation of learning designs, teachers often stay with well-known pedagogical approaches. If teachers were supported in the complex process of learning and incorporating new educational technologies, they would be more likely to create innovative learning designs with informed use of technologies, thus making them better able to meet the challenges of today's rapidly changing educational environment (Conole, 2012, p. 117). Learning design research is thus largely concerned with studying mechanisms for formulating practice and the ways in which new designs can be represented and shared (Conole, 2012; Laurillard, 2012). The following sections present examples of various types of learning design models.

According to Goodyear, Laurillard, Bailey and collegues *Pattern-based learning design frameworks* assist in presenting learning sequences for specific learning goals based on specific pedagogical approaches using specific technologies in specific contexts (Bailey, Zalfan, Davis, Fill & Conole, 2006; Goodyear, 2005; Laurillard, 2012). Pattern-based design sometimes takes the form of technological tools teachers can use to present and discuss their learning designs with their colleagues (Learning Designer, 2016; Cloudworks, 2016). The purpose of using design patterns is to present a bottom-up or practice-based approach for learning designs and to make the sequence of activities prominent, as this is where the creative power of the teacher's pedagogy lies (Laurillard, 2012). Though design patterns are conceptualised in various ways (Bailey et al., 2006, term design patterns "learning nuggets") the aim is to help teachers create a common conceptual language to share and (re-)use knowledge for learning designs involving technology based on pedagogical approaches (Goodyear, 2005; Laurillard, 2012). The use of design patterns “can be seen a way of bridging between philosophy, values, theory, empirical evidence and experience (on the one hand) and the practical problems of design” (Goodyear, 2005, pp. 93–94). When using design patterns for learning design, the teacher becomes conscious of learning sequences. This leads to considerations about how the various learning activities or sequences may be supported or enriched by using a variety of educational technologies, thus making it easier to create innovative learning designs (Bailey et al., 2006; Laurillard, 2012).

Other learning design models are offered as more top-down or theoretical approaches for designing for teaching and learning with technology. Three examples are 1) **The TPACK model.** This model contributes with a framework for technology-enhanced learning that focuses on the importance of teachers developing sensitivity to Technological, Pedagogical and Content Knowledge (TPACK) as well as the relationships between these components (Mishra & Koehler, 2006, Koehler & Mishra; 2009). This framework focuses on the importance of pedagogy and subject-specific knowledge when designing learning and emphasises that pedagogy and subject-specific knowledge should be supported by knowledge about technology. Although TPACK may be an easy-to-communicate concept from a theoretical perspective, it is also a complex concept to apply and has raised scholarly debate (Voogt, Fisser, Pareja Roblin, Tondeur & van Braak, 2013). 2) **Conversational Framework.** Created by Dianna Laurillard, the Conversational Framework model (2012) is based on various pedagogical approaches and maps out student–teacher and student–student interactions on theoretical as well as practical levels. This makes it possible to examine how technology may be of help in the various interactions. The conversational framework discusses in detail how specific pedagogical approaches match specific interactions and clarifies how to create a learning design based in pedagogy while choosing relevant technologies to support the specific pedagogical approach. 3) **Design thinking for education.** This model can be characterised as something in between a pedagogical approach and a conceptual learning design model that can involve the use of technology. Pedagogically, it bears some resemblance to constructionism (section 9.3.3) and problem-based learning (section 9.3.2). Design thinking is an iterative learning-by-creating approach with five key phases: empathise/inspiration, define, ideate, prototype and test (Carroll, 2014; Hasso Plattner Institute of Design, 2016; Brown, 2009; Article B). Design thinking, when used as a learning design, is not merely a means of reaching the learning goal. Since the design dimension can be characterised as being part of human and civilizational culture, this model also contributes to and supports the creative and innovative potentials of both students and teachers by using *design* as a main pedagogical activity (Kafai, 2006b). Using design thinking in thoughtful ways to encourage students to design and build physical models or artefacts with the help of technology may engage students and deepen their learning processes (Carroll et al., 2010; Koh, Chai, Wong & Hong, 2015, p.11; Papert & Harel, 1991).

When teachers engage in pedagogical innovation involving technology, they also need to develop technological literacy (Hasse & Storgaard Brock, 2015). They need to be trained to analyse the affordances of the technology (Norman, 2004; Webb, 2010) and become competent to learn, evaluate and analyse how the technology impacts the profession, what complex pathways are created when using technology and how the use of technology depends upon the situation in which it is used (Hasse & Storgaard Brock, 2015).

2.3. GAMES AND OTHER ACTIVE TEACHING AND LEARNING APPROACHES IN VIDEO-MEDIATED ENVIRONMENTS

For several years, researchers have investigated and experimented with how students in online synchronous learning environments can learn through constructivist learning processes and activating learning designs (Dede, 1996; Laurillard, 2012). Learning games have often been emphasised as an active way of learning by experience; if carefully designed, such games can allow learners to interact with learning situations that are not possible to replicate in a traditional classroom setting (Barab & Dede, 2007; Squire, 2011; Whitton, 2014, Gee, 2003). Games can be used in online learning designs both as individual learning experiences and as strategically designed group experiences that involve the whole class (Demirbilek, 2010; Whitton, 2010). Virtual multiplayer worlds which can be accessed from outside the classroom, such as Second Life (Duncan, 2012) and Minecraft (Short, 2012), have been used for educational purposes since the 1990s (Nelson & Erlandson, 2012). Virtual worlds have the advantage of enabling learning designs in which all students can meet on equal terms in the virtual teaching room with their own avatars (Molka-Danielsen & Deutschmann, 2009; Okita, Turkay, Kim & Murai, 2013); this advantage could be used in hybrid synchronous learning environments.

There is a growing body of research on extending game-based learning – be it the use of simulations, virtual worlds or games developed with the purpose of learning – to *creation of games for learning* (Earp, 2015; Kafai & Burke, 2015; Whitton, 2014). Creating games for learning enables the student to have a more active role as game designer instead of a less active role as game player (Articles C & D; Oygardslia, 2015). This concept has been explored in the challenging hybrid synchronous video-mediated learning environment (Articles C & D; Weitze, 2014a,b,d). Though games have been used as a means of learning in synchronous video-mediated learning designs (Bower, Dalgarno, Kennedy, Lee & Kenney, 2014, 2015; Articles C & D), the research on learning games has tended to focus on parameters of importance for creating motivating and efficient learning designs. Most articles in this area describe the use of games as part of a video-mediated learning environment only in general terms; they do not describe how this environment influenced the game-based learning design. I was challenged regarding how to prioritise Article C – whether to focus on learning through game creation, or if this could be combined with descriptions of how this was specifically facilitated in the Global Classroom. Articles B and C are both examples of how it is possible to create motivating game-based learning in a hybrid synchronous video-mediated learning environment and therefore fall within the scope of the PhD project (Figure 8).

2.4. LEARNING DESIGN FOR PEDAGOGICAL INNOVATION

The ongoing changes in organisations and educational technologies inherently create a need for continuously changing practices and innovative pedagogical competences in the educational institution. Therefore the education and professional development of teachers is often considered a keystone in educational change and improvement (Dede, Ketelhut, Whitehouse, Breit & McCloskey, 2009; Laurillard, 2012). There is, however, a need to conceptualise how teachers can become innovative and effectively integrate the use of technology into their pedagogical practices and how they can engage in technology-supported pedagogical innovations (Laurillard, 2012; Law, 2008; Law, Kankaanranta & Chow, 2005; Somekh, 2007). There is also a need for investigation of the learning design processes teachers develop, and of how these processes can be supported by effective tools, materials and procedures (Agostinho, Bennett, Lockyer & Harper, 2011; Groff, Clarke-Midura, Owen, Rosenheck & Beall, 2015). One of the problems is that mainstream teacher education does not pay much attention to technology (Hasse & Dupret, 2012; Kirschner, Wubbels & Brekelmans, 2008). While there are new initiatives in Denmark to make the use of educational technology part of teachers' education (Hasse og Storgaard Brok, 2015), a need for teacher professional development (TPD) remains for those teachers already in practice (Dede et al., 2009).

Learning to innovate and go beyond knowledge

The question is how to establish TPD for the development of competences for pedagogical innovation. When participating in TPD courses, it can be difficult to directly apply the newly acquired knowledge and skills in practice (Huizinga, Handelzalts, Nieveen & Voogt, 2014). To be able to actually create pedagogical innovation involving technology, teachers need time to develop the necessary skills by engaging in exploratory play with the relevant technologies. This is an important step to become familiar with any new technology, as the teachers inevitably will start without any skills for using these new tools (Somekh, 2008). Law proposed that "teacher learning for pedagogical innovation is more effectively achieved if the innovation process itself integrates a design for teacher learning in a supportive network of innovators"(p.432), based on that knowledge building and innovation require shared, intentional efforts from members of the community (Brown & Duguid, 1991; Engeström & Sannino, 2010; Lave & Wenger, 1991; Scardamalia & Bereiter, 2003). It can, however, be difficult for teachers to collaborate, organise and schedule effective design team meetings themselves without initial guidelines (Kafyulilo, Fisser & Voogt, 2014). Furthermore, teachers need to build and use their "socio-emotional capacity to engage in change, take risk, and foster trust" (Law, 2008). When working collaboratively in teams to create new learning designs, *agency* is an important factor (Voogt et al., 2015). Agency is the individual teacher's future-oriented creative potential that can be used to generate intentional change in human activities; therefore, agency is transformative (Voogt et al., 2015, p. 262). The change-potential varies for each individual, but when working with interventions in groups or the "proactive activity of design work by teachers" it can create a shared transformative agency, making it possible for the individual to contribute with his or her own capacity for change and innovation (Engeström & Sannino 2010; Voogt et al., 2015, p. 262).

In Denmark, a direction has been set at the national level for the use of digital technologies in education (UVM, 2012). Truly innovative learning designs involving the creative use of technology have resulted in radical and exciting changes at some educational institutions. This demonstrates the importance of having leaders with insight and power who support the implementation of new approaches and technologies within the educational system (Laurillard, 2008; Robinson, 2011; Somekh, 2008). Leaders and teachers must collaborate, however, as one of the difficulties that make educational systems change slowly is that they often are hierarchical command-control systems in stead of being devolved-power adaptive systems (Laurillard, Oliver, Wasson & Hoppe, 2009, p. 298). This means that teachers are not given the means or the power to improve the quality of the teaching and learning process with technology. The changes that are required in order to use educational technology to support learning processes in new ways are so fundamental that they cannot be carried out within one part of the system; it must be a systemic and full implementation in the organisation (Laurillard, Oliver, Wasson & Hoppe, 2009; Law, 2008). Although pedagogical innovation relies largely upon teachers' confidence and competence with technology, teachers are not "free agents"; the potential for innovation also depends upon the social, cultural, and organisational contexts in which they work (Somekh, 2008, p. 450)

CHAPTER 3. CASE STUDY: VUC STORSTRØM

3.1. THE HYBRID SYNCHRONOUS LEARNING ENVIRONMENT

The Global Classroom allows for synchronous lessons with a teacher who simultaneously teaches students present in the classroom and students attending remotely via their own computers (Figure 5). It is a teaching and learning environment in which all participants can communicate and are able to see and hear each other. With the use of additional software (Bridgit, 2016), they can also all write on an interactive whiteboard. The concept includes hardware and software. The at-home students download software to their computers and log into a virtual conference room, they can follow the class on their PC (Figure 4). The hybrid synchronous video-mediated teaching room (Polycom, 2016) is arranged with an interactive whiteboard and two flat-panel screens at each end of the room (Figures 2,3&4).

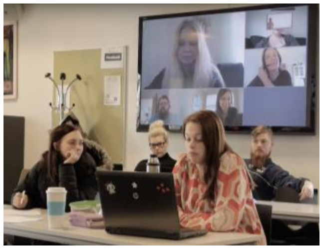


Figure 2 (left): Global Classroom teacher from the perspective of an in-class student.

Figure 3 (right): Students in class and at home (on the flat-panel screen in the background) from the teacher's perspective.

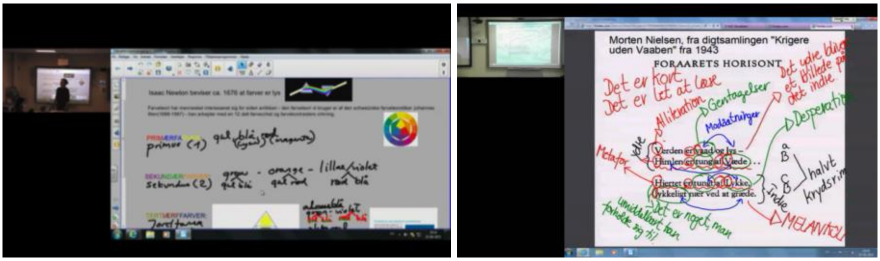


Figure 4: PC interfaces as viewed by two students attending class remotely.

This room arrangement makes it possible for the students in class to see the students at home on flat-panel screen 1 when looking up towards the teacher (Figure 2). The teacher is able to see the at-home students on flat-panel screen 2 (Figure 3) when looking towards the classroom students. There are two cameras to capture different angles and two microphones to pick up the sound from the room; the teacher can adjust the cameras and sound from a panel. The teacher can also use two pre-set, fixed positions for the camera, pointing Camera

1 at the class and Camera 2 at him- or herself as he or she stands beside the interactive whiteboard. The teacher must therefore pay attention to where to stand and must decide which part of the room to present to the students participating from home. The teacher can also record the lessons so students can watch them later.

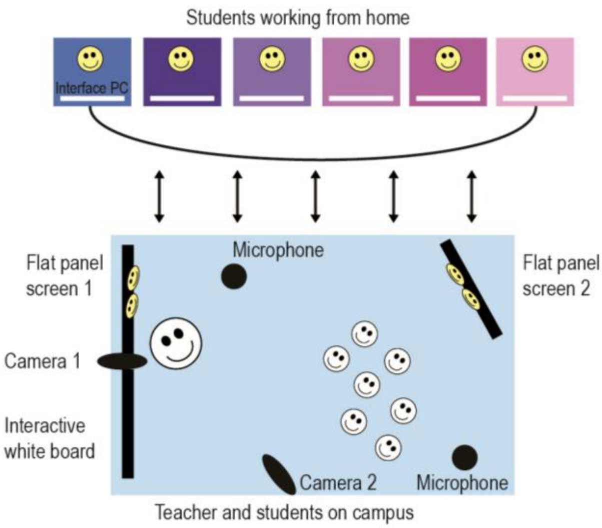


Figure 5: The Global Classroom - A hybrid synchronous video-mediated learning environment.

3.2. VUC STORSTRØM AS AN ORGANISATION

The General Adult Education Programme (VUC) forms part of the public education system in Denmark. It is designed to help young adult students improve or supplement their knowledge and skills within general subject areas. Denmark has 30 adult education centres; VUC Storstrøm, situated in the southern part of the region of Zealand, is one of these centres, comprising five campuses. In the school year 2015/16, VUC Storstrøm employed 200 teachers who taught approximately 6,000 part-time students, equivalent to 1,400 full-time students (VUC Storstrøm, 2015).

In 2011, VUC Storstrøm introduced *The Global Classroom*. The Global Classroom was part of the project “the new learning platform,” supported by the European Social Fund. The videoconference technology was developed in cooperation with Polycom, a U.S. company. In addition to offering a new flexible learning environment for the students, another goal for VUC was to share its experiences and knowledge about teaching and learning in this hybrid video-mediated learning environment with other interested educational institutions through the project Pitex – “educational IT-export” – which was supported by Region Zealand and Denmark’s Growth Forum (Vækstforum Sjælland).

3.2.1. THE GLOBAL CLASSROOM AT VUC STORSTRØM IN NUMBERS

VUC Storstrøm has four specially designed teaching rooms available for video-mediated education. In these videoconference rooms, 25 students can participate from home; up 16 of these students can be shown on the flat-panel screens. In addition, VUC has six mobile systems that can be used in normal classrooms, with up to eight students participating from home.

The Global Classroom started in the Nykøbing department in 2011 and in Næstved in 2014 (Table 1). A typical class consists of 25-28 students; these students remain together over the course of their two-year program. Four classes use the Global Classroom permanently for their full-time courses. Other classes may use the videoconference equipment by appointment. The hybrid synchronous video-mediated classes have run for five years; seven different groups of students have completed a total of 12 year-long units in the Global Classroom. Three of the seven groups have completed their studies.

Table 1: Number of Global Classroom classes at the different departments

Global Classroom classes	2011	2012	2013	2014	2015
Nykøbing Department (number of classes studying)	1	2	2	2	2
Næstved Department (number of classes studying)				1	2

Table 2 shows the number of lessons conducted in the Global Classroom per year at the different departments. The difference in the number of lessons between the departments is due to the subject areas: culture, physics and chemistry are not available as Global Classroom courses in Nykøbing.

Table 2: Lessons per year which students can follow from home.

	Lessons per year which students can follow from home
Nykøbing Department	700
Næstved Department	800

CHAPTER 4. HOW CAN PRAGMATISM AND DESIGN-BASED RESEARCH BE COMBINED?

This chapter attempts to identify a research paradigm and methodologies that are relevant and valid, in order to understand how teachers, students and organisations can create innovative and motivating educational designs encompassing the use of technology, with a pedagogical focus. Technology in this case encompasses the elements of the hybrid synchronous videoconference setting, as well as the additional educational technologies that teachers and learners use in such a setting. This chapter argues that choosing pragmatism will enable knowledge development within research on technology in education, with an emphasis on creating learning designs through active experiments with the users, thereby adding value to their practice. Pragmatism is discussed in relation to the area of educational research, on the grounds that this paradigm represents a creative and innovative research approach. It is then suggested that combining design-based research (DBR) and practice theory allows the research area to be deepened and enhanced. The chapter describes how the two methodologies can be used in an iterative process. Practice theory can be a methodological and analytical lens for zooming in on for example sayings, doings, bodily choreography and the use of artefacts (Nicolini, 2012), as well as a zooming out on the relations and connections outside the studied practice. This permits a deep analysis of the bundles of educational practices taking place among and between the three groups of actors in the educational institution. Design-based research methodology, on the other hand, is a design approach that helps create useful knowledge in a co-design process with users. The project's viewpoint, which contemplates both the philosophy of science and methodological approaches, enables a valid, creative, deep and relevant research and design process within IT and educational research. The aim is to contribute to the development of theory and description of valid learning trajectories that form the basis for change in an educational institution that will add value for the students, teachers and management, as well as the overall institutional goals.

4.1. WHAT WORKS?

Educationists in many countries believe that the best method of providing superior education for learners is to base educational practices on research, which may be termed evidence-based practice (Biesta, 2010; Lykins, 2012; Petersen, Reimer & Qvortrup, 2014; WWC, 2015). Although this approach is appealing, it is also complex (Cator & Adams, 2013). Evidence, or 'what works', often takes the form of experimental research and tends to be conducted as randomised controlled trials, the results of which are acceptable to governments and funders (Lykins, 2012). However, the kind of knowledge created in experiments is often evidence in cognitive terms – the measurement of 'what is', what took place in this particular experiment, with a number of fixed parameters and measured with validated instruments.

There is debate about how to view the evidence retrieved from such experiments and randomised trails, in particular whether it should be regarded as no more than possibilities and inspirations for future learning situations and not as firm and reliable cause and effect findings that can form the basis for political and strategic decisions (Biesta, 2010; Lykins, 2012).

One argument for a more nuanced view of evidence is that the connection between actions in learning situations and their impact on learning is not as straightforward as might be wished (Biesta, 2010). As human beings we are not closed systems that operate deterministically but open systems that will *probably* decide to interact with the environment and other individuals while at the same time experiencing feedback on this interaction. Our behaviour can therefore be seen as a result of a combination of external factors and internal dynamics that operate through the exchange of meaning (Biesta, 2010, pp. 496-497). As individuals – being the elements that make up these open systems – we are capable of thinking and of changing our behaviour on the basis of our own interpretations and understandings. This therefore makes us less 'reliable' as recipients and/or implementers of evidence-based practice. Thus, educational research enquiries into complex systems that are not simply causal (Biesta, 2010). When examining learning trajectories and causal connections in order to develop learning theories, researchers must be aware that it may not be possible to analyse the elements, processes and practices being studied as solely causal (thereby yielding reusable knowledge); they also can be complex and more difficult to unravel. This therefore questions as to *what* educational research measures, *how* the results of evidence-based research are implemented and what research methods actually work in practice. Is it possible for such research to be accurate through limiting and measuring specific variables and to yield information and findings that can be trusted and will deliver firm results when implemented?

Another point to consider in the discussion about *what works* as evidence-based practice in educational settings is the fact that education is normative[2] – it has an aim and a purpose. The *values in* and *goals for* an educational practice will always determine which actions are appropriate to take so as to reach these goals. The values will furthermore change according to the students and the context. Therefore, evidence-based practices or actions that are created, presented and used in the absence of educational values are blind and directionless, and can only be judged by their utility and merit in the context. New actions taken on the basis of evidence will therefore more likely contribute to the less strong: *evidence-informed* practice (Biesta, 2010).

The intention in this chapter is therefore to suggest a research paradigm and methodology that will provide inspiration to evidence informed innovative practices for students, teachers and educational organisations. The choice of these paradigm and methodologies makes it possible to develop context-based theory in cooperation with users with the intention to

[2] Normative is here used in the sense that education has value-based goals obtained through systematic and philosophical analysis and discussions about how to educate for what is best practice for leading ones life (Qvortrup, 2013).

provide inspiration to evidence-informed innovative educational practices and practitioners, specifically in the context of the innovative use of technology in learning.

4.2. EXPERIENCE AND EXPERIMENTS CREATING KNOWLEDGE IN EVERYDAY LIFE

How do we create knowledge in our everyday lives and practices? Practice is not only an individual habituation and socialisation into the local common culture – a repetition and re-use of our own or others' practices. There is also a need for innovative processes in practice, both for the teacher and for the researcher. Critical thinking and experimentation are part of everyday practices when we think (ideas, imagination, conceptualisation, theory generation, experiments in the mind), speak (communication, language) and act (knowing in action, bodily behaviour, interaction with other people and artefacts, innovative experiments).

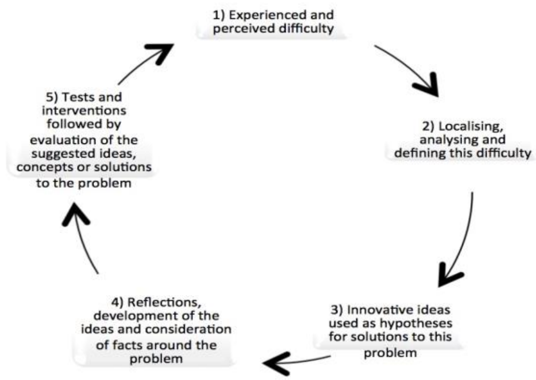


Figure 6: Experience and experiments creating knowledge in everyday life (based on Dewey, [1933] 2009).

Experiences can take the form of daily repeated practices, but they can also be a way to solve problems and gain new knowledge in our everyday life (Dewey, [1933] 2009, 2008). So how do we reflect intelligently on and investigate an issue in our daily lives? According to the philosopher and educational reformer John Dewey's pragmatic world view, there is a close relation between the following elements in an ongoing reflective process: 1) an experienced and perceived difficulty, 2) localising, analysing and defining this difficulty, 3) spontaneous and innovative ideas used as hypotheses for solutions to this problem, 4) reflections, elaboration of the ideas and consideration of facts around the problem, 5) tests and interventions followed by evaluation of the suggested ideas, concepts or solutions to the problem. If this leads to a satisfying result and thereby valuable new knowledge, the process ends; otherwise, we start again, armed with our new insight (Figure 6). These linked processes of reflection and experimentation are common ways to approach and solve problems in everyday life (Dewey, [1933] 2009, p. 95).

This pragmatic approach to research and development to solve everyday problems does not differ greatly from methodically led and controlled scientific research processes (Dewey, [1933] 2009). In Dewey's opinion, problem solving is much the same, whether it occurs in everyday life or in science, always consisting of reflections and interventions.

4.3. THE RESEARCH SITUATION – A LEARNING ECOLOGY

When innovating in contexts involving educational technology, there are many factors to take into account. Gravemeijer and Cobb (2013, p. 73), professors in learning and education, use the metaphor of *learning ecologies* to underline the fact that learning environments are conceptualised as interacting systems: "Elements of a learning ecology typically include the tasks or problems that students are asked to solve, the kinds of discourse that are encouraged, the norms of participation that are established, the tools and related material means provided, and the practical means by which classroom teachers can orchestrate relations among these elements" (Cobb, Confrey, diSessa, Lehrer & Schauble, 2003, p. 9). Throughout this learning ecology, innumerable elements, practices and processes are interacting in all kinds of explicit and tacit ways, with the aim of enabling different learning processes to take place, with higher or lower intensity, more or less motivation. This is what is traditionally called the messy setting in which educational research takes place (Brown, 1992; Kelly, 2004; Collins, Joseph & Bielaczyc, 2004). This setting often can make it difficult, when a new learning design is introduced, to distinguish what exactly has made a change to whom.

4.4. THE NEED FOR KNOWLEDGE ABOUT PEDAGOGICAL INNOVATION WHEN LEARNING HOW TO USE EDUCATIONAL TECHNOLOGY

Innovation is a debated term that has been conceptualised in many ways, but it is most often defined as processes or products or a combination based on knowledge and new ideas. Innovative processes and products are inspired by ideas and creativity, are developing new knowledge and opportunities, and are iteratively tested and refined until they are implemented to add value for the users (Quintane et al., 2011). The innovation process comes to life when it creates value and becomes more than just an idea in the mind. In educational contexts teachers engage in pedagogical innovative processes as they aim to create innovative learning designs using educational technology that will add value for the students. However, research shows that teachers do not fully utilise the possibilities provided by educational technology (EVA, 2012; Hasse & Storgaard Brok, 2015), which indicates that they need support for the process of innovation and the development of innovative thinking and acting skills (Darsø, 2011; Laurillard, 2012). The question is what kind of research approach will yield knowledge about how teachers can construct new concepts that combine what is already known with what is not yet known, in previously untried but relevant ways (Darsø, 2007, 2011).

The use of educational technology is not new and is moreover fully embedded in much teaching practice. The pace at which new technologies are introduced and implemented is, however, increasing, which places ever more demands on teachers to develop new skills (Cator & Adams, 2013; Collins & Halverson, 2010). Moreover, teachers need to keep up with upgrades and improvements to software. In the learning situation, the teacher is preserving culture in the sense that, when teaching the subject matter, she or he not only reconstructs the subject but also delivers value according to the current standards, rules and regulations of the society and the specific educational institution. Simultaneously, however, the teacher continuously changes his or her learning design to encompass new knowledge, new tools as well as changes in those tools, or in needs and regulations. For instance, educational institutions often introduce new initiatives initiated by the schools project management or on the basis of new laws and recommendations (Hasse & Storgaard Brok, 2015), such as the use of educational technology, integration of new values, or new curricula or societal or institution-specific changes, such as adaptation to a new student group with low motivation. These initiatives often have the intention of delivering more efficient and inspiring learning for the students. However, the development and implementation of the new initiatives can be a challenge for teachers, because they need the time, structure and support to experiment (Laurillard, 2012; Weitze, 2014d, 2015c).

Our everyday practices are to a great extent based on previous experiences and habits (Dewey, 1922, p. 15; Nicolini, 2012). This habituation keeps us from being overloaded by daily decisions about every detail of these practices. The innovative development and implementation of new ideas can be experienced as disruptive, disturbing the routine of the familiar, for example the introduction of IT in education disrupts the habit of the traditional way of teaching without digital technology (Christensen, Horn, Johnson, 2008; Laurillard, Oliver, Wasson & Hoppe, 2009). Teachers are thus continuously compelled to develop new pedagogical practices and incorporate them with their learning designs. This calls for development of daily innovative pedagogical practices based on the teachers' traditional pedagogical aims with their learning designs.

New practices can sometimes be inspired by the intended as well as the non-intended use of educational technology. Experiments in research in IT in education can therefore be approached from two angles: 1) the pedagogical angle: investigating how IT can contribute to the current learning design and learning goals, and 2) the technological angle: how the learning designs can be inspired by new technological possibilities, opening up for new ways of teaching and learning. In this 'dance' or interplay between pedagogical aims and technological affordances, it sometimes can be hard to determine where the impetus for moving in a new direction comes from.

The integration of new technology into educational practices demands a more conscious and progressive innovative departure from traditional practices. Since change is now the rule rather than the exception, teachers need continually to develop valid and meaningful learning designs, but It can be difficult for teachers to overcome the increased demands to develop new skills (Hasse & Storgaard Brok, 2015). Therefore, there is a need to develop knowledge about how to create and support continuous innovative pedagogical practices for teachers.

4.5. PHILOSOPHY OF SCIENCE FOR EDUCATIONAL RESEARCH

The knowledge we use in the present is our heritage from the past, but we use it while approaching an open future (Elkjær, 2012; Gimler, 2014; Kierkegaard, 1906). Seen from an educational perspective, this can inspire a paradigmatic approach that supports active movement towards that open future by creating new knowledge about how to develop innovative practices and problem solutions.

When considering what research paradigm may be valid in the area of creating innovative practices implementing educational technology, we are looking for a scientific framework that goes beyond 'what is' in the current learning environment and imagines 'what might be'. This will involve performing theory-informed experiments, in this case with new IT pedagogical learning designs. Pragmatism is a philosophy of science that has both a useful theoretical aim and a normative value as its goals (Biesta & Burbules, 2003; Gimmler, 2014; Goldkuhl, 2012). This is relevant to the present research area, enabling the development of learning and educational theory and producing normative knowledge that can be used to create meaningful learning designs through pedagogical innovative processes.

Development of pragmatic knowledge

In the American philosopher and educator John Dewey's ([1933] 2009) pragmatic understanding, there is a procedure for moving from 'what is' into the future world. The first step is to explore areas that are uncertain and disturbing in order to identify and define our problem. This specific problem definition will determine what kind of answer we find. The problem and the solution are, in other words, developed together in a parallel movement (Löwgreen & Stoltermann, 2007). This naturally makes the problem definition a very important part of the research phase. When defining the problem in pragmatism, it is suggested that, apart from deductive and inductive approaches, we should also be open to sociological fantasy – more artistic and innovative or abductive approaches – aimed at finding reasonable solutions (Gimmler, 2014). The addition of a more imaginative or creative approach supplements and enriches the cognitive approach with aesthetic, emotional and physical dimensions (Charles Wright Mills, according to Gimmler, 2014), which are already part of educational practice.

Pragmatism requires that new theoretical knowledge responds to problems and needs in practices and that it is also appropriate for the social, cultural and political context (Dewey, [1933] 2009; Elkjær, 2012; Gimmler, 2014; Goldkuhl 2012). This is the basis of the normative approach that can be found in both the problem definition phase and in the results or the prescriptive part of pragmatic research.

Another important point of pragmatism is that knowledge is developed in action (Dewey, [1933] 2009). In a search for a paradigmatic basis, Goldkuhl (2012) describes nine different kinds of knowledge that are created in the *active* innovative design research process when *designing artefacts*. The present project deals with the creation of innovative learning designs encompassing *the use* of educational technology, that is, the *design of the use of artefacts*, and also investigates the use of such learning designs. Goldkuhl's concepts can offer inspiration to the present study, when considering which kinds of knowledge are developed in a creative educational research process within the pragmatic paradigm.

Nine kinds of knowledge developed through design

In the following, we attempt to concretise the epistemic ground for the research process, investigating what knowledge is developed and how it is acquired in this field. This elaboration of knowledge development phases adds nuances to and extends epistemic knowledge concepts, from knowing *that* (a specific fact) to knowing *how* (knowing how to do something) (Fantl, 2014). The nine epistemic types of knowledge proposed by Goldkuhl (2012) may well be part of a learning trajectory through the innovative learning design research process. The nine types, set out below (in bold in the discussion), have been modified to adapt them to learning design research.

- Evaluative knowledge (making diagnostic judgements)
- Critical knowledge (diagnostic when disclosing problems, obstacles)
- Appreciative knowledge (diagnostic when finding positive resources)
- Conceptualising knowledge (categorising the world; giving definitions)
- Prospective knowledge (stating a possible world; suggesting innovative learning designs; developing new ideas and concepts – ideation)
- Explanatory knowledge (stating cause-to-effect relations, analysed learning trajectories)
- Normative knowledge (stating what is desirable, i.e. values and goals)
- Prescriptive knowledge (expressing means-to-ends relations)
- Theoretical knowledge (characterising and clarifying properties of learning designs)

In the research process, all the knowledge development phases above are also informed by theory. The above knowledge development process thus begins with exploration and investigation of the problem area, considering which elements and processes should be the object of **critical** diagnosis and which to retain or enhance since the users (learners) and the researcher (who may be the teacher as learning designer or the educational researcher) **appreciate** them. The knowledge used here is **evaluative** and **diagnostic**; and the area of interest is **categorised** and **conceptualised** through analysis. As mentioned earlier, the problem and the solution for the problem are developed in parallel, and the identification of the problem and of the appropriate solution will depend on the worldview, theoretical background and context of the person/s concerned. The epistemic trajectory then moves to **knowledge creation** through **ideation** – systematic creation, generation, development and testing of new ideas (Brown, 2009). The researcher/learning designer will thus employ creative skills, experiment and use innovative methods to conceptualise and reflect, in an attempt to provide **prospects** of a future world. This ideations phase takes place in an iterative process until a satisfactory solution is reached; and in these iterations the researcher/learning designer will return to the evaluative, critical, appreciative and conceptualising knowledge creation phases until a solution is found. When the new solution is found, it is **evaluated** – and the new solution within educational research, a learning design, can then be unravelled by looking back to the innovative process that has led to the accepted new result, examining the interpreted causes and effects along the way. It will then be possible to describe what this new design encompasses and how it can be performed, in which context and by whom – how it unfolded in the learning-ecology. This will be new knowledge that can then be **explained** and used as evidence-informed educational research to inspire new practices. It is worth noting that, although the new learning design may be obvious at the end of the development process, it has been preceded by an idea, or several ideas, whose value and validity were not known beforehand: its path to the destination is found only through experiments and dedication (Dewey, [1933] 2009). Until then, it is just an idea.

Part of the research process in the pragmatic paradigm encompasses **normative** knowledge considering what **values** and learning **goals** will make a better world, serving the common good. We then use **prescriptive** knowledge to communicate and effectuate the innovation, to explain how these research results were reached in order to validate the results and to answer the research question. In other words, we provide a **description of the learning trajectories** developed in the research process, which is often quite practical in nature to inspire new practices. In parallel, a more theoretical meaning-making is developed, condensing the results to more general learning theoretical patterns.

The researcher thus is using knowledge from the field of research as well as developing knowledge in all phases of this process. He or she is therefore building competence in these knowledge development processes, both by creating knowledge about new specific facts (knowing that) and by creating knowledge about how to perform specific tasks and processes (knowing how).

4.6. METHODOLOGICAL CONSIDERATIONS IN DESIGN-BASED RESEARCH

In this study, a pragmatist framework has been chosen as a paradigm for developing knowledge about pedagogical innovation within learning and IT. However, we still need to find a methodology with which we can carry out the research. In the following, it is argued that the iterative research approach of design-based research (DBR) can serve to explore, investigate, innovate and design within the area of educational technology.

> No conclusion of scientific research can be converted into an immediate rule of educational art (John Dewey, 1929, p.1,).

Researching and then implementing the findings of research in order to improve the learning experience and the acquisition of learning is not easy. In the 1990s, the cognitive science lab experiments used to gain knowledge on how to create the best possible learning conditions for students (Brown, 1992; Reimann, 2011) were criticised on the basis that they seldom led to results that were used by teachers. Moreover, the experiments were developed in lab settings that lacked the situational chaos that is often is part of a learning environment. Therefore the research outcomes were often difficult to implement in practice afterwards, since many of the educational parameters had not been taken into consideration (Brown, 1992; Dewey, 1929). Such criticisms led to the emergence of design-based research[3] (DBR). Unlike traditional experimentation, DBR is:

> a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories. (Wang & Hannafin, 2005, p. 6)

The purpose of DBR in education is to join the forces of teachers and researchers addressing complex problems in a situational environment to develop learning theories and knowledge that are relevant and implementable for teachers in their everyday practice (Brown, 1992; Reeves, 2006; The Design-Based Research Collective, 2003). This happens through integration of known and hypothetical design principles often with technological advances in order to provide plausible solutions to these complex problems and also to conduct rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles (Reeves, 2006, p.58). As stated before it is not enough to study 'how the world is': teachers also need knowledge about 'how the world can be in the future'. Taking this approach, educational research is less about education than for education (Biesta & Burbules, 2003, p. 1). Design-based research thus proceeds in a practical way, addressing the need to study learning in the real world (Amiel and Reeves, 2008), go beyond narrow measures of learning, perform design experiments and derive research findings from formative evaluations, often with a focus on implementing new technological elements into the educational setting (Reimann, 2011).

4.6.1. DBR PHASES AND ITERATIONS

In DBR, the problem area is initially investigated and analysed by the researcher and practitioners in collaboration. This happens through field observations and interviews (Amiel & Reeves, 2008; Collins, 1992; Brown, 1992; Herrington, McKenney, Reeves & Oliver, 2007).[4] This project used an informed grounded theoretical approach (Thornberg, 2012) when it investigated "what is/was" and contributed with analytical views on the practices in the problem area. Although the analytical approach often is implicit in articles about DBR, a combination of theoretical and empirical analysis is common in DBR, since it is a theoretically based interventive research approach. From these combined theoretically and empirically

---

[3] This research methodology is, though somewhat different in goals and characteristics, in the same 'family' (Plomp, 2013; Wang & Hannafin, 2005) as, for example, *design experiments* (e.g. Brown, 1992; Collins, 1992) and *design research* (Collins, Joseph & Bielaczyc, 2004; Edelson, 2002).

[4] This is, however, debated by some DBR theorists, who prefer researchers to take the initial initiative by providing a theoretically based learning design as a hypothesis, which the participants then try out (Gravemeijer & Cobb, 2013; Wang & Hannafin, 2005).

based analyses, DBR then moves on to suggesting new learning designs, often involving educational-IT, and with an abductive or creative/innovative approach. These learning designs are co-designed for the future and tried out with the users. A reflection phase follows, once again analysing the data from the design experiments using a combined theoretical and empirical view to investigate 'what is/was'. The researcher is sensitive to and chooses theory relevant to the practices and different layers of the multi-tiered design experiments (Reimann 2011, p. 39). This is followed by iterative cycles of testing and refinement with the users and then further reflections in order to produce 'design principles', that is, theory, and 'enhance solution implementation' (Amiel & Reeves, 2008, p. 34), that is, real world impact. These iterative phases continue until the users and the researcher reach a design that creates new knowledge for solving the defined problems or suggesting further research areas.

Amiel and Reeves (2008) have described the design-based research process in the model illustrated in Figure 7. The model does not, however, show where the research-based and theoretical considerations come in to inform the process or what the role of the researchers has in the development process.

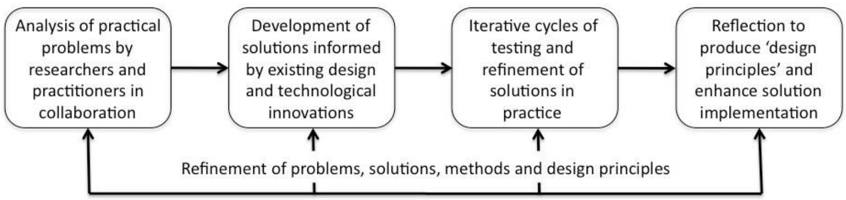


Figure 7: The design-based research process (Amiel & Reeves, 2008, p.34).

One intention in DBR is to develop clear interpretive frameworks for understanding the relations between specific activities and specific changes in students' reasoning - analysing the learning trajectories and looking for the 'argumentative grammar' (Reimann, 2011, pp. 43-44; Kelly, 2004) – a logic of process-oriented explanations. To establish the claim that certain aspects of a design are not only contingent but are necessary to bring about learning, it is often suggested that researchers make control-group designs in other learning environments, as it has been done in this research project. However, as DBR is conducted and situated in real educational settings, it is difficult to repeat the same design. This bias should be considered if the design is tested in a similar setting.

In DBR, the aim thus is to develop descriptions of the learning trajectories (DiSessa & Cobb, 2004), and from these process-oriented explanations more general learning theories can sometimes be suggested (Reimann, 2011). DBR therefore does not test if treatment A works better than treatment B, but instead has as its goal to provide 'an empirically grounded theory on how the intervention works' (Gravemeijer & Cobb, 2013). However, the theories developed will always be context-dependent. In DBR, one outcome could be a design solution encompassing materials, tasks and activities to teach a specific competence. Edelson (2002) distinguishes between three kinds of theories that are involved in design: "(a) domain theories (as an outcome of problem analysis); (b) design frameworks (generalisations of specific design solutions); and (c) design methodologies (generalised procedures for doing learning design)".

4.7. PRACTICE THEORY AS A METHODOLOGICAL LENS INFORMING DBR

This research project investigated pedagogical innovation and motivating learning designs incorporating the use of IT for actors in an educational institution. When conducting DBR, the researcher worked iteratively and shifted between mutually informed processes of intervention and analysis. When focusing on "what is/was" in the analytical processes, the project, in addition to grounded analysis of the empirical data, used theories of learning, learning design, the use of technology in education, and competence development in order to inform the design for learning and motivation. It has thus been relevant to scrutinise signs of individual cognitive learning processes as well as signs of social learning processes to assess whether the proposed designs promote successful learning processes (Illeris, 2007). The present project has also been a study of practices in an educational institution, relying on observations and analyses thereof. Teaching and learning processes can been seen as aspects of social life. The practices of learning are both structures and processes situated in time and space and there are relations and interactions between the materials, the actors, the actors' actions and the intentions of the actors. The knowledge is in the human bodies and minds as well as in objects/tools and different texts, all interacting in a chain in which one performance leads to another (Gherardi, 2012; Nicolini, 2012; Shove, Pantzar & Watson, 2012). But how can we collect and develop knowledge in this setting?

When observing practices, it is important for the researcher to find the right tools for the job. Learning processes and designs of learning processes are traditionally studied using qualitative methods, for example ethno-methodological methods such as observations and interviews and grounded theory; quantitative methods, for example experiments and surveys; as well as mixed methods that mix qualitative and quantitative approaches (Creswell, 2014). In a study such as this, we have to recognise the complexity, heterogeneity and uniqueness of the different practices and also the varying interests, methods and approaches that have to be adopted when carrying out research. Practice theorists such as David Nicolini (2012) argue that there is a family resemblance between the different theoretical approaches for studying practices and that we as scientists should deliberately adjust for different theoretical sensitivities, for example community-of-practice-theory (Wenger, 1998), ethno-methodology theory or activity theory (Engeström, 2000), in order to apply the most relevant to different parts of the research area. This way of applying multiple research methods and theories can be regarded as a means to strengthen validity and transparency in the process, since it is not possible to find one single method that can cover the totality or complexities of practices (Buch, 2015). Practice theory aims at describing the important interactions and features of the world we inhabit; these features are routinely made and re-made in practice, using tools, discourse and our own body (Nicolini, 2012). The analytical stance in the thesis has been inspired by practice theory in the sense that it has observed the world as a "vast array or assemblage of performances made durable by being inscribed in human bodies and minds, objects and texts, and knotted together in such a way that the result of one performance becomes the resource for another" (Nicolini, 2012, p.2).

This view is well in line with the observations in the thesis of the practical and often tacit knowledge of the actors and between the actors, inside the groups and between actor-groups (Students-teachers-management) in the educational setting. Practices are interdependent and nested inside each other in relational ties (Schatzki, 2002). Practice theory focuses on relations between entities and the social reality is conceived as dynamic, continuous and processual – a kind of relational epistemology. It will expect its objects of investigation to be continuing and incomplete (Gherardi, 2012). By focusing on practice it is possible to "see and to represent a mode of ordering the social in which doing and knowing are not separated and the knowing subject and the known object emerge in the on-going interaction" (Gherardi, 2012, p. 78).

Nicolini (2012), a professor of organisational studies, has collected an array of different practice theoretical approaches, from which he has created a box of tools for describing practice by 'zooming in' at certain focus points. The focus points are: saying and doings; interactional order; timing and tempo; bodily choreography; tools, artefacts and mediation works; practical concerns; tension between creativity and normality; processes of legitimation and stabilisation (Nicolini, 2012, p. 220). The zooming in is followed by a zooming out to the relations and the trail of connections outside the studied practice. These zooming in and out processes have different theoretical sensitivities and stop when it is possible to "provide a convincing and defensible account of both the practice and its effects on the dynamics of organising, showing how that which is local contributes to the generation of broader effects" (Nicolini, 2012, p. 219). The purpose of this zooming in and out is to capture an impression of all the relations between the actors – human and non-human – and the bundles of practices they are part of and influenced by, and themselves are influencing. This will enable an overview of *what is*, a description of the practices being performed.

When designing a new practice for teachers and students, practice theory suggests that if we aim at building a new institutional practice, it is not sufficient to make a new set of rules, ideas and principles (Nicolini, 2012). Rules and principles are fine for novices (Dreyfus & Dreyfus, 1986). But for a professional teacher a learning design or a new practice in the educational institution needs to be implemented in all the facets and nuances in a practice, and tried out through interventions with the relevant practitioners, the tools, materials and processes in order to become a qualified success. If, for example, a teacher is working on developing a research-informed new practice encompassing collaborative learning, the rules or theory of collaborative learning will not make the learning design. It will take a range of other practices and activities, such as considering what this will mean for these particular students, introducing and discussing the principles with them; determining how collaborative learning should be carried out in a particular lesson, deciding what learning content should be presented and anticipating how the students should interact. The actions taken will have to ensure that the students will learn in this new process, by designing the learning activities in a way that makes it possible to guide them and also evaluate them through formative and summative assessments. This will often have to be followed by new iterations, altering the parts of the learning design that did not work as well as hoped. It is these kinds of detailed practice considerations that are necessary and can help establish and consolidate design-based educational research.

4.8. SUMMARY OF RESEARCH PARADIGM AND METHODOLOGIES

This chapter discussed which philosophy of science and methodological approaches within educational research would construct a framework enabling the creation of knowledge about the elements, methods, processes and practices that could form part of innovative and motivating learning designs for teachers and students. It was suggested that pragmatism was a valid scientific approach when developing knowledge within the field of educational research, more specifically when creating innovative and motivating learning designs involving the use of IT, through active experiments with the users. The PhD project has now ended and by using design-based research (DBR), it was possible to deepen and qualify the research area and produce designs for the future. DBR enabled the researcher, in an iterative process, to produce innovative learning designs in co-design processes with the users, developing prospective knowledge and new practices. The use of DBR thereby not only enabled knowledge development *about* but also *for* education, learning and educational practices. However, practice theoretical approaches were also valid methodological lenses through which to analyse the relevant learning situations and complex bundles of practices (Nicolini, 2012). The practice theory approach offered a range of tools and investigated 'what is' before and during the design of new practices for learning, and also, after the interventions, was used to assess how successful and sustainable these new practices turned out to be.

CHAPTER 5. METHODS

5.1. INTRODUCTION TO METHODS USED IN THE PROJECT

This project investigated how to develop innovative learning designs that contribute to the creation of motivating learning experiences in hybrid synchronous video-mediated contexts. The goal of this project has been to contribute theories and guidelines regarding which elements, methods, processes and practices can contribute to the creation of reflected, innovative and motivating learning designs for teachers and students in a hybrid synchronous video-mediated teaching context, with a focus on how to create motivating learning for the students.

Therefore, the project examined how the teaching and learning processes and practices in and around the hybrid synchronous video-mediated learning environment at VUC Storstrøm were conducted, further developed and anchored. The project also explored the opportunities and barriers this learning environment presented for the three units of analysis: the students, the teachers and the educational organisation.

This was a joint research project of VUC Storstrøm and Aalborg University. The aim of the user-centred project was therefore both to add value to VUC Storstrøm and to develop theory and guidelines by investigating how to qualify the implementation of the Global Classroom Model in general (Reimann, 2011). In order to develop the project in a way that made it relevant for the educational organisation but also developed theory, the research took place as a design-based research (DBR) study. This approach was chosen to develop improved innovative learning processes that involve digital technology, are directly applicable upon the particular situation and develop the capacity of the members to solve their own problems.

In the course of this DBR project, as the learning researcher, I introduced learning concepts or designs (for example, theories, artefacts, practices) to the user groups (teachers, students and other actors) in order to impact learning and teaching (Barab & Squire, 2004). These learning concepts were prepared on the basis of previous observations and interviews with these user groups (Amiel & Reeves, 2008; Collins, 1992) and then co-designed and developed into new learning designs. These designs were practice-tested with the same user groups and also with new user groups in order to test the sustainability of the learning designs. The process was evaluated together with the users and was then repeated in an iterative process, implementing the new experiences gained from the empirical findings until a satisfying solution was reached. As a project developer, I had a dual role as both learning design/concept developer and researcher. The two roles complemented each other as I developed and researched in parallel.

The DBR project selected significant cases (Yin, 2014) and worked collaboratively with user groups. The project was problem-oriented, and the work took place in practice in order to develop ideas, action guidelines and theories to change practice (Barab & Squire, 2004; Creswell, 2014; Peters & Robinson, 1984). To investigate the focus areas, the project used a dual approach: analytical and exploratory (Creswell, 2014). The explorative DBR development process was ongoing and iterative in several sub-projects and various phases (Amiel & Reeves, 2008; Majgaard & Misfeldt, 2011). Emergent theory was continuously condensed and implemented in new versions of the learning design concepts that were discussed, further developed and tested with the users in an iterative process (Plomp, 2013; Reimann, 2011). The interventive part of the study was used to deepen the problem area and to develop ideas and theories. By choosing DBR as a framework to solve the problem statement of the thesis, it was possible to combine a theoretical approach based on a hermeneutic model that involves iterative analysis and discussion of the issue (Nielsen & Nielsen, 2015) with a development in practice in collaboration with the users (Brown, 1992; Sanders & Stappers, 2008). The empirical studies were conducted primarily in the qualitative domain; the DBR approach was valid because the empirical findings and emerging theory were used as arguments in the particular development of the concept. This choice of theoretical as well as interventive methodology allowed openness towards a variety of development directions for the PhD project. As the design process was exploratory, the learning design concepts changed in the process. Therefore, the understanding of the problem statement also changed during the process. The researcher was involved in a learning process that helped to inform the ongoing analytical view. The collaboration with the users in the co-design processes additionally allowed for a focus that was weighted on the users' experiences as a quality test of the theoretical and methodological guidelines.

The operationalisation of the concepts from the problem statement took place through theoretical and empirical analysis (Goldkuhl & Cronholm, 2003; Thornberg, 2012) performed in the research process before, during and after the DBR iterations. The analyses were done through transcription, interpretation and coding of the audio- and videotaped interviews, observations, digital processes, products and teaching materials that were uttered, created and used in the Global Classroom environment.

5.2. RESEARCH DESIGN

The DBR project's scientific investigation was divided into phases and iterations in order to operationalise the questions from the problem statement. The investigations in this project can be divided into two parts, which used the following methods and goals:

A. **Initial Explorative Phase** (Spring 2013): To provide insight into the current situation, the first part of the study examined the teaching and learning processes and practices in and around the hybrid synchronous video-mediated learning environment and the opportunities and barriers this environment presented in relation to learning and motivational processes for all three units of analysis: students, teachers and administration (figure 8). This took place in case studies through observation, interviews and analysis of the ongoing practices (Chapter 7, Article A: Weitze & Ørngreen, 2014).

B. **DBR Experiments:** (Fall 2013–Winter 2015) Based on insights from the first part: A, the second part: B (figure 8) experimented with new forms of competence development and new uses of IT in the Global Classroom in order to create theories and methods for development, change and anchoring of hybrid synchronous video-mediated learning environments in public educational institutions with a focus on learning and motivation. This was done through an explorative design-based research approach iteratively combined with phases of reflection and theoretical and empirical analysis. The aim was to provide guidance and competence development about how the three actor-groups in an iterative innovative process, through planning, development and reflection could change and anchor innovative digital learning designs (Chapter 8-10, Articles B, C, D). Observation, interviews and analysis of the ongoing practices were also included in this second part (Figure 8).

Figure 8: Parallel projects addressing the research area in the PhD project.

Sub-projects

The sub-questions for the problem statement (section 1.5) were therefore answered through different sub-projects for the three actor-groups. The following elaborates how each sub-question was investigated in sub-projects:

1) **Q 1 – The Teachers:** How can an educational organisation develop a reflective, innovative and competence-developing tool/method or practice for teachers? This tool, based on teachers' subject-specific pedagogical approaches, should enable them to carry out appropriate planning, execution and theorising on their own teaching in IT-based and video-mediated teaching programs. The tool should also enable teachers to make informed and relevant choices in the use of educational technology for their learning designs in a professional academic context. In order to

answer this question, several teacher workshops were conducted inside the hybrid synchronous environment in a DBR approach, and from these workshops an organisational learning design model for continuous competence development for teachers teams was developed (The IT-Pedagogical Think Tank for Teacher Teams (ITP4T)) (Weitze, 2014d&e, Chapter 8 and Article B).

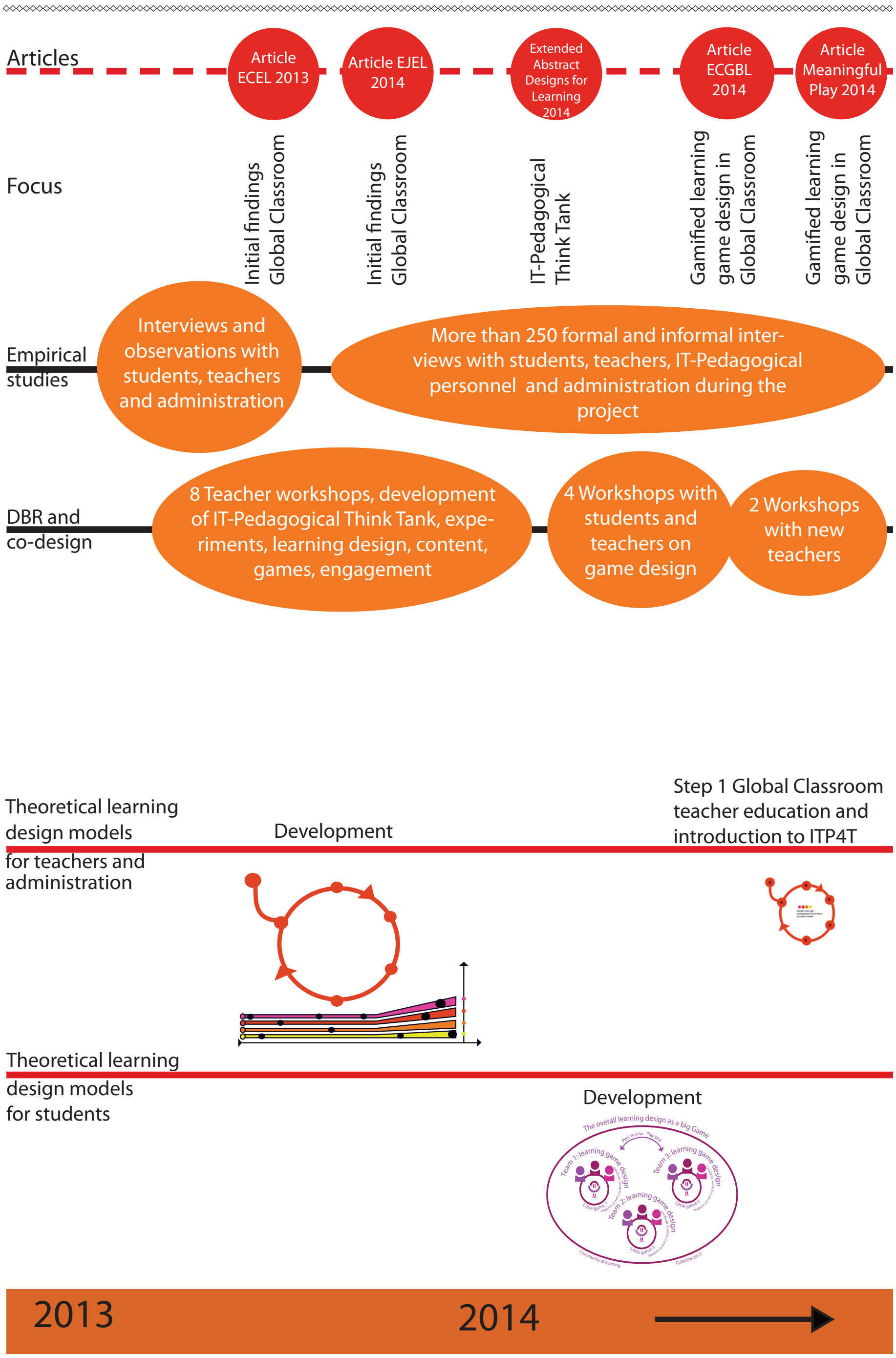
2) **Q 2 – The Students:** How can an educational organisation create motivating learning designs for adult students when they learn with and through educational technology? To what extent is it possible to measure how learning with and through educational technology affects student learning and motivation? Can students help in further innovative integration of educational technology in their learning processes, and if yes, how can this take place? In order to answer the second question, I studied learning designs in the hybrid synchronous learning environment as the students were taught by the teachers. I observed the learning situations by being either in the room, synchronously online or through asynchronous video recordings (Article A & Chapter 7). The learning designs for the students were also experimented on in the teacher workshops in the hybrid synchronous learning environment, as it was the goal for the teachers to create and try out motivating learning designs (Chapter 9). In addition, several student workshops with a gamified learning design were conducted in an iterative DBR approach to investigate opportunities and barriers encountered in attempting to create motivating learning designs for this environment (Article C, Article D). The workshops provided a learning environment where students participated as active learning designers who organised their own learning processes and those of their peers by creating digital learning games in the hybrid synchronous learning context. The PhD project examined what learning and motivation processes were created and supported in this gamified design. The aim was thus to develop and measure motivating learning experiences in the hybrid synchronous learning environment in order to investigate which new practices can emerge and which existing practices are challenged. By examining a specific learning design, the researcher was not only looking for a "best practice". The project also sought to investigate a) how to create a more intense learning environment, b) how to create deep and playful learning within this context, and c) the consequences these designs had in this context.

3) **Q3 – The Organisation:** What are the educational organisation's opportunities and responsibilities in relation to change, implementation and anchoring of IT-based and digital video-mediated educational programs? This question was studied throughout the research project in more than 250 formal and informal meetings and conferences with the administration and IT-Pedagogical team; the findings were summarised in a workshop (Winter 2015). The PhD project developed knowledge about how the overall educational institution experienced the implementation and development of the hybrid synchronous learning environment (Chapter 10). The meetings with administrative personnel were also interventive in the sense that the

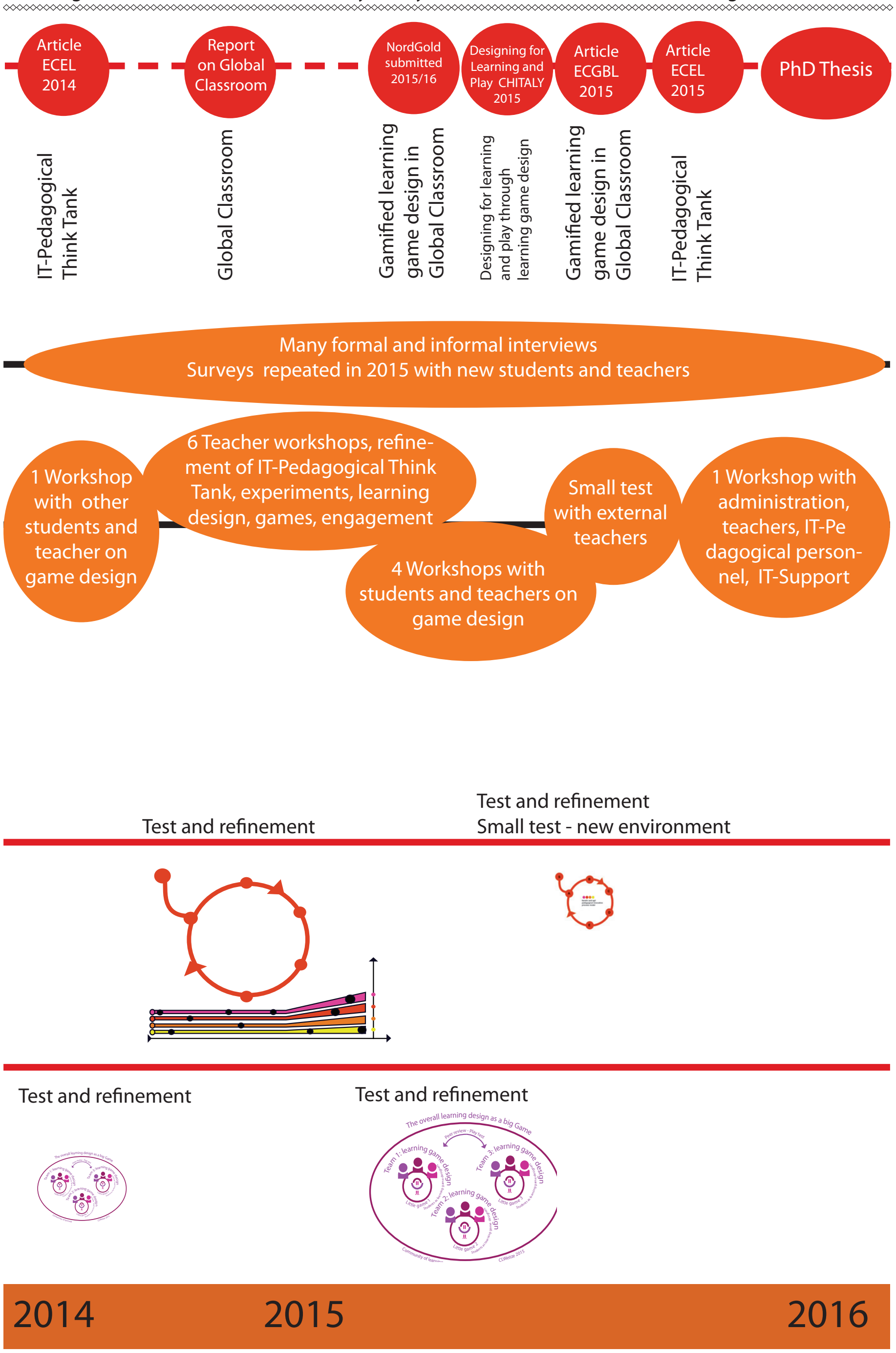
theories and products from the observations and workshops were disseminated and discussed and further developed in co-design processes with project managers and IT-Pedagogical personnel at VUC Storstrøm. This made it possible to develop context-based knowledge about how the administration could support the development and anchoring of the hybrid synchronous learning environment. The products, results and theories from this part of the process involved development of a four-step educational process for Global Classroom teachers and the dissemination of research results through 4 homepages, 10 publications, 5 reports, and approximately 50 presentations.

The DBR phases and iterations depicted in Figure 9 are described in the PhD thesis; Figure 9 is a graphical illustration of the research process. Please see Appendix A: Table 7: “Research and Concept Development Phases and Processes” for a more detailed overview of the research design phases and interventions.

Figure 9: Map of the design-based research design process, 2013-2016



How should pedagogical innovation be designed in order to contribute to the creation of motivating learning for students and teachers in a hybrid synchronous video-mediated learning environment?



5.2.1. RESEARCH *ON* AND *THROUGH* INTERVENTIONS IN DBR

According to Barab and Squire (2004), DBR is not one approach but "a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in naturalistic settings" (p. 2). This emphasises that the complex teaching and learning environment – the *learning ecology* - that is in need of pedagogical innovation can consist of several elements, products and processes. According to Plomp (2013), the purpose of DBR is

> to design and develop an intervention (such as programs, teaching-learning strategies and materials, products and systems) as a solution to a complex educational problem as well as to advance our knowledge about the characteristics of these interventions and the processes to design and develop them, or alternatively to design and develop educational interventions (about, for example, learning processes, learning environments and the like) with the purpose to develop or validate theories (p. 15).

McKenney and Reeves (2012) describe this difference between the two purposes as research *on* interventions and research *through* interventions. This PhD project has researched *on* and developed interventions; for example, in the form of a theoretical model for learning designs and practices to facilitate pedagogical innovation in order to solve complex problems for the educational institution. The project also investigated how to create motivating learning designs for gamified educational practices and explored how the teaching and learning strategies must be formed in order to create deep learning processes. The interventions (for example, a model of a learning design for pedagogical innovation) were developed in practice, within specific user groups. The PhD project tested *through* interventions when, in order to validate the design, it used, tested and refined the new design's learning trajectories or the new theory and concepts with new user-groups – students and teachers – to assess the sustainability of the interventions. The study was multi-level study in the sense that it linked classroom practices to other events and structures in the educational organisation. Therefore, the products of the research have included theories, artefacts and practices that can be used at VUC Storstrøm and can also contribute knowledge to the research areas described in "Literature review" Chapter 2.

5.3. QUALITY IN THE PHD PROJECT

This study was conducted by the use of mixed methods. Though DBR uses both quantitative and qualitative methods (Brown, 1992), and surveys have been a part of this study's investigations, the empirical data has mainly been collected as qualitative data. Qualitative research has different quality criteria than quantitative studies. Quantitative studies, in general, aim to answer research questions by describing trends, or they try to explain the relationship among variables by collecting numerical data from representative samples of a large number of people (Creswell, 2014). In their aim to pursue reliability, quantitative studies limit bias by creating stable and consistent measurement procedures; this makes the study possible for other researchers to repeat in order to verify the experiment by testing whether it is possible to achieve the same results. Qualitative studies focus on naturally occurring, ordinary but often complex events or processes in natural settings, and data is collected in close proximity to a specific situation. When studying the research problem through a case, the context is taken into account, and the local groundedness makes it possible to create knowledge about and understand the underlying and non-obvious issues (Miles, Hubermann & Saldana, 2014, p. 11). Though qualitative studies can inspire other researchers to create similar studies in the same or different contexts, qualitative studies are not possible to repeat (participants will not say the same words in new interviews, for example) or measure independent of context. Therefore, it is not possible for qualitative studies to achieve the same kind of reliability, validity and generalisation demanded of quantitative studies (Brinkmann & Tanggaard, 2015). As Corbin writes in the book *Basics of Qualitative Research* (Corbin & Strauss, 2008), quality in qualitative studies can be hard to define:

> As I search the literature, I find that everyone agrees evaluation is necessary but there is little consensus about what that evaluation should consist of. Are we judging for “validity” or would it be better to use terms like “rigor,” “truthfulness,” or “goodness” or something called “integrity” when referring to qualitative evaluation? Then there is the question: can one set of criteria apply to all forms of qualitative research? The notion of judging the quality of research seemed so clear before postmodernist and constructionist thinking pointed out the fallacies of some of our ways. Now I wonder, if findings are constructions and truth a “mirage,” aren't evaluative criteria also constructions and therefore subject to debate? The problem of how to assess qualitative research has not yet been solved (p. 297).

Later in the book, Corbin has this to say:

> I still believe that qualitative research is both a “scientific” as well as a “creative” and “artistic” endeavour, and that “quality” of the final product (findings) will reflect both these aspects [...]. Elegant and innovative thinking can be balanced with reasonable claims, presentation of evidence, and the critical application of methods (527–528; please note that the authors Corbin refers to has been removed in this citation for clarity).

Corbin thus sums up the debated and difficult issue of how to create honest and thorough qualitative research by pointing out the difficulty in setting criteria; this is a challenge, for example, in data collection, selection, analysis and dissemination (Bryman, 2012, p. 389; Creswell, 2013; Kvale & Brinkmann, 2009, p. 290; Marshall & Rossman, 2014). But she also expresses doubt about whether qualitative research findings are constructed illusions, and she ultimately believes that our findings are not merely scientific but also innovative and creative. These are particularly important considerations in design research projects in which the researcher contributes as both researcher and designer. Lincoln and Guba (1985, as cited in Marshall & Rossman, 2014) exchanged the quantitative quality concepts *reliability, validity* and *generalization* with the concepts *credibility, dependability, confirmability* and *transferability;* according to Kvale and Brinkmann (2009, p. 271), Lincoln and Guba's concepts can be regarded more valid quality concepts to strive for in qualitative research. But the debate on how to assess quality and what concepts to use when evaluating qualitative research remains.

One way to ensure reliability in qualitative research studies is to create and ensure transparency in the research process (Creswell, 2013; Kvale & Brinkmann, 2009). The aim when evaluating research quality is for the reader to be able to "look over the shoulder" of the researcher; the road from the study's design to its performance, analysis and results must be transparent (Brinkmann & Tanggaard, 2015). In qualitative studies, the researcher should make clear how she or he has gathered and processed data systematically and adequately. To make the research process transparent for the reader, the researcher must also provide insight into his or her own skills and presuppositions for the study. Transparency also encompasses providing insight into the various stages of the research process, from including a detailed description of the data collection (selection of informants, documents and focus points in participant observations) to describing the analytical strategy and process (clarifying the choices the researcher has made in the analysis of the data) (Brinkmann & Tanggaard, 2015; Bryman, 2012; Justesen & Mik-Meyer, 2010).

Since DBR is a research approach that does not only investigate "what is" but also the future "to be" (section 4.6.1), the objective of design research or design-based research is different from that of traditional empirical research. The strength of theories developed through DBR comes from their grounding in specific interventive experiences, and their explanatory power through the logic of process-oriented explanations (Reimann, 2011). Therefore, DBR has its own standards applying to the evaluation of quality in DBR studies. The goal of DBR is the generation of new, useful theories (Edelson, 2002, p. 118). Therefore, two important evaluation metrics for DBR are *novelty* and *usefulness*; DBR should create new learning or learning design theories that have utility for resolving important problems, corresponding to the normative and value-based pragmatic paradigm. According to Edelson, a design research theory is convincing if it is internally consistent and "accounts for the issues raised during the design and evaluation process" (Edelson, 2002, p. 118). Along with these DBR quality criteria (Edelson, 2002), Kvale & Brinkmann (2009, pp. 283-284) argue for a "pragmatic validity" concept, that is, the validity for the users in the research project. They assert that this concept represents a stronger knowledge claim that reaches beyond bare communication and dialogue. Pragmatic validity requires acting on the research analysis and results: "Action speaks louder than words." This kind of research follows its own validity criteria with action behind the research. This can be accomplished in a DBR approach by making the research process transparent and by examining the plausibility that the new processes and developed theories have created value for the users as a means to validate the research. Pragmatic validity can therefore be an additional consideration in judging the quality of qualitative research.

This study relied upon pragmatic validity, logical process-oriented explanations for creating theory, and transparency in methods and research processes in judging research quality. The study also applied Creswell and Miller's (2000, pp. 124-129) validation strategies to ensure transparency in relevant areas: researcher reflexivity, prolonged engagement and persistent observation, triangulation, peer review or debriefing, clarifying researcher bias, member checking and rich, thick descriptions. These concepts will be discussed in relevant areas of the thesis and have been applied and chosen with the intention of supporting the validity of the specific methods used to investigate the research question in this study (Cho & Trent, 2006).

5.4. MIXED METHODS AND DBR

Design research is recommended when there are no available "how-to-guides" and when a solution to the open problem will lead to significant advances in learning. *Open problems* are characterised by an initial state that is unknown or unclear, a goal state that is unknown or unclear, and "operators to move from initial state to goal states are unknown or how to apply the operators is unclear" (Kelly, 2013, p. 76). The initial problems in the PhD project can be characterised as open problems; the specific problems clarified in the research project's initial investigations had been difficult to solve for the three actor-groups (for example, lack of competences, time and structure to re-design and develop motivating learning designs for the hybrid synchronous learning environment). Given these open problems, the development direction had to be open as well in order to match the research approach to the research problems. This called for corresponding research methods. The project used multiple methods, including interviews, observations, surveys, workshops, co-design and document analysis. The primary techniques used were from the traditional qualitative domain (Brinkmann & Tanggaard, 2015; Bryman, 2012; Creswell, 2014; Kvale, 2007).

This study used an emergent mixed methods design (Creswell & Clark, 2011, p. 54), as is common in DBR (Brown, 1992; Reimann, 2011). The interventive research project's open approach allowed for taking new directions, and this demanded different kinds of research methods in the different phases of the project. Since these phases emerged throughout the project, the ability to select the most appropriate method to answer the research question in the specific context and with the current purpose of the ongoing study was relevant (Frederiksen, Gundelach & Skovgaard Nielsen, 2014). This mix encompassed a variety of qualitative methods, but also a mix of qualitative and quantitative methods. Mixed methods can be considered "multiple ways of seeing and hearing" (Creswell & Clark, 2011, p. 2), indicating that this mix will add value, as it provides opportunities to view the investigated case from different angles, presenting an opportunity to use method triangulation (Brinkmann & Tanggaard, 2015).

In mixed methods, there has been a debate about whether the quantitative methods relating to a more positivistic paradigm collide with the qualitative methods from the constructivist worldview when combining qualitative and quantitative methods in a research project (Brinkman & Tanggaard, 2015, p. 202; Morgan, 2007). This is an ongoing debate, but the mixed methods approach can be argued for within the pragmatic paradigm (Bryman, 2012; Creswell & Clark, 2011; Morgan, 2007). One of most used arguments for this approach is thus pragmatic, arguing that it is more important to take an empirical perspective for choosing the best methods through the research project's various emerging phases (Frederiksen, Gundelach & Skovgaard Nielsen, 2014) than accounting for the paradigmic foundation. However, Morgan (2007) argues for a combination of qualitative and quantitative methods in a sequential fashion "where the inductive results from a qualitative approach can serve as inputs to the deductive goals of a quantitative approach, and vice versa" (p. 71). This is also how the qualitative and quantitative approaches have been used in this study. Morgan (2007, pp. 72–73) finds it useful to think about qualitative research as research that emphasises an "inductive–subjective–contextual approach" (often with a small group of informants); whereas he believes that quantitative research emphasises a "deductive–objective–generalizing approach" (often with more informants and with the aim of creating knowledge that is generalisable and representative for the studied population). "Where we encounter problems is by treating these broad tendencies as absolute, defining characteristics for these two different approaches, and these problems become even worse when we deny the possibility of working back and forth between the two extremes" (Morgan, 2007, p. 73). But with a pragmatic, abductive approach – the result of going back and forth between inductive and deductive methods – by converting the observations into theories and then evaluating those theories through action in the research process, pragmatism and mixed methods match each other.

5.5. SAMPLING PARTICIPANTS AND SITES

This research project investigated an innovative hybrid synchronous video-mediated teaching and learning environment and the three actor-groups working or studying in this environment. The site and the participants were chosen based on their exemplification and representation of dimensions of interest according to the research area; this is traditionally termed *purposeful and typical sampling* (Bryman 2012; Creswell, 2014). The participants were selected based on their affiliation, either as students or through their employment, with VUC Storstrøm's Global Classroom. The research project took place at two sites: a department in Nykøbing Falster and a department in Næstved in Denmark, both of which offered a full-time upper secondary education for adults in the Global Classroom learning environment. The participating IT-Pedagogical personnel and administrators were employed by VUC Storstrøm in these departments. The teachers who participated in the interviews, observations and workshops were asked if they would like to participate in a competence development research project concerning the Global Classroom, and the teachers who accepted were chosen.

Within qualitative research methods, triangulation and data triangulation represent two recognised ways of ensuring validity, aiming at greater confidence in the findings (Bryman, 2012, p. 392; Creswell, 2013; Patton, 1999). A researcher uses several methods (for example, different data sources) to enhance a survey's credibility. The term *triangulation*, taken from land measuring and navigation, means to determine the exact position. *Method triangulation* means to examine the same phenomenon by means of various methods; for example, by combining interviews and observations with surveys, as has been done in this project. *Data triangulation* means to use multiple data sources (for example, multiple informants and informant groups) and to use data from different time intervals (longitudinal studies) (Bryman, 2012; Creswell, 2014). Choosing to study all three actor-groups – students, teachers and administration – made it possible to triangulate how the learning designs in and around the hybrid synchronous learning environment were experienced by the three actor-groups, providing valuable information about their multiple perspectives. At the same time, as this was a DBR study, it was possible develop the innovative learning designs for all three actor-groups based on this data.

This project has lasted almost three years, and therefore it has been possible to conduct a longitudinal study and test the validity and sustainability of the findings. The actor-groups were interviewed and observed over three years, and the surveys were conducted multiple times as new classes started using the hybrid synchronous environment. The workshops were conducted several times with multiple iterations, and the study has thereby overcome one of the challenges of short-term DBR projects: not leaving time for sufficient refining iterations (Anderson & Shattuck, 2012). Furthermore, the data collection was done at two sites, with smaller tests at other sites (a public school and a university), therefore there has been a data triangulation in the sense that two different audiences were interviewed and tried out and developed the new learning designs, making it possible to specify whether certain conditions and their underlying processes change over time and given the different participants (Yin, 2014).

5.5.1. GAMIFIED LEARNING: AN EXTREME CASE

It is possible to create deep knowledge about the problem area by choosing specific context-dependent cases (Yin, 2014) and studying learning processes in their real environment learning ecologies. In this research project, a number of cases and learning situations were studied. The studies were conducted as observations of students and teachers as they performed their daily practices in the Global Classroom. All three actor-groups were interviewed, and there were numerous (more than 250) occurrences of informal conversations. Along with this, competence development workshops for the teachers and game design workshops with the students and teachers were arranged. Finally, the research project studied and planned what could be regarded as an extreme or unusual case, one which could be said to deviate from theoretical norms or everyday occurrences in the classroom (Yin, 2014): the researcher proposed a new gamified learning design for students in the Global Classroom. After studying the teachers' more or less traditional and/or innovative learning designs, and inspired by emerging themes in a teacher workshop, the researcher developed the new learning design in order to experiment with and create motivating learning experiences for the students. This design was more challenging than learning designs teachers had previously tried. But according to Flyvbjerg (2006),

> When the objective is to achieve the greatest possible amount of information on a given problem or phenomenon, a representative case or a random sample may not be the most appropriate strategy. This is because the typical or average case is often not the richest in information. A typical or extreme case often reveals

> more information because they activate more actors and more basic mechanisms in the situation studied. In addition, from both an understanding-oriented and an action-oriented perspective, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur. Random samples emphasizing representativeness will seldom be able to produce this kind of insight; it is more appropriate to select some few cases chosen for their validity (p. 425).

In the case of the Global Classroom, participants and project managers were able to experience the learning trajectories and learning designs that can emerge within this hybrid synchronous setting. An unusual case can help project participants "learn by doing." The lessons learned from the gamified learning design for the students, described in Articles C and D, can generate knowledge about what is possible in this learning environment. This extreme case made it possible to focus on potentials and help break the barriers of the Global Classroom while providing interesting answers to the question of what was needed to develop motivating and activating education.

5.6. COLLECTING DATA

Given the nature of the research focus and questions, it is vital that the empirical data provide insights that deepen comprehension of the utterances and actions (the sayings and doings) and the arguments behind them. Consequently, the study employed mixed methods in the research to investigate how the three actor-groups experienced the hybrid synchronous learning environment and how the DBR experiments contributed to answer the research question. These methods included audio- and videotaped utterances and observations of teachers, students and administrators that took place in the described workshops and in other formal and informal meetings. Data was also gathered from questionnaires. The various empirical phases are listed in Table 7. in the Appendix A.

5.6.1. THE OBJECT OF ATTENTION

My participation in at least 250 formal and informal meetings, interviews, observations and workshops with representatives of the three actor-groups from VUC Storstrøm can be characterised as fieldwork. In fieldwork the researcher aims to understand and generate knowledge about the driving forces of social life (Hastrup, 2015, p. 58; Kristiansen & Krogstrup, 2015). The researcher, through *disciplined attention*, has the opportunity to gain insight into the specific circumstances and ways in which people act – ways that may be obvious within their life-world but less obvious to the researcher. The observations take place in the tension between the individual and the social community in order to unravel the relationship between the unique and the general about society at different scales (Hastrup, 2015). In fieldwork the concept of disciplined attention should be understood in the way that the researcher acts first out of respect for the research field's traditions and analytical concepts. Then the researcher turns towards the direction in which her attention is pulled. But what characterises and determines what your attention is pulled towards? In his book *Camera Lucida,* Roland Barthes ([1980]2004) described his ideas on what makes a photograph, or a detail in a photograph, stand out. These thoughts can be transferred to how objects can catch the researcher's attention in a research study. Barthes describes two phenomena that exist side by side and determine whether the observer will perceive a specific interest: *Studium* and *punctum*. *Studium* are the things about the site (or photograph) that we are familiar with – things we recognise and are able to conceptualise or name. *Punctum* are the things of a site or phenomenon that stand out – things we cannot name, things that puzzle us. The punctum can change the whole perception of the studium and is what makes us wonder (Barthes, [1980]2004). The punctum can be the thing that determines what we choose to follow in our study; this can be experienced in the situation with the participants, in the transcription phase of the data or in the final analysis. This kind of observation can lead to the development of new concepts or descriptions of learning trajectories that work in ways that puzzle us because we have not seen them before, or we have not seen them from this particular analytical view.

One of the characteristics when observing the field is that when we attempt to describe the research object, it will change shape in the process. For example, when I had conversations and conducted interviews and workshops with participants, the questions and discussions about new ways of understanding matters sometimes altered the participants' own views in the process. The border around the object of research is fluid, and the researcher should be aware of this in her methodical reflections (Alvesson & Sköldberg, 2009; Hastrup, 2015). In this DBR project, part of the intention has been to deliberately change the studied object – to create pedagogical innovation at VUC Storstrøm. There has therefore been an initial phase investigating "what is," and a twofold objective has followed this: to investigate "what is" and "what will be" for the future.

5.6.2. ASKING THE PARTICIPANTS

"The research interview is an inter-view where knowledge is constructed in the inter-action between the interviewer and the interviewee" (Kvale, 2007, p. 1). In interviews it is possible to hear about the participants' meanings and experiences and unfold their views on the world. But the researcher also interplays as she chooses the subject, critically follows up on the answers, asks for specific details and decides in which directions the interview goes. Therefore, the interview is an exchange of views between two persons discussing a subject of common interest (Kvale, 2007). The knowledge that is built through the interview is a combination of everyday knowledge and systematically examined knowledge. According to Kvale, "the interview is a powerful method of producing knowledge of the human situation" (p. 9) that can contribute to understanding the human situation and managing human behaviour. Therefore the project has used interviews to develop knowledge.

The interviews were designed from theoretical and empirical considerations about what needed to be discovered through empirical studies to answer the research question. The project developed interview guides for the interviews and workshops (Brinkmann &

Tanggaard, 2015; Brymann, 2012; Justesen & Mik-Meyer, 2010). These guides were based on themes from theory and previous empirical analyses.

The qualitative one-on-one interviews and group interviews with the three actor-groups took place with open questions and semi-structured interviews (Bryman, 2012). This open and explorative approach allowed the participants to bring up topics, angles and ideas and thereby provide knowledge that was not immediately planned for in the interview guide (Bryman, 2012; Kvale, 2007). In the preliminary interviews with the teachers in Spring 2013, I had prepared and asked similar questions for all four teachers. Each interview was individually formed, however, and enabled each teacher to come up with new relevant themes within the research area of relevance to the research project. These questions were explorative as well as informed by theory. For example, previous research had found that "though the use of technology seems promising, research shows that the teachers lack an established practice and support when navigating in the many new opportunities within educational IT" (Chapter 1). Therefore, the four teachers in the first semi-structured interviews were asked, "How has your cooperation been with the other teachers who teach in the Global Classroom? Do you talk and exchange experience? Do you have a procedure, and could you see benefits in having a practice for exchanging experiences?"

The project used theoretical sampling; new data was selected on the background of emerging theories/initial findings by considering such questions as "Who do I need to ask, or what kind of interventions would be interesting to carry out, to learn more about these issues?" For example, the first investigations found that, according to some of the students, certain teachers did not give enough attention to students participating from home, which made the students feel left out of the teaching situation (Weitze & Ørngreen, 2014). To investigate the teachers' perspective, surveys were created that asked all of the teachers, "Do you do anything special to give the students at home attention?" and "Must the students sitting at home do something additional in order to take part and get attention compared to if they sit in class?" A student survey investigated the general experience of students by asking, "Does how much attention students receive in class and at home differ from teacher to teacher?" and "Should you do more to take part and get attention when you sit at home compared to when you sit in class?" Both students and teachers were asked to come with suggestions or comments to the questions. These questions enabled an investigation of the theoretically and empirically defined concepts together with the participants (Andersen, 2008; Bryman, 2012). The answers for these questions then informed and contributed to the design of the workshops with the teachers and students, with the aim of developing new methods to approach the experienced problems. This is an example of how the use of mixed methods can be a contributing factor to the development of knowledge through the research project; it is also an example of methods and data triangulation. This project used data triangulation in three senses: 1) between the teachers and students, 2) between teachers and students at two locations; and 3) by using data from different time intervals (longitudinal studies). Certain questions, such as "What are your experience about teaching and learning processes in the Global Classroom?" were asked throughout the three-year study, making it possible to compare data over differences in time and actors, and before and after interventions.

5.6.3. PARTICIPATORY DESIGN: CO-DESIGN

“In design-based research, all participants are immersed in the setting and work as collaborators or co-constructors of the design” (Wang & Hannafin, 2005).

Participatory design (PD) was developed in Scandinavia in the 1960s and 70s (Sharp, Rogers & Preece, 2011). In PD, the users have a role as co-designers, which gives them the opportunity to contribute with valuable design suggestions (Sharp et al., 2011). Sanders and Stappers (2008) define co-design as “the creativity of designers and people not trained in design working together in the design development process” (p. 6). To involve the users in the PD/co-design process, the designer/researcher can organise a workshop, for example, where users (teacher/students/administration) are presented with different materials and asked to come up with ideas for the specific design. In the present study, two kinds of workshops were organised with two of the target groups: students and teachers (the project also conducted workshops with the IT-Pedagogical personnel and the administration). The findings and ideas resulting from the workshops were continuously analysed and used to inform and inspire the iterative design process (Blomberg, Giacomi, Mosher & Swenton-Wall, 1993). With co-design, users have the power to participate in the development because they are the future users of the product.

In the project, the aim was to involve the users in all the phases (Anderson & Shattuck, 2012), which included 1) the initial exploratory and problem-defining phase, investigating what the issues about teaching and learning in the Global Classroom might be; 2) the co-design, implementation and assessment of a pedagogical innovative competence development tool for the teachers, in several iterations; 3) the co-design and assessment of a gamified learning design for letting students develop their own digital learning games in the Global Classroom setting in several iterations; and 4) users validating the designs during the various iterations. Thus, the research design can be regarded as being a participatory or co-design approach (Sanders & Stappers, 2008).

5.6.4. WORKING WITH THE PARTICIPANTS

The final learning game design workshops in Spring 2015 are another example of design and data collection in a research situation. In the first workshop with the two teachers, I had prepared some introductory exercises to help them understand the learning game design concept. These exercises were based on findings and lessons learned from the game design experiments in Spring 2014. I video recorded this workshop and also used a software program (AudioNote, 2016) with a dual function of field note-taking and audio recording, allowing a researcher to record audio and add written transcription later. Audio and transcript are linked together, making it easier to relocate significant observations. The workshop was conducted as a combination of short instructions, followed by the teachers’ game development. While this took place, we had informal talks combined with semi-structured interview questions about the following: the teachers’ prior knowledge of learning games, their ideas and thoughts about how students could use this kind of learning design, their reflections about what would be important to consider for this target group, their experiences working in the Global Classroom environment, and their learning goals for these workshops. The semi-structured questions for the teachers were also based on the problematic part of the findings from the previous game design workshops; for example, asking for suggestions and emphasising how the teachers could contribute to create deep learning processes in this gamified design. The data collected from this workshop was then used to inform the design of the first workshop for the students. For example, based on their suggestions, the teachers were given access to all of the students' game design documents in Google Docs, enabling at-home students to participate on more equal terms and allowing the teachers to follow their progress. The teachers also decided to move one of the groups that had students participating from home to another classroom, giving them better working conditions.

The three student workshops were videorecorded and audiorecorded. I also took field notes, and a tape recorder was placed at each of the five teams' tables to record what was said. This added up to 75 hours of data from these three student workshops alone. This could be seen as an example of "over-methodologisation" (Dede, 2004). But because I participated in all the workshops in the Global Classroom, I had an overview of what happened within the teams. I listened to the ongoing conversations, watched the development of the learning games and then noted when conversations or materials caught my attention. This allowed me to return to that time and place in the recordings and transcribe that part. In the three student workshops, I held informal conversations with both students and teachers to hear about how they developed the games and their experiences of learning and motivational processes in this context. This was combined with surveys that asked questions about learning and motivation. At the end of the last student workshop, I conducted semi-structured interviews with each team to hear and learn from their experiences with this learning design.

I was also able to follow some of the teacher-initiated student reflections in Google Docs describing to what extent the students felt they reached the learning goals. I interviewed the teachers after each workshop to hear their evaluations of the students' learning and motivational gains and to get ideas about altering the design, but also to hear about what specific aspects we had to take into consideration when creating a design like this in the Global Classroom.

The co-design processes with the users can be seen as a mutual learning process in which users participate in, learn about and give feedback on the design while the designer learns about the context and the users. Therefore, these co-design processes not only contributed to knowledge for the research project, but at the same time contributed to the teachers' competence development.

5.6.5. OBSERVING THE PARTICIPANTS

Observation is a research approach that aims to generate data about non-verbal behaviour (Kristiansen & Krogstrup, 2015). Nonverbal expressions can include gestures, facial expressions and the way things are said (Borghäll, 2007). Observation was a significant part of this study, as the study examined teachers' and students' presence and interactions in the Global Classroom and the perceived phenomena in this connection. Examples of observations include the silent waiting time as teachers and students waited for the videoconference equipment to work, causing the concentrated teaching-flow to break down; or the unmotivated student lying with his arms and upper body across the table, signalling that the teacher had conducted monologue-based teaching for too long to keep his attention.

The project also provided an opportunity to compare participants' actions with what they reported they did, and perhaps thought they had done, through observation (Blomberg et al., 1993, p. 130). As interview participants are generally friendly people who wish to collaborate, it is important to take into account a tendency to want to "make the interviewer happy" (Schwarz, 1999) with their answers. Also, some of our daily actions can be partly unconscious to us. Therefore, observation can be a useful addition to interviews, as the participants' actions and expressions can help to uncover their attitudes and opinions.

My observations in the Global Classroom took place both inside the brick-and-mortar classroom and remotely, under the same conditions as students participating from home. By observing from both classroom and my own home, I was able to experience barriers and opportunities at each site. Participating from home, I experienced what happened if a teacher forgot to turn on the "share" function: students at home could not see the teacher's slides or smart board illustrations. But I also experienced the advantages of participating in class from home: I did not have to travel for three-and-a-half hours to the school from my home. This gave me an understanding of the participants' perspective and their non-verbal and verbal expressions (Brinkmann & Tanggaard, 2015).

5.6.6. DOCUMENTS AND OBJECTS AS EMPIRICAL DATA

The documentation of the empirical studies was carried out using field notes, audio- and videorecordings and photos. During the research project, I kept a logbook and created files with the field notes, memos, pictures, interview guides, test plans, transcriptions and other documents that were collected and interpreted during the study. Along with the documented interviews, surveys and observations, many types of data were part of the PhD project. Therefore, the use of different types of analysis to interpret these data has been appropriate. The bulk of the data consist of audio- and videotaped interviews and observations, as well as questionnaires. But the participants (students, teachers and administration) also created many artefacts that were analysed, in interactions and afterwards, to inform the research process. Figure 10 shows examples of artefacts used or created in the research process.

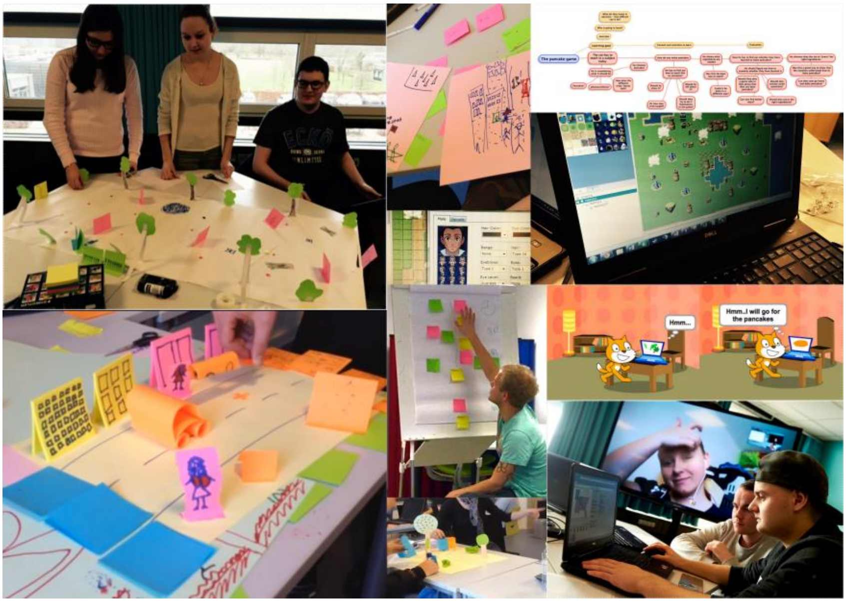


Figure 10: Artefacts from the research process with the students.

In the project research procedures, interpretations and understandings were documented closely using research journals and field notes. This made it possible to use the relevant available documentation for altering decisions about the design (Wang & Hannafin, 2005). For example, in some of their competence development workshops, teachers used a digital tool, the “Learning Designer” (2016; Figure 35), to document and discuss their learning designs. This contributed the knowledge that teachers could benefit from using a digital tool with specific characteristics and not just the website and Learning Management System (LMS; Fronter, 2016) they had previously used in their planning of new learning designs.

5.7. THE RESEARCHER’S ROLE – ANCHORING THE RESEARCH PRACTICES AND MAKING THEM SUSTAINABLE

In the research process, I observed, interviewed and designed, but I was also teaching in the sense that I planned and led some of the initial workshops. This planning was done on the basis of the preliminary interviews and observations. My active participation in the workshops calls for close attention to my role and awareness of the possible danger of biasing the research, but at the same time, this participation has made it possible for me to observe, analyse, create new theories in a real world context and share these theoretical inputs with the teachers in the successive iterations. I monitored and attempted to counteract this bias in various ways. For example, I became increasingly concerned with making myself “expendable.” In the workshops with the teachers, an IT-Pedagogical employee participated in order to develop competences so that she could later start up new pedagogical innovative teams; in addition to this, the first teacher team was starting up a new team with the philosophy that this way of working could spread like “rings in the water.” In the student workshops, the learning design was improved in the second and third iteration so the facilitator and teaching role could be taken over by the teachers.

I have also been aware of the asymmetric power relationship between my role as a facilitator of the workshops and the participants’ role, even though the processes were co-design processes; this is because I had theoretical background knowledge and initiated and defined many of the tasks in the initial development phases (Dourish, 2006b). In a research project, the designer/researcher has the power to decide which theories, phenomena and observations will become part of the development process. Though the participants’ voices were heard, I nevertheless made many decisions in the framing of the process, which, taken together, have established a particular direction throughout the workshop processes; in this way, there may be a "bias" in the power relationship (Kvale & Brinkmann, 2009). The designer/researcher could be regarded as a kind of leader who both observes and decides which ideas will "find favour" in the design process. This “leading role” requires that the researcher evaluate the current problems and consider and motivate the user of the learning designs in the development process. Despite the researcher’s power to decide on the significant ideas and findings in the project, participants’ experience of the development and research process remains uniquely theirs. Participatory design is a way to empower users as designers in the research process (Ehn, 2008), and, according to teachers at VUC Storstrøm, they felt empowered both by participating in the development process and later, when using the new learning designs from the research project.

My practice as a researcher has been developed in the context of being in a *researcher community of practice* contributing to my knowledge about how to conduct thorough research (Duus, 2009). I have been trained in this community of practice by participating in supervision situations, discussion among colleagues, listening and discussing at conferences, through discussions with many foreign researchers on my three study trips and through the reflected inspiration and provocations I have experienced when reading academic literature. The experiences in these communities of practice, together with my own critical self-reflections, guided my habitus – my ways of conducting and evaluating what is a valid and reliable way of conducting research (Duus, 2009). In addition to the empirical studies on VUC Storstrøm, I had the opportunity to have dialogues and conduct interviews with researchers from universities abroad within the fields of online education, competence development for online teachers, use of games as a mean for learning, and more. This contributed to state of the art knowledge within the research area of the PhD project.

A DBR researcher has a responsibility to give something useful back to participants in the design process, and thus a responsibility to brief the participants both during and after the project. As with all major projects, there must be responsible decision makers on the project team so the new proposals can be tested and implemented (Cadle & Yeates, 2007). This can create a dilemma for the researcher when she must negotiate with organisational decision-makers (in this case, the administration) as well as core-users of the new practice (in this case, the teachers). Though I have been very conscious of this potential dilemma, it can be a difficult balance to suggest and test new practices if two actor-groups have different interests at stake.

My own empirical foundation (Please see CV) contributed to the overall concept development when I, on the basis of theoretical and practical experiential knowledge, made choices in the analysis of the collected material and in the development of the project design. I may have also made less conscious choices, based on my preconceptions, in deciding that “this” will be a truer and more interesting choice to make than “that.” The reliability and validity of the choices were therefore co-designed and tested with the participants. In the research project there was an emphasis on “member checking” – asking participants whether they had the same experience and could agree about the research findings (interpretations and results), and if they found the learning designs efficient and motivating. Participants’ reactions to the learning designs and learning processes that resulted from the research were solicited at different times and phases in the research process: in the problem formulation phase, in the co-design development phase, in debriefs of workshops or interviews before the next iteration of a workshop series, and in final interviews and questionnaires after a workshop series.

5.7.1. ETHICAL CONCERNS

Ethical concerns in the PhD project were taken into consideration in the following areas. Each time I started working with new participants, I informed them in advance about the purpose of the project, and I set an ethical frame by encouraging them to be frank and open, while explaining that it was important for me to ensure anonymity in connection with the reporting of the knowledge coming from the project. This was relevant, for example, when I interviewed participants from the three actor-groups who sometimes had different views about a particular matter. It was my experience that participants were trustful and honest when being interviewed and observed. The connection between the researcher and the participants can develop into a friendly relationship in a research project (Brinkmann & Tanggaard, 2015; Kristiansen & Krogstrup, 2015). Therefore, I was cautious in my communication with the participants to maintain a balance between respecting their privacy and taking care not to treat them merely as objects of research. I tried to talk to participants “at eye level” – from an equal position. I also tried to maintain a neutral position towards the three actor-groups in the research project – teachers, students and administration (Brinkmann & Tanggaard, 2015). This project involved a collaboration contract between VUC Storstrøm and the researcher, so all participating informants were aware that the experiments and interviews they participated in were part of a research project.

5.8. THEORETICAL AND ANALYTICAL APPROACHES

The following section describes what constitutes a theoretical concept how theory traditionally is created in DBR. Next, the roles of the concepts of *abduction* and *theoretical playfulness* are discussed as a creative contribution to theory development. This is followed by elaboration of how the theory development in the thesis has been supported by analysing the argumentative grammar of the students’ and teachers’ learning trajectories and also by creating analytic generalisation by testing the learning designs in other contexts with other users. Finally, the analytic approach *informed grounded theory* is described and exemplified.

5.8.1. WHAT IS THEORY?

Bacharach (1989) describes *theory* as a "statement of relations among concepts within a boundary set of assumptions and constraints. It is no more than a linguistic device used to organize a complex empirical world […] [T]he purpose of a theoretical statement is twofold: to organize (parsimoniously) and to communicate (clearly)" (p. 496). Theory formation in qualitative research can be seen as the understanding of invisible connections, which is the result of systematic and committed studies of actual facts (Hastrup, 2003). Theories will always be based on the researcher's construction or assumption about a subject matter that is being investigated (Alvesson & Sköldberg, 2009, p. 51). In qualitative research, theories suggest interpretations, express particular aspects of the world, and in this way add something to the world – they densify the empirical relationships into new material (Hastrup, 2003). Qualitative theory presents and conceptualises the already given, which has not yet found its expression, and in that sense, it is new knowledge that has then turned into a concept that can be discussed and taken into consideration. DBR researchers DiSessa and Cobb (2004) describe *theory development* in DBR as the development of ontological innovative theories, that is, "the invention of new scientific categories, specifically categories that do useful work in generating, selecting among, and assessing design alternatives" (p. 78).

5.8.2. THEORY CREATION IN DBR

The purpose of theory creation in DBR is to use design "in the service of developing broad models of how humans think, know, act and learn" (Barab & Squire, 2004, p. 5). Therefore, though it can be a difficult balance in a DBR project, the purpose of the project is both to find innovative solutions for the actors and to generate evidence-informed claims about learning "that address contemporary theoretical issues and further the theoretical knowledge of the field" (Barab & Squire, 2004, p. 6). It has therefore been the aim of this project to create models of *how we learn*, by creating learning designs that facilitate or enable this. The project also aimed to create value for the actor-groups as an additional pragmatic validation of the theories.

I have been inspired by the informed grounded theoretical approach (Goldkuhl & Cronholm, 2003; Thornberg, 2012) combined with *meaning condensation* (Kvale, 2007). In grounded theory, "the main objective of research is the generation of theory" (Alvesson & Sköldberg, 2009, p. 56) and "to generate theory that grows out of or is directly relevant to activities occurring in the setting under study" (Emerson, Fretz & Shaw, 2011, p. 167). This does not mean that verification of theory is neglected, but that discovery of theory is emphasised over verification of theory (Glaser & Strauss, [1967]2009). In grounded theory, the researcher begins with data, and her first loose concepts from data are developed through the collection and confrontation with new data by which new concepts and categories emerge. The researcher seeks to define categories of mutual relationships and examines whether the emerging theory is saturated (*theoretical saturation*) through the collection of further theoretical relevant data (*theoretical sampling*). This saturation process stops when new data no longer gives rise to the formulation of new concepts and categories (Creswell, 2014; Glaser & Strauss, [1967] 2009). There is, however, an ongoing debate on whether it is wise to start the research process without first consulting theory from the research area. As DBR generally starts from a theoretical outset, it is relevant to use an informed grounded approach that emphasises taking "advantage of pre-existing theories and research findings in the substantive field in a sensitive, creative, and flexible way" (Thornberg, 2012, p. 14). The reason for omitting theory in radical GT is the aim to collect and analyse data without a background in theory in order to have an open mind when constructing or discovering new concepts – to be a *tabula rasa* (Glaser & Strauss, [1967] 2009). But "there is a difference between an open mind and an empty head" (Dey, 1993, p. 63, as cited in Thornberg, 2012). As researcher, I have been open-minded towards the data material, looking for new patterns contributing to theory in the data. But I dispute the naive conception that it is possible to be a tabula rasa, uncoloured by the theoretical background, preconceptions and life-world in which I live. This would also be in opposition to what general learning theory believes – that unless we have never before seen the thing we are studying, we always learn by incorporating new influences into our existing knowledge structures (Piaget, [1952] 1965). I view theoretical background as a strength that helps inspire me to see new patterns and also prevents me from "creating" theory and methods for something that was already known.

5.8.3. ABDUCTION AND THEORETICAL PLAYFULNESS

In informed grounded theory, the researcher moves back and forth between induction and deduction, that is, between empirical and theoretical analysis. Critical and systematic thinking – being attentive to detail, reflexive and critical about emerging patterns – are central parts of informed grounded theory; such thinking helps the researcher evaluate whether an element provides support for the new concepts. But another important part of the research process is *abductive reasoning* (Thornberg, 2012). In abduction, the researcher discovers new ideas, concepts and explanations by finding the things that puzzle her and that cannot be routinely explained by pre-existing knowledge. She sees possibilities, establishes connections and asks questions (Charmaz, 2006). In abduction, the researcher goes beyond empirical data as well as pre-existing theory. This demands scientific creativity and is an innovative process whereby the researcher experiences new insight as she explores and tries to explain the new data by modifying and elaborating upon prior knowledge and putting old ideas together in new ways. The researcher writes some of these abductive hypotheses in her field notes or memos as they turn up as new concepts or emerging learning trajectories. The researcher then, in an open-minded way, seeks to identify issues and ideas by carefully sifting through and piecing together the memos – the documentation of the researcher's thinking process and theorising on the data (Emerson, Fretz & Shaw, 2011; Thornberg, 2012). The researcher remains open to other possibilities and gives serious consideration to processes and issues that become apparent as she reviews the data. Analysis and interpretation is a reflexive process for the researcher, who has to think about and compare the different signs and views and be careful and considerate in her interpretation and reflection processes (Alvesson & Sköldberg 2009, p. 9). Abduction can thus be used as a search strategy to suggest which road or "path through the exponentially explosive search space of possible explanatory reasons" we should first try to set out upon in our further inquiry (Schurz, 2008, pp. 203–204). Where Strauss and Corbin (1990, p. 27) see creativity as a means to name categories, generate questions and make free associations, Charmaz (2006) talks about how *theoretical playfulness* and openness to the unexpected "can lead you to see the novel in the mundane" (pp. 135–136) and expand the researcher's view of theoretical possibilities in data analysis. Thornberg (2012) suggests expanding theoretical playfulness to invite "extant theories and concepts in this playfulness, i.e. playing with them in new, innovative, creative and unorthodox ways during the constant comparison process" (p. 13). These descriptions of abductive reasoning and playfulness correspond to the important aspects of this thesis's theory generation process.

5.8.4. THEORETICAL GENERALISATION

The study was conducted with purposeful and typical sampling; participants were chosen based on their exemplification or representation of dimensions of interest according to the research area. The focus has thus not been to verify theories through the testing of a large representative number of participants. The project has instead aimed for "*application of the theory*, not asking whether the theory is true or false, but when it applies, and under what circumstances it works" (Alvesson & Sköldberg, 2013, p. 57). The argument for a new conceptual understanding will gain strength if can be explained in terms of more abstract conceptions of learning (Reimann, 2011). In DBR, the researcher traditionally analyses the relationships between specific activities and specific changes in students' or teachers' reasoning – the learning trajectories involving interactions and transactions between and among learners, teachers and elements, in processes and practices (Dewey, J. & Bentley, 1960; Elkjær & Wiberg, 2013). These causal connections are the underlying argumentative grammar of DBR that allows us to establish causality independently of generalisation (Reimann, 2011). By creating systematic and longitudinal studies, as has been done in this case, it is possible to document how each successive form of reasoning emerges as a re-organisation of prior forms of reasoning (Cobb & Gravemeijer, 2008, p. 87; Reimann, 2011). We can then compare across the different design versions, so it can be further recognised which elements in the learning design are contingent upon other elements, and which need to be changed for improvements in competence to occur (Nelson, Ketelhut, Clarke, Bowman, & Dede, 2005). Nevertheless, the new theories will still only be able to contribute with evidence *informed* value to the users' future practices – the use of the new theory will depend on the users, the context, their values and aims (section 4.1). Some quantitative researchers work with the concept *analytic generalisation* (Kvale & Brinkmann, 2009; Yin, 2014, pp. 40–41). The aim of analytic generalisation is to reinterpret the experiment or case to other concrete situations and reflect on how the generalisations from the new theory may potentially apply to a variety of situations beyond the original case (Yin, 2014). This study has developed theoretical models following the argumentative grammar of the students' and teachers' learning trajectories. The DBR experiment went through several iterations, allowing the researcher to follow which elements in the learning design were contingent upon other elements and which were necessary to change in order to meet the actor-groups' needs for new competences. This enabled saturation of the theoretical findings. The project also aimed to create analytic generalisation by testing the learning designs in other contexts with other users.

5.8.5. ANALYSIS, CODING AND INTERPRETATION

Analysis process

The project ran for three years, and though the analytic approach was generally the same, there were also variations guided by relevance for each analysis event. The procedure in the analysis was conducted in the following steps:

1) **Selection:** Selection of interesting transcription areas from field notes, photos, video- and audiorecordings. *Interesting* indicates that I tried to distinguish the general as well as the unique – what my attention was pulled towards (section 5.6.1). Since I was present in all data collection phases, I had a first-hand impression of all the data. This gave me an advantage concerning the selection of significant parts of the data.

2) **Transcription:** Transcription of the selected areas. A transcription will always be a "bastard" (Kvale & Brinkmann, 2009); that is, the transcription is somewhere between the spoken/acted and the finished meaningful summary of what occurred. It is therefore important to reflect on how to transcribe in order to describe the object/phenomenon of transcription in the best possible way. It is also important to give details about the context and non-verbal actions in order to provide a more complete description.

3) **Coding:** The project used coding of transcriptions - data-driven and conceptually driven (Charmaz, 2006; Creswell, 2014; Kvale & Brinkmann 2009). That is, inductive and deductive reasoning – bottom-up and top-down coding was used. The primary part of the coding process in the analysis was conducted as inductive or data-driven open coding, as in traditional grounded theory. Here, I basically looked for themes that could clarify the problem area. This encompassed a mix of line-by-line coding and incident-to-incident coding (Charmaz, 2006, pp. 50–54). Coding with these strategies implicitly encompasses comparative methods as the researcher compares one part of the data with a different part, or with a previous set of data from the research project. According to Charmaz (2006), "Coding means naming segments of data with a label that simultaneously categorizes, summarizes, and accounts for each piece of data" (p. 43). In the grounded theoretical approach, notes Charmaz (2006),

> Coding is the pivotal link between collecting data and developing an emergent theory to explain these data. Through coding, you define what is happening in the data and begin to grapple with what it means […] By careful attending to coding, you begin weaving two major threads in the fabric of grounded theory: generalizable theoretical statements that transcend specific times and places and contextual analyses of actions and events (p. 46).

Coding is, in other words, analysis; it is a deep reflection about the data's meaning and is thereby deep analysis and interpretation (Miles, Hubermann & Saldana, 2014). As theory emerged, I also used these new theoretical concepts when coding the new data to investigate whether the new data confirmed or changed the findings (in other words, if the concepts were valid); this is termed *theoretical saturation*. But I also used concepts from learning theories and learning design theories from my theoretical framework (Hiim & Hippe, 1997; Illeris, 2009) in my coding process when I examined whether the data revealed signs of learning among the participants. In this DBR project, I used my empirical findings as arguments in the development of the concept – naturally, with the condition that it make sense in the context of the existing concept.

Software for the coding process

I used the Nvivo (2016) software program to code most of the workshop experiments. This enabled me to get an overview of the large amount of transcribed data. The software made it possible to create many categories, and as the categories emerged, I could then move them into bigger categories in coding trees and, in this way, represent the hierarchical relationships between the themes I had identified. By using Nvivo, it was easy to find the strings of citations in the transcriptions that supported a new theme when I later cited them in articles or chapters. It was also possible to code a string of text into more than one category if it supported more than one theme. Besides Nvivo I also used other coding and categorisation approaches: coding trees, hierarchy charts and mind maps. By thoroughly coding all transcribed documents, it was possible to ground the analysis and the emerging themes in the empirical data. Besides the transcribed sayings and doings, I also coded my own field notes into the different categories, as well as relevant documents that supported or critiqued the themes. I created memo documents with my reflections on particular themes, and these were attached to the relevant citations or documents.

4) **Writing up:** The step from the coded transcriptions to the written findings was conducted as further reflections. Studying and comparing existing theories, descriptions of significant learning trajectories in the data as well as abductive reasoning made it possible to generate theory. For some of these abductive reflections, I used mind maps to map out the findings and generate empirical and theoretical themes. In grounded theory, the researcher often uses axial coding to uncover relationships between different categories. Axial coding consists of identifying relationships among the open codes to answer questions such as when, where, why, who, how, and with what consequences (Charmaz, 2006, pp. 60–61). For example, if the data reveals a problem, as with the statement, "it is difficult to create collaboration on equal terms for the students sitting at home and in class" (teacher in the Global Classroom), then the researcher can look for relationships by posing such questions as: "What seems to cause this problem? How do the teachers try to solve this problem? What are the consequences of this problem?" and so forth.

5.8.6. EXAMPLES FROM THE ANALYSIS: THICK DESCRIPTIONS AND MORE

Due to space constraints, examples from the analysis have been moved to Appendix B. In Appendix B1, there is a section titled “From transcription to article – Thick descriptions.” In the article format, word count is often limited. This makes it difficult to include many *thick descriptions* in the arguments in the enclosed articles and also in the thesis (Geertz, 1973; Gravemeijer & Cobb, 2013; The Design-Based Research Collective, 2003). Appendix B2, “Examples from the Analysis,” explains my work with induction, deduction and abduction, which included reading theory, collecting data, analysing, interpreting and creating DBR innovation proposals in the PhD project. The theory has been used together with the empirical findings as a “conversational partner – inspirer – mentor” in the research project. Therefore, the appendix includes examples of how I used the data in the articles. Appendix B3 includes examples of “Categorisation of problems for the DBR interventions.” This categorisation was elaborated upon in order to create a systematic contribution to the DBR experiments from the initial explorative empirical findings. Appendix A includes an overview of the research and concept development processes.

CHAPTER 6. THEORETICAL FRAMEWORK

This chapter introduces the theoretical framework for the PhD project. Since this is a cross-disciplinary project, Chapters 8–10, which investigate the sub-questions for the thesis, will introduce theoretical background that in the analytical phases were found to be relevant to these individual sub-projects. The present chapter is, however, a presentation of the general theoretical framework for the PhD project. This encompasses learning theory, learning design theory and theory about technology in educational settings.

6.1. LEARNING AS CONCEPT

Learning is fundamental to us all. An innate curiosity to understand phenomena we do not yet grasp makes us look for new meanings and answers drives us to learn (Bruner, 1966). Illeris (2009) defines *learning* as “any process that in living organisms leads to a permanent capacity change and which is not solely due to biological maturation or aging” (p. 7); in other words, learning is a lasting change. From a philosophy of science perspective, *learning theories* study the phenomenon of learning through both theoretical and empirical work in order to develop knowledge about what learning is, how we develop knowledge about learning, how we learn and how learning can be evaluated (Qvortrup & Wiberg, 2013). For the concept of *learning* to make sense, we have to learn *something*. This something that is learned can take the form of expertise, skills, understanding, insight, opinions, attitudes or qualifications. Moreover, there is always *someone* who learns *something.* In an educational organisation such as VUC Storstrøm, the *someone* learning can be the individual (teacher, student, administrator), the team (if the team, for example, agrees on a new way of seeing or doing things) and/or the organisation (if the organisation, for example, decides on a new visionary strategy or a new educational concept).

When someone learns something, there is a subject and an object; it is the acquisition of this *something* that is the element of learning (Illeris, 2007). However, epistemologies and learning theories debate the concepts of *subject* and *object* that are used to conceptually separate, identify and discuss the connection between the human being as a perceptive/cognitive being and the object of the human cognition. Does our ability to *perceive* influence what the reality is, and can we change reality by participating in it? Or are we already part of reality, and therefore it does not make sense to separate individual and reality? It is always worth considering the connection between the way man perceives/acknowledges reality and the way reality is presented to man, as this will influence, and be reflected in, our chosen learning theory when it describes how and what we learn, and how we create knowledge (Qvortrup & Wiberg, 2013, p. 55). Another relevant question regarding learning theory is this: Are the learning processes self-regulated cognitive construction processes or social processes in interaction-based communities? Learning theories of today, have moved towards describing learning processes as construction processes in the individual (Kolb, 1984; Piaget, [1968] 2006), in the social community (Vygotsky, 1980; Wenger, 1998) or in both places (Dewey, [1933] 2009; Illeris, 2007; Sfard, 1998), resulting in change processes in the individual, the social or both. Additionally, depending on the choice of learning theory, our learning processes are then regarded as more or less dependent on the context and situation.

As we learn, we are creating knowledge. But knowledge is understood and conceptualised in many ways by various learning theorists; it is a complex and dynamic phenomenon. For example, there are many spectrums of knowledge, from *knowing that* (knowledge as essence; a kind of firm knowledge or passive knowledge) to *knowing how (*knowledge as ability; as a competence or something practice-oriented you are able to do). Knowledge can be tacit (non-spoken) (Polanyi, 1966) or explicit (spoken). Knowledge occurs not only in a completed form, but also in an ongoing development, and therefore knowledge processes and knowledge emergence are just as important as knowledge products and the ability to gather as much knowledge as possible (Illeris, 2007; Qvortrup & Wiberg, 2013, p. 37). This can also be described as the difference between a more *static* and a more *dynamic* knowledge view; *dynamic knowledge* can be seen as more of an analytic ability – not looking for a specific correct answer, but a knowledge that enables developing or identifying solutions. "[T]he permanence of having gives way to the constant flux of doing" (Sfard, 1998, p. 6). A more static kind of knowledge can be seen as representing the past, and a more dynamic kind of knowledge will be actualising the future (Qvortrup & Wiberg, 2013). To elaborate on how and under what circumstances learning generally best takes place, this project used Knud Illeris's general learning theoretical model, which will be described in the following sections (Illeris, 2009).

6.2. GENERAL LEARNING THEORY

The Danish learning theorist Knud Illeris developed a general learning theoretical model of how learning takes place that encompasses two basic processes and three dimensions of learning (Illeris, 2007, 2009). The two processes are

1) The internal psychological process of elaboration and acquisition; and
2) The external interaction process between the individual and the social, cultural and material environment (Illeris, 2009, p. 8).

Many learning theorists believe that learning takes in one of two process: the individual/acquisition learning process and the social/participation learning process. But Illeris (2009) combines these processes. As Anna Sfard (1998) concluded, we need to consider both metaphors for learning in order to provide a more complete description of the learning landscape. Illeris thus emphasises that both cognitive learning theories and social learning theories are relevant in order to be able to describe learning processes and to develop/facilitate them. Further, both processes must be active for learning to take place. That is, we are constantly in interaction with our social and material environment, and learning happens through this contact (Figure 11).

At the same time, an internal learning process takes place in the learner: the inner psychological acquisition process, which occurs as content is acquired (Piaget, 1968). For this individual learning process to take place there must be interplay between the function of managing the content and the incentive function. The incentive function has a direction, a desire, a focus and a motivation to learn in order to provide and direct the necessary mental energy to run the learning project (Illeris, 2007). The two processes, *acquisition* and *interaction,* are part of the three dimensions of learning (content, incentive and interaction dimensions) (Figure 11).

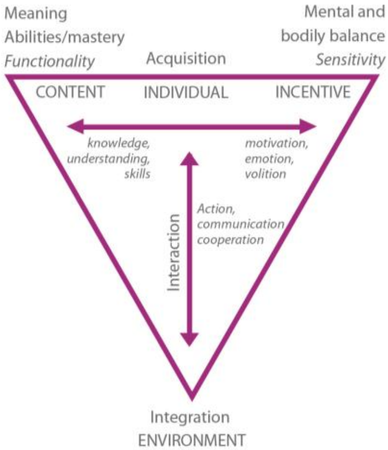


Figure 11: Three dimensions of learning and competence development (Illeris, 2009, pp. 9-10).

The *content dimension* deals with what is learned by someone. From this point of view, the learning always has both a subject and an object. The content dimension typically concerns knowledge, understanding and skills, but may also encompass meaning, insight, attitudes, values, methods, strategies, opinions, and more. Through this dimension, the learner will develop what he knows, understands and can do (Illeris, 2007). The learner tries to achieve mastery and to make sense in the learning situations by constructing meaning and ability to deal with the challenges of practical life, and thus develops personal functionality.

The *incentive dimension*, or the driving force, is the mental energy necessary for the learning process to take place; this encompasses such elements as motivation, feelings, emotions, volition and the *will to learn*. We have a need to be in emotional and physical balance (Illeris, 2007). It may be uncertainty, curiosity or unmet needs that make us seek new knowledge, understanding or skills. In this search or this learning process, we wish to restore the balance while at the same time developing our sensitivity in relation to the outside world and ourselves (Illeris 2007; Qvortrup & Wiberg, 2013, p. 430).

The content dimension will always be influenced by the incentive dimension, since the result and quality of the learning process will depend upon whether it is driven by the desire or interest to learn or is a result of necessity or compulsion. Conversely, the interest and will to learn will also be influenced by what content the individual will learn. Therefore, there is a strong connection between the cognitive and emotional (Illeris, 2007, 2009; Vygotsky, 1980).

The *interaction dimension* deals with the individual's interaction with both the material and social world. In this dimension, action, communication and cooperation are in focus, both in relation to the close social world and to the overall societal level. Here, the individual's integration in the community and society and his or her ability to engage in meaningful interaction with other people are developed. These social learning processes may include participation, imitation, demonstration, activity, experience and perception.

Theoretical models for learning can be used for analysis and for facilitation of learning. Therefore, to create valuable learning situations, we have to design for, and subsequently look for, signs of learning within the individual, collaborative and motivational learning dimensions. According to Illeris (2007), it is practically impossible separate the three dimensions, because all learning takes place as an integrated process; but by separating the three areas analytically, it becomes possible to dive deeper into the nature of learning. In the following sections (6.2.1-6.2.3), each of the three dimensions of learning will be discussed.

6.2.1. THE CONTENT/ACQUISITION/COGNITIVE DIMENSION OF LEARNING

The content or cognitive dimension of learning can be regarded as the basic foundation for learning, since all kinds of learning have a skill or meaning as content. To explore the content learning dimension, or where the inner psychological acquisition process takes place, we include Jean Piaget.

The Swiss biologist, psychologist and cognition theorist Jean Piaget has had great influence with his learning theory. Piaget is considered a constructivist, which means that he believes that we construct our understanding of the world through learning and cognition (Illeris, 2000, p. 26). Knowledge is therefore not outside of ourselves; it is something we construct inside ourselves. Piaget’s subject field is the cognitive side of learning, and his theory, learning can be described as an equilibrium process. According to Piaget, equilibrium is maintained through a continuous process of adaptation to the environment. The individual adapts to his or her surroundings in a simultaneous quest to adapt the environment to his or her own needs. Piaget uses the abstract general concept of *scheme or mental pattern* to describe a mental model of a changing and dynamic reconstruction of reality (Kauffmann, 2013). Piaget thus regards the inner psychological acquisition of learning as a process in which the individual builds up *mental schemes* or structures (Piaget, [1952]1965). The metaphor *schemes* should be understood as memories, knowledge, understanding and interaction potential in relation to the present issue (Illeris, 2007). Piaget describes the state in which we learn a thing for the first time as a *cumulative learning* process. In addition to the cumulative learning process, the individual adapts to the surroundings through two different processes: assimilation and accommodation. Through *assimilation* we incorporate new influences into our existing knowledge structures and movement patterns, that is, perceptions of the world. *Accommodation* requires a reorganisation of our existing knowledge; because impressions from the environment can no longer be adapted to existing forms, we must change our perception so it fits with what we are experiencing now. In learning, both of these the adaptation processes take place as we interact with the environment (Illeris 2007, 2009; Piaget, [1952]1965). If we conceptualise learning as an interaction between further developing and exceeding our existing knowledge, it becomes necessary to take the students' preconceptions (the knowledge they already possess) into account when planning lessons. Most learning designs are planned so that students experience all three learning processes: the cumulative learning process, assimilation and accommodation.

Along with the concepts of assimilative and accommodative learning, Illeris (2007, 2009) presents the concept of *transformative learning* – a forth learning process (Mezirow, 1991). Transformative learning, or significant learning, is learning that changes the student's worldview. It is a type of learning that cannot really be prepared for in the learning situation. In the mild form, transformative learning is what might be called an "aha" experience. In the deeper version, it can be a life experience that creates personality change; here, transformative learning will often be a result of something unavoidable that forces us to change ourselves in order to get any further in a complex situation (Illeris, 2013). With innovative learning processes like those developed in this project, actor-groups often encounter complex points and situations that have the potential to create transformative learning processes, enabling new world views and possibilities.

Tacit knowledge

In order to extend our understanding of the content dimension or the cognitive learning theoretical approaches about how the individual learns, Oliver Kauffmann (2013), a researcher in learning theory and pedagogical philosophy, suggests regarding Polanyi's (1966) implicit learning theory, or theory of *tacit knowing* (*knowing* is Polanyi's term, 1966), as a cognitive learning theory. We move from "I think" to "I can." Tacit knowledge is considered inarticulable and non-conscious cognition and learning, in contrast to linguistically articulate learning, or explicit and conscious learning. Tacit knowledge is linked to our own experience but cannot be expressed in words or symbols (Polanyi, 1966). However, tacit knowledge and explicit knowledge are often tightly interwoven and interdependent. Polanyi's use of tacit knowledge makes it possible to express the body's role in learning and cognition (this is relevant for individual cognitive learning) as well as the tacit distributed socialised meaning making (this is relevant when learning in social contexts). Tacit knowledge is a significant part of the three actor-groups' daily professional working practices and is important to be aware of when observing, designing for or analysing learning processes for the three actor-groups. Tacit knowledge is often relevant in connection with *knowing how* to do something. Both Polanyi (1966, p. 12) and Merleau-Ponty (1962, p. 143) used the example of a blind man using a cane. Merleau-Ponty described how the blind man initially uses the cane as a medium to feel the different impressions from the street in his palm, and then, through these cues and tacit impressions from the can, he becomes aware of the surface he is walking on (Merleau-Ponty, 1962). This experience remains tacit as long as nothing interferes; but if the cane comes across something unusual, the man will intentionally become more conscious of the signals from the sensations, and a process that moves from sensations to conscious explicit spoken knowledge may take place. The silent sensations thus have a functional role for our conscious experience (Kauffmann, 2013). By investigating, conceptualising and verbalising the actors' tacit knowledge processes in the research project, it becomes possible to make individual implicit knowledge explicit (Nonaka & Takeuchi, 1995). This will make it possible not only to share and further develop tacit knowledge with peers, but also to become aware of unconscious daily habits that either need to be supported in the new innovative processes or may be hindering the actors from moving in new directions. Verbalising of tacit knowledge happens in the new practices described in Chapter 8 and Article B as the teachers become explicit about their old and new complex teaching practices.

6.2.2. THE INCENTIVE DIMENSION OF LEARNING

The *incentive dimension* represents the extent and character of the mental energy we invest in learning; typically, this refers to the motivation, feelings and will that we mobilise in a learning situation or a learning process (Illeris, 2007, p. 106). The incentive dimension is an important and integrated part of all learning processes. If we experience learning activities as interesting and fun, they will catch our attention and ultimately make us want to participate and thereby learn (Boekaerts, 2010; Wlodkowski, 2011). Having the will and desire to deal with something helps us focus on the current topic, which in turn means that we have an opportunity to acquire knowledge in that specific area. Therefore it is crucial that students learn how important it is for their learning processes that they take an interest in what is to be learned, and that teachers design for motivation in their learning designs (Boekaerts, 2010; Illeris 2007; Laurillard, 2012; Perlman, 2015). Illeris (2007) makes a distinction between the emotions, which are directly related to the learning situation, and the motivation, which encompasses the will and attitudes and relates more to the content. In order for us to learn something, it must ideally take place in an atmosphere we enjoy being in, and we must be interested in what we have to learn. A student's motivation consequently is an important contributing factor for learning (Koster, 2005).

Researchers typically examine one or more core motivation constructs (Elliot and Dweck, 2005; Usher & Morris, 2012); for example, what belief students hold about their own academic capabilities (Bandura, 1997), or how goal setting may increase motivation in formal learning environments. Motivation has been studied for many years within the field of learning. Svinicki and Vogler (2012) used the concepts *conation, drive, goal, need, purpose* and *volition* as synonyms for motivation. Motivational theories differ in their definitions as to whether the nature of motivation is a process, a characteristic or a state. Svinicki and Vogler define motivation as “a process of interaction between the learner and the environment, which is marked by selection, initiation, increase, or persistence of goal-directed behaviour. Motivation has been thought of variously as a quality of the individual, the situation, or the activity in which the individual is engaged” (p. 2336). This definition leaves room for the understanding that the student, the teacher, their interactions and the learning environment are vital components of building a motivational learning situation. However, since motivation is a psychological construct, it still can be difficult to concretise; this has led to many different theories aiming at describing the same phenomena (Svinicki & Vogler, p. 2336). This is the case, for example, with attribution theory, expectancy value theory, self-efficacy theory, achievement goal orientation theory and self-determination theory (Deci & Ryan, 2000).

The variety of theories leads to different views on how motivation can be designed, achieved and measured, but there is a common understanding when attempting to assess students' motivation to learn that it is reasonable to look for choice of tasks, effort, persistence and achievement (Schunk, Meece & Pintrich, 2010, p. 13). In order to measure or assess motivation in learning, this project used direct observations, ratings by others and self-reports. The self-reports encompassed questionnaires, interviews and dialogues with students and teachers (Schunk et al., 2010). However, when interpreting empirical data, it is important to be reflexive about and compare the different signs and views and to be careful in one's interpretation and reflection processes as a researcher (Alvesson & Sköldberg, 2009, p. 9). These reflexive processes are perhaps even more relevant to be aware of in considering a phenomenon like motivation, a "diffuse" concept that participants may not think consciously about on a daily basis, and one which they may be defining in different ways according to their goals and the contexts. Therefore, the researcher in this project had to carefully consider and evaluate the different utterances and observations against each other and consider the setting as well.

A model for motivation in learning

This PhD project used Jerome Bruner's (1966) concepts regarding how inner motivation is activated. These three concepts can be used to design for and analyse motivation in the interventions. Bruner, an educational psychologist, took a learning theoretical approach to motivation; the concepts, along with representing the intensive dimension of learning, correspond well with the two other learning dimensions described by Illeris (2007, 2009). Bruner (1966) asserted that our will to learn, or the intrinsic motivation to learn, consists of three primary underlying forces that cover basic human psychological needs:

1) **Curiosity:** the desire and freedom to explore things and the agency to decide for ourselves (we experience it as being in a playful and investigative mood.) We challenge ourselves and investigate new areas in which we are not yet strong and confident. When investigating new ground – *learning* – we are seeking explanations for new patterns that do not seem to fit with our previous understandings (Bruner, 1966; Dewey, [1933] 2009; Illeris, 2007). Conversely, as adults we can sometimes find it overwhelming to have to add new knowledge to our existing knowledge; it can also be provoking to have to admit that there are areas in which we are not experts. This can result in a kind of resistance towards learning (Illeris, 2007). This resistance hinders the curious and open attitude and approach that welcomes new learning.

2) **Competence:** the desire to show that we are independent individuals who can control and master a situation, take the initiative and develop solutions. If we are supported to take the initiative and develop solutions to our problems, we experience joy and pride. Acquiring new skills – obtaining control of a situation and mastering something – creates joy and pride and is motivating.

3) **Reciprocity:** making a difference and being an indispensable part of the community while achieving goals together with others. People like to achieve goals with others. They like being part of a “learning community” – a community of practice (Wenger, 2004). Reciprocity occurs when we feel that we are contributing to a joint project that makes a difference and the community cannot do without us. When collaboration succeeds, a positive feeling arises of belonging to the community. Reciprocity (also referred to as *relatedness*) can be achieved through collaboration or friendly competition.

These three motives are the driving force behind intrinsic motivation (Bruner, 1966). If learning is planned in a way that enables the student to achieve one or more of these three motives, it will help the student feel an inner motivation to learn (Gärdenfors, 2010). The self-determination theory (SDT) (Deci & Ryan, 2000) argues that inner motivation is achieved by reinforcing these three elements: autonomy, competence, and relatedness. These three primary elements described by Deci and Ryan strongly resemble Bruner’s three driving forces. As a teacher for 15 years, I find Bruner and Dewey’s emphasis on the importance of curiosity in the motivational learning process fundamental. But Deci and Ryan’s (2000) concept of autonomy can be encompassed in Bruner’s concepts of curiosity and competence, since the experience of agency/autonomy is elemental to curiosity and the freedom to explore. An individual also needs the feeling of agency to achieve the feeling that he or she can control and master a situation. The third concept, reciprocity or relatedness, has the same aims.

When considering how Bruner’s three motivational forces can contribute to the learning processes in Illeris’s three dimensions of learning, certain connections become apparent: 1) Competence and the cognitive dimension: Educators may be inspired by thinking about how the individual learning process can be facilitated so the student experiences the feeling of achieving competence. 2) Reciprocity and the interaction dimension: Educators who design for motivating learning may be able to create learning situations in the interaction dimension with the motivational force reciprocity/relatedness in mind. 3) Curiosity: Finally, thinking about how to spark curiosity and the freedom to explore and inquire may lead to motivating learning designs (Mitra, Dangwal, Chatterjee, Jha, Bisht, & Kapur, 2005).

6.2.3. THE INTERACTION DIMENSION OF LEARNING

The interaction dimension takes place on two levels, an interpersonal interaction level and a societal level. In social and situated learning theories, learning takes place as an interaction between socially defined competences and personal experience (Lave & Wenger, 1991). In the following sections, the theories of *community of practice* and *situated learning* are presented to describe how we learn in a social community.

Situated learning and communities of practice

Cognitive anthropologists Lave and Wenger's theory about communities of practice is based on an understanding of learning as situated and distributed in a social, cultural and historical context and a belief that this context has an influence on the quality and the result of the learning process (Lave & Wenger, 1991, p. 35). In opposition to the cognitive learning theories, learning is not regarded as a fixed concept that exists inside the individual's head, and it also cannot be stored or transmitted. The premise in social learning theory is that the individual is seeking to acquire physical, social and cultural reality through his existence in the world and through his actions. Therefore, knowledge is found among participants in specific practices and in the tools and languages participants use. This becomes crucial for the way we view learning processes, because knowledge then exists in the social and collaborative part of a community of practice.

An argument for regarding learning as *situated* is that so-called “general knowledge” is valid only under specific circumstances and that abstract representations are meaningless and empty unless they are made specific in relation to the present situation (Lave & Wenger, 1991, pp. 33–34). The fact that we know a rule does not ensure that the generality it may imply is activated in a specific circumstance. So the specific situation leaves its mark on the learning that is taking place, but the situation also additionally affects which part of the applied general theoretical concepts are activated and how they are interpreted in the current learning situation (Illeris, 2007).

The individual belongs to and is part of a community of practice and is actively involved in this community through participation in the specific social and cultural practices. In these communities, learning happens in a process of meaning negotiation. According to Wenger (2000), “Communities of practice are basic building blocks of a social learning system because they are the social ‘containers’ of the competences that make such a system” (p. 5). In this project each actor-group represents their own community of practice, while they together also form an overall community of practice representing the whole educational institution. “By participating in these communities we define with each other what constitutes competence in a given context” (Wenger, 2000, p. 5). If the distance between the competence in the community and the individual experience is big, there is a big learning potential. If the distance is small and we are already competent within this community of practice, then the learning potential is small (Wenger, 2007).

Communities of practice produce products and processes. An important point in the theory of situated learning is the creation of physical and conceptual artefacts – for example, words, tools, concepts, methods, stories and documents. These physical or mental objects reflect our shared experience, and we organise our participation around them (Wenger, 1998, 2010). This is called *reification*, meaning “making into an object.” Reification thus refers to both the process and the product. Through reification we externalise our experience and understanding of the world into tangible or thinkable products; for example, into a new learning design in which we can discuss and design learning practices. To create meaningful learning experiences in social contexts requires interplay between participation and reification.

> Artefacts without participation do not carry their own meaning; and participation without artefacts is fleeting, unanchored, and uncoordinated. But participation and reification

> are not locked into each other. At each moment of engagement in the world, we bring them together anew to negotiate and renegotiate the meaning of our experience. The process is dynamic and active. It is alive (Wenger, 2010, p. 180).

For a community of practice to be a learning community with knowledge acquisition and creation of new knowledge, three things are required (Wenger, 1998, p. 73):

1) **Mutual engagement:** The participants have a common goal and a shared responsibility in the community. Meaning is negotiated among the participants. *Negotiation* does not necessarily mean that everyone agrees, but that each participant constructs meaning for himself or herself (Wenger, 1998). The joint project requires that participants demonstrate a need to share knowledge with each other. This ensures that participants depend on each other and feel shared responsibility for the project.

2) **A joint project:** The participants are engaged in the activities they do and negotiate with each other concerning them. All are involved and want to do the activities in interaction with other participants. There will often be a kind of community spirit, and, according to Wenger (1998), the participants' mutual commitment is the source of the cohesion in the community.

3) **Shared repertoire:** The participants adapt to the common repertoire used in the practice community and share knowledge. The participants have approximately the same backgrounds and share tools and understandings (public discourse). This means learning to use the different tools, artefacts, traditions, etc. These will be developed over time in the community of practice (Wenger, 1998).

Lave and Wenger (1991) used the concept *legitimate peripheral participation* to analyse and describe how we learn from participating in a community of practice. Through legitimate peripheral participation in the community's productive aspects, e.g. the apprentice gradually acquires essential skills, knowledge and values in relation to the craftsmanship by moving from a peripheral participation to become a full member of the profession.

Tacit knowledge also makes it possible to express common social knowledge - knowing *how*. In apprenticeship, for example, a great deal of learning occurs by studying and imitating other professionals' demonstration of tacit knowledge (Nielsen & Kvale, 1999; Nonaka & Takeuchi, 1995). In this way of learning, spoken language is given a subordinate role. According to Polanyi, we rely on the student's intelligent collaboration to "grasp" the meaning of the current demonstration (Polanyi, 1966). Teachers can learn how to implement a new learning design from another teacher by studying and imitating all the tacit processes of this learning design along with the more explicit parts of the learning design.

Learning thus arises in a community of practice through the learner's presence in the community and is thus dependent on social and cultural contexts. Knowledge is shared among the participants in their practices, tools and languages, and the knowledge is negotiated in opinion building processes. Learning takes place and knowledge is created in mutual engagement through participation in the community with common projects and reification through artefacts. Artefacts – the products and processes created – thus express our understanding of the world; we create and share knowledge while we learn to master the common language, tools and traditions.

6.3. ADULT LEARNERS AND MOTIVATION FOR LEARNING

The overall learning theoretical frame for the project in section 6.2 described general learning theories, emphasised the importance of being motivated to learn, and discussed both individual learning and social learning processes. There are, however, specific aspects of motivation and learning that must be considered when the learners are adults. Adults' maturity and life experience create a natural desire to decide for themselves and be respectfully treated as experienced and independent people. In today's society, the volume of information and potential learning is so vast that it is not humanly possible to take it all in. This means that adults need to select or deselect learning. These choices are based on motivation for learning and are evaluated against how useful the knowledge seems to be for the adult's future working life or interests. Motivation is therefore a key determinant of what is selected, and this motivation is created on the basis of the adult's own understanding and identity (Illeris, 2012).

Motivation can be difficult to design for and cannot be determined in advance, but it can be influenced by conversations, guidance and motivational learning designs. In this project, we used Bruner's three motivational forces to design for and investigate motivation (Bruner, 1966; section 6.2.2). Malcolm Knowles (2014) devised guidelines for the motivation of adult learners. Though it can be debated how these guidelines differ from general problem-based and experiential pedagogical approaches, they support a focus on learning processes based on the adult's life-world, recognising that adults need to know the reason for learning something before they consider it a worthwhile investment of their time and energy. By taking outset in adult learners' own experiences when planning activities, the learning process becomes more meaningful and relevant for their future. Adults have a need to be self-directed and to take responsibility for their own learning. Their unique experiences and personalities can be an advantage when individualising teaching and learning strategies (Knowles, 2014, p. 45). The individual learners' motivation, interests, needs and goals may be the richest resources or inspiration for their learning processes. Pedagogical approaches that support this strategy include experiential learning, problem-based learning and other approaches that can take outset in the adult learners' own experiences; for example, group discussions and collaborative learning processes.

Conversely, adults can sometimes find it overwhelming to have to add new knowledge to existing knowledge; it can also be provoking to have to admit that there are areas in which we are not experts, making us unwilling to be open to new perspectives. This can result in a kind of resistance towards learning (Illeris, 2007). This resistance can hinder the curious and open attitude that welcomes new learning. Therefore, adult learning can also sometimes be unlearning (Dede, 2007, p.21) – letting go of old habits and embracing new learning in accommodative or transformative learning processes (Piaget, [1952]1965; Illeris 2007).

6.4. LEARNING THEORY AND LEARNING DESIGN

What is the relationship between learning theory and learning design? *Learning theory* has the phenomenon of learning as its object; it aims to uncover and describe learning on the basis of theoretical and empirical work. The aim of *learning design* is to discuss the content and goals for teaching, while at the same time taking an interest in *how we learn,* in order to organise the best possible framework for learning to take place. Learning theories are thus not defined by whether learning is intentional and planned, whereas the actual concept of *learning designs* refers to the planning and facilitation of possible learning processes. Therefore, the content dimension (what we aim for students to learn) is represented in learning design but not necessarily in learning theories, whereas the learning theory arguments are not specified with the same rigor in the different learning design theories. In learning design, we discuss objectives for learning; learning theories focus primarily on how we learn (Qvortrup & Wiberg, 2013).

6.5. LEARNING DESIGN AND LEARNING DESIGNERS

The term *learning design* describes how the teacher shapes social processes and creates conditions for learning, as well as the phenomenon of the individual student constantly re-creating or re-designing information through his or her own meaning-creation processes (Selander & Kress, 2012, p. 2). Teachers should be considered professional designers, like other people working in creative professions, since they are in the business of changing existing situations into desired ones (Laurillard, 2012). For this process, they use theory, but they also work and evaluate their practice in order to create effective learning designs. Diana Laurillard (2012), professor of learning with digital technologies, argues that design for learning is not an exact science; “[W]e need a continual iteration of ideas and experience to generate the knowledge in the field” (p. 78). Teachers are themselves learners and should have access to continuous professional development, because the art of designing for students’ learning is complex and uncertain, and the results – the means-to-end relationship – is very non-deterministic.

Learning design theory investigates how to create effective teaching and education. It is the teachers’ professional science and aims at reasoning about: how teaching and learning practices create knowledge (what) and knowing (how) about teaching and learning. The practical affordance and application of learning design theory is to offer tools based on concepts and theories about teaching. This also to some extent encompasses learning theory, as teaching can be described as the facilitation and organisation of frameworks for learning (Qvortrup & Wiberg, 2013, p. 19).

6.5.1. A LEARNING-THEORY-BASED LEARNING DESIGN MODEL

Learning theorists Hiim and Hippe's didactical relationship model (1997, 2003) is a student-centred learning design model that emphasises the influence of the context on the student's learning processes. It comes from the "Hamburger-didactic" tradition (Qvortrup & Wiberg, 2013), in which the aim is to take a new holistic approach to the dynamic interaction processes in teaching, offering a more neutral alternative to the earlier focus on "Bildung" (Klafki, [1974] 1983). In this model, learning is designed through an interplay between six elements: 1) the student's prerequisites for learning (learning qualifications); 2) the setting (framework conditions for the teaching); 3) the learning goals; 4) the educational content (curriculum and subject); 5) the learning process; and 6) the need for evaluation of learning. These six elements should be taken into consideration when the teacher plans and designs for learning and carries out teaching (Figure 12) (Hiim & Hippe, 1997, 2003).

The PhD project used Hiim and Hippe's (1997, 2003) learning design model as a framework to investigate and design learning processes for the different sub-projects in the thesis. This relationship learning design model is dynamic; the idea is that one parameter cannot be changed without affecting the others. For example, the choice of videoconference as a teaching medium (framework conditions) sets requirements for the learning activities when the teacher is designing for and facilitating the learning process. Also, the learning process should change according to each student's learning prerequisites, both in terms of innate and acquired skills, in order for each student to be able to meet the learning goals. The six elements of the model are outlined below.

Figure 12: Learning design relational model (Hiim & Hippe, 2003).

1) **The student's prerequisites for learning/learning qualifications:** *Definition: mental, physical, social and professional opportunities and barriers that the student may experience in various areas in relation to the current teaching* (Hiim & Hippe 1997, p. 134). It is important to try to clarify each student's learning qualifications. What prior knowledge can the learner be expected to have already, or what knowledge does she or he need to have to reach the learning goals and be a successful learner? Which things interest and motivate the student? What is the student's reason for attending classes (Illeris 2009)? Does the student have specific problems? What can you say about this target group in general? After mapping these

learning prerequisites, the teacher has the opportunity to differentiate his or her teaching in relation to each student.

2) **The setting – framework conditions for the teaching:** *Definition: Framework conditions are factors that can give opportunities or barriers in the learning situation* (Hiim & Hippe 2003, p. 28). There can be different kinds of settings or framework conditions for the teaching process. Formal framework factors might include social, economic and political factors that are designed into rules and regulations. Practical factors might include available equipment, knowledge about equipment, room conditions and time available for teaching. Softer frame factors might include individual teacher opportunities in relation to resources, methodologies, knowledge, values, her own limits or traditions; also the opportunity to work together with colleagues in professional development.

3) **The learning goals:** *Definition: What is the objective of the teaching and learning process?* Learning goals refer to what students are expected to have learned through their learning activities (Hiim & Hippe, 1997). Learning goals are tools that can be used by the teacher and students to improve teaching and learning, and they should be clear, relevant, realistic and meaningful. Clear learning goals will make it easier for the student to evaluate her own learning process and work. When developing learning goals, it is important that they are made operational – that is, formed in such a way that students clearly understand what to aim for and work towards. It is important to make students familiar with the objectives. Allowing students to choose their own learning goals can be highly motivating and can make the goals more meaningful. These goals can be viewed as a contract between the student and the teacher, which clarifies their respective aims for learning and teaching. This creates greater responsibility in the individual student as he or she then can contribute to determine the direction in which she or he should move to achieve the set goals.

4) **The educational content:** *Definition: Content* is what the teaching and learning is about. *Content, curriculum or the subject matter* refers to those things the student must learn during the education; it is the means or the way to the goal. There must be a clear link between the learning objectives and the content in order for the teaching to succeed. How the content is organised is also important. If the learning goals are known in advance, the "content-road" to the learning objectives can be organised in accordance with the student's prerequisites and the setting.

5) **The learning process:** *Definition: Learning process* refers to how learning should take place. What is learning, how do we organise it, and which methods and teaching principles are relevant? What responsibility does the student have in the teaching process? What is the role of the teacher? How can the student be motivated? How can we create a good climate for teaching and learning? What working methods are most appropriate in order to achieve the learning objectives? These are some of the questions the teacher must consider when designing the learning process. When the teacher designs the learning, he must consider what kind of learning activities will help the student to achieve the learning goals. The learning processes are supported by all the learning activities the teacher designs to help the student

reach the learning goals. These activities are determined by the subject matter, but also, to a great extent, by which pedagogical approaches and learning theories the teacher chooses to use. As stated in section 6.2, it is relevant to examine the learning process (Illeris, 2007) from the perspective of the three dimensions of learning: the inner psychological process of acquisition, the interpersonal interaction level and the incentive dimension (dealing with motivation to learn). If we aim to create a smooth learning process through *assimilative learning processes* (section 6.2.1), that is, by incorporating new influences into our existing knowledge structures, we should organise teaching through scaffolding in relation to students' zones of proximal development (Vygotsky, 1980), and divide instruction into meaningful units for the beginner (Dreyfuss, 2001).

6) **Evaluation/Assessment:** Definition: Evaluation of the teaching. We need to design for evaluation and assessment of whether our learner has reached the learning goal and the growth and mastery we have aimed for. The teacher must decide: Who should evaluate? Should the evaluation happen jointly between student and teacher? What should be evaluated? Evaluation can take place in relation to the teaching process, the student's learning and the learning goals. How and when should these be evaluated? Generally, a "diagnostic assessment" takes place at the beginning of the course to uncover the student's learning prerequisites. During teaching, a formative assessment may take place so the learning design can be adapted and shaped according to what happens during class. At the conclusion of the course, a summative assessment may take place, either as a formal assessment by means of a test or a more informal assessment with interview and feedback (Hiim & Hippe, 2003).

All of these elements are intertwined and affect each other, and all should be considered when designing for learning. By using Hiim and Hippe’s (1997, 2003) *learning design relation model,* it is possible to reflect on the different elements that are essential for developing a successful teaching process. At the same time, the model can be used to remind the teacher to be aware that changes in one element will influence other elements in the model.

6.6. TECHNOLOGY IN EDUCATIONAL SETTINGS

This project investigated learning and teaching practices and processes in a hybrid synchronous learning environment. This environment has, however, been the context for the investigation and not the primary focus. The hybrid synchronous technology is a tool and mediating factor in the learning processes, but the primary goal has been to create motivating learning experiences for the students and the teachers in this environment. Furthermore, as the purpose was to examine and facilitate learning processes, it was also relevant for teachers to involve other technologies besides the videoconference equipment; for example, learning management systems and other web-based applications for creating or presenting documents, games and film, as well as specific collaborative learning technologies. This section will outline areas of interest when aiming to understand how humans interact with the symbolic and material properties of technology, what role the body has and how the hybrid synchronous teaching and learning room is experienced. Another important point of attention when researching technology is the distinction between the aspects of *technology as artefact* and the *use of technology* (Gheradi, 2012). It is also relevant to consider what potentials and barriers can be expected when teachers learn to use technology in teaching processes as they aim to facilitate learning situations encompassing technology.

6.6.1. THE MEDIUM, THE MESSAGE AND THE EXTENSION OF THE SELF

The video conferencing system mediates information sent from the sender to the receiver; it is the medium between the two. But as information is sent through this system, the system influences the message. McLuhan's expression, *the medium is the message,* can be explained in two steps (McLuhan, 1964). The content of the medium is always another medium. Every medium is a remediation (Bolter, 2007) of another medium: "The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph. If we asked, 'what is the content of speech?' it is necessary to say, 'it is an actual process of thought, which is in itself non-verbal'" (McLuhan, 1964, p. 1). In this sense, every media form can be understood as an extension of another media form and essentially of ourselves. The videoconference medium is an extension of ourselves into another geographical place. But how does the medium become the message? Depending on which media we use for communication, a symbiotic relationship is created between the media and the message, and this relationship influences how the message is perceived. Therefore the videoconference systems, as well as the additional educational technologies used, not only communicate the messages between the teachers and learners but also have their own characteristics that play a role in the dissemination process. Therefore, as we will see, the initial choice and thereby change of the learning ecology, by using videoconference as an additional offering for the students, will transform the social practices in the teaching/ learning situations. These changes are unique and unpredictable and involve incorporating new technologies as extensions of the self (Somekh, 2007). Some videoconference students, for example, were reluctant to ask questions if they did not understand the teacher's instructions. They therefore had to become aware of this experience and compensate for it by asking questions even when they felt uncomfortable.

6.6.2. TECHNOLOGIES AS CONCEPTS: SIGNS

When describing material things, we use *signs* (indexes, icons or symbols) to refer to them (Pierce, as cited in Atkin, 2013). Our experiences with things, including technology, can be conceptual in that things can mean something to us not only when we are close to them, but also when we are not. If we regard this kind of conceptual existence as a *sign* (Pierce, as cited in Atkin, 2013), then such signs can mean something to us in our social world (Sjørslev, 2013, p. 165). Depending on the context and situation, these signs can have different conceptual meanings; these meanings are negotiated between the users of the things and signs and therefore may change over time. If administrators at VUC Storstrøm say, "We are having great success with Global Classroom," this may be difficult to understand for a teacher who regards Global Classroom as a difficult new working environment. That teacher has had a different experience and attaches a different meaning to the concept Global Classroom.

Figure 13: The control panel for the videoconference.

Limited physical objects can also represent different signs or conceptual meanings. When a technician looked at the control panel for controlling the technology in the Global Classroom, he saw a very user-friendly device that allowed for rapid adjustments for different educational situations (Figure 13). When a teacher looked at the same panel, the teacher expressed that it could be frustrating and difficult to assess what functions could help him do what, that it was difficult to remember those functions that the teacher seldom used and that this control panel was an extra thing the teachers had to be able to operate while teaching, all in all leaving the teacher with a very different experience of the control panel. Over time, the teachers got more familiar with this panel. Therefore it was important to be observant of how different actors interpreted different technological concepts, and what social practices and experiences grounded these understandings.

6.6.3. TECHNOLOGY AS DESIGNED ARTEFACTS: HOW TECHNOLOGY ACTS

"An artefact is a material object, produced for a specific purpose, and reinterpreted in a situated practice*"* (Hasse & Storgaard Brok, 2015, p. 12).

New technologies allow for a conversation kinaesthetically, iconic and symbolic, this can happen synchronously or asynchronously in space and time. Through this we may have unique new ways to be creative, to learn and to explore the world (Manovich, 2007). With the computer and a broad digital platform, educators can build a learning environment with open learning resources and tools. These tools can be used to actively solve problems and construct ideas through exploration, experimentation, reflection and collaboration with others. The resources and tools may also allow for many alternative ways creating knowledge in thinking and acting processes (Stahl, Koschmann & Suthers, 2006). This can be done in the form of digital products, processes and instructional materials (Laurillard, 2012). Educational technology is designed based on various learning theories and pedagogical approaches and therefore supports and widens the range of possible learning designs (Dede, 2008). Teachers and learners have the task of selecting appropriate technologies with the appropriate affordances[5] for the planned pedagogical approaches. Technology therefore contributes to

[5] "Affordance refers to the perceived and actual properties of a thing, primarily those functional properties that determine just how the thing could possibly be used. Less technically, a doorknob is for turning, a wagon handle is for pulling" (Pea, 1993, p. 51). "In an IT-supported learning environment affordances for learning are provided by interactions between the hardware, software, other resources, teachers and other students" (Webb, 2010, p. 96).

shape education, but the pedagogical approach also shapes technology and the way technology is used.

Dourish (2004, p. 163) argues that computation, not the computer, is the medium that conveys the message (the information we send out or receive in the learning process). This distinction emphasises that it is not the digital encodings we make in the digital devices that contribute to our meaning and knowledge creation; instead, meaning is conveyed “through the way that computation enlivens those encodings with semantic and effective power” (Dourish, 2004, p. 163). This enlivenment or animation can happen if we create a digital slide show as a tool for teaching and learning in the video conference, have a Twitter chat in class or use games or game design tools as learning environment resources. Depending on how the technology (hardware, software) is designed, it can be used as an active tool for constructing learning experiences (Harel & Papert, 1991). Technological resources can therefore be used to explore abstract ideas in the same way that analogue devices, resources and tools can, only here the ideas will be expressed, developed, communicated and shared through computation or manipulation of the digital technologies; for example, by constructing and designing in the visual programming language Scratch (Dourish, 2004; Papert, 1980; Resnick et al., 2009;).

6.6.4. SOCIO TECHNOLOGY: HOW WE USE TECHNOLOGY

Socio technology can be defined as the study of processes in which the social and the technical are indivisibly combined (Vojinović & Abbott, 2012, p. 164). In teaching and learning, a range of interactive processes takes place. In these processes, teachers often use a variety of tools to mediate students’ learning. These tools can be language, conceptual frameworks and artefacts (books and educational technologies, for example), and the tools are continually developing and changing. We gradually become skilled in using the tools and incorporate them into our social practices to such an extent that they are experienced almost as extensions of ourselves (Dourish, 2004; Merleau-Ponty, 1962; Somekh, 2008, p. 450). Consider, once again, a blind man who uses a cane to feel the surface of the street in his palm when walking. In this interaction between the man and the street, the cane becomes an unnoticed, extended part of himself. The same can be said when we use a computer mouse; once we have learned to use it in a skilful way, it disappears and becomes “invisible” or transparent to our consciousness; we notice only the actions for which it is used (Dourish, 2004). When we use tools in our practices, they shape and change the nature of those practices, empowering us to do things that were previously beyond our capability (Rabardel & Bourmaud, 2003).

The designer of an educational technology has a purpose in mind for the technology, often multiple purposes. In order to be useful in many situations and for many kinds of users, the technology is designed to become part of a specific set of work practices (Dourish, 2004, p. 171). But when the technology is taken into use and incorporated as one part of a pattern of actions, the intended use of the technology may change and develop in organic ways, multiplying the possible uses of the technology in the learning design (Dourish, 2004, p. 154;

Hasse & Storgaard Brok, 2015; Rabardel & Bourmaud, 2003). In some cases, it may fail to solve the problem or do the task the user intended; this calls for a redesign of the learning design or even a change in the technology. Therefore, though the affordance and purpose of a particular technology can be suggested by the designer, that technology will find its true use and meaning in the teachers' and students' use of it in their daily knowledge creation, sharing and evaluating processes and practices. The integration of technologies into the classroom can lead to substantial changes in the student–teacher relationship, in the social organisation and in a myriad of other factors that are hard to predict in advance (Amiel & Reeves, 2008). For example, when the teachers started to teach in the hybrid synchronous learning environment, they suddenly had many new tasks added to their traditional teaching preparations, and this influenced their professional practice.

6.6.5. THE BODY IN THE ROOM/S IN VIDEOCONFERENCE ENVIRONMENTS

What role does our body play when we participate in a videoconference? Children having videoconference conversations with their friends over Skype (2016) as they play together in the virtual multiplayer world of Minecraft (2016) has become an everyday practice that is not given much notice. The children are all "there inside the game" with their avatars, chatting over Skype with each other, while their bodies are sitting in their individual homes, as if it is the most natural thing in the world. An example of a non-technological virtuality, as described by Don Ihde (2002), is how we can imagine ourselves being in another place in the world (or on the moon) from a third-person perspective – we are "disembodied" in this thought. This illustrates that virtuality is not only a technological phenomenon. The virtual body has always been a part of our imagination; it is natural for us to imagine being somewhere else. These everyday life experiences might make us think that teaching and learning over videoconference should be natural and easy – that we can imagine being presented and being present in the other place as persons, only without our physical bodies being present there. To some extent, this is true, but when participating over videoconference, we cannot move around with "eyes in the head on the shoulders of a body" (Dourish, 2004, p. 119), sensing and interacting with the world around us as we walk, and that makes a difference.

The individual feeling of being present in a remote location over videoconference is often called *telepresence* (Draper, Kaber, Usher, 1998). But this is a word that has been interpreted in many ways (Dolezal, 2009; Friesen, 2014; Levinsen, Ørngreen & Buhl, 2013) and conceptualised in various ways (Bell, Sawaya & Cain, 2014; Bower, Dalgarno, Kennedy, Lee & Kenney, 2014a&b, 2015; Dourish, 2004, 2006). The point to keep in mind is that the videoconference experience attempts to give participants the experience of being in the same room, and to provide the same opportunities, even though participants are far apart. The objective of offering equal working conditions is, however, essentially an illusion in a hybrid synchronous video-mediated environment, as the working conditions are inherently unequal. But the focus is this: what are the determining experienced phenomena, the choices of technologies, the use of technologies, designs of learning experiences and more, that will contribute to learning conditions which will perhaps never be equal – but which will become as good as being together in the same room? Therefore I have aimed to describe the different phenomena that teachers and students experienced when studying and learning in the Global Classroom environment, and I have focused on which learning designs, interactions and uses of technologies might contribute to the experience of participating on "equal" terms while creating motivating learning experiences.

One of the advantages often highlighted in the use of the videoconference medium, as opposed to asynchronous or mono-channel media, is the ability to communicate using non-verbal body cues (eyes, face and hands; Friesen, 2014). But communicating over videoconference sometimes makes participants feel alienated. Technical errors that interrupt sound and picture can contribute to this alienated feeling. But even if we presuppose that there are no technical errors, it can be difficult to put a finger on what exactly causes this alienated feeling; it is often tacit knowledge even to ourselves. Communication is more than being able to hear and see each other with sound and moving pictures on a screen. When our bodies are in the same room and we turn our attention towards each other with the intention to communicate, in this case in the service of teaching and learning, we look into each other's eyes. This gaze goes both ways – I see that you see me, and you see that I see you – and in this contact a *perceptual alignment* takes place (Friesen, 2014; Merleau-Ponty, 1964, p. 1). We see intention and attention, or lack thereof, in each other's eyes, and if the alignment is positive, then we can continue into the teaching and learning processes; we trust that we are on "the same track." This eye contact and alignment takes place multiple times during a lecture and is also used to manage conversational turn-taking (Dourish, 2004). Videoconference disturbs or disrupts this contact in the sense that we must choose between looking at the screen – at the image of the other person – or into the camera for the other person to experience that we are looking at him or her. This disrupts the feeling of videoconferencing as an extension of ourselves into the other room; we cannot "look each other in the eye"; it is only an illusion of doing so, and making eye contact actually requires that we look away from each other and into the camera. Although it was possible, according to the teachers and students, to get used to this quiet alienation, it still could be experienced as a silent, disturbing layer beneath contact and communication, and it may have contributed to the feeling of difficulty in reaching and being reached by those in the other room.

Other points of attention when teaching and learning over videoconference include these questions: To what extent can we BE in the other room, or at least have a feeling of being there? How can we DO something in the other room, or at least have a feeling of doing it? The need to be in the other room, in this case the classroom, might be to socialise, for formal or informal purposes. Collaboration is important in learning processes (Wenger 1998; section 6.2.3). But informal contact during classroom breaks can also be important to the learning experience (Friesen, 2011). In school, it is a natural thing to go to the cafeteria for lunch and perhaps discuss small things of importance to one's education. Such breaks also provide an opportunity for friendly mingling, which is often a contributing factor in developing or sustaining the desire to complete one's education, which is of particular importance for student population at VUC.

As an attempt to create a social climate, some teachers left the videoconference on during the breaks as an “open window to the social room” so in-class and at-home students could have informal talks. In this way, the videoconference did not just connect people; it also connected places (Dourish, 2004, p. 148; 2006a).

6.6.6. LEARNING DESIGNS IN HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENTS

This study took place in a hybrid synchronous video-mediated learning environment, but the study’s focus was to investigate how pedagogical innovation should be designed in order to contribute to the creation of motivating learning for students and teachers in this environment. The hybrid synchronous video-mediated learning environment was therefore the context for the investigation and not the main focus. As seen in the literature review (Section 2.1), this is a new but growing field. There are not yet many learning design proposals for this environment, although two recent studies on learning design frameworks for a hybrid synchronous video-mediated learning environment were based in empirical research with a pedagogical focus and have particular relevance for the present study.

The CEPSE/COE Design Studio at Michigan State University (Bell, Sawaya & Cain, 2014; Cain & Henriksen, 2013; Personal communication, October 15, 2014) investigated how technology and specified setups could support various pedagogical approaches so “hybrid students during the online portion of their program could share the same rich learning experiences at the same time” (Bell, Sawaya & Cain, 2014, p. 68). This was enabled by combining specific hardware components (cameras, flat-panel screens, iPads and motorised iPad stands) and placing them in specific variations of *synchromodal models* (Bell, Sawaya & Cain, 2014; Figure 14), that is, hybrid synchronous video-mediated learning environments, enabling different combinations of interactions between students, teachers and content. Based upon various teachers’ pedagogical approaches, the assistants aim was to “support the array of information and communications equipment and applications necessary for streaming multiple modes of audio, visual, and text-based interactions in real-time to that physical space” (Cain & Henriksen, 2013). One of the configurations, the *shared portal,* was very close to the Global Classroom setup (Figure 5). Another configuration, *personal portals*, attempted to create an extended feeling of being in the classroom by using a tablet on a motorised stand. This made it possible for at-home students to choose where to aim the camera and also enabled them to walk (roll) around with peers and engage in social interactions (see also Lee & Takayama, 2011; Kim, Han & Ju, 2014). Being present through a “robot” opened up new possibilities, and the positive findings emphasised the importance of having a body in the classroom, but navigating these remote robots sometimes proved difficult. The *small groups model* (Figure 14; Bell et al., 2014) is also relevant to the current research project and will be described in Section 7.2.6.

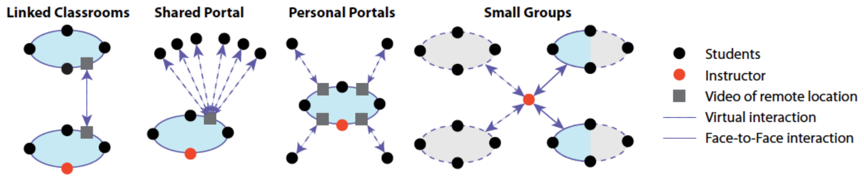


Figure 14: Synchromodal Models learning designs (Bell, Sawaya & Cain, 2014, p.80, fig.14).

The Blended Synchronous Learning Project (Bower, Dalgarno, Kennedy, Lee & Kenney, 2014a&b, 2015) investigated how web conferencing, desktop video conferencing and virtual worlds could be used to effectively unite remote and face-to-face students in the same live classes. This project developed a *Blended Synchronous Learning Design Framework* (Table 3) based upon the synthesis of student, teacher and researcher observations across seven cases of blended synchronous learning designs that were part of the project (Bower, Dalgarno, Kennedy, Lee & Kenney, 2014a&b, 2015). The framework used Biggs model (1989) with the elements: the Presage (contextual elements influencing design), Process (elements that influence how designs are enacted and interaction is supported) and Product (outcomes resulting from the implementation of lessons) to conceptualise how the learning designs of the educational resources influenced outcomes in learning environments.

Table 3: Blended Synchronous Learning Design Framework (Bower et al., 2015, p.14).

Presage	*Pedagogy* • Clearly define learning outcomes • Design for active learning • Determine whether to group remote students with face-to-face students • Utilise general design principles	*Technology* • Match technologies to lesson requirements (see MRSTCF in Chapter 4) • Set up and test the technology in advance	*Logistics/setup* • Be highly organised in advance • Solicit the right institutional support • Prepare students • Prepare self • Establish a learning community
Process	*Pedagogy* • Encourage regular student contribution • Distribute attention between remote and face-to-face students • Identify the focus of learning and discussion • Avoid duplication of explanations • Circulate amongst groups • Draw upon existing pedagogical knowledge • Be flexible, adaptive and	*Technology* • Know how to use (and troubleshoot) the technologies • Appropriately utilise audio-visual modalities • Ensure students have correct permissions • Advise students how to use the technology • Use tablet devices to facilitate visual input if required	*Logistics/setup* • Start lessons 10 mins early for technology testing • Apply tactics to work with text chat contributions • Log on to a second computer (to see student view) • Seek teaching assistance where possible and desirable

	composed		
Product (Outcomes)	• More active learning (remote and face-to-face) • Enhanced sense of community (through co-presence) • More flexible access to learning LEADS TO • Increased student satisfaction		

An analysis of the elements and processes in the two exemplified learning designs makes it clear that learning designs for hybrid synchronous video-mediated learning environments encompass a number of considerations: 1) type of hardware, amount of hardware, placement of hardware (to be able to see and hear each other from relevant angles) and abilities of hardware; 2) what additional communication and educational software to use for interaction and collaboration; 3) new pedagogical approaches with more active and varying learning designs; 4) logistics and coordination before, during and after the lesson for the involved teachers, students and technicians; and 5) knowledge about new technical skills (teachers, students and technicians). Even before all of these considerations come decisions about traditional pedagogical approaches and learning goals for the lessons. These learning designs illustrate that it can be complex to facilitate learning processes in this environment. One aim of this research project was to deepen this research field (Chapter 7-10; Articles A-D).

6.7. ABOUT THE FOLLOWING CHAPTERS

The following four chapters present the theoretical and empirical findings from the design-based research project. These chapters incorporate four articles[6] (three previously published and one submitted) which are presented in the thesis in relevant places. I have chosen to use the thesis template for the articles, since the font size of the original articles would make them difficult to read. The literature cited in these articles has been placed together with the literature cited in the rest of the thesis in the References.

[6] I have chosen to use the thesis template for the articles, since the font size of the original articles would make them difficult to read. The literature cited in these articles has been placed together with the literature cited in the rest of the thesis in the References. The articles have separate figure lists placed after the References.

Initial Experiences and Further Findings

7

CHAPTER 7. INITIAL EXPERIENCES AND FURTHER FINDINGS IN THE HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

Chapter 7 falls into two sections. The first part of the chapter consists of Article A, which describes the initial explorative phase of the PhD project. In order to gain insight into how the students, teachers and management experienced the first year and a half in the innovative learning environment of the Global Classroom, the article presents findings about learning designs, pedagogical innovation, technological–pedagogical issues, motivational elements, IT-Pedagogical roles and organisational challenges. The article also suggests various interventive approaches for the creation of more motivating and qualified teaching and learning processes.

The second part of Chapter 7 presents the students' and teachers' new experiences in the Global Classroom in the period Spring 2014–February 2016. Sections 7.2–7.3 thus follow up on the findings in Article A, presenting additional possibilities and barriers when teaching and learning in the Global Classroom. These sections are based on numerous formal and informal interviews, observations and surveys with students and teachers from the departments in Nykøbing and Næstved (please see Appendix A for an overview of the data collection phases). Like Article A, these sections establish a foundation for understanding the design-based research project described in Chapters 8, 9 and 10.

A

7.1. ARTICLE A: THE GLOBAL CLASSROOM MODEL

SIMULTANEOUS CAMPUS- AND HOME-BASED EDUCATION

USING VIDEOCONFERENCING

Authors: Charlotte Lærke Weitze (lead author) & Rikke Ørngreen.

The paper was published in the Electronic Journal of e-Learning, May 2014, Volume 12, Issue 2, pp.126 – 226.

The Global Classroom Model Simultaneous The Global Classroom Model Simultaneous campus- and home-based education using videoconferencing

Charlotte Lærke Weitze[1, 2] and Rikke Ørngreen[2]
[1]VUC Storstrøm, Denmark
[2]ResearchLab: IT and Learning Design, Aalborg University, Denmark
cw@learning.aau.dk
rior@learning.aau.dk

Abstract: This paper presents and discusses findings about how students, teachers, and the organization experience a start-up-project applying videoconferences between campus and home. This is new territory for adult learning centers. The research is based on the *Global Classroom Model* as it is implemented and used at an adult learning center in Denmark, named VUC Storstrøm. . After a couple of years of campus-to-campus video streaming, VUC Storstrøm started a fulltime day program in 2011 with the support of a hybrid campus and videoconference model. In this model the teachers and some of the students are present on campus in the classroom, while other students are participating simultaneously from their home using laptops. In this paper, the case and context of VUC Storstrøm, the research design chosen, and the literature that already exists in this area constitutes the backdrop for the analysis and discussion of the first activities in this long-term project. The research is based on interviews, on utterances in feedback sessions, and on the observed interaction taking place in the first sixths month of 2013 (i.e. 1. year after the first program commenced). Evaluations show that the students are happy with the flexibility this model provides in their everyday life. However, findings also show several obstacles: Technical issues are at play, but also the learning design of the lessons, as well as general organizational and cultural issues. In this paper we focus on the students and teachers experiences and on the organizational issues related to the transition to the Global Classroom Model as well as provide outlines to the consequences these findings may have, for example in relation to the continued development of the teachers' educational designs.

Keywords: Global Classroom, videoconferences, hybrid campus- and home-based education, adult education, competence development, teacher education.

1. Introduction

This paper presents experiences from a long-term research study on how students, teachers, and the educational organization experience a videoconference start-up-project, where students attend class on campus and from home synchronously. This is a new field for adult learning centres, and as our literature study in relation to our analysis shows, the specific Global Classroom model is a new kind of setup that influences the pedagogic and learning design in different ways than what is known from the more well-established campus-to-campus or desktop videoconference settings.

1.1 Videoconferencing in education

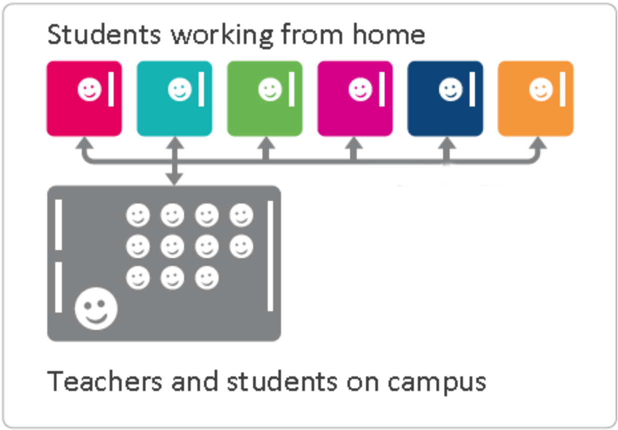
Videoconferencing is a synchronous technology that allows for a direct and immersive learning experience for on-line students since it enables a simultaneous face-to–face interaction with both audio and video, giving a sense of connectedness and utilizing the premise that visual signals improve human interaction (Bower, 2012 and Lawson 2010). According to the literature videoconferencing has “promised benefits of real-time interaction, immediacy, motivation, and collaborative learning” (Gillies, 2008: 108). Though the literature gives examples of these benefits, many also points to technical problems, difficulties in adapting to new teacher roles and functions, and critical challenges to adapting and developing learning designs (e.g. Hedestig and Kapetilinin, 2005 and Kjær et al., 2010).Videoconferencing has developed into two main forms in education: The oldest is the parallel form that uses dedicated videoconference-hardware and is used for reaching one or multiple remote campuses, where the teacher and some of the students are in one location and other students are at another location. Today, other uses of this model exist for instance international guest lectures and virtual study trips (Lawson 2010). The newer desktop form uses personal devices as PC’s or tablets and is a software-solution. Students sit separately at home or together on campus, using live-streaming from everyone to everyone (Andrews and Klease, 1998; Freeman, 1998; Kjær et al, 2010; Roberts, 2009). The two videoconference forms both has a major impact on the learning design as the first one takes out-set in the classroom and the teachers’ physical location herein, and the second one uses a shared laptop space as the starting point of the educational activity. In a third videoconference studio-form, the teacher is in a studio by herself and the students either together at another campus or at home, and thereby hybrid versions emerge.

1.2 VUC Storstrøms Global Classroom Model

VUC Storstrøm is our case organization. VUC is a generic abbreviation for adult learning centres in Denmark. When we refer to VUC, we only refer to our case organization and not VUC’s in general unless specifically noted. In the VUC a new hybrid videoconference form named *the Global Classroom Model* is used. The teacher and students on campus use dedicated hardware solutions (Polycom Realpresence), while the students at home sign-in to the classroom via a desktop-software solution. Unlike the literature describing technologies as Adobe Connect etc. (Kjær, 2010; Karabulut and Correia, 2008; Lawson 2010) this teaching process uses the classroom and the physical boards (digital smart boards) as reference point.

The teacher addresses the students in the physical classroom at the same time as the students online via representations on the projected screen on campus (see figure 1), this being two distinct modes of communication. The students have the choice to participate from campus or from home on a daily basis. Very few describes this hybrid form, and all are new pilot-like-studies (as Ellingson and Notbohm, 2012; Ørngreen et al., 2013) and this is why further research in the area is needed.

Global Classroom uses videoconference equipment that allows the teacher and students on campus to see and communicate synchronously with the students at home and vice versa. From the start the students could attend from home every other week, and every other week they were obliged to go to the campus. Today students generally can chose if they want to attend from campus or from home.



(a)

(b)

Article A Figure 1: The Global Classroom set-up

The equipment in the class is situated in a way that enables 1) the teacher to see and hear the class at campus and at home at the same time, 2) the students to see the whiteboard in class and to see and hear the teacher in class and the students at home 3) the students at home to hear the classroom, to see the whiteboard as well as the teacher or the students at campus depending on which camera is used at campus (see figure 1). It is also possible to establish virtual-group rooms for group-assignments.

In the school year 2010/11 VUC had approx. 5,500 students (VUC, 2013). HF-Global Classroom represents a very small proportion of this (two classes respectively 10 and 26 participants (1.3.2013)). Applying the Global Classroom Model to the HF education is the first initiative in a long-term strategy in a relatively low population density area with long distances. One of the purposes is to ensure each citizen access to education regardless of time and place.

1.3 New demands for the adult learning teachers in the videoconference setting

VUC is an adult learning center and our research also fills a gap concerning the teachers, since there has been a decrease in the academic interest in "*The roles, characteristics and capabilities of educators"* (Harris and Morrison, 2011: 42). According to the review of the 50-years history of the *Australian Journal of Adult Learning*, papers on teachers in adult learning fell from 32% to 7% from 1960-2010. However, due to the increased demand of technology in education there is a continued interest in researching the roles, development of learning design, and general professional development for teachers using on-line technologies (Dede et al, 2009; Laurillard, 2011 and 2012; Beetham and Sharpe, 2013; Baran et al., 2011). Thus, there is a need to gain knowledge about how to enable the teachers and the organization to establish effective and engaging designs for learning in videoconference settings.

VUC is implementing *the Global Classroom Model* to the *HF* education. HF is a Higher Preparatory Examination Course (upper secondary general education program) that lasts 2 years. To teach at HF requires*" a Master degree in at least one relevant subject and to have completed a Post-graduate teacher training course for upper secondary school teachers"* (Milana, 2008: 7). However, it is a recent phenomenon that the majority of the teachers at VUC use technology in their teaching practice, such as sharing digital materials and using traditional learning management systems. The distributed videoconferencing will furthermore make technology constantly present during the teaching.

For the last 10 years, the Danish Government has focused on the implementation of IT in education, as a mean to increase the academic level and ensure that more people get an education. The argument is that IT provides better opportunities for differentiated and more flexible learning and evaluation forms (TDGME, 2012). However, teachers lack an established practice and support when navigating in the many new opportunities within IT (Riis, 2012; Laurillard, 2011), and there is a need to examine what it takes to achieve a well-functioning communication and decision-making flow between the organization and teachers (Henriksen et al., 2011).

2. Research objective and methodology

This is a joint research project between VUC Storstrøm and Aalborg University (AAU). The overall research objective is to investigate: *the design of innovative methods, practices and evaluation tools in relation to the use of IT in Global Classroom settings, with a focus on how to enable teachers to create motivating and qualified learning design for the students.*

This paper deals with the first two phases of the cyclic action research process, namely diagnosing and action planning (Susman and Evered, 1978). Our understanding draws on the assumption that an innovative implementation of IT in formal learning situations takes place as an interaction between different actors, and that research of this kind needs to be grounded in mutual learning and dialogue. As such this is a participatory action research study.

This is done by means of a PhD study as well as a research-based competence development project with senior researchers. We have thus gained knowledge about the experiences, challenges, and potentials when teaching and learning within this hybrid videoconference model. Both studies are action research studies, and the PhD-study furthermore uses a Design Based Research approach to formulate empirical and user-driven theories relating to the Global Classroom Model.

The book *Interaction Design* applies Eason's concepts about primary, secondary, and tertiary users (Rogers, Sharp and Preece 2011:333). Primary users often directly use a given system, in this VUC-case the teachers and the students at home using the videoconference. Secondary users do not directly use the system, but are influenced by other person's use. Alternatively, they only use the system occasionally, as in the VUC case those students almost always attending class on campus. Tertiary users are affected by or have influence on the system, for example as administrators, managers, and it-support personnel. Interaction Design as a discipline argues that systems and technologies first and foremost need to be usable for the primary users, the end users. We agree to this, and furthermore we find that students and teachers are the most important to listen to in the evaluation processes. However, previous investigations also show that in learning technologies the more organizational issues of tertiary users should not be neglected. This does not only mean being able to correct technical errors in the system, when they occur, but also to collaboratively further develop the system to support the intended learning processes and the learning culture of the organization (Ørngreen, Nielsen & Levinsen, 2004). This makes it important to exchange information and share knowledge between the three user levels. In the VUC case, the students at HF-Global Classroom had not yet been involved in or asked about the process. The teachers had received technical assistance in system use, but very little had been done to discuss pedagogical issues at stake, and the administrators, managers and it-personnel knew little about how the actual teaching situation was carried out. We see knowledge sharing as a vital step in sustaining competence development processes and organizational learning. In these first phases, our units of analysis are primarily directed at understanding the primary and secondary users' experiences, and thus identify steps to establish knowledge sharing and competence development processes.

The sub-questions for these particular phases become: *Which teaching practices are sustained or emerge? How do the students perceive the learning situation and the motivational aspects? Can any guidelines and/or future steps be derived from these first experiences?* The empirical material provides insight into these questions in the diagnoses and action-planning phases as listed in table 1.

1 & 6) In the project both formal and scheduled meetings and more informal conversations were held, all of which were part of the *getting to know each other*.
2) The workshop with the teachers was inspired by the *Personal approach to SWOT* (strength, weaknesses, opportunities and threats) (SWOT, 2013). We chose to organize it in three rounds: personal, team and plenary, all with pre-prepared question sheets to trigger reflection and dialogue.
3 & 4) The formal conversation took place via videoconference. The researchers had prior to the conversation received written input (from some teachers) to the perceived challenges and thoughts on future focus points .
5) The student evaluation workshop participants was the HF-class (N = 14) that started their education with the Global Classroom Model in August 2012. It was a four-hour workshop, and in the introduction the students were encouraged to be constructive in their criticism. Inspired by interaction design and appreciative inquiry, we argue that informants can be creative, and that by focusing on the areas that are working well, the informants can help to promote and develop these.
7 & 8) The purpose of the interviews with and observations of the teachers was to identify the experienced potentials and barriers in the Global Classroom Model, and to see if innovative approaches in their own learning designs had emerged. A particular focus was to identify motivating elements in the teaching situation.

Table 1: The material from the diagnose and action plan phases

1) Meetings and ongoing conversations with project owners, management and (IT) pedagogical consultants at VUC	From early Autumn 2012 to Spring 2013
2) Workshop with teachers, incl. project owners and pedagogical consultants	26 November 2012

3) Written input from teachers – on challenges and future plans	December 2012 and January 2013
4) Formal conversations between teachers and researchers – i.e. scheduled and planned activity	29 January 2013
5) Student evaluation workshop – a qualitative workshop, 14 participants	22 February 2013
6) Informal conversations with teachers	Spring 2013
7) Interviews with teachers – based on semi-structured interviews	15 April – 8 May 2013
8) Observation of Global Classroom teaching	Spring 2013

3. Learning and motivation theory

Since one of the inquiry points in the study focuses on how to create motivating and qualified learning design for the students, we briefly unfold relevant theories on motivation and learning in the following. In Knud Illeris renowned model on how learning takes place, he argues that the following three dimensions are involved in all learning: the inner psychological process of acquisition (content dimension), the interpersonal - interaction dimension, and the willingness and desire to deal with what should be learned (the incentive - dimension) (Illeris 2007). The first two dimensions involve the cognitive (content) learning and collaborative learning domains respectively, which are important in teaching and learning. However, the motivational dimension is equally worth focusing on since VUC's are considered as a "second chance". Many (60%) students attending HF at VUC has at least one other discontinued education in their past, where lack of motivation is often mentioned as a key element (Pless and Hansen, 2010). Motivation can influence *when* we choose to learn, *what* we learn and *how* we learn, and "*motivated learners are more likely to undertake challenging activities, to be actively engaged, to enjoy and adopt a deep approach to learning, and to exhibit enhanced performance, persistence, and creativity*" (Schunk according to Hartnett, George and Dron, 2011:21). The 3rd of Illeris' dimensions, the driving-force-dimension, deals with the desire or the motivation to learn. Several relevant motivational theories deals with this matter in educational settings. The self-determination theory (Deci and Ryan, 2000), the ARCS model (Keller, 2008), and Flow Theory (Knoop, 2004) are all theories offering basic principles on how to measure and apply motivational elements and practices to the different learning elements and situations. It is beyond the scope of this paper to describe these theories in detail, but they are relevant for the further development in the project; that is in the 3rd and 4th phases of the action research process as the experiments with the teachers and students are taking place in workshops and other design-based research approaches. However, we have already seen signs of the motivational elements in the Global Classroom Model in the findings among the students (see later), mainly related to the freedom this model provides for the students. This is supported by Jerome Bruner, who believes that our intrinsic motivation to learn consists of the three following underlying main driving forces: 1) Curiosity: the desire and freedom to explore things, and decide for yourself - a playful mood. 2) Achieving competence: the desire to show that we can do things and therefore are independent individuals. Mastering something creates joy and pride and is thus motivating. 3) Reciprocity: the desire to be an indispensable part of the community. People like to achieve goals with others, to be part of a “learning community”(Bruner according to Gärdenfors, 2010). The argument is: if the learning is planned in a way that enables the student to achieve one or more of the three motives above, it will help the student to feel an inner motivation to learn (Gärdenfors, 2010).

That said, motivation is also complex, multifaceted, and influenced by both person and context. Motivation cannot be fully explained from the perspective of neither the effect of “learning environment design” nor the “learner characteristic”. Therefore, it is important to consider both the learning environment design as well as the relevance and interest from the learners perspective (Hartnett, George and Dron, 2011). In our study of the videoconference literature we have found little that relates the combination of the three perspectives of the acquisition, interaction and motivation of learning processes as presented in the Illeris learning model.

4. Theoretical and grounded analysis of the empirical data

Our analysis applied the above theoretical focus on learning and motivation, with the unit of analysis being the three user groups. Apart from this our primary objective was to be open to emerging themes in the eight activities (table 1), an approach inspired from grounded theory. When interpreting the themes we related them to the existing literature on the various identified videoconference forms.

4.1 The students

The Global Classroom Model consist of the videoconference as a mediated learning process, and also comprises the use of other forms of IT in education including digital materials, software, and processes because of the changed environment for the learning design. For example, all the instructional materials should be accessible online (Rice, 2012). In this way, the Global Classroom concept has inspired some of the teachers to implement new kinds of IT in their teaching practice. These new ways of involving IT in the teaching may, together with the Global Classroom concept, potentially help to create a more relevant and motivating learning for the students appealing to the students’ curiosity (Gärdenfors, 2010; Somekh, 2008).

According to the German professor of pedagogy Thomas Ziehe there has been a "de-conventionalisation" - a change in young people's knowledge, behaviour, and motivation (Wiborg, 2009). Today, young people are choosing what they want to learn, and young people's behaviour has changed because they have become major media consumers. The student's motivation helps establishing interest in the subject matter and is therefore an important contributing factor to the learning process (Koster, 2005; Weitze and Ørngreen, 2012).

Motivational elements: In this study, the students explain that they find a number of aspects of the Global Classroom concept motivating; this is supported by other findings of the increased motivation for students in videoconference settings (Lawson, 2010). For example the students own choice of environment gives them the freedom to manage their family and everyday life by not always having to be present at school (Gärdenfors, 2010). Several students are also pleased with being able to vary their classroom environment during a day by changing geographical location, and when sitting at home they have the feeling that the school-day ends sooner. These flexible possibilities can partly be seen as equivalent to the *work-life flexibility practise* known from many modern companies. Another equivalence is that the students also have to show up when needed at school; for instance, when they are conducting experiments at the lab. The format also creates a new "intermediate solution" for some students, when they feel "sluggish" and normally would have taken a sick-day. In this way, the concept contributes to their ability to complete their education, because they end up attending school more often during the year.

Technological-pedagogical issues: The students' experienced technical problems and many of these problems were solved along the way. Problems were partly due to Global Classroom being a new concept developed through a bottom-up approach, and partly due to the fact that students and teachers, had to learn how to use the system from scratch. That said the experience remains that once in a while periods with more technical problems occur. For instance when the software in the systems are updated at some points in the "supply chain" and not updated synchronous at other points by the suppliers. This is a constant point of frustration for the students and the teachers.

The Global Classroom seems to provide a transparent experience (Dourish, 2001), giving the feeling that it is possible to simulate a traditional classroom. Therefore the teachers expect to be able to apply various educational activities equivalent to what takes place in a traditional classroom. But for instance it can be a problem to make the students at home engage in class conversation, because the technology sometimes, against the teachers expectations, causes noise in the class, or causes delay in audio and photo (Lawson, 2010; Allen et al. 2013). So because of the noise and delay the students at home often perceive it as a disturbance when they speak. In addition, the human ear cannot filter sounds in the same way in online space as in physical space; all sounds are mixed and more difficult to differentiate (voices, moving of chairs, coughing etc.). It has also proved difficult to create groups across home and campus because of technological problems and issues with too much noise in the class. Pure home-based-groups also have problems in detecting when to “return” to the classroom debate. We see a need for the teachers to experiment with various ways of working actively across the constellations of home and campus.

The students tell that they have been frustrated in relation to the communication with the technicians when something is wrong with the technology. Some problems are of so vital importance that the teacher or student should be able to get immediate technical assistance, as videoconferencing in its nature is very sensitive to the kind of technical breakdowns that stops transmission and has the effect that the teaching cannot be carried out (Gillies, 2008; Hedestig and Kaptelinin, 2005). Uncertainty about deadlines for repairs and corrective actions are inconvenient in everyday life and has also concerned the students.

Learning Design: The students’ experience that the teachers are very different in their approach when activating the students at home. Some teachers are very aware of home-students asking them very directly to participate in the debate, while other teachers hardly pay any attention to the students at home. This finding is well in line with previous findings in the videoconference and online learning literature, where one of the mayor emphasis and keys to success are on how the teachers has to develop strategies in their learning design for activating and creating collaboration with the online learners (Majid, 2006; Baran et al 2011; Bower 2012; Gillies, 2008; Kjær 2009; Lawson 2010; Laurillard, 2011). Some students find it difficult to make the teacher aware that they want to answer a question. This makes the students at home frustrated and uninvolved. Therefore, the students feel it is important for teachers to take this issue into consideration in the learning design and to be aware that the students at home would like to be invited more into the class activity. The students at home are using different strategies to solve this problem like writing to the campus-students on Facebook etc. In our dialogues with the teachers we have also found that the class from August 12 who participated in the qualitative student evaluation is very different from the class from August 11. In the 2011-class the students at home are always very active and also often the "diligent" ones in the class. Consequently, it might not be the teachers that ignore the students at home, it may also be that students at home are less active, hiding a bit and not so easy to activate (Lawson, 2010).

Another consequence of the Global Classroom setting is that it is important for the students to have access to all instructional material as well as assignments on-line before the lesson begins. This gives the students a chance to participate actively in the current lesson by solving these assignments in spite of any technical difficulties that might arise (Rice, 2012).

Rules in Global Classroom: The students are satisfied with the rules of conduct in Global Classroom regarding the recommendations on behaving as in a traditional class, e.g. not to attend in pyjamas from bed, no smoking etc. These rules have been developed bottom-up as such situations did happen, and are changed regularly according to new experiences. One can, however, consider whether it also would be beneficial to develop pedagogical recommendations on for instance: active participation, working in groups etc.

Pedagogical Innovation: The students have been pleased with the new learning designs that involved working and interacting on the Internet, as this gave equal opportunities for students at home and on campus, as e.g. preparing multimedia presentations (Lawson, 2010; Bower 2012; Kjær 2009). However, when inquiring about ideas for other initiatives the students had difficulties articulating new ideas. Thus, as for teachers it can be hard for students to think beyond the traditional educational culture. This calls for the development of a more innovative pedagogical culture and practise, if students and teachers are participating in further development of the learning design (Laurillard, 2011; Lawson 2010).

It is important to acknowledge that in spite of the many problems, in terms of technology, in relation to pedagogy, and mental stress issues, the students still perceive the videoconference as advantageous and want to continue within the Global Classroom concept.

4.2 The teachers

The teachers have not been employed specifically as Global Classroom teachers (Rice, 2012). Though they received initial training in the concept, it was, at first, difficult for them to imagine how it would be to work with. The IT-pedagogical project group chose different approaches to educate the teachers: short seminars, and later involving researchers conducting innovative workshops, but all the time also with a bottom-up/ learning-while-doing approach. At times this was frustrating for the teachers, but considered necessary by the IT-pedagogical project group, since this was new terrain. Somekh stresses that adopting to change is learning and, "*like students, teachers need to learn actively and have opportunities to try things out and evaluate the outcomes on the basis of evidence, with the support of strong leadership and a community of peers*" (Somekh, 2008: 9; Baran et al., 2011). What sometimes is regarded as "*teachers resisting to be innovative in their pedagogical practice*" is indeed a complex and cross organizational issue, since teachers, students, managers, and project groups in the organization are all embedded in an educational culture that at the same time supports and restrains its members. Pedagogical innovation does not only concern and involve the teachers but the entire learning organization.

Motivational elements: At the moment the teachers primarily regard Global Classroom as being beneficial for the students, and they appreciate that it makes it possible for some of the students to complete their education. The fact that the teachers themselves doesn't yet find the Global Classroom Model motivating could be seen as a sign of the model not yet being sufficiently matured and developed. In a more matured model containing 5 levels related to online learning, it shows that it is often not until level 5 that the organization's learning system have the ability to cater for motivation and engagement, after the other levels subjects are cared for. (Suzuki and Tada, 2009). At VUC, problems are still in the technological area (level 1) as well as in the learning design (level 4). The future development of the pedagogical aspects in the concept will hopefully also contribute to the teacher's own motivational experiences within this frame.

Pedagogical-Technological issues: In the initial phase at VUC the teachers often had to spend a large part of their time and attention on making the videoconference technology work, experiencing that they wasted valuable teaching time. However, in our latest observations and interviews with the teachers, we note that several of the teachers tell that the technology now is running most days.

Cognitive demands: The teachers experience sudden interruptions in the middle of a sentence in class, when students at the videoconference cannot see or hear the teacher clearly and therefore interferes out of the teaching context. Students use different strategies to solve this problem as for instance writing to campus students on Facebook, since there are no chat facilities with the teacher in the current videoconference system. At the same time, the teachers experience mental overload due to the many media at play and the many points of attention. Many teachers experience an immense fatigue after a Global Classroom lesson. The student evaluation showed that it would be advantageous and less disruptive if the students used chat to submit information to the teacher during a lesson, but this is not necessarily the teacher's desire. On the contrary, many teachers expressed reservations about getting one more media to communicate in and keep an eye on, though a few forerunners seemed to have the energy to work with multiple media and students at 2 locations at the same time.

Learning design and activity level: Just like the students, the teachers find it possible to carry out teaching and learning in a traditional manner in the Global Classroom Model including the content-, interaction- and incentive- dimensions (Illeris, 2007), and they see this as an advantage. But there are communicative difficulties partly due to lack of the valuable flow and synergy experienced in the interaction in a traditional classroom discussion; these difficulties are due to sound delay and poor lighting from the students at home; and due to some students that deliberately choose a passive role (Gillies, 2008). Depending on where the most active students are, the "centre of gravity" in the activity level in the class or at home shifts. This is an interesting aspect in the debate since this highlights the importance of student engagement and study skills in general instead of only focusing on trouble with the technology (Illeris, 2007). As teachers are based on campus, and since some students are always there as well, it might be less obvious for the teachers to consider teaching strategies from entirely online teaching, as for example online discussion forums, online games etc. (Bower 2012; Lawson 2010; Laurillard, 2011; Beetham and Sharpe, 2013).

Facial decoding and visual attendance: Another problem occurs when the teacher cannot read students' facial expressions or they “disappear” from the screen. Sometimes the teacher can only see the student's silhouette if he sits with the light coming from behind. By reading facial expressions the teacher evaluate whether the student does not know the answer, or if he's shy and the teacher just needs to ask. "*They are all adults, and the moment you ask them a question and they don’t respond; then I can’t see any point in going on.*" a teacher utters, with reference to the students’ having to take responsibility of their own learning process (Illeris, 2007). Since it was more difficult to see the facial expressions of the students at home, he asked them less frequently, if he was in doubt that they were able to answer. *Another* problem is when a student at home "disappears" during a session (leaves the laptop, turns of web-cam or logs-off the system). There is an 80% attendance-rule. When a student cannot be seen on the screen, some teachers choose to ignore it, others comment on it. At the student evaluation, some of the students expressed that the teachers were violating their trust if they commented harshly on how often they walked away from the screen. These are stress-creating issues that underlie the teaching and runs as an additional point of focus for the teacher during the teaching.

Pedagogical Innovation: Research shows that apart from few enthusiasts, it is in general difficult for teachers to be innovative in their use of IT in the teaching. Teachers often settle for transferring their existing and inherent practice. This practice can certainly be really good, but according to the Danish Evaluation Institute teachers do not fully utilize the pedagogical and academic possibilities lying in front of them concerning the use of IT (EVA, 2012). This indicates that teachers need to learn to work with IT learning tools, but also that they need support for the process of innovation and for the development of innovative thinking (Darsø, 2011; Laurillard, 2011).

4.3 The organization

Conversations and meetings with the organization's project owners has, along with the other empirical activities, illuminated classical issues in the change processes in which project managers at times are well ahead of the rest of the organization since they already understand the ideas within the process that they themselves have developed. This was evident in the SWOT analysis with the teachers, where the teachers articulated that they had a fundamental lack of insight into and influence on the process, as well as a frustration with the basic challenges in technology, pedagogy, and the organizational setup. This was in contrast to the project owners' first dissemination about the situation to us as researchers at the first meetings, and this indicates the potential in looking at the different stakeholders views and at the movement between topdown and participative management in the organization, and possible adjustments in the organizational change management processes (Jacobsen and Thorsvik, 2008).

IT-pedagogical roles: The IT-pedagogical project department at VUC has a tripartite role since they are 1) visionary designers for future learning, 2) helping with the actual implementation process in cooperation with the department managers and teachers, for example by participating in the organizing of training courses for teachers and 3) contributing to the evaluation and anchoring of the many IT-in-education-initiatives, e.g. by involving researchers in the development and documentation of the project, as well as in the dissemination of these results.

Organizational challenges: The teachers get frustrated when they are faced with new challenges from the organization and asked to think in innovative ways in relation to the implementation of the new systems, not at least when technical issues are at play. The teachers feel that they are being asked to redefine their teaching role and thereby themselves. The literature supports the redefinition of the teachers’ role, recognizing that there is a need for new roles and competences for teachers using technology in education (Lawson, 2010; Dede, 2009; Laurillard 2011, 2012). Furthermore the teachers miss that the organization decides, establishes, and announces a more general framework on “how we do Global Classroom", rather than each teacher using a personal approach that needs to be negotiated with the students every time. Different views exist between teachers and technical staff in the assessment of the frequency and seriousness of the technical problems occurring. This calls for knowledge exchange between these groups.

5. Discussion and findings

Our analysis reveals these primary themes:

- That the students perceive Global Classroom as motivating because of the freedom/agency to select their own educational environment with the flexibility this provides in their everyday lives. And that it is important to develop motivating learning situations for the VUC audience.
- That the students were motivated when presented for technological tools that allowed them to work equally from campus and from home.
- That the teachers find that their teaching can be carried out in a fairly

traditional way in the Global Classroom setup. At the same time they find it difficult to change the part of their teaching practices that could benefit from being changed. In the videoconferencing literature it is generally recommended to re-design student interaction and collaboration compared to traditional teaching, for instance with new kinds of interactive educational technologies as well as with asynchronous collaboration (Lawson, 2010; Kjær, 2009, Gillies, 2008).

- That the Global Classroom model is a hybrid model, always having the teacher and part of the students on campus. This situation – always having part of the class at campus - might contribute to a greater expectation of being able to teach in a traditional way, than in other forms of videoconferencing settings. Therefore, it might be a bigger leap in the teachers' awareness of the need for a different design for learning when teaching in the Global Classroom Model. But "*online teaching is different from face-to-face teaching and […] as such, it requires the development of its own pedagogies*" (Baran, 2011:425). The teachers in The Global Classroom Model will thus have to innovate and develop their own best practices to make the concept a success.
- That both students and teachers are experiencing communication difficulties and that some of the problems arise because the Global Classroom concept is so close to a traditional classroom that they consequently have high expectations to the communicative "flow" in the learning situation. This should also be taken into consideration when developing educational designs for learning.
- That after this start-up period there is a need for the organization in collaboration with teachers and students to elaborate a more detailed framework that defines and helps establishing a culture of "how we do Global Classroom at VUC", while also providing room for a sandbox approach. A culture that works on revealing and disseminating the basics of teaching in the Global Classroom concept, on finding ways to establish clear and sufficient communication, and to build upon the good examples of innovative cooperation between the different agents in the educational institution. There should also be an openness to continue developing rules and best practices "bottom up" in order for the learning environment to work in an un-stressful way.

Certain characteristics of the VUC students make VUC particularly challenged by dropout issues (VUC, 2009; VUC, 2011; EVA, 2013). These issues make the findings of the students' positive and motivating experiences of the Global Classroom concept essential.

For the students and the teachers the start-up process of the Global Classroom concept has involved so many technical problems that the quality of the teaching was affected. However, evidence from our observations shows that Global Classroom for most teachers today (spring / early summer 2013) operates with few technical problems in daily life, contrary to what the teachers expresses verbally which is perhaps sparked by occasional problems leading to unpleasant loss of control during a lesson. This means that although the percentage of technical problems may have decreased, their influence on the learning situation is still servere, as it still takes valuable time to recover from such incidents.

There is an interesting paradox in the different views of the students and the teachers in relation to class activity. Many teachers express that this HF class has students who make a deliberate choice to be at home since this allows them to be somewhat passive in class. While the students suggest that teachers tend not to activate them at home. Both parties may well have the ”right” perception of this experience, as this might be an example of self-reinforcing pedagogy built on assumptions about a specific group of students without it necessarily being an explicit and chosen pedagogy of the teaching staff.

6. Conclusions and future perspectives

VUC Storstrøms transition to the Global Classroom Model has been challenging and has contributed to the organizations consciousness of needed skills in supporting innovative developments, skills they are already taking new initiatives to develop. At the same time, the students have found the Global Classroom concept to have motivational aspects, because they have obtained freedom to design their own learning environment.

Although students who have chosen the HF-Global Classroom class to begin with want to continue with this model, there are still technical difficulties. Our study showed that one or more sessions between teachers, students and the technical staff would provide the technical staff with more knowledge about which pedagogical and learning design activities they particularly need to support.

It is essential that the teachers have the opportunity to innovate, develop and practice new designs in safe-zones to get a better sense of what it takes to create activity and motivational training in the Global Classroom concept. This requires an attention and willingness to schedule this from the management at VUC. The purpose of phase 3 and 4 of the action research process is to implement innovative pedagogical activities with workshops and design-based research approaches.

The Global Classroom Model differs from other videoconference models, using either solely hardware- or desktop based solutions, in a new combined model. The Global Classroom Model generally gives the students a freedom to choose if they want to attend school from campus or from home, giving the adult learners new freedom to create a work-life balance on a daily basis. Nevertheless, this at the same time calls for an increased awareness from the teachers on how to innovate and redesign the traditional education in a way that provides equal opportunities for the students on campus and at home.

Future perspectives: The use of more innovative IT-pedagogical elements inside the Global Classroom frame can provide further opportunities. Based on the analysis, we argue that play and gamification, and bodily activation with the purpose of motivating both the students and also the teachers are worth investigating. This could be explored through the use of learning games, students' digital productions, role playing, or complex multimodal presentation forms etc. (Koster, 2005; Weitze and Ørngreen, 2012).

Acknowledgement: We thank VUC teachers, students, managers, and support personnel. We are as researchers very impressed by the openness and willingness to learn which we found at VUC, particularly when research findings point to the more difficult to handle and subtle subjects. We also thank Karin Levinsen, who as our colleague AAU also participated in some of the activities presented in this paper.

END ARTICLE A

7.2. NEW LEARNING AND TEACHING EXPERIENCES IN THE HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

The following sections describe students' remote-learning experiences, including why and how often they have used this flexible option. The characteristics of the common teaching and learning room are explored, as well as the experience of learning in a room without being physically present. The chapter includes examples of how the learning environment influences motivating learning designs and pedagogical processes planned for traditional (non-hybrid-synchronous) teaching, outlining some of the challenges that Global Classroom teachers and students face.

7.2.1. STUDYING FROM HOME: REMOTE STUDENTS' EXPERIENCES

"There are times where you lose the connection … and then miss what is said; but there are also advantages, like if you have to read or do assignments, then you can mute the entire class, which can be a huge advantage." (Student's comment about participating from home)

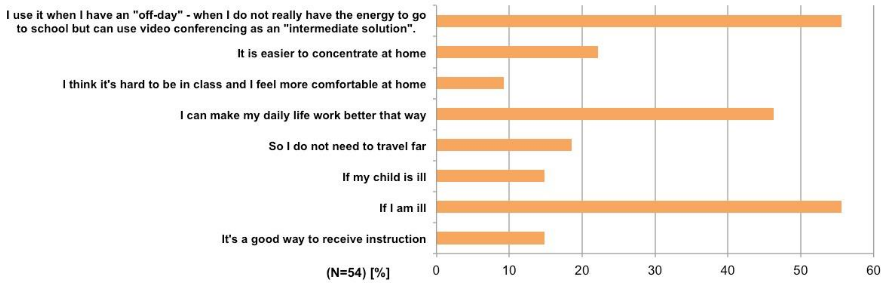
"I still think it's a challenge to get the students sitting at home involved. I do not think they benefit enough from the teaching." (Teacher's comment about at-home students in the Global Classroom)

Learning from home: Students participating from home experienced the classroom via their computers' interfaces (Figure 4). Some students were satisfied and felt that the learning experience was the same when participating from home as when they were in the classroom. But for other students, it quickly became "boring" to watch the lessons over videoconference; they sat in their private home surroundings with other spheres of interest that could distract their attention. Some remote students indicated that they felt somewhat left out and as if they were in a spectator position, and sometimes there were technical problems when using the microphones from home that delayed the response option. Students observed that when they listened to a class presentation from home, their concentration would drop faster than it did when they were in the classroom. Therefore, participating in the video-mediated lessons required more initiative and concentration than being present in class. Most remote students did not participate in the same active way as students in the class, and, according to many students, as well as the teachers, the remote students learned less than the students in class. This finding is well in line with previous findings and calls for learning designs that involve students more actively in the learning situation, and also for designs with more frequent variations in the pedagogical patterns to help the students participate in a more active way (Bower, Dalgarno, Kennedy, Lee & Kenney, 2015; Friesen, 2009; Greenberg, 2004; Roseth, Akcaoglu & Zellner, 2013; Stewart, Harlow & DeBacco, 2011).

7.2.2. WHY AND HOW OFTEN DID STUDENTS STUDY FROM HOME?

Sixty-seven percent of the students[7] in the Global Classroom had chosen to be there; the rest of the students were placed there by the school administration when they applied for an ordinary upper secondary general class. This may explain why some students said they never used the option of studying from home, instead preferring to be in class every day. The option to participate from home was, however, appreciated by many of the students (Knowles, 2014). Students chose to participate from home for a variety of reasons (Table 4, N=54). Many of the students reported that they used this new opportunity to make their everyday adult life function more easily (46%). This also included the opportunity to study from home if they were ill (56%) or their children were ill (15%). Some students (15%) felt that it was a good way of studying; some (22%) found it easier to concentrate at home. Apart from being ill, the advantage that most students reported experiencing was that they could participate even if they had an "off-day" (56%). This is an important discovery, because the Global Classroom class included an increased number of students with social difficulties. This response indicates, and the qualitative answers further confirm, that the option of studying from home helped them participate in school on days when they would otherwise not have come to class. This option may support the completion of education for these students.

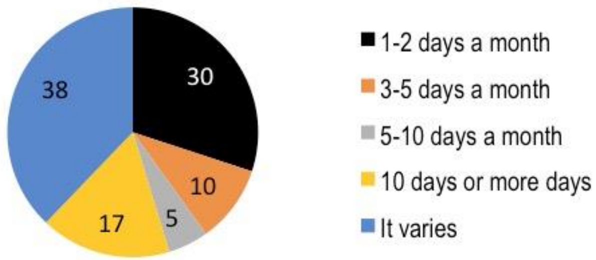
Table 4: Students answers to why they chose to participate from home.



When asked how many days per month the students participated from home, 30% said 1–2 days a month; 10% said 3–5 days a month; 5% said 5–10 days a month; 17% said 10 days or more a month, and 38% answered that it varied. Some students reported that they decided to come to class because they had experienced difficulties in concentrating and learned less when participating from home, but the survey indicates that more than half of the students used this option on a monthly basis. Thirty-two percent of the students studied from home more than three days a month. Taking into account that there are 20–22 school days in each month, 17% of the students studied from home more than half of their time in the course. In spite of the challenges of studying from home, the students frequently chose this option.

[7] The surveys in these sections were collected from February 2014 through December 2015 from four classes in the Global Classroom. N= 58. Approximately 20 students did not participate in the survey.

Table 5: Students' answers to how often they participated from home.



7.2.3. BROKEN TRANSPARENCIES IN THE VIDEOCONFERENCE SYSTEM

The teachers' experiences of teaching for two years or more in the Global Classroom varied. When the teachers were asked, "How do you handle this teaching situation – that there are two locations?" One teacher answered, "*I experience it split in two. It is a feeling of distance. I do not feel that the at-home students are present.*" Another teacher answered, *"[I experience it as] challenging for the learning process. I try to remember that there are students sitting at home and try to keep an eye on the big screens to see what those sitting at home are doing."* A third teacher answered, "*Fine. I try to pay attention to both rooms. I try to think about the space as one.*" The teachers thus had different experiences of how easy it was to create a united feeling of one teaching and learning room and whether it was possible to address the students on equal terms (Dourish, 2006; Levinsen, Ørngreen & Buhl, 2013). Taking this challenge into account became part of the teachers' considerations when designing learning activities for the Global Classroom.

In order to establish a well-functioning learning environment[8], this videoconference system's aim was to make the artefact (the videoconference system) a transparent detail in the interaction between the teacher and the students; in other words, the technology should ideally disappear from the teachers' and students' immediate attention during the interaction process (Dourish, 2004; Ihde, 1990, p. 106) and become entangled in practice (Orlikowski, 2010). However, this transparency experience disappears the moment technical problems occur. In fact, the smallest technical flaw in sound or picture can eliminate the system's "invisibility." For instance, if the sound is unclear or a delay occurs during a classroom discussion, the result will be a disturbance in the learning environment. The students and teacher can no longer focus on *what* is being said – the learning content – but instead must focus on the medium and the missing information. The conversation in the classroom is not just about the exchange of information, but also about shared meaning-making on multiple levels (Ruhleder & Jordan, 2001). A disruption in conversational turn-taking when talking together over videoconference – whether caused by delay, by disruptive noise, or by the failure to transmit any sound at all – can contribute to difficulties ranging from unpleasant

[8] These two sections are slightly edited versions of a section from (Weitze, 2014d).

feelings to misunderstandings to a breakdown in which conversation cannot take place (O'Conaill, Whittaker & Wilbur, 1993).

Figure 15: Learning situations that were difficult to re-create for home-students.

In the hybrid synchronous learning environment, it was also relevant to consider the physical body (Bell, Sawaya & Cain, 2014; Friesen, 2014). When learning in a traditional brick-and-mortar classroom, we are seldom conscious of our bodies. Thus, the body can be regarded as transparent as long as it is functioning well. When experienced as transparent, the body immediately engages with the space and the objects in its proximity; postures and movements occur without a need for conscious reflection. This feeling of bodily transparency lets us experience our bodies as being *in the world* and not separate from it (Dolezal 2009, Merleau-Ponty, 1962). When learning through the videoconference interface, the students at home were represented in the classroom via picture and sound, and the students at home could see and hear representations of the students and the teacher from campus. However, in the interaction with the classroom, the transparency of the body was broken because the students could not act with their bodies in the classroom from home. If the teacher brought large pieces of paper for students to use in a shared brainstorming process or for creating games (Figure 15), the students at home could not see or draw on this paper; they were sitting at home "behind their windows – looking in"; their bodies were in another place. Although the teachers and students may not have explicitly discussed these phenomena, they are examples of tacit knowledge and new practices, or the lack thereof, in the hybrid synchronous learning environment (Polanyi, 1966). These various manifestations of broken transparencies in the Global Classroom call for further attention and innovative learning designs aiming at creating equal opportunities for students at home.

7.2.4. RE-DESIGN OF MOTIVATING LEARNING DESIGNS

The teachers had developed many strategies to motivate and active their students over the years, but they had trouble in transferring these learning designs to the hybrid synchronous video-mediated learning environment. What emerged was a need for pedagogical innovation. As one Global Classroom teacher explained, "It is the creative + physical – things I would have invented in a regular class; for example, workstations, QR code, a treasure hunt around the school, walk & talk, playing ball, etc. I cannot use these with the Global Classroom students, and I still miss being able to think out of the box and come up with alternatives for those students who sit at home so they can get out of their chairs. This deficiency makes my teaching less engaging and varied than I want." The teachers also dreamed about a camera that could follow them around in the classroom, giving them the opportunity to move freely and still remain visible to the at-home students. This has been solved in other video-mediated teaching contexts with the use of wide-angle cameras (Bell, Sawaya & Cain, 2014) and motion-sensitive cameras (Ørngreen, Levinsen, Kelsbak, Møller & Bendsen, 2015).

7.2.5. TOO MANY PRESENTATIONS AND TOO LITTLE COLLABORATION

"Paradoxically, I have been forced to turn to more traditional solutions in the Global Classroom. I haven't been able to make initiatives with matrix groups, role-playing or learning games work." (Teacher from the hybrid synchronous video-mediated learning environment)

The narrative or monologue form of teaching was a big part of several teachers' learning designs in the Global Classroom. This was evident from the live observations and from studying more than 20 hours of video recordings of lessons with various teachers teaching a variety of subjects in the Global Classroom. According to many teachers, this was a dilemma, as their pedagogical aims were to make the students participate actively in the lessons. There were various reasons for the widespread use of lectures; the adult audience was one of these reasons. According to the teachers, many of the students in the adult upper secondary general education program were not doing their homework and came to class unprepared. Because the teachers were determined to contribute to the students' learning processes, they chose to use the time during lessons for lecturing, explaining and demonstrating concepts, theories and perspectives in order for the students to acquire the new knowledge (Illeris, 2007; Piaget, [1952]1965; Laurillard, 2012). The narrative approach was often supplemented with questions and invitations for dialogues with the students in order for the students to construct knowledge (Illeris, 2007; Lave & Wenger, 1991). According to the teachers, these invitations were accepted and acted on by only a few students.

7.2.6. GROUP-WORK PRACTICES SUPPORTED BY TECHNOLOGY … OR NOT

The learning environment conditioned a second reason for the extensive use of lectures. Many teachers traditionally created learning designs with group-work in order to create active and collaborative learning experiences for the students and as a way to vary and create shifts in the learning design. This group-work might take place two or three times over the course of lesson, for anywhere from two to ten minutes, giving students an opportunity to discuss a small matter in groups and to activate them in a different way than merely listening as the teacher spoke. But group-work proved difficult and time-consuming to establish in the video-mediated learning environment. Establishing group-work for students in the brick-and-mortar classroom was not a problem, but cross-over groups (with both at-home and in-class students) and entirely online groups experienced various difficulties. Students and teachers often negotiated the issue of forming cross-over groups or letting in-class students and at-home-students work in separate groups (Table 3; Bower et al., 2015). Some teachers assigned specific virtual meeting rooms for each group so they knew where to “meet” the groups online. This could be done by writing the group names and virtual meeting room numbers on the interactive whiteboard for everyone to see and remember. When cross-over groups were created, the Global Classroom space was noisy, and there were not enough stable internet access points, so groups often left the brick-and-mortar classroom for another location in the school, making it difficult for the teacher to find them. An alternative strategy was to ask groups to be back at a specific time, but this design precluded teacher supervision on campus during group-work. According to many teachers, these problems led almost imperceptibly to altered pedagogical approaches and practices with less group-work and an extensive use of monologue-based teaching. This disappointed the teachers, whose ambitions had been to change this. Therefore technology contributed to shape the pedagogical approach, but not necessarily in a way that satisfied the teachers (Dourish, 2004). Another important issue was that the additional technological tasks required to establish group-work or other pedagogical initiatives, while minor, all took time and concentration away from the teachers’ primary obligation: to create motivating learning experiences.

Technological aspects of group-work: The web-conference system Adobe Connect (2016) is often used in educational situations in which students participate individually from different places. In Adobe Connect, the teacher can design groups for the students within the software system and send these students to break-out rooms for group-work. By pressing a button, the teacher can easily log into each virtual room to supervise the group; the teacher can also invite everyone back to class with the click of a button. In Næstved, some teachers started using a second videoconference room for students in the cross-over groups. They turned on the videoconference screen, and the in-class students could keep their own PCs for their individual work and communicate with the students at home by looking up at the big screen/camera (Figure 16).

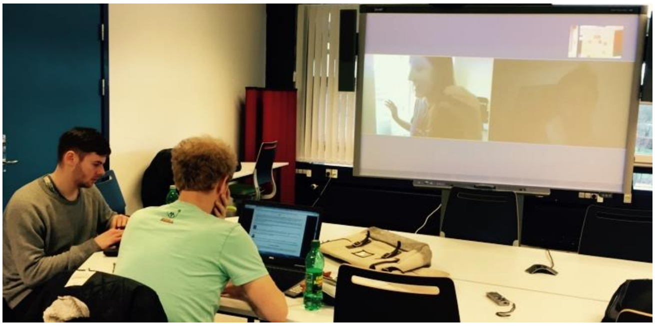


Figure 16: Collaboration with one extra screen as well as individual PCs.

This is equivalent to the *small-groups design* by Bell, Sawaya and Cain (2014; Figure 14). On a study trip to the Design Studio at Michigan State University, I was introduced to this solution for *staying* in the classroom and working in cross-over groups sitting at small, separate tables with additional screens. I introduced this concept to the Global Classroom teachers, and one of the teachers made a suggestion (Figure 17) for a rearrangement of the classroom, making it possible to stay in the room and increase the frequency of group-work during lessons. In this design, the tables along the wall had interactive screens with specific videoconference rooms assigned so students in the cross-over groups could meet in these specific physical/virtual rooms when sitting at specific tables in class. The students would still have to wear headsets to avoid disturbing other students and to minimise audio interference with other groups.

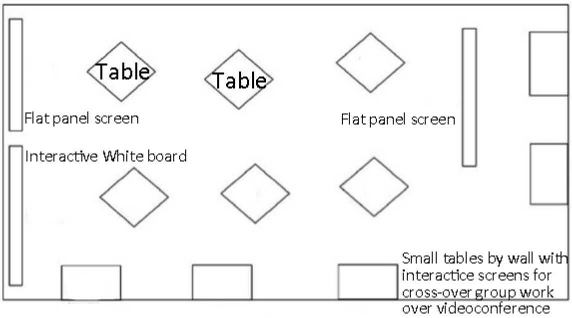


Figure 17: Classroom arrangement that allows multiple cross-over groups to work in class.

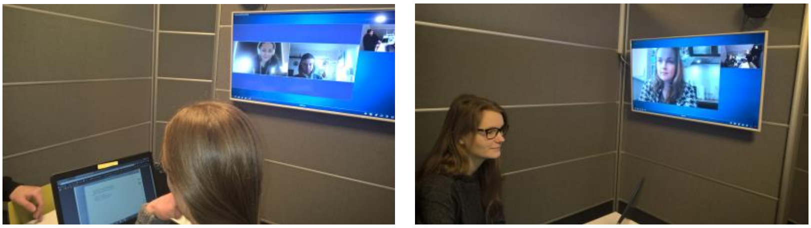


Figure 18: Separate booths for combined physical and virtual group meetings in class.

This design possibility would also solve another problem that teachers experienced when at-home students worked in groups. When teachers used their laptops to log into the group-rooms of online students to supervise them, they often discovered that these groups were not working on their assignments. Students in online groups often found it difficult to take responsibility for their own learning processes. By creating cross-over groups with some of the students placed inside the brick-and-mortar classroom, teachers could more easily supervise and motivate all of the students to work. This learning design is being realised as of February 2016. The initial findings, based on teacher and student reports, are that opportunities for group work have improved considerably (Figure 18).

High or Low Fidelity[9]: The chosen videoconference system featured high-definition pictures and multiple streams to make students (up to 16) visible on the large flat-panel screens in the

[9] *High Fidelity* is defined as the reproduction of an effect (as a sound or an image) that is very faithful to the original (Merriam Webster, 2016).

brick-and-mortar classroom. Teachers and students were able to see each other and positively respond to each other's presence in the teaching and learning situations. This should be considered in contrast to web-conference systems that do not allow as many simultaneous high-definition live picture streams of participants on the screen. If students are only represented as thumbnail-size pictures on a web-conference system, or as small green dots indicating they are online because the bandwidth is too small to show pictures, it is easier to forget about the online students when other students are attending "live" in the brick-and-mortar classroom (Nortvig, 2016). However, when using the current videoconference technology to facilitate group collaboration (Lave & Wenger, 1991), it can be a challenge to maintain a timely rhythm, the normal shift and flow of the teaching process and easy access to supervision. The question is whether the "high fidelity" solutions of the videoconference system become "low fidelity" pedagogical solutions when it comes to the technology's affordances and potential for shared knowledge creation (the possibility to collaborate in cross-over groups). The possibilities to collaborate were reported to improve if the brick-and-mortar room was arranged in compensating ways, as illustrated in Figure 17 and 18.

7.2.7. LEARNING DESIGNS FOR DIALOGUE AND ENGAGEMENT

"Lisa involves the home students, so you have to pay attention, because you might be called on!" (Student about teacher's activating strategies).

Several of the teachers developed strategies to involve the at-home students in class dialogues and discussions. They looked directly at the students at home, mentioned their names and asked them to answer specific questions and contribute to the debate and discussions. The teachers did this by moving towards the camera and speaking directly into the camera-lens as they turned their attention to the online students (Friesen, 2014). According to the teachers, establishing a personal relationship with each student, especially the students frequently participating from home, became even more important than when the students participated from class. That is, a more personal knowledge about who was sitting on-screen made it easier to contact this person in a friendly but also direct way when the teacher had the intention to motivate the student to participate more actively (Figure 19).

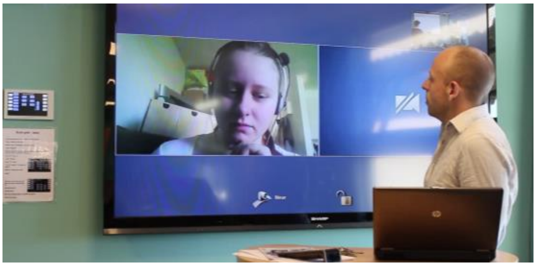


Figure 19: Keeping personal contact with each student at home was important for active participation.

The tendency of students participating from home to learn less may, to some extent, have been based on the difficulties in establishing equal learning conditions. According to interviews and surveys, the teachers and students agreed that the responsibility to establish and maintain the dialogue between the classroom and the students at home was a mutual responsibility. Though both teachers and at-home students still experienced it as challenging, they intended to keep trying. Clearly, this was still not something that came naturally.

According to students and many of the teachers, many of the students who chose participate from home were also students who liked to "hide"; they did not have a desire to participate actively in assignments and discussions. This lines up with the finding that many students participated from home when they had an off-day. The teachers therefore had many concerns that later turned into rules: Participation from home should be a "privilege," and this privilege could be withdrawn for a certain period of time if the student was not actively participating in the class activities. Since the goal was for the students to learn, which demanded both internal and external activity from the students, this seemed a reasonable rule. However, when asked what was motivating about participating in the flexible education offered by the Global Classroom, many students answered that they found it motivating because it gave them the opportunity to participate from home on off-days. This enabled them to stay in school. The conflict between this desire to participate quietly from home on off-days and the requirement for active participation in class can create a dilemma; some teachers solved this by creating new, activity-intensive learning designs (Chapter 9) that all students had to participate in, including at-home students.

The percentage of Global Classroom students with social phobias and other diagnoses was higher than in other classes at VUC Storstrøm because school counsellors had advised these students to choose the Global Classroom. The teachers, however, did not entirely agree with this decision; their experience was that Global Classroom students had to be more pro-active and take more responsibility for their own learning processes than students in traditional classes.

7.2.8. THE "COST" OF THE GLOBAL CLASSROOM

Students and teachers expressed that participation in the Global Classroom came at a certain cost for the in-class students. Many in-class students expressed their understanding for other students' need to stay at home. But, as one student said, "It causes a lot of little interruptions when people need to make sure that the sound works or find out who to work with from home. When they can't talk together without it coming over the loudspeaker, it makes for a lot of confusion. I see the idea of having it [Global Classroom] as a tool, but when I sit in class, it gives a less positive experience and less professionalism." A teacher added, "Everything is slower and less spontaneous in the Global Classroom. For those students who always sit in the classroom, it is distracting that the participants at home must be considered. Sometimes the waiting time for responses from the home-students becomes almost unbearable both for students in the classroom and for me, when the at-home student must first log off and then on again to be able to answer." Though it was perhaps more the exception than the rule, incidences of waiting one minute or more for a response after calling on the at-home students were observed (this could be the fault of their internet connection at home). This "punctuated" the flow and rhythm in the turn-taking of debate and dialogues. Studying and working in the hybrid synchronous video-mediated learning environment also makes one aware of the many tacit practices, as well as the characteristics of good conditions for collaboration, that are present in a brick-and-mortar classroom. These characteristics include sounds/noise (not too little and not too much), time and timing (the opportunity for rapid shifts, no waiting periods). *"The ability to be spontaneous in your teaching and to seize the situation when you can feel the concentration drop in the classroom. That is definitely more difficult, at least until I get some more experience in this environment. The old tricks don't work here"* (Teacher in the Global Classroom).

In the Global Classroom[10], students are in two different spaces or modes at the same time, partly in class and partly at home. Some teachers noted that when they focused their attention on the students at home, the students on campus started to talk about other things. Similarly, during on-campus debates, the students at home tended to remain passive. As one teacher put it, "If I just had to teach an online class, I think it would be easier." This situation called for new strategies to provide students with equal working conditions, for example, through the use of collaborative interactive educational technologies (Chapter 9).

7.3. SUMMARY OF THE NEW LEARNING AND TEACHING EXPERIENCES

Though the project's findings indicate that the Global Classroom comes with a cost, many students studying there were clearly motivated by the opportunity to participate from home, and a third of the students used the flexible option more than three days a month. The Global Classroom was motivating for students experiencing off-days, because it allowed them to participate quietly from home. This posed a potential dilemma, however, because learning demands active participation. Teachers experienced an increase in the use of lecturing and a decreased use of other motivating teaching strategies which could not be used in the new environment, with the consequence that their teaching approach became less engaging and less varied. Many home students reported that they lost their concentration during lectures more easily than when sitting in class. Consequently, teachers and students agreed on a mutual, increased responsibility for students' active participation.

Although the aim was for the videoconference system to become a transparent detail in the interaction between teacher and students, technical flaws in sound or picture sometimes eliminated the system's "invisibility," breaking this transparency and forcing students and teachers to move their focus from the learning activities and content to the medium and the missing information. Establishing a shared room and equal learning conditions for students who did "not have their bodies" in the brick-and-mortar classroom could also be a challenge; this became part of the teachers' considerations when designing learning activities for the Global Classroom. The remote students could not perform the tacit practices they traditionally performed with their bodies in a brick-and-mortar classroom. Traditionally, our body is transparent for us for in the sense that we do not notice it when we are using it in

[10] These sentences are re-written from (Weitze, 2014d).

concentrated action. But with learning designs and class activities involving physical artefacts in the classroom, this transparency of the body was broken. Students sitting at home “behind their windows – looking in” were all too aware that their bodies were in another place.

The teachers developed strategies for involving at-home students, using direct questions and fostering a stronger personal and professional relationship. Many of the teachers regretfully cut back on the amount of collaborative student work; they reported difficulties in making cross-over groups and purely online groups function well with the current videoconference system’s affordances. Some teachers developed strategies that could support cross-over groups by placing the in-class members in a separate room, where noise and distraction were reduced and where there were enough stable internet access points for all groups. In February 2016, VUC Storstrøm established group environments inside the classroom to solve the cross-over group issues by rearranging the brick-and-mortar classrooms; separate “booths” were designed as combined physical and virtual group meeting rooms. Each booth had a specifically assigned virtual room and a separate screen presenting the remote students. According to the initial findings, this solution was promising.

The challenges experienced in the Global Classroom environment highlighted the need for teachers to develop innovative pedagogical competences to equip them in developing active, varied and motivating pedagogical strategies that provide equal working conditions and learning opportunities for students in class and at home.

The Teachers - Creation of Pedagogical Innovative Processes

8

CHAPTER 8. THE TEACHERS – CREATION OF PEDAGOGICAL INNOVATIVE PROCESSES

This chapter describes the exploration of the problem statement from the teachers' angle. The sections (8.1.1-8.1.8) outline background and theory relevant for competence development for teachers. Sections (8.2-8.4) present the first iteration of a new practice for pedagogical innovation for teachers, and Article B presents the second iteration of the same model.

8.1. THEORETICAL AND EMPIRICAL BACKGROUND FOR RESEARCH ON AND DEVELOPMENT OF A CONTINUOUS COMPETENCE DEVELOPMENT MODEL FOR TEACHER TEAMS

The study investigated how pedagogical innovation could become a new practice for teachers. The aim of these new practices was to contribute to the creation of motivating learning experiences for students in a hybrid synchronous video-mediated learning environment. In this chapter the sub-questions for the teachers were investigated:

> **Q1:** How can an educational organisation develop a reflective, innovative and competence-developing tool/method or practice for teachers? This tool, based on teachers' subject-specific pedagogical approaches, should enable them to carry out appropriate planning, execution and theorising on their own teaching in IT-based and video-mediated teaching programs. The tool should also enable teachers to make informed and relevant choices in the use of educational technology for their learning designs in a professional academic context

This question was examined through the design-based research project in co-design processes with the teachers.

8.1.1. COMPLEX PROBLEMS IN A HYBRID SYNCHRONOUS LEARNING ENVIRONMENT AND HOW TO APPROACH THEM

Chapter 7 described some of the problems experienced when teaching in the hybrid synchronous video-mediated teaching context. The DBR project used this knowledge as the problem-based starting point in a series of explorative workshops in order to develop competences for the teachers, or rather, as it turned out, to let the teachers develop competences for themselves. This competence development was therefore considered an important contribution to make teaching in the Global Classroom work – to help the teachers to become effective Global Classroom teachers.

8.1.2. PROFESSIONAL DEVELOPMENT PRACTICES FOR TEACHERS

Once a teacher is educated and has begun working, additional teacher professional development (TPD) often takes place as 1) short courses arranged internally at the educational institution or by outside partners; 2) learning through participation in projects; 3) informal learning in a school context among peers; or 4) independent studies (Eraut, 2008; Illeris, 2013). TPD can be introduced and initiated by others and/or by the learner herself or himself. TPD can take place through the acquisition of new practical professional experiences or new theoretical knowledge, as well as through a combination of the two; it can happen in individual learning situations or together with other teachers. When aiming to design a new professional development practice for teachers, it is important to investigate the current practices that the new practice is being designed to support (Schlager & Fusco, 2003). Therefore it is also crucial to investigate and understand the nexus of practices: what other communities of practices exist, what their goals are, and how they work together, depend on each other, and support each other – or not (Nicolini, 2012). Understanding these structures and processes, how they connect and how a new practice can fit in will determine if the experiments and innovations can continue. Otherwise, the new practice stays "disconnected from the larger learning context—the norms and practices of the collective community—then the system will not improve" (Schlager & Fusco, 2003, p. 217). The advantage in performing DBR in co-design processes with teachers as this study does is that the participants know the existing practices very well and will naturally take those existing practices into consideration.

8.1.3. DEVELOPMENT PRACTICES IN THE EDUCATIONAL INSTITUTION

The observations and the many formal and informal interviews gave the impression that the teachers at VUC Storstrøm were very busy people who used almost all their time in planning and teaching. After the introductory courses that instructed teachers how to operate the videoconference technology, the teacher professional development was, to a great extent, a self-directed individual practice. Therefore, the actual change in practices for the new conditions also took place individually. Such changes will, of course, always be based on the individual teacher's pedagogical preferences as well as the specific subject matter. But the teachers' experiences were that it was difficult to prioritise the development of new learning designs, and they also found it difficult to come up with new solutions on their own. The administration had arranged opportunities for teachers to observe each other's teaching practices as a means to get new ideas for their own learning designs, but the teachers stated that they did not feel that they gained anything from these observations. Teachers pointed out problems but did not suggest innovative solutions, and the difficulties they experienced with teaching in the hybrid synchronous learning environment remained.

The second team of teachers beginning to teach in the Global Classroom in Næstved participated in a teacher team. This team held detailed discussions about the problematic issues of teaching and learning in the new environment. They discussed how new students could be introduced to the new learning environment and what technological tools were relevant for the students to become familiar with. They also listed the problems that occurred when teaching in the videoconference system and sent these lists to the administrators and the IT-Pedagogical team in the hope that they could help solve the problems. However, according to observations and interviews with the teachers, this initial teamwork did not contribute to the development of innovative learning designs. Many of the problems occurred in tacit practices that had to be re-designed. In the team discussions, the teachers only progressed to the first step: the problematizing of the new practices. They did not move further into experimentation and reflection (Dewey, [1933] 2009). According to the observations, and this was the case at both departments (Nykøbing and Næstved), there seemed to be a gap between teachers and administration in their expectations and hopes for each other. The teachers hoped for help to create innovative learning designs (the administration had already contributed with different kinds of teacher professional development initiatives, but the teachers still found it difficult), and the administration hoped that the teachers could re-design their teaching approaches themselves (the teachers stated that they had come as far as they could on their own but still faced problems they could not solve). Basically, no one yet had the necessary expertise and competences.

8.1.4. TECHNOLOGIES BECOMING ENTANGLED IN PEDAGOGICAL PRACTICES

Orlikowski (2010) distinguished between different conceptualisations of the use of technologies. Her concepts can be used as a means of understanding how the teachers conceptualise and act on the technologies that are part of their daily working lives. The *emergent* process perspective can be defined as the understanding of technology as emerging *“from situated and reciprocal processes of interpreting and interacting with particular artifacts over time” (*p. 131). Orlikowski conceptualised *entanglement in practice* as a dynamic process in which technology and human both affect practice. When entangled in practice, these relationships are so close that it is difficult to determine where one stops and the other starts (Orlikowski, 2010, p. 135). This resembles Merleau-Ponty’s (1962) and Dourish’s (2004) understanding of technology as becoming *transparent* to the user. As humans using technology to complete a task, there often comes a point where we no longer distinguish between what WE are doing and what the TECHNOLOGY is doing; this is when the technology becomes 'transparent' (section 6.6.4). In this project, *emergent practices* were defined as practices that emerged as teachers began using new technologies as part of their daily pedagogical practices. As observed in this experiment, the emergent practices were initialised as an attempt to support and redesign previous pedagogical practices, but new practices could also emerge when a teacher became inspired by the affordances a technology offered and started using it as a new contribution to an existing practice. The level of a technology’s *entanglement in practice* can evolve over time. If the technology – through interpretation, in interaction processes and use over time – becomes a familiar part of practice to such an extent that the teacher or student no longer focuses on the technology, then it becomes transparent and entangled in practice (Dourish, 2004). This will not happen if the technology keeps interrupting the seamless operation of the primary task (the teaching and learning practices). But if the technology has become a condition of the practice, as the videoconference equipment has in the Global Classroom, then the teaching and learning practices will sometimes change in order to accommodate the technological (im)possibilities.

In that case, it is important that teachers and students are aware of these altering conditions so they can evaluate whether the pedagogical changes are acceptable or whether they must look for new alternatives. Two of this project's aims were therefore to observe what new pedagogical–technological practices emerged and to develop supportive practices for how the teachers could contribute to the technologies' becoming *entangled* in their pedagogical practices – as long as this entanglement still supported the underlying pedagogies. As described in Chapter 7, this called for innovative pedagogical practices. The challenge was how to enable this pedagogical innovation for, with or by the teachers, and how the administration could support these processes. The teachers had to develop a new kind of professionalism and competence. What was investigated in DBR co-design processes was if a new type of community of practice with mutual engagement, a joint project and shared repertoire (section 6.2.3) could create new common knowledge and language to support innovative pedagogical practices (Wenger, 1998).

8.1.5. THE PRACTICES OF THE *PROFESSIONAL* TEACHER

Erling Lars Dale, a Norwegian professor of pedagogy, distinguished between three levels of competence for the *professional teacher* when the teacher acts in his or her daily teaching practice (Dale, 1998)[11]. The following section discusses these three levels of competence and presents concepts which describe how learning design practices unfold at each levels and how these practices can be innovative on a smaller scale in daily life (Schön, 1983).

Competence level 1 (Comp1): The first competence level addresses the teacher's execution of the daily teaching practice in class. How well does the teacher target learning to the students? Do the learning activities appear to support students' learning processes? The teacher who has achieved competence at level 1 communicates with the students, (re)organises, structures and leads the learning activities. The teacher is a cultural creator and educator. Donald Schön (1996) studied this process more closely to investigate how the teacher acts in and around the live learning design process. He recognised that the (learning) designer's practice in the moment of teaching cannot be reduced to linear and rational well-defined tasks that solve the problem of teaching. ”There is no direct path between the designer's intention and the outcome. As you work a problem, you are continually in the process of developing a path into it, forming new appreciations and understandings as you make new moves” (Schön & Bennett, 1996, p. 171). Problems and solutions are developed in a parallel move as the teacher performs her or his practice; the teacher cannot plan everything in advance or be prepared for every challenge. The teacher therefore acts with *knowing in action* in the design process (Schön, 1983). This is tacit knowledge (Polanyi, 1966). An experienced practitioner thus knows what to look for while acting in the situation and what to do with what she or he sees. Schön (1983) also works with the concept *reflection in action.* This describes how the teacher can be surprised during the design process – something unexpected happens and the teacher reflects and decides what to do while acting. A new development takes place during the action.

---

[11] This section is re-written from a part of (Weitze, 2014d).

Comp2: At the second competence level, the teacher plans. The teacher constructs, analyses and interprets the curriculum, produces training material and organises professional, interdisciplinary, differentiated and subject-specific instruction. The teacher formulates goals and evaluates as well as discusses current problems with colleagues (Dale, 1998). These evaluations have been conceptualised as *reflection on action* by Schön (1983). Reflection on action means that the teacher stops and thinks about the design situation. The teacher reframes a problematic design situation and the possible unintended consequences and may redefine both means and goals for the design situation. In a reflective design situation, the teacher approaches these problems and unintended consequences as creative challenges and surprises and often discovers new facets and perspectives that could not be seen at the beginning of the design process.

Comp3: To become a *professional teacher*, the educator must be able to reflect and develop her practice systematically in collaboration with colleagues and through the application of professional theory (Dale, 1998). The third competence level is a professional pedagogical reflection space. This space is a place for dialogues, lengthy critical reflections, development and research. Since learning design is the science of the teaching profession, teachers study both subject-specific and general learning design theory along with other relevant themes (Jank & Mejer, 2006). At this competence level, teachers devote time to joint discussions of their learning design practices, incorporating their own and their colleagues' experiences as well as research-based theory, and through discussions and analysis they develop their own new theories. In this way, teachers consciously expand their design world throughout their careers. In this process, the teachers develop concepts – language they can use to discuss and develop a community of practice at a high professional level (Wenger, McDermott & Snyder, 2002). Dale’s point, therefore, is that teachers should theorise on a conscious level (Comp3) and not only in order to resolve their individual learning design situations (Comp2). According to observations and interviews, the teachers in the Global Classroom were working as teachers at Comp1 and Comp2 but with support, they would be capable of achieving Comp3 and become professional teachers (Dale, 1998).

Relevant competences when creating new teaching practices – Comp 3

An important aspect in investigating procedures for using educational technology was that teachers had to have a clear overview of their learning designs to successfully redesign, develop and adjust their teaching to manage the new opportunities or barriers offered by the technology. At Comp3, teachers’ tacit practices had to become conscious practices, transformed into explicit language and conceptual understandings. By developing an explicit and nuanced language for discussing learning designs, pedagogical innovation and technological literacy the teachers would be able to study, reflect, analyse, experiment and discuss with their colleagues (Dale, 1998; Dewey, [1933] 2009; Wenger, 1998). With these new shared concepts, the teachers could construct educational theory based on their analysis of own learning designs and practices (Dale, 1998; Schön & Bennet, 1996).

The investment in theoretical competences can facilitate creative work that furthers the innovative process (Runco, 2005). By investing time and energy in building theoretical and experiential competences, teachers will learn to identify difficulties in their practices and recognise and define good problems when they see them (Runco, 2005). Furthermore, “motivation is recognized in virtually all contemporary definitions of creativity” (Runco, 2005, p. 609). Support from the organisation for creative and innovative processes could therefore also affect the teachers’ motivation and self-confidence as they continue to teach in the new environment.

8.1.6. PEDAGOGICAL INNOVATION FOR DESIGNING LEARNING

As described in section 2.2, design thinking can be used as a pedagogical approach that emphasises learning by creating. By thinking and acting as a designer, the teacher may develop innovative approaches to education, as explained by Verbeek: “Not only the products of design activity, but also the activity of designing itself should be approached as a mediator: design thinking is not a functional tool to solve a problem, but a mediator in our very understanding of what a problem can be and how we could deal with it” (Verbeek, 2015).

Characteristics of the divergent and iterative design process

When designing for learning, the teacher has to create space for and accept a dynamic and iterative design process (Schön, 1983; Weitze & Ørngreen, 2012); the teacher must accept that the goal is not obvious and provided in advance. As a designer, part of the job comprises keeping the design in a divergent process and being open to new angles, informed by both empirical and theoretical knowledge, and not being fixed in your own ideas on the basis of preconceptions (Löwgren & Stolterman, 2007). To achieve a high quality design that provides the user/student with a good experience, the designer must be patient and prepared to take many different development methods into use (Buxton, 2005).

Practices for pedagogical innovation

A number of studies have shown that teachers need support for the process of innovation and the development of innovative thinking and acting skills (Darsø, 2011; Hasse & Brok, 2015; Laurillard, 2012). This mirrors the findings in this project. The project’s challenge was to create a new understanding and new knowledge in the educational institution of how innovative practices could support new ways of approaching difficult pedagogical–technological problems. *Innovation* can be defined as activities, based on old and new knowledge, that experiment with and develop new ideas and thereby opportunities, products and processes that, when used, generate added value. Innovation thus consists of ideas and creativity that can open up new opportunities (also section: Concepts). The question this study sought to answer was how teachers could be supported in this process.

There are a number of models of how knowledge creation and innovation can take place collaboratively (Engeström, 2001 [model of expansive learning]; Nonaka & Takeuchi, 1995; Paavola, Lipponen & Hakkarainen, 2004). In Nonaka and Takeuchi’s model, the knowledge sharing processes occur in four stages. First, the individual’s tacit knowledge transforms into explicit and shared knowledge in the group (*externalisation*). The knowledge transforms from one persons explicit knowledge to another persons explicit knowledge, as the participants discuss and combine the knowledge in new ways (*combination*). The knowledge moves from explicit back to tacit (*internalisation*) as the new inventions and ideas are used in practice. Finally, participants can learn from doing together (*socialisation*). Inspired by the Nonaka and Takeuchi model, Lotte Darsø (2011)[12] developed a pedagogical innovation model called *the Innovation Diamond*, suggesting which knowledge and social frameworks promote innovation processes in groups. The Innovation Diamond thus constitutes an analytical tool for the preparation and planning of an innovative pedagogical development phase. The four areas in the diamond are knowledge, non-knowledge, concepts and relationships.

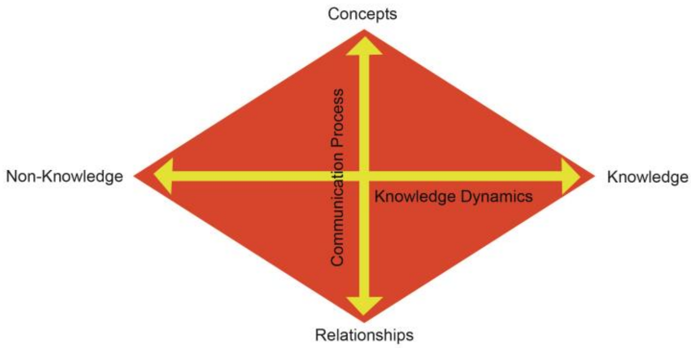


Figure 20: The Innovation Diamond (Darsø, 2011, p.94).

When using the model, the learning takes place through experience in practice – *learning by doing*. In essence, if all four corners of the diamond are considered, rich conditions will emerge for pedagogical innovation (Darsø, 2011). When working in the model, a team starts out with a problem area or area of interest to be approached in the Innovation Diamond and then approaches the non-known area while creating new concepts (Darsø, 2002, 2011).

The areas in the Innovation Diamond are (Figure 20):

1) Knowledge: What is already known? In the knowledge phase the group discusses the existing knowledge that can be built upon. Knowledge is necessary for innovation, but it can also slow down the process because it often is subjectively based. If the group is composed of different professionals, each one is "elevated" to an expert, and experts tend to talk about what cannot be done rather than on where the opportunities are.
2) Non-knowledge: What is it we want to gain new knowledge about? Here it may help to adopt a slightly provocative attitude that cannot be satisfied with answers such as "This is how we have always done it" or "I have tried – it does not work". Non-knowledge may be found in different versions: what we know that we do not know; what we do not know that we do not know, and what we did not even know that we could know about. There are knowledge dynamics between knowledge and non-knowledge on the horizontal axis.

[12] This section is re-written from a part of (Weitze, 2014d).

3) Concept development: Concepts can be both a starting point and the product of an innovation process. A concept might be a model, a prescription for something, a deepened idea or a collation of knowledge; this is equivalent to an *innovative reification process* (Wenger, 1998, 2010). Tools and methods for conceptualisation might involve drawing the problem; finding pictures, metaphors or examples describing the problem; or brainstorming about possible solutions using sticky-notes. Conceptual tools can thus help the participants externalise their knowledge.
4) Relationships: One of the basic conditions for collaborative innovation and knowledge development is a culture that supports trust and caring (Alavi & Leidner, 2001; Nonaka, Toyama & Konno, 2000; Von Krogh, 1998; Von Krogh, Nonaka & Rechsteiner, 2012). Knowledge creation and innovation are very fragile processes; the individuals coming up with new ideas have to stand up for their personal beliefs, and it can be difficult if they do not perceive the environment as safe (Argyris, [1992]2012). Great ideas and concepts can be abandoned prematurely and never turned into successful new learning designs, making the participants passive rather than active contributors. Relationships are the way we relate to each other and depend on the degree of sympathy/antipathy, attraction/repulsion, inclusion/exclusion, trust/distrust, power, position and company culture. The communication process occurs between *Relationships* and *Concepts* on the vertical axis in the Innovation Diamond. An important factor in determining if an innovation project will succeed is therefore the quality of the human relationships. The team must work on creating an atmosphere of mutual trust and respect for each other to dare to go out into the unknown – to encourage open, creative communication.

An individual teacher's contribution to the common knowledge creation process can be hindered if a) there are difficulties in finding a common language; b) the culture has many stories or habits about what is possible and not possible; c) the formal procedures in the institution do not allow for or invite alterations; or d) the educational institution's strategic intentions and values appear to be different than what the new knowledge allows for (Argyris, [1992]2012; Von Krogh, 1998). Again, this underlines the importance of having an open idea creation phase in which initial ideas are not suppressed (De Bono, 1999; Löwgren & Stolterman, 2007).

In the workshops with the teacher teams, part of the aim was to introduce teachers to the concept of being at Comp3 and to start developing a common language for pedagogical innovation within learning designs. Teachers therefore read texts by Dale (1998) and Darsø (2011) as well as texts about learning designs in order to inspire and establish a common understanding of these theoretical areas in addition to their individual theoretical backgrounds and experiences. Relevant reading for future teacher teams might include texts on technological literacy for teachers (Hasse & Storgaard Brok, 2015).

8.1.7. INNOVATING IN A COMMUNITY OF PRACTICE AND STAYING FOCUSED

What is innovative for one teacher might be a traditional way of working for another teacher; therefore, the teachers benefited from working together and learning from each other's strengths while supporting one another's weaknesses (Wenger, 1998). Working with innovation in teams should therefore be beneficial since working in a dynamic community instead of solely as individuals enables the construction of strong concepts that combine knowledge and non-knowledge in previously unknown but highly relevant ways (Darsø 2007; 2011; Nonaka & Takeuchi, 1995; Wenger, 1998). Working in teams to create improved conditions for teachers' professional development in educational institutions is not a new idea. But when teachers work in teams with the goal of developing the best possible conditions for facilitating student learning processes, they often end up focusing on the practical, disciplinary and organisational aspects of teaching (Tingleff, 2012). Also, teamwork among teachers tends to happen in a culture with comfortable, family-like structures, which can make it difficult to move beyond the participants' core beliefs and experiences (Tingleff, 2012). Therefore, it was important to maintain a focus on creating innovative learning designs *for the students*, going beyond the borders of the team members' experiences and maintaining the focus on working at the third level of competence, Comp3, in the innovative team process (Dale 1998).

A need for agile development?

The IT-Pedagogical Think Tank for Teacher Teams model (described later in more detail) bears a resemblance to working in scrum teams (Schwaber, 1997). The various human interaction processes that software is designed to support are continuously changing. The software industry has realised that the success of software development in this fast-moving business is often dependent on agility and the ability to quickly change and move in new directions. Scrum teams break down tasks and collaborate in a structured way to create the best solution for the situation at hand instead of making long-term plans (Schwaber, 1997). Agile software development takes place as organic processes in which small software elements or parts of processes are built one at a time. The elements are tested to investigate whether the planned affordances are fulfilling the consumers' needs before continuing to the next step. In scrum teams, solutions evolve through collaboration between self-organising, cross-functional teams. There are specific roles on the team and specific ways of planning the workflow. The team uses specific artefacts to supervise and control the work processes, and they work in collaboration with consumers to test the product along the way. As educational software is developing at the same speed, is created and changing in the same organic ways as software in general, it is worth considering creating work practices for teachers that follow or are inspired by the same agile and iterative way of collaborating in the innovation of learning designs involving the use of educational technology. Planning the workflow in specific ways, breaking down tasks, collaborating in structured ways to create the best solution for the situation, using specific artefacts to supervise and control the work processes and collaborating with consumers (students) to test the product (learning design) along the way can aid and inspire teachers in the creation of innovative pedagogical approaches for using educational technology.

The following IT-Pedagogical Think Tank for Teacher Teams model (ITP4T) emerged as a result of the workshops and the teachers' active participation. Every point (A-E) in the model, as well as the organisational context and the structured way in which it is used, has evolved as an answer to a part of the research question.

8.1.8. CONSIDERATIONS LEADING TO THE IT-PEDAGOGICAL THINK TANK

The following section[13] 8.2-8.4 describes the development and first iteration, and Article B the refinement and second iteration, of the IT-Pedagogical Think Tank, a continuous competence development model co-designed with teachers from the Global Classroom in a DBR approach. The think tank was developed from the teachers' needs for competence development in a "bottom-up" approach. The first iterations took place in Fall 2013, and included eight workshops with three teachers, the development consultant and the principal from Nykøbing Falster VUC.

8.2. DEVELOPMENT OF A CONTINUOUS COMPETENCE DEVELOPMENT MODEL FOR TEACHER TEAMS: THE IT-PEDAGOGICAL THINK TANK FOR TEACHER TEAMS IN THE GLOBAL CLASSROOM

Article A and Chapter 7 presented the initial and ongoing research (figure 8) conducted to explore and investigate users' experiences in the hybrid synchronous learning environment. After the diagnostic phase, it was clear that some experiences were close to traditional learning situations, but others were problematic for teachers and students (Weitze & Ørngreen, 2014). Therefore, the DBR project proceeded to interventions with the users in order to develop new designs and new knowledge in collaboration with the users (Amiel & Reeves, 2008; Brown, 1992; Collins, 1992; Sanders & Stappers, 2008; Susman & Evered, 1978). The IT-Pedagogical Think Tank consisted of a group of teachers who would meet for a two-hour period to address a chosen issue by following a specific procedure. The ITP4T was a combination of the concept, the process, and the group enacting the process using the model, thereby establishing a new practice within the organisation.

8.3. INTRODUCTION TO THE IT-PEDAGOGICAL THINK TANK FOR TEACHER TEAMS (ITP4T)

The following sections present the first iteration of the IT-Pedagogical Think Tank for Teacher Teams, a continuous competence development model. The sections describe how and why the different components of the model were developed. The model was co-designed in a design-based research approach with teachers from VUC Storstrøm's innovative hybrid synchronous videoconference concept Global Classroom. The IT-Pedagogical Think Tank model responds to the needs and challenges the teachers and the administration in VUC's

[13] The material in sections 8.3-8.4 is a rewriting of the following article: Continuous Competence Development Model for Teacher Teams: The IT-Pedagogical Think Tank for Teacher Teams (ITP4T) in Global Classroom. Proceedings of the 13th European Conference on e-Learning. Copenhagen. 578–588. (Weitze, 2014d) After this the article will be cited as: (Weitze, 2014d).

Global Classroom were experiencing in the new technological teaching environment (see Chapter 7 and Article A). Teachers reported feeling that they: 1) lacked the competence to teach in the hybrid synchronous environment both concerning considerations about pedagogical as well as subject specific learning designs (Jank & Meyer, 2006; Nielsen, 2012), 2) lacked the time to invent learning designs that could correspond to the new technological learning environment, and 3) had a need for extended support from the educational organisation. The teachers had to become pedagogical innovators, adapting to new educational technology and changing their learning designs accordingly (Collins & Halverson, 2010; Weitze & Ørngreen, 2014). As students are the end-users, the purpose of using the IT-Pedagogical Think Tank was to support the creation of qualified and motivating learning opportunities for the students (Hutters, Katznelson, Sørensen & Juul, 2013). Ultimately, the purpose of the model was to create a new practice and a reflective tool for the teachers and the educational institution that enabled them to create pedagogical innovation in a sustainable, ongoing and structured way.

The model that came out of this first iteration enabled the teachers to create their own continuous competence development with the support of the administration, which allocated time resources and also participated. The teacher team used the new model to inspire their work at weekly two-hour meetings; the focus of these meetings was to create motivating and engaging learning designs for the students. This interventive research project found that it was possible to establish an agile and continuous practice that enabled the teacher team to reflect, innovate and create. The teachers were also able to use the model as a thinking[14] and acting technology on a theoretical and practical level that enabled change in their learning designs. The teachers were able to use the opportunities to locate new issues, create and experiment with solutions and anchor the new knowledge; this new team innovation process empowered, engaged and motivated the teachers in their daily working life. The purpose and aim of the IT-Pedagogical Think Tank is to provide a chance for competence development in the teachers' busy lives, using their daily teaching problems as starting point and providing team support in their close teaching environment (Dede et al., 2009).

---

[14] **Thinking technologies**: *Technology* originates from the words *techno*, meaning "method, craft, an art, a system or method of making or doing," and *logy*, meaning "a speaking, discourse, treatise, doctrine, theory, science" (Merriam-Webster, 2016). When combined as *technology,* the word can be defined as "systematic treatment of an art, craft, or technique" (Merriam-Webster, 2016). According to Donna Haraway, a scholar in the field of science and technology studies, when using methodologies and theories, the operations we perform are based on skills. They are not just ideas; they are thinking technologies that, when used, have materiality and effectivity (interview with Haraway by Lykke et al., 2004). When thinking in theories and methods, the way in which they are used stabilises meanings in certain forms rather than others. When theory and methods are used to categorise and analyse, it is a work process with its own materiality. Therefore the IT-Pedagogical Think Tank is not just a *thinking* technology but is also an *acting* technology; it uses theoretical frameworks and methods, but it also involves actions in order to create an innovative pedagogical effect.

8.4. DEVELOPMENT OF A INNOVATIVE PEDAGOGICAL PRACTICE

One idea that emerged for addressing teachers' challenges in the Global Classroom was to experiment with ways of providing a space for teachers to experiment with and develop new hybrid synchronous learning designs in their daily working life.

Therefore, the first workshop with the teachers in the Global Classroom project proposed a new practice to enable pedagogical innovation. Based on educational theory that took the described problem areas into consideration, the practice involved encouraging teachers to establish common ground for team discussions by reading brief pedagogical theory articles about learning design theory, teachers' professional development and pedagogical innovation (Dale, 1998, Darsø, 2011, Hiim & Hippe, 2003).

Learning goals[15] were established for the workshop series to focus the professional development and creation of innovative learning designs. The teachers were initially hesitant about the formality of reading articles and focusing on learning goals as part of their professional practice, but teachers and administrators later mentioned these aspects as important for developing a common language. The practice was also liberating in the sense that, for some teachers, it became more accepted to have explicit and deeper conversations about part of their teaching practice that earlier had been tacit knowledge. The aims of the eight workshops were: 1) to experiment and co-design with Global Classroom teachers through design-based research (DBR) in order to create a new continuous pedagogical innovative practice in the organisation based on teacher preferences; 2) to work on theoretical and practical levels in this development phase, discussing and implementing the results in the process; 3) to develop an agile working practice that enabled the teachers to change teaching strategies in relation to current demands, new issues and the organisation's strategies; and 4) to provide a structured, reflective and pedagogically innovative way to experiment and find solutions that would empower the educational institution to move quickly in new directions, with the help of the teachers' professional knowledge.

8.4.1. AIM OF THE INTERVENTION

The aim of this part of the PhD project was to do interventive research in order to investigate the research area: "W*hat elements, methods, processes and practices can contribute to the*

[15] **Learning Goals for the Eight Workshops:** After the course, the team members will be able to do the following:

1. Describe own learning design and identify and formulate possible problem areas in the current educational context.
2. Select and plan the use of and create a process of collective reflection about relevant literature in relation to the team's experience of current issues.
3. Develop and carry out a process leading to individual goals for innovation, both in the short and long term.
4. Master innovative tools that can be used in the innovation process in a pedagogical team.
5. Be innovative concerning their own teaching, involving technology as well as new/innovative learning designs.
6. Organise and lead an innovative team process.
7. Choose a strategy and method for knowledge development, knowledge sharing and anchoring in the team.

creation of reflected, innovative and motivating learning designs for teachers and students in a hybrid synchronous video-mediated teaching context, with a focus on how to create motivating learning for the students?" In this first iteration of the IT-Pedagogical Think Tank, the teachers in the Global Classroom participated in mapping their own experienced problems and then solving these problems through the development of innovative learning designs that involved digital technology.

Based on the research area and the initial findings describing the problematic issues for the three actors in the Global Classroom context, the sub-questions for this part of the DBR process asked *Which elements, practices and processes are essential* in the following circumstances:

1) When creating a practice where change and anchoring can take place in the organisation;

2) When teachers are seeking to become initiators and developers of their own visions and innovative teaching practices;

3) When creating tools and methods for innovating the teaching practice due to the continuous changes in educational technology;

4) When creating an organisational tool that enables continuous competence development in a sustainable form, thus giving teachers opportunities to participate in the daily visionary leadership of the educational institution; and

5) When attempting to help teachers move from feeling victimised in the Global Classroom to feeling empowered.

The data from this iteration of the development of the IT-Pedagogical Think Tank for Teacher Teams (ITP4T) included field notes, audio- and videotaped utterances, and observations from the workshops and informal meetings (Table 6). The data were analysed with an informed grounded approach (Thornberg, 2012) (see also Chapter 5, "Methods.")

Table 6: Elements from the first iteration of the IT-Pedagogical Think Tank research project.

1. Student evaluation workshop –qualitative workshop, 14 participants	February 2013
2. Informal conversations with teachers	Spring 2013
3. Interviews with teachers – based on semi-structured interviews	April–May 2013
4. Observation of Global Classroom teaching	Spring 2013
5. Planning of workshops with teachers together with project management	Spring 2013
6. 8 workshops with teachers – co-design of ITP4T	Fall 2013
7. Conference – teachers present the model and their work in the model	October 2013
8. Examination: teachers complete their course/workshop and serve as facilitators for a new teacher group	January 2014
9. A new group of teachers is introduced to the ITP4T	Spring 2014
10. Questionnaires with the students and the teachers in the Global Classroom	Spring 2014

8.4.2. RESEARCH DESIGN

In Fall 2013, three teachers and one member of the pedagogical IT team (the Development Consultant) from the Global Classroom at VUC Storstrøm participated in a competence development project. The research design was formed as two parallel movements:

1) The first parallel movement consisted of a series of eight competence development workshops. Teachers participated in reflective and pedagogical innovative considerations in order to respond to the issues and needs expressed by themselves and other Global Classroom teachers (Article A; Weitze, 2014e; Weitze, Ørngreen & Levinsen, 2013). The researcher led the first four workshops. In the last four workshops, the teachers led the competence development, while the researcher participated as a contributing facilitator and debater. The result of the workshops was the IT-Pedagogical Think Tank model that teachers were able to use for ongoing continuous competence development. After the workshops, the teachers presented their version of the IT-Pedagogical Think Tank model at a Global Classroom conference at VUC Storstrøm. Finally, the researcher designed a small assessment and the teachers were examined as IT-Pedagogical Think Tank model teachers. In May 2014, two new teacher teams were introduced to the IT-Pedagogical Think Tank model as preparation for working in the Global Classroom in Fall 2014.

2) The second parallel movement of the research design involved a participatory and iterative DBR project. In the workshops, the researcher and teachers experimented with and discussed how to structure the reflective and innovative pedagogical process in the best possible way. The different methods were heavily discussed and reflected upon using an appreciative inquiry approach (Mejlvig, 2012). Between workshops, the researcher evaluated the notes, utterances and observations in order to develop and refine the IT-Pedagogical Think Tank model. Each workshop thus became small iterations of the new working practice. As noted in Section 5.7, the researcher's active involvement in the workshops calls for close attention to the possibility of her role biasing the research. At the same time, this participation made it possible to observe, analyse, bring up relevant theories and share reflections with the teachers in the iterations in order to bring the interventive research process as well as the product – the model – to a higher theory-informed and research-based level.

8.4.3. THEORETICAL AND GROUNDED ANALYSIS OF THE EMPIRICAL DATA: CREATING A MODEL FOR CONTINOUS COMPETENCE DEVELOPMENT

A series of coherent theoretical and empirical based pedagogical patterns or themes for pedagogical innovation emerged through the co-design processes with the teachers and researcher. The themes are arranged into categories based partly upon the **order** in which they emerged in each co-designed workshop; and partly on the findings about the most efficient and logical **content and actions** for each theme when we aim to create innovative learning designs. By working through this pattern, or this model – a two-hour procedure – the teachers as mentioned discovered that they were able to create innovative learning designs for the Global Classroom and the educational institution.

The following is a description of how the teachers worked through the different elements of the IT-Pedagogical Think Tank model. Each process, pattern or "workstation" of the IT-Pedagogical Think Tank model will be described in terms of the following: 1) problem areas: the reason competence development or new solutions are needed; 2) experiments: empirical and theoretical background for experiments, and description of experiments and co-design with the teachers; 3) findings in the research process; and 4) lessons learned as an analytic result of the research. All the themes (A, B, C, D, E, S, G, M) are illustrated in Figures 21 and 22. Following the description of this iteration, the process of the IT-Pedagogical Think Tank model is summarised in Article B.

G & M: Goals and milestones for competence development

(Duration: approximately 1–2 hours at the first meeting) (Figure 21: G & M)
Goals and milestones (G & M) are developed at the beginning of the teamwork process; therefore, the G & M process is performed at the starting point (**S)**. The G & M differ from the other themes/processes in that they are the strategy the teachers are aiming for.

Problem area: The teachers found it difficult to be innovative and to find time in their daily lives to develop competences for teaching in the hybrid synchronous learning environment; they also found it difficult to distinguish what the problems actually were when teaching and learning in the Global Classroom (Weitze & Ørngreen, 2014). The teachers acknowledged that they needed to practice how to use different interactive and collaborative pedagogical technologies, but they also realised that they had to experiment with ways to develop and use the technology from a pedagogical angle. They believed a combination of experiments and practice would help them develop a sense of how to combine the learning design with technology use to enable motivating learning for the students. The teachers' dialogues supported findings about the necessity of developing a common understanding and a sense of how learning design and technology are two parts of the same practice and cannot be separated. Learning design and technology practices are very diverse, needing to be innovated upon and developed over time (Dourish, 2004; Orlikowski, 2010; Rabardel & Bourmaud, 2003; Søndergaard & Hasse, 2012; Weitze & Ørngreen, 2014).

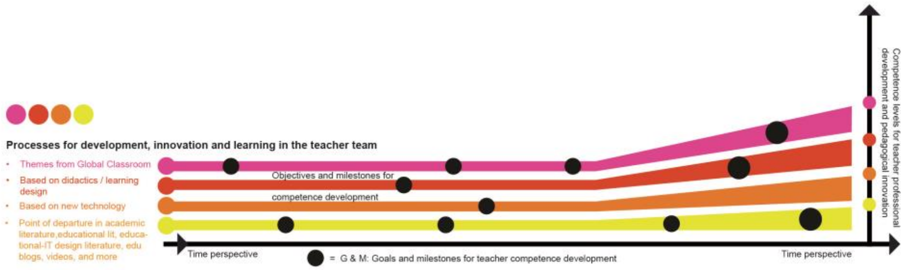


Figure 21: Goals, milestones and competence levels in four types of processes in professional development and innovation for teacher teams.

S – Starting Point: Experiments and findings

(Figure 22: **S** – *Starting point*)

In the first workshop, the teachers began clarifying the problem areas and brainstormed on the types of competences they wanted to develop. The teachers thus created visions for the educational organisation based on their own professional knowledge and their experiences in the Global Classroom. The teachers used an online collaborative sticky-note tool for the brainstorming, essentially “taking their own medicine” by training in the use of interactive tools in the course of their innovative processes. The brainstorming was inspired by discussion of learning designs (Hiim & Hippe, 2003; Selander & Kress, 2012) and the problems and possible advantages of teaching in the hybrid synchronous video-mediated environment. The questions and ideas from this brainstorm session were made into a list and documented in the teachers’ online Learning Management System (LMS). With the new team (Spring 2014), the issues were stored in an interactive agile project development tool (Trello, 2015) that continuously enabled the teachers to prioritise and keep track of their goals and milestones for the different areas of their competence development.

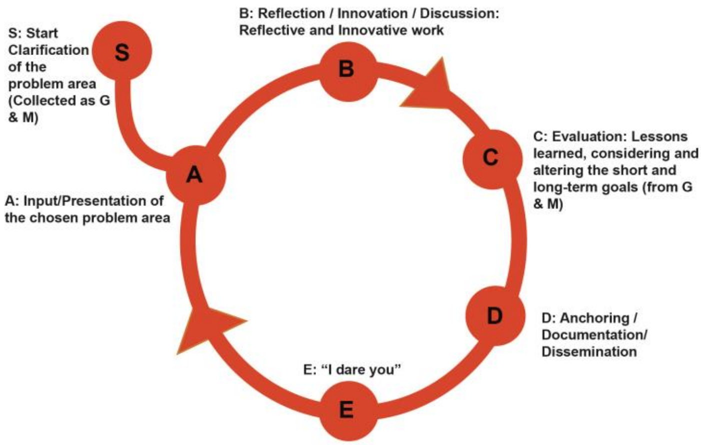


Figure 22: Coherent theoretical and empirical pedagogical patterns or themes for pedagogical innovation.

Lessons learned: By brainstorming (**S** – in Figure 22), discussing, setting goals and milestones (Figure 21) and continuously evaluating the problem areas and competence goals, the team became initiators and developers of their own visions and innovative teaching practices. The teachers were developing competence within the following four areas (Figure 21): 1) themes from the Global Classroom, 2) innovative learning designs, 3) innovative use of educational technology, and 4) familiarity with professional theoretical literature (edu-blogs, videos, etc.) within the pedagogy and other relevant subject areas. The graphs in Figure 21 plot the teachers’ competence levels (vertical axis) over time (horizontal axis) to illustrate the rising level of the teachers’ pedagogical innovative competence. The black dots in the graphs represent G & M, illustrating how teachers can set concrete goals for new competences or problems that need to be solved over time. These divisions are slightly artificial, because the themes were intertwined; however, it is beneficial to regard them as different approaches to the issues in order to clarify which themes were present.

A: Input/presentation of the chosen problem area by the team leader of the day
(Duration: approximately 10 minutes) (Figure 22: A)

Problem area: Initially, the teachers had problems concretising the problem areas of working in the Global Classroom. They perceived the administration as "victimising" them with unrealistic demands, insufficient support and a lack of opportunities for relevant competence development. This was in spite of the fact that they already had participated in various educational–technological courses arranged by the administration. The teachers dealt with their issues individually, but they felt the need for an established practice that would enable them to discuss, experiment and gain knowledge and competence in cooperation with colleagues.

Experiments and findings: In the workshops, the teachers began by prioritising their issues. Following this approach, teachers took turns being team leader for the day. Each team leader researched her own problem area and gave a presentation in which she unfolded and thematised the problem, thereby adding new knowledge to the team. Each presentation ended with a call for debate and conceptualisation with other team members. By taking turns as team leader, teachers could choose the subjects they found most pressing and relevant. In the experiments, they found it fulfilling to bring their individual issues up for debate. Examples of emerging themes included literature about reflection and pedagogical innovation in teams, means for activation of the at-home students, discussion of online interactive tools and the use of learning games in the Global Classroom, and development of knowledge sharing practices in the educational institution.

Lessons learned: The analysis showed that, although teachers initially resisted leading the innovative process, they became positive about leading the process and empowered as they developed and conceptualised their own relevant issues for their team members. Though the individual team leaders traditionally chose the theme, another option would be for the whole team or the principal to select it. It would also be possible to have an expert as team leader for one or more days to help achieve new competences. Teachers found it important and helpful to have the team leader act as a timekeeper to ensure that the team made it through the whole process within the given two hours.

B: Reflection/Innovation/Discussion: The team is working
(Duration: approximately 1 hour) (Figure 22: B)
This process involved development of new learning design concepts, reflection on the third competence level (Comp3; Dale, 1998) concerning general pedagogical and theoretical issues, conceptualisation and experiments with new innovative learning designs, experiments involving new educational technology and discussion of new organisational regulations and needs.

Problem area: In the first years of teaching in the Global Classroom, the teachers planned their learning designs as they would for a traditional brick-and-mortar classroom, but some situations in the Global Classroom demanded changes to the learning designs (Chapter X). The teachers had to redesign their learning designs in order to take new learning situations into consideration. Students and teachers sometimes experienced frustration when teaching and learning in the Global Classroom, but determining how to create new learning designs that would help solve the various problems proved challenging. One Global Classroom student explained, "You might feel a little bit left out when there is some cool discussion [in class on campus] and you can't participate, then the sound doesn't work, and then you're just frustrated." This is an example of a problem with many different angles that will have to be solved in different ways, and this has to happen simultaneously with helping students reach their subject matter learning goals. The first evaluations (Chapter 7 and Article A) showed that teachers could benefit from theoretical knowledge about innovative pedagogical and reflective processes, management of innovative teams, knowledge development and knowledge sharing in teams. It would also be advantageous for them to gain experience in having explicit discussions about their own learning designs.

Experiments: In the workshops, the teachers discussed pedagogical innovation. They were conscious of the importance of staying at the pedagogical professional's third level of competence (Comp3) – that is, the conceptualisation of studying learning design theory and for the need for critical reflection, development and research in collaboration with colleagues (Dale, 1998).

Lessons learned and findings: Grounded in theory and inspired by the team leaders' well-planned presentations, the teachers conducted highly innovative and qualified discussions. They came up with suggestions for new learning designs and were able to move in new directions quickly. Darsø (2011) recommends letting team members be responsible for the various aspects of the innovation model (knowing, non-knowing, conceptualising and relationships). The findings indicated that, though Darsø's (2011) framework was a good *technology of thought*, the team members felt uncomfortable identifying themselves with one specific area but acknowledged that knowing, non-knowing, conceptualising and relationships were relevant for moving forward in an innovative process. Therefore, it will be more relevant to use these general pedagogical innovative concepts as points of attention for the whole team in the development phase (**B**) only. Another finding was that teachers emphasised the importance of one person taking responsibility for keeping discussions at the Comp3 level of competence in order to enable the development of professional and qualified concepts; in this way, they avoided going into functional discussions about other practical matters (Comp2), a common pitfall in group discussions (Tingleff, 2012). The teachers also emphasised the advantages of consciously guarding positive team relationships but also asking provocative questions that go beyond the team members' established experiences and teaching norms.

C: Evaluation: Lessons learned, considering the short and long-term goals

(Duration: approximately 10 minutes) (Figure 22: C)

Experiments and lessons learned: After the development part of the workshops **(B),** the teachers discussed their results **(C)** – new innovative learning designs or new concepts describing problematic issues in the Global Classroom learning environment. The teachers made formative and summative evaluations of the various competence goals they had previously set for the current day or the long term; or they discussed additional future aims and goals for competence development. These goals could be set for the individual teacher, the team or the organisation. For example, one goal might be to find more interactive IT tools that would enable in-class and at-home students to work under the same conditions. Another goal might be to develop knowledge sharing in the educational organisation or to study different collaborative learning approaches together to use them in the Global Classroom. The teachers found the evaluation process important and helpful because it put their new concepts into a common language; they could agree on the new concepts, or they could agree to disagree. The evaluation process also supported the team in prioritising and developing their future goals for competence development.

D: Anchoring/Documentation/Dissemination

(Duration: approximately 15 minutes) (Figure 22: D)

Problem area: Knowledge sharing is a difficult art in an educational institution (Jones & Sallis, 2013), and the teachers expressed that they seldom had opportunities for knowledge sharing in their daily working lives. Elements, methods, processes and practices in new educational projects can also be regarded as new organisational knowledge. Projects are a common way to create new knowledge in educational organisations, but research has shown that it is difficult to anchor projects when the project period has passed and the organisation no longer allocates specific resources for the initiative (Henriksen, 2011). To enable development and anchoring of the new project, teachers must be given opportunities to exchange knowledge with their colleagues.

Experiments: Knowledge sharing took place in a structured way on an LMS (learning management system) platform that was available to all Global Classroom teachers and the organisation. This was done for the benefit of individual memorisation and common conceptualisation of new competences regarding Global Classroom issues and solutions. The LMS provided an opportunity for all teachers from the team to participate in creating and using the new knowledge, which could later be shared with new teachers. An official website was created to inspire teachers with new learning designs and technologies (Global Classroom Teacher, 2016). The concept of knowledge sharing and how to create it was heavily discussed, both in terms of oral/written documentation and dissemination. The group discussed how much to write, which genre to use, and accessibility. The teacher-team suggested having verbal dissemination of their pedagogical inventions at pedagogical meetings for the teachers from the rest of the organisation.

Lessons learned: When two new Global Classroom teams started at a new VUC Storstrøm department in Spring 2014, the first question they asked was whether there was any written advice about effective learning designs for teaching in the Global Classroom; this emphasises the importance of documenting and disseminating experienced teachers' innovative knowledge within the organisation. The form of the documentation and the structure of the dissemination remain research areas worth investigating. The teachers became accustomed to documenting their work from the IT-Pedagogical Think Tank model and emphasised the importance of the practice in their end-of-workshop evaluations. It is important to consider the difference between information and knowledge when disseminating new knowledge to peers. Learning about others' tacit practices demands opportunities to engage in similar situations in order to learn about the knowledge or knowing that lies between the acting, thinking, knowing, evaluating and negotiating. Teachers have to participate in their colleagues' practices to learn about these practices as well as the considerations behind them (Wenger, McDermott & Snyder, 2002).

E: "I dare you": The challenge

(Duration approx. 15 minutes and one hour at home between meetings) (Figure 22: E)

Problem area: The teachers could not find time to develop and experiment with new learning designs for the Global Classroom environment and expressed that they lacked the appropriate knowledge.

Experiments and lessons learned: The purpose of the workshop segment called "I dare you" was for participants to maintain a playful and motivating atmosphere while challenging each other in a way that would take them beyond their comfort zones. In this part of the workshop, the team leader for meeting the following week agreed with the team on a fixed assignment as preparation for the next week's theme. The assignment might be reading new theoretical literature and discussing it in an online discussion forum before the next week's meeting, creating and experimenting with new learning designs or finding new interactive collaborative technologies and posting the suggestions in an online forum. Sometimes this assignment was an experiment with the students that would be performed, discussed and collaborated on for more than one week. For the teachers, an important aspect of this assignment was the requirement to create a *product* – a *reification* for the next team meeting, rather than just thinking about an issue; teachers noted that this product or reification was a crucial element for moving forward in their competence development (Wenger, 1998, 2010). The teachers emphasised that "I dare you" made a big difference for them; they made a commitment to each other to attend this joint competence development between each meeting.

The IT-Pedagogical Think Tank model then started all over again the following week, enabling continuous competence development for and by the teachers (Figure 22: A–E).

Administration: The local principal participated for approximately 15 minutes in most workshops, which enabled knowledge sharing and motivated the teachers to focus on teamwork during the week.

The teachers agreed to participate in a brief assessment after the workshops to evaluate what they had learned. The teacher prepared a common presentation on how to work within the model and invited four colleagues to try it out. This also gave teachers an opportunity to introduce a new four-teacher team to this way of working together to create pedagogical innovation in the educational institution.

8.4.4. DISCUSSION OF THE EXPERIMENT

In the discussion following the teachers' final test in the IT-Pedagogical Think Tank model, the teachers emphasised the importance of the principal's willingness to engage in and support this way of working in innovative pedagogical teams. If the institution is to benefit from the teachers' new concepts and visions, a new distribution of leadership and initiatives between the administration and the teachers in certain areas may be called for.

The model consists of a list of procedures, but for the model to function properly, participants must decide upon and actually *do* the new team practice, collaborating in the team and personalising how to work in the model on a weekly basis (Gherardi, 2012; Nicolini, 2012). In the beginning, when starting to work with the new practices in the ITP4T model, the teachers would take on different roles (team-leader, time-keeper), but what are new practices other than an initial role-playing? The teachers were tested in the IT-Pedagogical Think Tank model they had co-designed, as described above, by presenting a new workshop with four teachers, simultaneously demonstrating that the learning goals for the workshops had been reached. The assessment experience clearly contributed to a new kind of professional identity for the teacher team; they discussed how they were now able to educate other teachers in the educational institution and help them become pedagogically innovative teachers. Teaching new teachers will also be an authentic way to disseminate the model to the rest of the organisation; the teachers disseminate their own versions of the team model in such a way that it spreads like "ripples in the water." This is likely to be a more authentic way of learning a new practice for teachers, as compared to participating in a course, because this model is tried out and co-developed by the teachers themselves. The IT-Pedagogical Think Tank model resembles other models in terms of teamwork; it has been inspired by action research (Groundwater-Smith & Irwin, 2011) and problem-based approaches (Savery, 2015). The contribution of the IT-Pedagogical Think Tank model is its ability to provide an ongoing practice and a structure, based on relevant theory and methods. It is focused on pedagogical innovation and reflection, with a foundation in teachers' and organisations' relevant professional issues and problems, enabling change and structured anchoring of the new innovative concepts and resulting in a visionary contribution to the educational institution. The new team practice gives teachers an identity not only as teachers but also as (self-regulated) learners.

The findings indicated that the teachers had a more positive perspective of their own abilities to create changes after participating in the workshops. In addition, they valued the professional support they gave and received when developing new learning concepts in the team. As one of the teachers in the workshops put it, "If VUC Storstrøm wants to be one of the best adult education centres in the country, this is perhaps one of the ways to do it. But the administration must want it." In the eight workshops, we followed specific learning goals that incorporated pedagogical innovation, reflection and learning designs (Footnote 15).

These learning goals served as guiding points in choosing the content and format for these first workshops and should therefore be seen as a contribution to the current version of the IT-Pedagogical Think Tank model. Though the teachers approved the IT-Pedagogical Think Tank model, it was developed and used by only a small group, and these teachers had a positive attitude about participating in this experiment. However, the pace at which the teachers moved through the issues and came up with new pedagogical innovations indicated the great potential for use of the model in other new educational environments involving technology. The model was tried in an alternative environment with successful results, requiring only minimal guidance from the researcher (Laboratory Technician Education, VIA University College, Århus; Appendix A).

8.4.5. CONCLUSION ON THE DEVELOPMENT OF ITP4T

The purpose of working in the IT-Pedagogical Think Tank (ITP4T) was to create a continuous and sustainable practice that enabled teachers to become more competent as innovative teachers by providing tools to develop new motivating learning designs. The teachers working in the IT-Pedagogical Think Tank took responsibility for choosing and setting goals for their own competence development, creating change with the potential to participate in the daily visionary management of the educational institution. The goals and milestones (G & M) were an important part of the model, since setting personal goals and developing and adjusting them over time made the process highly relevant for the teachers (Turkay, 2014). The Global Classroom teachers contributed to the model by describing their problematic issues, by co-designing and working with the suggested new practices and by experimenting with and reflecting on the different parts and iterations of the model. They qualified the model by participating in the design process.

The IT-Pedagogical Think Tank model did, in this first iteration, prove to be a reusable continuous competence development practice, consisting of elements of pedagogical innovative and reflective *thinking and acting technologies* as well as practices and processes enabling change and anchoring of the new conceptualisations developed by the teachers. Through their development of new learning designs and their implementation of new technology in the Global Classroom, teachers became empowered initiators and developers of their own innovative pedagogical concepts. This type of competence development differed from more traditional Teacher Professional Development (TPD) courses, which involve learning from more knowledgeable others. The establishment of this new practice could be termed *Teachers Professional Innovation Development* (**TPID**), as the teachers developed competences in pedagogical innovation. For this model to be successful, it is vital that the administration support and engage in the practice by providing resources, by participating and by being open towards a possible change in the distribution of leadership and initiatives between administration and teachers.

B

8.5. ARTICLE B: PEDAGOGICAL INNOVATION IN TEACHER TEAMS – AN ORGANISATIONAL LEARNING DESIGN MODEL FOR CONTINUOUS COMPETENCE DEVELOPMENT

Author: Charlotte Lærke Weitze

The paper was published in the proceedings of the ECEL 2015. Proceedings of the 14th European Conference on e-Learning. University of Hertfordshire, Hatfield, UK, 29-30 October 2015, pp. 629-638.

The second article (B) about the IT-Pedagogical Think Tank describes the general learning and innovative processes that take place when working in the IT-Pedagogical Think Tank and makes suggestions for how these essential innovative processes may be supported in a new organisational learning design. This article describes the next phase of the DBR iterations from Spring 2015, which involved six workshops with five teachers and the manager from VUC Storstrøm, Næstved Department.

Teachers after the IT-Pedagogical Think Tank teachers' test.

Pedagogical innovation in teacher teams – an organisational learning design model for continuous competence development

Charlotte Lærke Weitze[1+2],
[1]Research Lab: IT and Learning Design, Aalborg University, Denmark
[2]VUC Storstrøm, Denmark
cw@learning.aau.dk

Abstract: This paper presents findings from a longitudinal design-based research project examining how to enable reflection and pedagogical innovation in teacher teams. The article identifies and analyses the teachers' learning trajectories and innovative strategies when working together in the IT-pedagogical Think Tank for Teacher Teams (after this: ITP4T) (Weitze, 2014d), a competence development model, which was developed in an earlier phase of the research project. By using theoretical lenses from innovative knowledge development frameworks to examine the teachers' utterances, interactions and new learning designs, the research aims to clarify what kind of knowledge is being developed and shared in the teacher teams, and how this contributes to the organisational learning process. The context is Global Classroom, an innovative synchronous hybrid videoconference concept, where adult students can choose between participating in class on campus or from home via videoconference on a daily basis. The ITP4T model is a response to the needs and challenges the teachers and the organisation at VUC Storstrøms´ Global Classroom have been experiencing in this new teaching environment. The teachers find that they need to be pedagogically innovative when teaching in this learning environment, particularly when aiming to create equal learning conditions for the students in class and at home; in other words, they need to reframe their learning designs. The ITP4T model thus aims at creating a continuous practise for the teachers to be able to create their own competence development in teams in which the manager participates. The use of this new practice inside the school empowered the teachers in the organisation and created a new organisational learning design, which can innovate, help unravel complex questions, create new organisational knowledge and anchor new knowledge and practises. The teachers became both their own and the organisation's continuous competence developers when working in this learning design/innovative model. They experienced this as an efficient way of working which made them feel empowered.

Keywords: pedagogical innovation, competence development in teams, video conferencing, synchronous hybrid campus- and home-based education.

1. Introduction

> [It can be said in] one word: **Responsibility** for your own learning—**that** is motivating—more efficient. You get more out of it [...] if you have an organisation like this that brands itself in terms of being inspiring and creative, then something like this is madly important in that we are allowed to work and think and develop together (A teacher that has worked in the IT-pedagogical Think Tank for Teacher Teams model (ITP4T)).

This project investigates reflects on and looks into how new *practices can contribute to the creation of reflected, innovative and motivating learning designs in a hybrid synchronous video-mediated teaching context.*

1.1. A need for technological literacy

In many countries, the state and the municipalities are prioritising the use of many resources to digitalise education. The aim of such efforts is to create more motivating, efficient and differentiated learning possibilities for the students in order to provide them with the best possible education (Collins and Halverson, 2010). The world of education is changing, and many schools are challenged by motivational issues among the students. Educational technology can be defined as technology used in educational contexts. The Danish government has a hope that educational technology will serve as leverage to help develop a new and better way to create motivating learning possibilities. However, the impact of technology in the context of education depends on the way in which it is used (Luckin, Bligh, Manches, Ainsworth, Crook and Noss, 2012). Although technologies are physical tools and not theoretical thinking tools or concepts, they change not only the way we carry out a task, but also the way we think about the task (McLuhan, 1964; Hasse and Storgaard Brok, 2015). Recent research indicates that teachers should be better equipped to handle the interaction with new technologies at work. To meet the needs in modern educational institutions, the teachers must be trained to be able to learn, evaluate and analyse the following: new technology, technology in a situational practice, the technologies' complex pathways, the impact of technologies on the profession and the interaction between these factors. These abilities can be described as *technological literacy* (Hasse and Storgaard Brok, 2015: 395). Technological literacies and innovative skills must be integrated as part of the teachers' training to build their competence and understanding of the technology which they need to use in the workplace (Hasse and Storgaard Brok, 2015; Weitze, 2014d).

The development of technological literacy is complex and has to take into account that the experience and use of technology changes when it is situated in the constantly evolving context of everyday life (Hasse and Storgaard, 2015). Digital technologies differ from stable, well-established technologies, such as pens, paper and books, by constantly demanding attention, challenging the teachers' routines and often providing more hidden and unexpected affordances. Therefore, the teachers must continuously learn about the many unexpected good and bad effects of digital technology in order to comprehend and be able to handle them. To foster the teachers' technological literacy, the teachers and educational institutions must be able to develop their own learning strategies for this continuous development in order to adapt it to the needs of their organisational context. In this research project, the teachers experienced difficulties with working in an innovative videoconference-based learning environment. In order for the teachers to be able to handle relevant but also unexpected and unpredictable problematic situations encompassing educational technology, there was a need for new approaches to competence development for this educational institution.

1.2 Organisational learning for teachers in an educational organisation

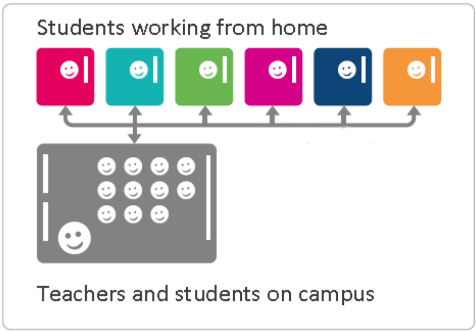
A strategy for organisational learning at many schools is to let a few engaged teachers lead the innovative development process and inspire the other teachers regarding how to use educational technology in their teaching. However, this approach can still make it difficult to enable the whole teaching staff to learn as not everyone is involved (EVA4, 2008). Another strategy is to offer courses, which introduce the features of the new technologies. Although this is a necessary step in learning about the technology, the teachers still experience difficulties in knowing how to use the technology in their specific learning situation, for their specific students and within the context of the specific subject matter and learning goals. After attending a course, the teachers often find it difficult to find the time to experiment and invent new learning approaches within their already sparse preparation time, as their main responsibility is to ensure that the students will reach the relevant learning goals. The teachers often also miss the possibility to work and innovate with peers within these new knowledge areas (Dede, 2009; Weitze, 2014d).

Finally, many educational institutions create projects as part of their organisational learning strategy as a way to develop new knowledge. However, many projects are only for a few selected participants, are not anchored beyond the primary project's lifetime and are thus not retained as part of the organisation's knowledge. Therefore, it is important to develop ways to plan not only the development phase, but also the implementation and anchoring phase when using projects as innovation and learning strategies (Henriksen, Buhl, Misfeldt and Hanghøj, 2011).

For the above reasons, there is a need to develop reflective and innovative tools and methods for teachers in relation to the use of the IT in practice which will enable them to make informed choices when creating motivating and qualified learning designs with educational technology for the students. There is also a need to investigate what it takes to achieve a well-functioning knowledge sharing, communication and decision flow between the managers in the organisation and the teachers. This will enable the two actors to support each other in the best way, using their professional experiences to make the best choices in relation to the use of IT (Hasse and Storgaard Brok, 2015; Weitze, 2014d).

In the following, I present the case of the Global Classroom at the adult education centre (VUC) Storstrøm, including the empirical background for this research project, and introduce the challenges experienced when teaching in Global Classroom. This is followed by an introduction to the qualitative research methodology and the research design. In order to overcome the challenges, the teachers experiment with a continuous competence development model (ITP4T), which is presented after the introduction to the research design. This is followed by a theoretical and empirical analysis of important innovation and knowledge-creation processes.

(a)



(b)

Article B Figure 1: The Global Classroom set-up.

2. Case

The research takes place at VUC Storstrøms' Global Classroom. Global Classroom is an innovative learning environment implemented in a full-time upper secondary general education programme for adult students lasting two years. In this learning environment, the students can choose between participating in class or participating individually from their homes using laptop computers on a daily basis (Figure 1 a,b).

The students have to attend at least 80% of the lessons to enter for the examination. VUC Storstrøm's management has decided to create this innovative learning environment to meet the adult learners' needs for variation and flexibility during the school day; the possibility to participate from home has been motivating for many of the students. However, the choice of this new digital learning environment, which aims to break down the walls of the classroom, puts the teachers in a challenging new teaching situation. This new teaching situation, in turn, requires that they develop new teaching strategies. The teachers were educated at universities, and very few, if any, have been trained in using educational technology during their previous education.

2.1 Challenges when developing learning designs in Global Classroom

A teacher's major role is to facilitate the learning processes for the students in order to develop qualified and motivating learning possibilities. Selander and Kress (2012: 2) use the term *learning design* to describe how the teacher shapes social processes and creates conditions for learning. A learning design can, in other words, be described as someone trying to facilitate a learning process for someone in order for this person to learn something (Qvortrup and Wiberg, 2013).

When a teacher experiences a new learning environment, he/she will have to consider if they can continue using their previous pedagogical strategies. A teacher's teaching strategies and learning designs are (at least as is often the case in Denmark) a personal decision, and thus teachers will often develop habits or best practices and personal teaching styles. The learning design will depend on the subject matter, the current area of the subject matter and who the students are (Hiim and Hippe, 1997). Most of the teachers in the Global Classroom experienced that they could reuse many of their previous teaching methods, except when occasional technical problems occurred. Additionally, they found that they had developed new competences after working in the Global Classroom environment for half a year.

However, the teachers also experienced problems. Generally, they used many different teaching strategies for creating active and motivating learning designs to *move* the students to learn when teaching in a traditional brick-and-mortar classroom. These strategies often encompassed a range of hands-on activities and short periods of breaking out in groups etc. These motivating strategies are important in Global Classroom, since many of the adult students, according to the teachers, had motivational issues with respect to learning. According to statistics, 60% of the students at VUC had dropped out of school at least once before in the past. (Pless and Hansen, 2010). Many of the teachers' previous motivating learning designs were thus dependent on everyone being together in the physical classroom. For example, the biology teacher would teach about how the human heart was functioning by asking the students to dissect pig hearts in order to allow the students to discover and compare with what they had learned from reading about the subject. This was an example of a learning design that could not be re-used in Global Classroom. The teachers generally experienced difficulties activating the students at home to the same degree as the students in class. The students and teachers agreed (both in the questionnaires and in the interviews) that the students at home learned less, were generally more passive and often behaved like they were watching TV and not attending a lesson. This also encompassed difficulties when using teamwork between class-based and home-based students as collaborative learning break-outs during the lessons. During such activities the students often disturbed each other because of noise issues when staying in class to work in teams with the online students; the teams would also occasionally leave the classroom, and as a result, they would not know when the teachers wanted to start teaching the whole class together again. Some teachers reported that this made them use less teamwork, which left the teachers dissatisfied. As a consequence, many of the teachers used more monologue-based teaching strategies. Such strategies were not very well-suited for this group of students who benefited from interactive and varied learning methods which involved them more and encouraged them to participate more actively in the learning process. Though the organisation had arranged courses to train the teachers for teaching in Global Classroom, it was difficult for the teachers to develop new ideas and to have time to develop their own learning designs for these new learning situations. In order to develop a new learning design for the educational institution, the research project therefore worked on two levels: 1) the teachers developed innovative learning designs for the students to facilitate motivating learning processes; and at the same time, 2) the research project developed a sustainable working practice that enabled the teachers to create new knowledge for the organisation by leading innovative learning processes—i.e. a new organisational learning design.

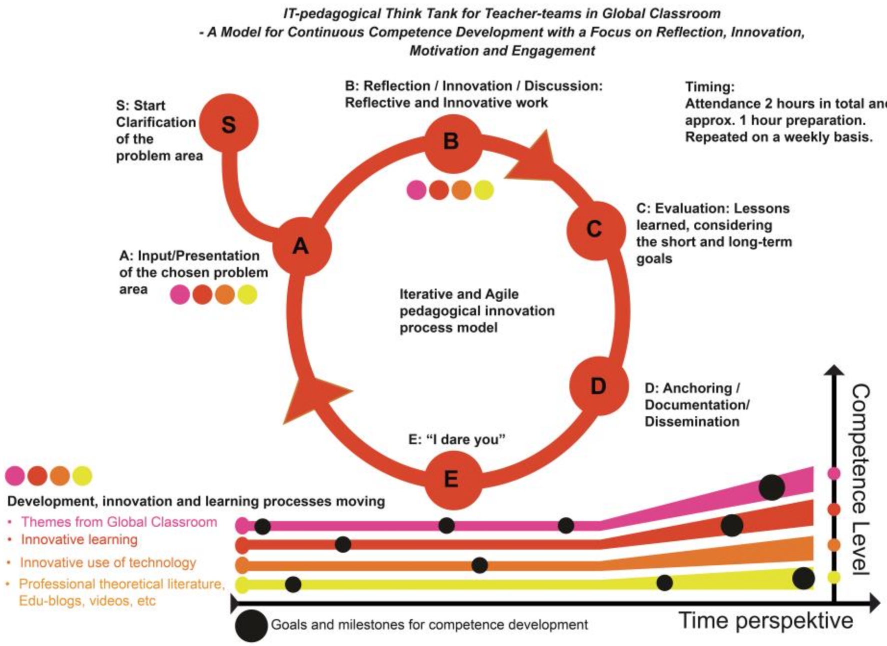
3. Methodology and research design

The research is part of an ongoing (2,5 year) design-based research project (DBR) (Reimann, 2011) which investigates the following: 'What elements, methods, processes and practices can contribute to the creation of reflected, innovative and motivating learning designs for teachers and students in a hybrid synchronous video-mediated teaching context, with a focus on how to create motivating learning for the students?' The products and processes from the research project have been co-designed with the participating teachers. After the development phase of the ITP4T (Weitze, 2014d), the model underwent a test phase with new teachers at another of VUC Storstrøm's schools to test the sustainability of the model and to enable further refinement processes. The study is conducted as a mixed method study using qualitative methods and informed grounded theory (Thornberg, 2012) to analyse the data. The data from the research project encompasses the following: field notes; audio and video recordings of actions and dialogues; observation of the teachers and students in class; questionnaires and semi-structured interviews with the teachers and students. The teachers' new learning designs, ideas and presentations from all the workshops (which are presented on a webpage) are also part of the data. The data was collected from eight development workshops in fall 2013 with one teacher team and manager (n = 5) and six test and development workshops in spring 2015 with another teacher team and manager (n = 6). This article will mainly focus on the six test workshops in spring 2015. Furthermore, more than 200 conversations and interviews have been conducted with the teachers, management and students; questionnaires and other gamified experiments were also utilised with the students and teachers in Global Classroom. This has contributed to a large amount of data, providing a good basis for being able to describe the teachers' experiences when teaching in Global Classroom.

In this next iteration of the DBR, during spring 2015, five new teachers from the Global Classroom learning environment participated in a competence development project. The ITP4T model (Weitze, 2014d) guided the competence development. This framework was co-designed with other Global Classroom teachers in a previous DBR cycle. As part of the current workshops, the teachers were studying literature about pedagogical innovation (Darsø, 2011), reflections on theoretical concepts for the professional teacher (Dale, 1998) and learning designs (Laurillard, 2011). The researcher and author of this paper conducted the first two workshops, introducing the ITP4T and coordinating the goal-setting phase. In the last four workshops, the teachers themselves facilitated the competence-development process. During and after the workshops, the researcher conducted formal and informal interviews with the teachers to be able to identify and investigate the participants' learning trajectories and refine the model further. The researchers' active way of participating in the workshops calls for attention regarding her role, with a danger of biasing the research; at the same time, this approach makes it possible to observe, analyse, learn and bring up relevant theories and share these reflections with the teachers during the different iterations.

4. IT Pedagogical Think Tank for Teacher Teams (ITP4T) – theoretical framework

This article describes the learning and innovation trajectories and knowledge-development processes for the teachers that worked in ITP4T. Therefore, the following presents a short description of work in this *thinking and acting tool* for a continuous competence-development process for teacher teams. Please see Weitze (2014d,e) for an elaborated version of the model and notice that the letters in brackets in the following refers to figure 2. This innovative learning practice consists of a weekly two-hour meeting, with one hour of preparation between these meetings.



Article B Figure 2: IT-Pedagogical Think Tank for Teacher Teams (ITP4T).

To establish the teacher team, the first meeting was used for:

(S) clarifying the problem areas through discussion, brainstorming etc. The teachers wrote up their problem areas individually as well as for the team. The problem areas lead to the goals for their competence-development process. This is illustrated as the coloured lines with the black goal-dots in the bottom of figure 2; as time passed, new goals were set and the level of competence increased.

The teachers also discussed how to evaluate if the problems were solved or the goals were reached. The problem areas, for example, encompassed the following: 1) problematic themes from the Global Classroom learning situation; 2) how to create innovative learning designs in Global Classroom; 3) innovative use of educational technology beyond just videoconferencing and 4) the fact that the teachers were also studying professional theoretical literature, new research, Edu-blogs, videos etc.

At the following weekly meetings, the teacher teams worked through a weekly process consisting of the following:

(A) Input/Presentation of the chosen problem area/theme by the team leader of the day; the team members took turns being the team leader. The presenting teacher’s theme was always a *burning problem* or an idea for a solution for this problem (all the teachers prepared an hour for this theme every week).

(B) Reflection/Innovation/Discussion (this was the ideation and development part of the think tank). The teachers were doing reflective and innovative work (Dale, 1998; Darsø, 2011); that is, the teachers intentionally worked at Dales’ (1998) third level of teacher competence, putting aside their daily practical and functional practices and instead discussing issues of a comprehensive character and analysing them from a theoretical viewpoint. They were also conscious of dealing with *what they knew* and *what they did not yet know,* and they used structured methods to conceptualise and discuss the problem areas. They also aimed at creating a friendly and open space for this conceptualisation, reflection and innovation.

(C) Evaluation: The team discussed the lessons learned, considering their own short-term and long-term goals as well as new goals. They wrote up these new goals along with the previous goals.

(D) Anchoring/Documentation/Dissemination: For the benefit of memorisation and common explicit conceptualisation of the innovations and solutions, knowledge sharing took place in a structured way on a platform that was available to all teachers and the organisation. This gave everyone an opportunity to participate in creating and using the new knowledge.

(E) ‘I dare you’: The team leader of the following week initiated this activity, and together with the team, settled on a task for the following week’s meeting, thereby enabling an informed discussion. It was important that some of the tasks consisted of conducting experiments in the class since the main aim for this think tank was to create motivating learning designs for the students. The tasks also consisted of finding and reading new material for a problem area, or finding and experimenting with new educational technology. The teacher team’s manager (the head of the department of this school) participated for 10 minutes every week. His interest and support for the team was found to be very important since the aim was to create a new organisational innovative learning design. His participation enabled new forms of knowledge development and knowledge sharing between management and teachers. This innovative and reflective team model is different from traditional teacher teams that often have a more functional and practical focus (Tingleff, 2012).

5. Theoretical and grounded analysis of the empirical data

In the following, the objects of the innovative learning processes are described and analysed, and problems are identified in order to identify the objects and processes in need of pedagogical innovation. This is followed by a theoretical analysis and reflection about how learning and innovative processes are connected in order to develop analytical frameworks and understandings for what is happening and should be supported in a pedagogical innovation and knowledge-development process. Then the article presents examples of what processes, products and new knowledge has come out of the teachers' work in the ITP4T model.

5.1 The objects for the innovative learning processes

In Global Classroom, the teachers aimed at creating motivating learning processes enabling the students to achieve the learning objectives. Therefore, they were concerned with how to create a learning design, and with choosing content and relevant and motivating learning processes that would facilitate this. The teachers would generally begin by taking pedagogical considerations into account when deciding how to enable deep learning processes; furthermore, the use of technology would always be subordinate in the learning design.

However, sometimes the technology comes before the learning design. For example, if the technology's affordance— that is, what it is designed and used for—has inspired the teacher to create a new learning design; or if the technology is a premise in the teaching situation as the videoconference equipment is in Global Classroom. In Global Classroom, the learning activities and processes were mediated through the videoconference equipment for the students who were participating from home. Therefore, the teachers had to re-design their learning designs with this technology and its affordances in mind.

Learning to press the right buttons alone did not teach the teachers how to create deep learning processes in the video conference environment. They had to plan and experience learning situations with the students in order to identify the problematic situations that occurred in this environment (Weitze, 2014d). In addition to the videoconference technology, the teachers also used a learning management system (LMS) that all the students had access to. The LMS was mostly used as a 'virtual desk' where the students and teachers could upload and access relevant literature and assignments. Since the teachers aimed at creating engaging and activating learning processes, they were looking for new teaching strategies and technologies to create learning situations where the students in class and at home could experience equal working conditions and be engaged and activated. The teachers were concerned that the students at home were less active, and generally learned less, and they were therefore searching for ways to improve this experience for the students. One possibility was to be more direct and engage directly with each single student sitting at home; in fact, this was a strategy that many teachers used. However, as most teachers also relied on collaborative and problem-based learning strategies, the learning environment also should be able to facilitate these strategies through combined sociological and technological processes; for example, by using additional educational technology in the video conference setting.

Educational IT is a concept which encompasses a broad range of technologies, including e-books, presentation tools for a range of different and combined multimedia, learning games, virtual shared documents, drawing programs, video conference etc. Some of these technologies are easy to use, but in spite of how well they may have been designed and intended, all technologies possess aspects of affordance, use and implementation that 1) are unexpected, and 2) are modified according to which setting they are used in. Furthermore, technologies are continuously altered, a frustrating fact for the teacher that has just found his or her favourite tool. In other words, it often becomes complex to find and use relevant educational technology in class. It will always be an explorative process, with the risk of disturbing the intended learning situation, sometimes to a degree that the teaching processes fail in the first experiments, even for the skilled and experienced teacher. Also, small usability issues in the technologies may confuse, delay, disturb or directly hinder the intended learning processes.

In Global Classroom, aspects of class management in teaching may also be affected when using educational technology as teaching processes often encompass social and bodily aspects. In a classroom, for example, we 1) learn collaboratively by sitting together in the physical room; 2) work with learning materials while discussing and negotiating meaning; 3) make spontaneous shifts in learning processes and activities according to what is suddenly needed in the present situation—a rapid change in what we do and in who does what in order to keep the learning situation on track; and 4) when we teach, we work with rhythm and smooth changes in the learning process. Regarding this last point, teachers try to adopt a rhythm that ensures that the students are not kept waiting too long and thus become impatient and lose their concentration. Teachers also employ smooth shifts, which enable the students to focus on what they are working with and learning about, instead of shifting their focus to a mediating technology (Dourish, 2004). To master these aspects of learning situations in Global Classroom requires the teacher to be technologically literate. The teachers had many experiences with how the class management became more difficult and had to be rethought in this new environment.

5.2 Learning and innovative processes

In order to learn how to create innovative learning processes, it is relevant to investigate how the two concepts of innovation and learning relate to each other in knowledge-creation processes. Innovation can be defined as the first introduction of a new product, process, method or system (Quintane et al., 2011). A new invention can be innovative in relation to the individual, a specific culture or the world. In this article, the learning design is considered innovative if 1) the teacher has never tried it before; 2) if he/she is not just imitating what he/she has read or heard from another source, but instead 3) has created this new invention by taking part in a development phase for a new learning design for a learning situation. The following is a description of innovation and knowledge-development processes taking place when creating pedagogical innovative learning designs—a process that the ITP4T model aims to support.

Problems and ideas: In the ITP4T model, the teachers work from a problem-based outset. They work with a burning problem—an issue they have a desire to solve. A problem-based innovation process will start with knowledge, i.e. the teachers' background and experience, as well as non-knowledge, i.e. the solution the teachers are searching for (Darsø, 2011). To move towards a new solution, we need an idea. According to John Dewey, ideas or visions are endpoints we are searching for a way towards. That is, the idea is a tool or the means to provide a solution for our problem. Ideas are therefore also the direction for our investigations (Dewey, 2009/1933). There is not a fixed solution in an innovation process; the problem and the solution will always develop together (Löwgren and Stolterman, 2007). As you get closer to your interpretation and analysis of the problematic situation, the solution will be *your* solution for this interpretation; other teachers can perhaps see other problems and other solutions in the same learning situation. It is not a straightforward process to create a learning design encompassing IT, but rather a process that is experimental and iterative. *Design thinking* is a discipline that aims at innovating by using the designer's sensibility and methods to match people's needs with what is technologically feasible (Brown, 2008: 2; 2009). Although the teachers in Global Classroom are not dealing with the design of software technology from the creator's side (but rather from the user's side), it is worth looking for inspiration for the innovative process from design thinking when designing for the use of technology in educational settings. This will provide concepts that are relevant to discuss and be aware of in processes where you plan how to design for the interaction between humans and artefacts.

Exploration and inspiration: In design thinking, the abovementioned process of defining and exploring your problem area is called *inspiration*. It encompasses the analytic unravelling of the situation as well as gathering new knowledge from research and from observation of and discussions with your users or learners (Brown, 2009).

Ideation and reflection: The next step in the innovation process is called *ideation* and encompasses generating, developing and testing ideas. For this process, the designers use brainstorming tools and sketching and prototyping tools for their concept development (Brown, 2009). Pedagogically innovative learning designers also go through an ideation phase. When ideating, the idea generation and exploration should be kept in a divergent phase—working with multiple proposed solutions or angles of solutions—before going into a more critical analysis (Löwgren and Stolterman, 2007). This encompasses verbal or physical conceptualisation of the ideas, discussion, elaboration, experimentation and test of the concepts. This will provide space for changes to a traditional approach (Brown, 2009; Löwgren and Stolterman, 2007). Reflection on the previous knowledge from the problem area and the new ideas is also an important part of this process (Dewey, 2009/1933). Teachers need to develop skills to master this ideation phase in order to become professional learning designers using educational technology. Therefore, it is important that both teachers and the organisation develop an understanding of the necessity of allocating resources for this phase.

Test, implementation and anchoring: After ideation, there is a more convergent phase where the teachers will have to choose between their ideas. This may lead to synthesis and perhaps recombination of their solutions. Often the students will have been involved in trying some of the teachers´ designs before reaching a meaningful innovative learning design that will match the students, the learning situation and the learning goals of the curriculum. This is called the ‘implementation phase’ in design thinking.

New knowledge: When the teachers find a satisfactory solution, i.e. a new innovation, they will later be able to unravel how they arrived there—the learning trajectory to their solution that most likely will make it possible to repeat. By ‘thinking backwards’ in this way, the innovation turns into knowledge again; that is, we now know how to repeat this new learning design, this new learning process or this new way of sharing knowledge in the organisation. For the innovative learning designer, the learning trajectory of the innovation process or product may thus always be understood afterwards—but seldom before. If the innovation process or product was known before, then it would not have been an invention for the relevant teachers; instead, it would just have been a learning process for a known destination.

5.3 Knowledge creation in the team

The following are examples of what processes, products and new knowledge came out of the teachers’ work in the ITP4T model. The letters in the brackets are referring to the points in ITP4T (Figure 2).

(S) Goal setting: Since it was difficult for the teachers to create activating learning processes on equal terms for the students in class and at home, the following question was a complex problem area which was proposed as a burning problem from the start: *How can we create activating learning designs for the students?*

Though the teachers were experts in various disciplines, this interdisciplinarity in the team helped them focus on approaches to the problems that all could benefit from. At the same time, each teacher could reflect on the solutions from their individual viewpoint. The teachers used interactive project-management software to write up their individual problem areas as well as the common problem areas for the team. They also wrote hypotheses about how they could evaluate if they had reached their goals, which would later give them a feeling of having developed their competence through their own efforts. To identify the problems, the teachers evaluated their learning situations from Global Classroom and were critical when they decided what needed to be changed and what they needed knowledge about. They considered and discussed what knowledge they already had individually, and how this knowledge could contribute in their common search for new solutions. When sharing their individual problem areas, the rest of the team started contributing both their own practical experiences and new ideas for experimental paths to try out. In this way, the teachers in this initial phase had time for their individual reflections and also benefitted from the collaborative learning possibilities that the team enabled. These combined individual and collaborative learning and ideation phases continued throughout the development in ITP4T.

(A) Input/Presentation: In one workshop the team leader of the day had the ambitious goal of creating a learning design for the students in Global Classroom that encompassed physical movement (she was a social studies teacher). She made a PowerPoint presentation for the team that described the problem, and presented new research on the benefits physical movement could provide in a learning design. The findings were that the teachers switched with ease between being a student with a problem area to being a professional teacher finding and presenting relevant research, educational videos or other new knowledge to inform the debate and the innovative process in the team. According to the teachers, this approach was very motivating and also made an important difference compared to traditional meetings where they solely discussed the difficulties of working in Global Classroom. In other words, their reflections now could take place from an informed position and not only based on their own experiences. Furthermore, the teachers experienced that these inputs gave them much more specific and relevant new knowledge compared to traditional courses; they also gave them a sense of being able to work very specifically with their problems.

B) Reflection/Innovation/Discussion: In the workshops, the teachers designed small experiments for the other teachers in the team to try out. This was arranged as practical hands-on as well as reflective verbal and written exercises. This sparked many discussions and ideas on how to invent and implement the designs into Global Classroom. All in all, it enabled the teachers to develop innovative knowledge about how to create new processes and products together, thereby allowing conceptual discussions to move alternately between a theoretical, conceptual level and a practical level. In every workshop, the teachers had planned methods and chosen tools for this collaborative ideation and experimentation. In the workshops, one or two of the team members participated by videoconference from home, and many of the used tools and methods were Internet-based. This enabled the teachers to 'take their own medicine' and in a safe place try out the interactive tools that they considered using for the students' learning designs. The teachers thus developed informed ideation processes and experiments, which were facilitated by relevant tools.

In the physical movement workshop (mentioned above), the teachers tried out a learning design encompassing a mobile chat-based walk-and-talk assignment to experiment with the students at home moving and interacting with the students in class in equal conditions. The teachers thus developed prospective knowledge since they aimed at being innovative and planning for the future learning design (Goldkuhl, 2012). They also developed normative knowledge since the goals for their innovative learning designs was to motivate students and create deep learning processes. The teachers were operating in a free and open space, developing skills as innovative learning designers, with methods and tools that enabled them to experiment together with peers in an atmosphere that generated new ideas, informed by new knowledge. Here they had the opportunity to develop competence to experiment on new and unknown ground and seek for information that could inform their individual problem areas. According to the teachers, the shift from being a teacher who was searching for relevant training and competence development to being a teacher that was responsible for her own experiments within a problem area was experienced as a motivating and much more relevant and concrete competence-development process while learning together with and being inspired by peers.

(C) Evaluation: The purpose of the teachers' evaluation was to return to their initial goals, evaluate how far they had come and develop a common language for their pedagogical innovation products and processes. As part of starting to work in this ITP4T, the teachers read literature about learning designs, pedagogical innovation and being a reflective teacher developing theory through research. This gave them a common ground and a theoretical/conceptual pedagogical language. Though they all had read this kind of literature before, the teachers expressed that this was important for the quality of their conversations and new concepts, and thus made it possible to share and develop their (often tacit) knowledge within their teaching domains.

D) Anchoring/Documentation/Dissemination: All of the teachers' presentations, innovative products and new learning designs were presented on a webpage in order for other teachers to benefit from this new knowledge. However, the teachers had many discussions on how and where to disseminate the new knowledge, and agreed that an oral and practical dissemination would have the best effect. Together with the manager, they therefore proposed a new practice at the school where teachers could meet for an hour in the computer room every Friday morning. Here they could educate each other and develop the new knowledge and practices further. This would also overcome the teachers' concern about disturbing their busy colleagues with questions about alternative teaching practices and use of new technology. The manager supported this proposal and discussed how to make it become practically possible together with the teachers. Disseminating the prescriptive knowledge the teachers had developed enabled them to explain what to do in specific learning situations with specific technology in a way that enabled other teachers to learn from them. The new knowledge the teachers disseminated was developed by 'thinking backwards' about how they solved their problematic issues, thereby creating the transformation from innovation to new knowledge.

E) 'I dare you': According to the teachers, one of the most crucial points for the development process was this last assignment in the ITP4T. It made a difference to have this common challenge and to come prepared to the next meeting; for example, when all the participants had used one hour for reflection, looked for new pedagogical-technological solutions, experimented with their students and/or had read and discussed a text in an online debate forum with the team. In this way, they had moved themselves to a new place before the next meeting and had already moved beyond the practical knowledge from their habitual teaching practice. In these individual 'I dare you' assignments, all the teachers actually moved through an additional round of the points in ITP4T; for example, they identified the problems in the assignment, looked for new research, reflected, experimented and evaluated.

The manager's role: The manager (the head of the department) participated for 10 minutes in every workshop. He expressed that it was valuable for him to get insight into how and what the teachers discussed and innovated on. By participating, the manager was inspired to find new ways to share knowledge in the organisation, and also learned about the teachers' new skills. For the teachers, the manager's participation made them feel that he was interested in their innovative designs, and this was motivating for them. Additionally, it may be easier to implement new ideas if the manager that participates has the power to make decisions about new changes in the organisation. A teacher working in ITP4T observed as follows:

> Pedagogically, it's [ITP4T] very much about how to think new thoughts and how to think outside the box, and this is perhaps what we have come a long way doing. This also means that in the future we will be able to explore different places than we normally would.

The members found that the quite tight structure of the framework worked well as a model and enabled them to develop many new ideas. They all used their new learning designs with the students, and some of the designs were used by several of the teachers. The teachers agreed that it would be a good frequency to go through four or five workshops in ITP4T twice a year, depending on the number of team members. The organisation has decided to educate a member of the pedagogical IT staff to coordinate the initial phases for new ITP4T teams as they learn to work in the model. The ITP4T model was only developed and used by two small groups. To test the positive results, this DBR experiment should be scaled and tried out by new teacher teams.

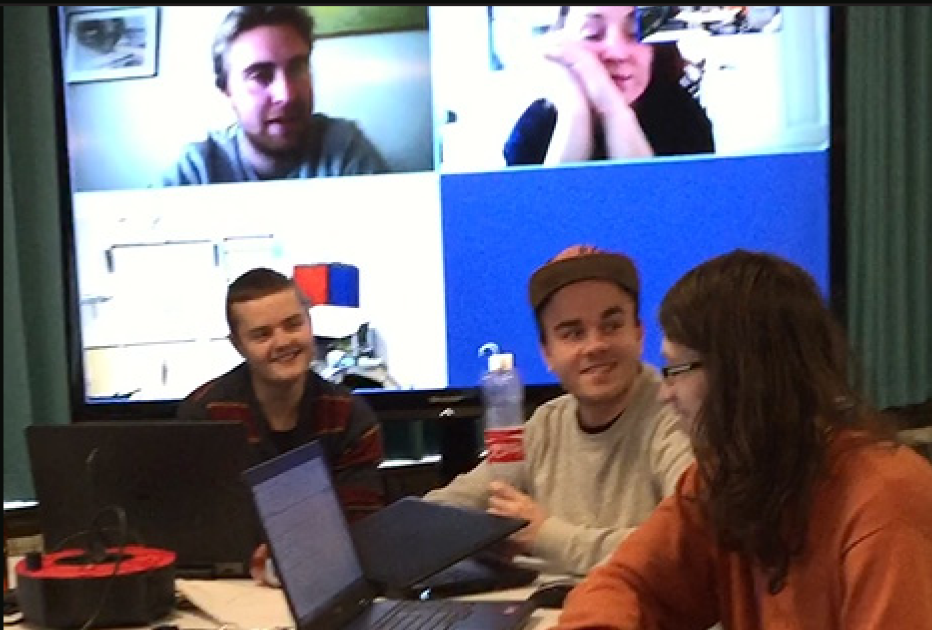
6. Conclusion – new innovative competences

By working in this model, the teachers developed new competences that they were able to transfer to their teaching practice. They became innovative learning designers developing new knowledge concerning learning designs, new use of technology and new ways of sharing knowledge in their educational institution. The teachers became able to identify and formulate possible problem areas in their educational context, always with the central aim of creating motivating learning designs for the students. They acted as team managers and were able to design and create innovative pedagogical processes with collective reflection, finding and discussing relevant literature in relation to current issues. The teachers invented and carried out development processes leading to individual as well as team-based goals for innovation; they were also able to find and use relevant tools and methods to facilitate the ideation phases for the team. All teachers were innovative in relation to their own teaching, involving pedagogical strategies, new technology and new/innovative learning designs. All teachers contributed to reflections on how to design a strategy and method for knowledge development, knowledge sharing and anchoring in the organisation. The teachers co-designed the development and tested a new innovative organisational learning design, transforming non-knowledge or problems into ideas and pedagogical innovation and then back into new anchored knowledge in the educational organisation. The teachers and manager found it motivating and effective to work in ITP4T; it provided them a new frame and support to be responsible for their own learning processes. Therefore, the teachers and the organisation should develop an understanding of the necessity of allocating resources for ideating and developing new learning designs. It will be interesting to scale this research and try it in other learning contexts.

7: Acknowledgement
I would like to thank the participating teachers and management at VUC Storstrøm for their highly patient, committed participation and input in the research project.

END ARTICLE B

Studying in the Global Classroom



9

CHAPTER 9. STUDYING IN THE GLOBAL CLASSROOM

9.1. INVESTIGATING HOW TO CREATE MOTIVATING LEARNING DESIGNS INVOLVING EDUCATIONAL TECHNOLOGIES

This chapter describes the exploration of the problem statement from the students' angle. It therefore presents areas of pedagogical innovation that were examined in the investigation of how to create motivating learning for students in a hybrid synchronous video-mediated learning environment. The sub-questions for the students included the following:

Q2:

1. How can an educational organisation create activating and motivating learning designs for adult students when they learn with and through educational technology?
2. To what extent is it possible to measure how learning with and through educational technology affects student learning and motivation?
3. Can students help in further innovative integration of educational technology in their learning processes, and if yes, how can this take place?

These questions were examined by exploring which existing practices concerning the creation of motivating learning designs were challenged and which new practices emerged in the hybrid synchronous video-mediated learning environment. The characteristics of the interplay between the pedagogical practices and technology were also examined. The teachers developed new learning designs as a part of their daily practices. Both teachers and students participated in co-design processes in the design-based research projects which explored how to create new motivating learning designs for this environment.

The investigation in this chapter originated with the issues described in Chapter 7. Although Chapter 7 addressed learning designs from the Global Classroom, the current chapter presents learning designs that aimed to overcome the issues and also explored new opportunities offered by the Global Classroom environment. It was the teachers' experience that their pedagogical approaches changed when teaching in the new learning environment, which sometimes hindered the active, motivational teaching approaches they had used previously and created unequal learning conditions for their students. Chapter 9 begins by outlining pedagogical approaches that support active and motivating learning experiences; next, it describes the presentation of new activating and motivating learning design patterns created for the hybrid synchronous video-mediated learning environment. Finally, two articles (Article C & Article D) describe the DBR experiments in which students created gamified learning designs in the Global Classroom. Article C describes learning and motivational processes in a learning design for adult student game-designers which allowed them to learn in a gamified learning design while designing small digital learning games in cross-disciplinary subject matters. Article D describes the characteristics of the same gamified learning design and investigates how the teachers contributed to the students' cognitively complex learning processes and how four parallel types of processes for designing and learning supported the gamified learning design. These experiments investigated the opportunities and barriers encountered when attempting to create motivating learning designs for the hybrid synchronous video-mediated learning environment.

9.2. DESIGNING LEARNING FOR THE HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

The following analysis uses Hiim and Hippe's learning design framework to explore the elements, processes and practices teachers should take into consideration and gradually develop a new practice around when creating a learning design for the hybrid synchronous video-mediated learning environment. The learning Design model involved the following elements: 1) the student's prerequisites for learning/learning qualifications, 2) the setting – framework conditions for the teaching, 3) the learning goals, 4) The educational content, 5) the learning process and 6) evaluation/assessment (Section 6.5.1; Hiim & Hippe, 1997, 2003).

1) Regarding the students' *prerequisites for learning,* it was important to consider that the Global Classroom was made up of adult learners (Knowles, 2014); it was a diverse group of students, and some of these learners were likely challenged regarding their motivation to learn. The teachers were looking for new ways to reinvent their previous motivational learning strategies for this target group.
2) Concerning the *setting,* the practical factors included the videoconference equipment, the level of the educational institution's knowledge about the equipment and the way in which the room was arranged. Basically, the room had been turned into a videoconference studio. But the setting also involved the at-home students' rooms, as well as sound and light in those rooms. The setting encompasses the time available for teaching. For example, teachers had to use the beginning of each lesson to start up the equipment and make sure that each at-home student had a good connection. Teachers had to solve subsequent errors in the system and call for help, leaving less time for teaching. Softer frame factors included the individual teacher's ability to handle the videoconference equipment and other relevant educational technologies; the teachers' educational values; and the available opportunities to pursue professional development together with colleagues.
3) The *learning goals* depended on each subject area taught, on educational rules and regulations and on the individual teacher's and student's interpretations of these learning goals.
4) The *educational content,* or the means of reaching the learning goals, was determined by the teachers. When student-directed pedagogical approaches were used, however, the adult students drew from their own daily lives, interests and personal experiences to make the learning meaningful (Knowles, 2014).

The fifth and sixth elements in Hiim and Hippe's learning design model, the *learning process* and the need for *evaluation of learning,* will be covered in the analysis of the pedagogical approaches in the sections below.

9.3. PEDAGOGICAL APPROACHES – ACTIVATING STRATEGIES

When teaching students in traditional general upper secondary classes for adults at VUC Storstrøm, the teachers generally designed the learning as a combination of teacher-controlled and student-controlled learning activities. The current study examined teachers' embodied actions or dispositions, know-how, skills and tacit and explicit understandings to interpret their chosen pedagogical approaches (Schatzki, 2002, p. 7). These approaches were interpreted as combinations of learning theoretical beliefs lying within the three dimensions of learning (Section 6.2; Illeris, 2007). That is, the inner psychological acquisition process as well as the individual's interaction with both the material and the social world. In many cases, the teachers also had clear aims to create and support motivating learning processes for the students - the incentive dimension of learning.

Very few teachers adhere to and live by a single pedagogical approach. Although they may have opinions about pedagogy, the question is how to implement those opinions in real life, and what rules you must comply with to be "true" to the chosen pedagogy. Several pedagogic directions can be said to fall within the constructivist domain (Piaget, [1952]1965; Wenger, 1998); for example, collaborative learning, problem-based learning, constructionist and experiential pedagogical approaches. The learning designs created by the teachers in the hybrid synchronous video-mediated learning environment involved the teacher as narrative guide (Laurillard, 2012), that is, learning through acquisition. But most teachers used constructivist pedagogical approaches and designed learning activities that supported the students in constructing new knowledge through assimilative and accommodative processes (Piaget, [1952]1965); for example, through discussion and negotiation of meaning with their fellow students and the teacher (Wenger, 1998). Other examples were learning activities that involved work with analogue and digital tools; students worked alone or in collaboration with their fellow students to acquire and create new knowledge. The teachers generally used more than one pedagogical approach in each lesson. The following section briefly presents pedagogical approaches which emphasise collaboration, activity and reification through work with materials and tools. These are offered as suggestions to inspire for the future and to illustrate the basis of the new learning designs in the Global Classroom.

9.3.1. COLLABORATIVE STRATEGIES WHEN USING EDUCATIONAL TECHNOLOGY

Can we use technology to support, develop and shape learning processes that promote collaboration, mutual development and construction? For example, to ideate together, to challenge each other, to discuss, synthesise, negotiate and interact dynamically? For many years, the challenge of using technology in education has been investigated within the field of *computer supported collaborative learning* (CSCL). In CSCL, the focus is on how technology can support social activity that affords collaborative learning (Stahl, Koschmann & Suthers, 2006). Collaborative learning has similarities to learning in communities of practice, described previously (Wenger, 1998; Section 6.2.3): "Learning can be construed as the act of bringing divergent meanings into contact […] and instruction as the social and material arrangements that foster such negotiation" (Stahl et al., 2006, p.10). CSCL focuses on understanding in more detail how small groups of learners can construct shared meaning using various artefacts and media, software and hardware, and how these tools can be used as means of support for an analysis within an emergent practice. There must be opportunities for reflection on past experiences and openness to continuous negotiation and re-evaluation. The teachers took these considerations into account as they designed learning for students in the Global Classroom. Nevertheless, they faced obstacles in successfully controlling whether the learning design was facilitating collaborative or cooperative learning. In *cooperative learning*, partners split the work, solve sub-tasks individually and then assemble the partial results into the final output. Learning takes place individually; the result of this learning is passed on to the rest of the group and becomes part of an overall product. In *collaborative learnin*g, partners do the work "together" (Dillenbourg 1999, p. 8). They negotiate and share meanings relevant to the problem-solving task at hand. Collaboration becomes a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem (Stahl et al., 2006, p. 3). In this definition, learning takes place as a social construct. It is individuals who are part of a group, but they learn by sharing and negotiating knowledge (Wenger, 2010). When the VUC Storstrøm teachers aimed at facilitating knowledge creation for students within small groups or communities of practice, their objective was to create learning designs involving educational technology that primarily supported collaborative, not cooperative, learning processes.

9.3.2. PROBLEM-BASED LEARNING

Problem-based learning (PBL) is a commonly used pedagogical approach in Denmark (Dirckinck-Holmfeld, 2009). "PBL is a learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" (Savery, 2015, p. 5). In PBL, the students themselves find, or are introduced to, ill-structured, complex (but also meaningful) real-world problems. These complex problems often do not have a single correct answer, but students can learn from developing solutions for them. The problems are the essential elements and the driving force for inquiry. The students work in collaborative groups to identify what knowledge is needed to solve the problem. This process helps them become self-directed and self-assessed learners and engaged problem solvers who use critical thinking and reflection to identify the root problem and the conditions needed for a qualified solution (Barrows, 1986). The teacher acts as a facilitator of learning and has a major role in supporting the development of the metacognitive thinking associated with the problem solving process. In PBL, the teacher does not have "the right answer"; the learning exchange/interaction between the teacher and the students could more precisely be described as the teacher's guiding the students and providing a learning scaffold within the students' zone of proximal development (Vygotsky, 1980). If the students engage successfully in the PBL approach by taking ownership of the learning process and responsibility for the solution to the problem, this can result in greater learner motivation (Barrows, 1986; Savery, 2006). Apart from an explicit social learning approach, PBL is not far from John Dewey's thoughts about learning as being grounded in everyday experiences, driven by the student's active interest and the belief that students learn best by doing and thinking through these problems. This approach also has many similarities to experiential learning approaches (Kolb, 1984).

9.3.3. CONSTRUCTIONISM

One focus in the project was to create active learning through the use of tools that would activate the students, since lack of activation has been one of the issues in this learning environment. Michel Resnick and Yasmin Kafai (Kafai & Resnick, 1996; Kafai, 2006; LCL, 2014) have worked for many years using the constructionist approach, letting students construct games as a method of learning[16]. In constructionism, one of the fundamental ideas is that there is a strong connection between design and learning, and that activity that involves making, building or programming provides a rich context for learning and building knowledge (Harel & Papert, 1991; Kafai & Resnick, 1996). Piaget's constructivism, which focuses on the students' construction of meaning as a condition for learning, is taken further by Papert's constructionism theory, which emphasises that meaning in particular can be constructed by the creation of artefacts, often with the help of digital media of different types (Harel & Papert, 1991). The construction of these artefacts enables reflection and new ways of thinking based on the tools the students use alone as well as in collaboration with peers, empowering the students to take charge of their own education (Dede, 2008; Harel & Papert, 1991; Kafai & Resnick, 1996; Kafai, 2006). Learning and creative development happens when the material *talks back* to the students in unexpected ways during the development process (Schön, 1992). Articles C and D describe how this can happen when the design of learning games is used as a means of learning. The students learned that the constructed concept turned out differently than the student game-designer's intended vision. This *talking back* can thereby spark creativity in the designer (and learner), who will have to engage with dilemmas that arise out of the discrepancies between the *situation* (the actual learning situation the student is designing for), the *vision* she or he has for the learning game and the *actual* learning game as it has been conceptualised during the stages of the design process. Handling this dilemma forces the student to learn, be innovative and create new concepts (Löwgren & Stolterman, 2007).

9.3.4. LEARNING THROUGH GAMES

Motivation in learning processes has been central to this project. Therefore, the project experimented with motivational learning strategies through game design. Instead of simply using commercially produced learning games in class, students were asked to create their

[16] This section is a slightly edited version of a section from the article: An Experiment on How Adult Students Can Learn by Designing Engaging Learning Games. Meaningful Play 2014, 16-18 October 2014: Conference Proceedings. Michigan: University of Michigan Press. After this (Weitze, 2014a).

own learning games in a gamified learning environment as a means of learning. This project therefore worked with an extreme case – game design as a means of learning – to challenge the borders of how a learning design could be constructed in Global Classroom, investigating the potentials and barriers when learning within this learning design. What should be considered, what was motivating or difficult and was it possible to learn in this environment? The aim was that this gamified learning design would involve active, collaborative, constructionist, problem-based and motivating learning approaches where the students could become their own learning designers as well as learning designers for their fellow-students, enabling deep and cognitively complex learning approaches. Though these game experiments were used to explore the hybrid synchronous environment, another purpose was to investigate if it was possible to create motivating and cognitively complex learning experiences for adult upper secondary students, since this was one of the overall aims of the PhD-project. According to a survey of Global Classroom students, 70% of them played games on a daily basis, 10% played 3–5 times a week and 20% never played games. Since 80% of the students thus had experiences with playing games it was relevant to investigate if the students could potentially be interested in using games as a means of learning.

Relationship between games and learning

When using games as a means of learning, it is relevant to consider these questions: How do successful learning games and effective learning processes relate to one another?[17] What can be accomplished by using effective games for learning? The number of teachers who utilise games for learning to vary the traditional learning processes within formal education continues to grow. The purpose of using games for learning is to create motivation and variation in the classroom, but many scholars have also argued for using learning games in education as a potential means of learning (Barab, Gresalfi & Ingram-Goble, 2010; Connolly et al., 2012; Gee, 2003; Tobias & Fletcher, 2011). Ratan and Ritterfeld (2009) investigated 600 learning games and found that these games had been used for practicing skills (48%), cognitive problem solving (24%), gaining knowledge through exploration (21%) and learning social skills (7%). This indicates that learning games can potentially be used to develop the cognitive, affective and psychomotor domains (Ratan & Ritterfeld, 2009). Although this seems promising, it should at the same time be considered that numerous studies have found that there is no optimal pedagogy effective across every subject matter, and that the nature of the content and skills that are to be learned determines what type of instruction and learning activities will be most effective (Dede, 2011). Therefore, when researching how to use games for learning in education and when aiming to facilitate the learning process, it is important to focus on the subject matter, the curriculum, the context, and the characteristics of the students and the teachers (Dede, 2011).

When designing games for learning, learning game designers generally aim to design games that trigger learning and motivate students deeply (Gee, 2005). Learning games can be created to provide learning trajectories for the learner/player by encouraging students to

[17] This section is a slightly edited version of a section from the article (Weitze, 2014a).

identify with the game characters' roles and assignments as a means of guiding them through the learning process. By building principles of learning into effective games, the aim is to empower learners, teach them problem solving and enable understanding of the subject matter (Gee, 2005). Students can choose to follow their own storylines by making in-game choices. By becoming familiar with the problems, tools, experiences, perspectives and consequences in the learning environment's gameplay, learners presumably develop a richer understanding of the subject matter being taught (Barab, Gresalfi & Ingram-Goble, 2010). These ways of learning while playing learning games are reflected in the learning processes when students *design* games for learning. When students design games for learning, they consider and construct similar processes within their own games. For example, the students at VUC Storstrøm learned about the American Civil War and human rights by creating a variety of digital learning games. They used original sources from the Library of Congress to inspire the creation of various game narratives that involved different possible learning paths for the students who would play the games.

This project experimented with learning designs by having students create games for learning, embedding curricular learning goals within their created games. In addition to inviting the students to work with the creative game design process, the project aimed to scaffold and evaluate the learning process for the student game-designers and also to facilitate the learning process for the potential game players. Some schools have already begun to work with "gamifying" (applying game elements to non-game environments; Deterding, 2011) their curriculum for different age groups and for different lengths of time. For example, Quest to Learn, a public school in New York, has a pedagogical strategy that aims to transform the learning experience by using the underlying structure of games as the foundation for its curriculum (Salen, 2011). Gamification was also tried in the current project; the game design assignments were presented as tasks in a "big game," that is, a gamified overall learning design for these experiments. These experiments are described in Article C and Article D, which follow section 9.4.8.

9.3.5. GAMIFIED LEARNING

Articles C and D introduce the use of *the Smiley model,* a theoretical model for creating engaging learning games (Weitze, 2011; Weitze & Ørngreen, 2012). The model addresses how to design the learning and how to implement learning elements into the game while, at the same time, considering how to make the game motivating and engaging. This model uses Hiim and Hippe's learning design model (2003; section 6.5.1), Bruner's three motivational forces (Bruner, 1966; section 6.2.2) and "traditional game elements" as part of its framework. These game elements are not detailed in the articles, but because the Smiley model has been used for the gamified learning design process in both articles, the game elements are introduced here.

The Smiley Model

In the Smiley model (Figure 1 in Article C), after the learning for the game has been designed, six game elements are used to "set the learning design into play" (Weitze, 2014c). The six game elements are 1) game goals, 2) action space, 3) choices, 4) rules, 5) challenges and 6) feedback[18]. All of the game elements are intertwined and related to the other game elements when designing a learning game. The game goal differs from the learning goal, and therefore it is important to consider how we actually implement the learning objectives in the game. The game mechanics – which actions can be taken in the game, or what the player can do – provide the structure of the game (Weitze, 2014c, p. 237). While designing these game elements, the designers constantly have Bruner's (1966, section 6.2.2) three motivational forces in mind. The six game elements involve the following:

1) G*ame goals* must be designed in a concrete way; the game's ultimate goal must be clear to the player. If there are a series of goals, these should also be understandable. The goals should be challenging but achievable, letting the player feel that he will be able to reach the goals so he does not give up (Bruner's "feeling of competence," 1966). The goal(s) should be designed in a way that makes the player both look forward to achieving the goal and enjoy having reached the goal. If the designer has placed the goal after the appropriate level of challenge, the goal will be rewarding in itself. The designer must also balance the game's goals in the short- and long-term and let them relate to each other in a meaningful way (Schell, 2008). The overall goal should be split into many small and large goals, which will help to provide an overview and a sense of achieving many small successes. In this way, the player can gain ownership in relation to his success and development (Chatfield, 2010). These goals must be linked to each other in a meaningful way so the game can be experienced as coherent (Schell, 2008).

2) The *action space* of the game must be easy to understand and act within. The learning content should be a part of the game design, and the problem and tasks should be presented in the actual elements of the game. If the learning material is deeply embedded in the game mechanics and the game reacts as a result of the player's actions and choices, then the player will achieve a feeling of "learning by doing" in the game.

3) The *choices* must be meaningful to the player; as she receives feedback to the wrong or right choices she will learn in the game. The frequency of the choices and the cleverness behind the related consequences are a major part of the fun of the game. It is important that each decision has its own consequence; two choices should have two different results. By assuring meaning and weight behind the choices, the player will experience agency or the ability to act in the game.

[18] These sections about gamified learning are shortened rewritings of sections from: Developing Goals and Objectives for Gameplay and Learning (Chapter 12). In Shrier, K. (Ed.). *Learning, Education and Games: Volume One: Curricular and Design Considerations*, pp. 225–249. Pittsburgh: Carnegie Mellon University ETC Press. (Weitze, 2014c, pp. 236–237) and Concept Model for Designing Engaging and Motivating Games for Learning: The Smiley-model. *Proceedings in Meaningful Play Conference 2012*, Michigan State University, University of Michigan Press. (Weitze & Ørngreen, 2012, pp. 18–19).

4) The *rules* should be clear and fair. The rules determine what effect the player’s choices will have. If learning is embedded within the game mechanics, the player will learn while learning the capabilities and limitations of the game’s rule system (Flanagan, Hash & Isbister, 2010).

5) The *challenges* in a learning game encompass the learning goals, the learning content and the learning activities. Challenges might include recognising patterns, learning rules, solving tasks and developing hand-eye coordination (Koster, 2005). The framing of the learning goals should determine which challenges are appropriate to include in order to help the player meet the game’s learning goals. The purpose of playing a learning game is to attain the learning goal and to learn to master the action or understand the pattern. By playing the game successfully, the learner will automatically show her competence in overcoming the challenges, since completing the game requires the knowledge to solve the problem. If the student/player finds it difficult to meet the challenge in the game, the game should provide feedback or scaffolding, breaking down the task into smaller game goals to support the player.

6) The sixth game element, *feedback,* is crucial to let the student/player know if he has reached the goals and to ensure that learning has occurred. In fact, feedback in the game corresponds very closely with the feedback that is needed when learning (Murphy et al., 2013). The player should also receive feedback if he does not meet the learning goal. The “long-term feedback” given in a game should be instructive; it can provide guidance and strategic feedback (*process feedback*, which resembles *formative feedback* in learning) or give information on action/performance-based data (*outcome feedback*), which then will lead the learner toward the learning goal (Sanchez, Cannon-Bowers & Bowers, 2010). Furthermore, the feedback should be of such a nature that the player does not lose self-esteem. There is thus a tension between the need to provide clear performance feedback and the need to avoid damaging the student’s self-esteem; rather than discouraging the student/player, feedback should urge him to move forward with the task (Malone, 1980). When developing the game, designers should work to transform the student/player’s feeling from one of "failing" to one of "not having managed it yet" (Chatfield, 2010). Reward (*extrinsic motivation*; Gärdenfors, 2010) is a key component in games (Koster, 2005) and is also a type of feedback. It is important that the student/player is only rewarded for a real effort or achievement in the game. Rewards recognise the player for the effort she makes in the game (Chatfield, 2010) and at the same time, give the player a sense of autonomy (Fullerton, 2008). These rewards are not just medals and earned points; they can be new opportunities or access to a new kind of task. A guiding concept when determining feedback content and strategies is that the feedback should correspond to the selected learning, which has required an effort from the player, and should relate to how the player has performed the task. Otherwise, receiving feedback will feel hollow and meaningless (Deterding, 2011).

9.4. MOTIVATING LEARNING DESIGN PATTERNS FOR HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENTS

The following sections describe seven examples of innovative learning designs emerging from and developed for the hybrid synchronous video-mediated learning environment. Though the bulk of the teaching that took place in the environment was conducted as presentations, dialogues and variations of teamwork, the following sections describe alternative learning designs involving educational technologies additional to the mediating videoconference system. The aim for these learning designs was to create equal and motivating learning conditions for the students sitting in class and at home. The following analysis is based on the qualitative and quantitative data that was collected from February 2013 to January 2016 through interviews, observations, surveys and in workshops (appendix A). The described learning designs were developed by the teachers in their daily work with the students in class through *reflections in* and *on action* in their performed teaching practices (Schøn, 1983). Other learning designs were developed through common ideation and creation in teacher teams that were part of the design-based research experiment (Chapter 8; Article B; Weitze, 2014d&e, 2015c). All of the designs had an aim to meet the combined needs for relevant and active learning for students in class and at home, and the purpose of the designs was to create motivating learning experiences for the students. The project worked with the development and qualification of the teachers' innovative competences. The project also contributed to development of and experiment with teaching methods using a blend of digital products, processes and teaching materials in addition to the videoconference system in the Global Classroom. The PhD-fellow followed the teachers in their daily teaching and competence development practices and had access to observe, interview, co-create and experiment together with teachers and students to investigate the project's problem area. The aim of the following empirical analysis is to give an overview of the potentials and barriers for creating learning designs in the Global Classroom. The findings were that the teachers, through innovative pedagogical strategies, developed knowledge about how their pedagogical patterns in this hybrid synchronous learning situation could be supported by the well-designed use of an array of additional educational technologies in order to create motivating learning designs for the students.

9.4.1. LEARNING DESIGN #1: USING THE LEARNING MANAGEMENT SYSTEM (LMS)

The learning management system (LMS; Fronter, 2016) offered many possibilities for communication, documentation, storage, sharing, collaboration and more. The teachers working in the Global Classroom became very familiar with the LMS, which was new to many of them. It became a good practice to upload all class materials online to give in-class and at-home students equal access. According to the surveys, both at-home and in-class students were satisfied with this easy access to the materials and also found it easy to hand in assignments. A few teachers reported using the asynchronous discussion forum as part of their learning design, but most teachers used the LMS solely for sharing materials; very little collaborative work took place within this LMS. In the hybrid synchronous environment, teachers and students found it most effective to use the entire lesson time for synchronous teaching, since many students were present in class. Apart from individual asynchronous homework assignments, as is common in traditional brick-and-mortar classes, this synchronous teaching approach differed from the strategies in other hybrid learning models, which also used asynchronous collaborative learning (e.g., discussion forums) as a part of the shared interactions in class.

Figure 23: Students collaborating in a cross-over group between home and school in the Global Classroom.

9.4.2. LEARNING DESIGN #2: COLLABORATIVE WRITING PROCESSES AND FORMATIVE EVALUATION

Though the teachers had the option to create collaborative learning designs using documents from the LMS, many preferred to let their students work together in Google Docs (2016). The specific affordance of Google Docs is that it is easy to access and use, and everybody can write in the web-based documents, synchronously collaborating. This allows for collaborative learning designs where students in class and at home can work together under equal conditions. The web-based software also has a feature which makes it possible to see the names of the other students as they write, creating an impression of individual appearance within the document when students write together in groups (Figure 24). If these writing processes are combined with video-mediated cross-over groups (Figure 23), then the experience of working together can come close to the feeling of sitting in the same room, even though the students are at different locations. But as in all group work, creating this experience also requires that every student take responsibility to contribute to the work process; in addition, the video-mediated groups must be set up and working well where audio is concerned. In the Global Classroom, in-class students participating in crossover groups wore headsets and worked at a non-disturbing distance from other in-class students. (In Figure 23, the students are in a room by themselves and therefore do not need headsets.)

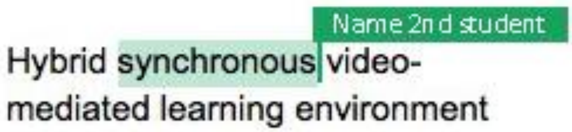


Figure 24: Group members' names are shown live as they write in Google Docs.

Individual formative evaluation

"It is very difficult to keep track of the students at home, and therefore one cannot differentiate teaching when you cannot sense what they have learned" (Teacher in Global Classroom). This was a recurring problem that several of the teachers experienced. The reasons varied. Some at-home students were shy and quiet; sometimes it was difficult to see students' facial expressions, making it difficult to determine whether they were actively listening and understanding or drifting away. One teacher approached this problem by using Google Docs as a reflective tool for the students. In his lessons, every individual student had a shared Google document with the teacher; at the end of the class day, the teacher wrote two or three questions for each student about how he or she had understood the subjects or assignments of the day. Then, while the class was busy solving other assignments, the teacher would have time to stand by his computer, read the answers and comment in their Google documents. He could then also immediately attend directly to students who were experiencing specific difficulties. According to the teacher, this enabled close, direct attention to each student and made it possible to differentiate the learning process while also documenting each student's learning process. Other teachers chose to synchronously follow and comment on the collaborative teamwork in the various teams' Google documents. This was used for in-class groups, at-home groups and crossover groups.

Brainstorms and ideation

Another web-based collaborative construction software (Laurillard, 2012, p. 200) that the students and teachers appreciated and frequently used for brainstorms and discussions was Padlet (2016; Figure 25). Padlet is a virtual sticky note tool that is easy to access. The students just need a link, and then everyone can create relevant virtual reifications (words, pictures; Wenger, 1998, 2010) and collaborate by discussing while moving the notes around as if they were in a physical room. One teacher asked the students to do a shared brainstorming session on subjects for an upcoming assignment. The subjects were then discussed and assigned for the different groups to work with. Both teachers and students found this tool very useful for common collaboration, and it was equally accessible by all of the students. It became "one of the tools in the box" for collaboration.

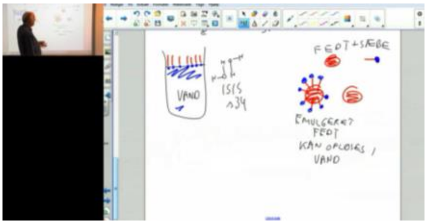
Figure 25: Learning design in which students brainstorm on subject areas for group assignments in an English as Second Language lesson.

9.4.3. LEARNING DESIGN #3: LAB EXPERIMENTS – TEACHING CHEMISTRY

In teaching chemistry classes, teachers used the interactive whiteboard to present chemistry formulas. They also showed slides, pictures and web-pages and continuously explained the formulas as they wrote them on the interactive whiteboard. The interactive whiteboard, which was visible for both in-class and at-home students, was thus used both for sending/showing static content and for writing and explaining (Figures 26 & 27). The two chemistry teachers used three different approaches for making learning designs for the chemistry lab experiments:

A) In the early stages of the Global Classroom, one teacher asked students to come to campus on the days these lab experiments took place. The students participated in the experiments in the chemistry lecture room using the chemical solutions and laboratory supplies. There was no videoconferencing system. There were, however, days when some students stayed at home in spite of the teacher's requirement to come to class. These students asked their peers if they would help them participate. Their fellow-students placed their own computers next to the experiment and used Skype (2016) to video-mediate the experiment for the at-home students. This was a viable alternative for the students at home, enabling them to follow the experiments and (to some extent) to see what happened.

B) In 2014, the number of days students were required to attend class from campus was reduced. The chemistry teacher moved to the videoconference room so students could participate from home, showing pictures with the relevant experiments on the interactive whiteboard to create equal access for student in-class and at-home (Figure 27). This learning design lacked the hands-on experience of performing a real-life experiment. In this case, taking the needs of the online students into consideration meant that the students attending class had a poorer learning experience. The teacher spent most of the time lecturing, the at-home students remained passive and the in-class students were also very quiet.



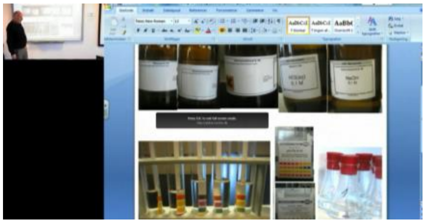


Figure 26 (left): Writing chemistry formulas on the interactive whiteboard.

Figure 27 (right): Pictures of chemistry experiments on the interactive whiteboard.

C) Another chemistry teacher who started to teach in the hybrid synchronous video-mediated learning environment in 2014 had ambitions to keep the experiments part of the teaching concept. He used a small table with wheels to bring the chemicals for experiments into the classroom. He experimented with the camera angles and the zoom feature so the table could be seen by both the home and in-class students (Figure 28 and 29).

Figure 28 (left): The teacher talks to the camera and the students "on the wall," as seen from the class.

Figure 29 (right): Small table with chemicals for experiments, as seen by a at-home student.

The students in class came up to the table and conducted small experiments; the teacher instructed them where to stand so the online students could watch. The teacher and students discussed how to experiment, mixed and stirred the fluids and discussed the different outcomes by using the theory behind them. One at-home student asked experimenters four different times to step aside so she could see. This indicated that camera angles could be improved, of course, but it also showed that she was following the experiment closely and that the students and teacher in class could help her “be” actively and attentively “in the classroom” by letting her hear and see the experiment close up. The teacher even explicitly discussed the smell of a fluid, instructing students to be careful when smelling an unknown fluid and demonstrating how to wave a hand over the bottleneck in the direction of one’s nose. The class discussed what the fluid smelled like, noting that it was like the smell of new cloth, making it possible for online students to imagine the smell. The teacher said in an interview that he was conscious of being very explicit in describing chemical phenomena such as changes of colour or crystallisations that were difficult for home-students to see, essentially "being their eyes."[19] The teacher ended by showing something on the interactive whiteboard; this was (perhaps by oversight) not sent to the online students. In addition, the camera showing the classroom was not switched back to the teacher, and it became difficult for the at-home students to follow his final explanation. This final chemistry learning design (C) could have been improved as far as the camera angles at the end of the lesson, but it became an interesting and almost tangible and sensory experience for the online students as well as the classroom students. This experiment illustrated how the teachers tacit practices were altered in the video-mediated environment.

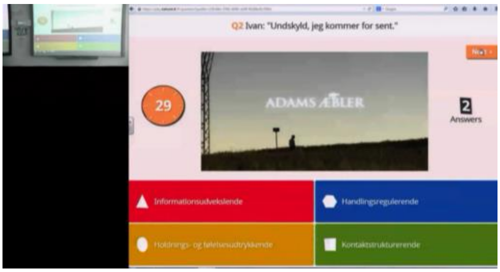
9.4.4. LEARNING DESIGN #4: GAMIFICATION THOUGH INTERACTIVE WEB-BASED SOFTWARE

One of the aims when creating new motivating learning designs in the Global Classroom was to create equal conditions for the students to work and perform activities. One of the new initiatives tried was the interactive software Kahoot (2016). On one occasion, the teacher put the Kahoot program on the interactive whiteboard, saying, "You asked me for one more Kahoot; here it is. I have worked hard on this one" (Figure 30). The students' comments indicated that they enjoyed this teaching approach as a variation to more formal approaches.

Figure 30: Kahoot software: Gamified assignment for the class.

The learning design of this particular lesson in the mother tongue involved each student's individual analysis of how four concepts of communicative acts applied to different sentences from a Danish film. The teacher presented the questions on the interactive whiteboard one at a time (Figure 31). After answering the 38 questions, students watched the film as part of their education.

[19] This experiment could be further improved by adding a document camera (AVerMedia) to film the table surface during the experiment (Freeman, 1998). A document camera was used as an additional videoconference technology at the Center for Puppetry Arts (2016) when the online teachers involved the remote students in video-mediated experiments and when it was crucial to demonstrate the tangible aspects of puppet creation (P. Dees, personal communication, October 21, 2014).



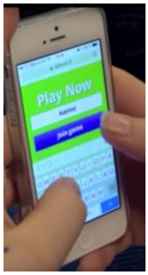
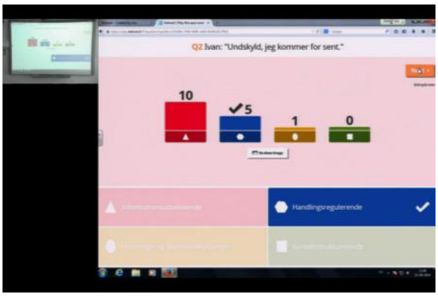


Figure 31 (left): Four concepts of communicative acts applied to different sentences.

Figure 32 (right): "One-click access" to the gamified software.

The students had "one-click access" to the gamified software and could use a computer, tablet or smartphone to access the questions (Figure 32). Using Kahoot, it is possible to present videos, images and diagrams as part of the questions, and the software can be used for debate, evaluation or tests (quizzes, discussions and surveys). The teacher presented a question in Kahoot and then, while the students were considering the answer, three gamifying or engaging sounds were played: 1) one musical "excitement sound" that motivated the students to make them answer before their peers. But while the students wanted to win, they also wanted to answer correctly, and this made for an engaging tension; 2) one sound like a clock ticking – also to stress to the students that the 30 seconds for voting were running out, and finally: 3) one soft sound, activated each time a student voted as a kind of feedback to indicate everyone's participation, illustrating the social aspect of the game as well. The students laughed and conversed, with the teacher acting as discursive mentor for both in-class and at-home students.



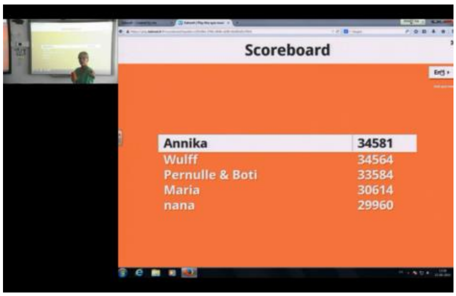


Figure 33 (left): Results showing how many students voted on each answer to one question.

Figure 34 (right): Scoreboard showing final winners; teacher (left on scoreboard) talking to a winning online student.

After each question, the number of votes on each of the four possible answers was shown, along with the correct result (Figure 33). This was, at the same time, direct feedback – a summative evaluation (*outcome feedback; Section 9.4.6, #6*) shown on their devices for each student, indicating whether they had understood the concept and pushed the right button. Students could win the game firstly by answering correctly and secondly by answering quickly. Varying answers to the questions sparked class discussion; students might ask why one question was right and another wrong, or whether the answer might in fact be completely different. Depending upon how the teachers designed the assignments or challenges, and depending upon the level of involvement of individual students, the general experience was that using Kahoot made it possible to engage the students in discussions about relevant subjects. Online students participated more actively, and the students often had fun as well. The software was available to everyone, and everyone at home and in class was “shown” on the interactive whiteboard list of voters/discussants/interpreters (Figure 33 & 34).

For some teachers, the experience was that this tool engaged the online students and gave them an experience of becoming part of the game in class. The teachers also used Kahoot for learning designs in which students designed assignments for their fellow students as a way of learning from being learning designers for the other students. In the lesson described here, the teacher extended the competition beyond the interactive software and had bought five small gifts the students could compete to win. When an online student won one of the gifts, the teacher turned to her through the camera and told her where the gift was placed in the classroom to be picked up the next time she came into class (Figure 34, top left). This could be interpreted as an additional kind gesture to help the student feel that she belonged to the social community in the classroom.

9.4.5. LEARNING DESIGN #5: WALK AND CHAT

One of the things teachers missed in the Global Classroom was the opportunity to activate students through movement – especially at the end of the day when the students became tired. This applied to most of the teachers. One teacher had previously done QR-code assignments in the schoolyard to send the students outside to discuss and get some fresh air. When teaching in the Global Classroom, teachers felt grounded, and students at home sat statically on their chairs all day. A Global Classroom social science teacher experimented with the concept “walk and chat” in the innovative teacher-teamwork – ITP4T (Article B & chapter 8). This was at the same time an example of how the work in the IT-Pedagogical Think Tank allowed teachers to try out their innovative designs on safe ground with peers, being able to discuss and innovate the learning designs in this common forum before trying them out in class. The teacher had prepared a discussion topic, “movement in class,” beforehand and facilitated an ideation process on the learning design with her team members. The teachers tried out the learning design using their smartphones with the software TodaysMeet (2016), this software was easy accessible. This educational chat platform enables everyone to chat together while taking a walk outside in the fresh air, regardless of where they are geographically. The aim was to chat about concepts within a subject area that could be further explored when the team/class met on videoconference afterwards. The experiment worked, but the teachers discussed how the questions should be formulated, and what subjects would be appropriate within each of the teachers’ subject areas, to make the content and the form work together in an engaging way.

9.4.6. LEARNING DESIGN #6: STUDENTS PRODUCING FILMS

One of the new initiatives among many initiated by teachers in the IT-Pedagogical Think Tank was to create designs in which the students formed groups and made short videos about problem-based subjects. The teachers were very impressed by what the students accomplished using the software Screencast-O-Matic (2016); the students also stated that it was fun to work with. The program was used to make five-minute movies. One teacher used this learning design to evaluate an American Civil War topic; others used it to let the students make instructional videos to train oral communication. Screencast-O-Matic can record images, music and speech. The only requirement was for each student or group to be undisturbed while they recorded. Several of the teachers reported that this learning design with video had been fully integrated into their teaching practice in class – entangled in practice. In the Global Classroom, the challenge was twofold: 1) For a team to create a film, most tasks had to be done together in the same physical room as students recorded each other. 2) It was not possible work together in this tool in virtual groups, as the software worked on each person's individual computer. One solution might be for one student to record the film and work in the tool (Screencast-O-Matic), sharing his or her screen online with the group (the class was familiar with using the software Bridgit [2016] for screen sharing) while the other students collect information and discuss the making of the film. If an at-home student created their own individual video, this video could be played online for the class. But this hurdle was an example of how crossover-group collaboration can become difficult because of the (missing) affordances of a tool. It is possible to create workarounds by sharing screens, but the teachers often experienced that the pedagogy changed for the online students. Students who worked in crossover groups ended up working cooperatively; students distributed the assignments among themselves and later combined their individual results; whereas the in-class students, sitting in the same brick-and-mortar classroom, had other options for close and discursive collaboration, working with tools that afforded equal and collaborative work opportunities. Even though the in-class students could not collaborate within the same tool, they could walk over to a fellow student's computer and sit beside it, pointing out on the screen what to alter and what to do next in the making of the film.

9.4.7. LEARNING DESIGN #7: COLLABORATING IN A LEARNING DESIGN TOOL AND DESIGNING FOR A GLOBAL CLASSROOM GUEST TEACHER

When the teachers collaborated in the IT-Pedagogical Think Tank to create new learning designs, one of the digital tools they experimented with was a tool created by London Knowledge Lab – Institute of Education called "Learning Designer" (2016; Figure 35). The teachers often used this tool in the documentation phase in the IT-Pedagogical Think Tank (Phase D: Article B figure 2). The tool makes it possible to create "pedagogical patterns" for learning designs that later can be shared and discussed with other teachers (Laurillard, 2012). The teachers could choose between a range of features, for example, different learning types.

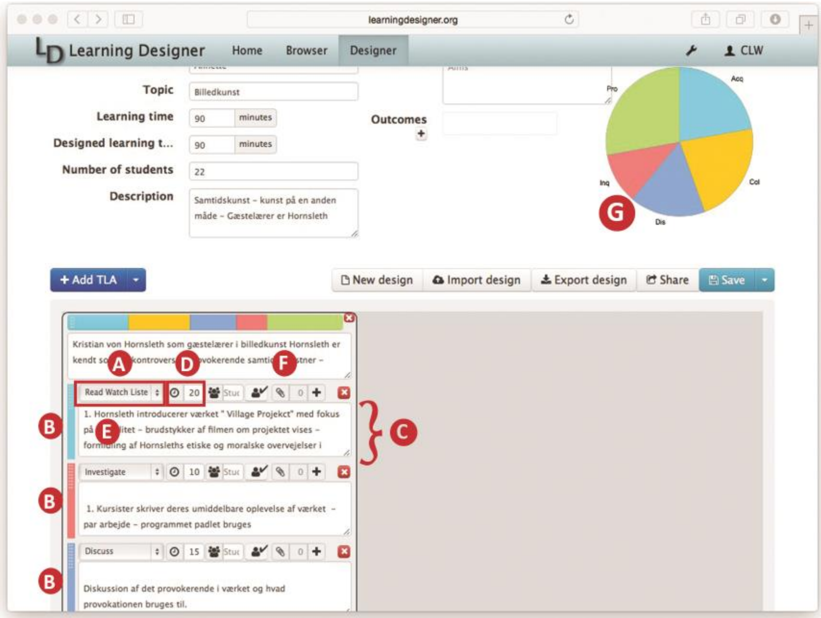


Figure 35: One teacher's learning design in Learning Designer (2016) – the virtual guest teacher.

Each of the red letters in Figure 35 highlight one of the features of the Learning Designer Software. (A): The teachers could choose from various pedagogical approaches or activity type: read–watch–listen, collaborate, discuss, investigate, practice and produce. (B): Each activity type had its own colour. (C): An example of one pedagogical pattern (Laurillard, 2012). (D): The teacher annotated the duration. (E): The teacher could specify the activity going on in each pedagogical pattern. (F): Details about the activities and eventual use of and links to additional technology. When the teacher created the small pedagogical patterns or sequences, the tool generated an illustrative diagram (G) of the summarised minutes and activity types. The diagram and patterns made it easy to monitor the duration of the planned lesson (G & C) and how much the activities were varying, and it was easy to alter the whole lesson plan with the drag-and-drop software. This tool enabled collaboration when creating new learning designs because teachers could easily compare and discuss approaches for good learning designs even though they taught different subjects.

Virtual guest teacher

According to the final interviews with the teachers and administration in December 2015, the Global Classroom concept may be expanded in the future to include international collaboration; for example, by bringing in video-mediated guest teachers. This would be a natural development, considering the technological possibilities of the videoconference equipment. In the teacher workshops (Article B & Chapter 8), one of the challenges ('I dare you') was for each teacher to create a learning design within their own subject matter area that involved a guest teacher. For this assignment, the teachers used Learning Designer (Figure 35). The teachers created individual learning designs in this digital tool involving guest teachers who would participate over videoconference in the various subject areas: mother tongue, math, arts and social science. The teachers' plans included inviting artists, scientists and a building surveyor as guest teachers to create inspiring and real-world learning experiences. By discussing and ideating on these learning designs, it became possible to examine the pedagogical aspects as well as the technological and practical aspects of inviting a virtual guest to the classroom for the first time[20].

9.4.8. DISCUSSION AND SUMMARY OF MOTIVATING LEARNING DESIGN PATTERNS

What are the common guidelines in these new learning designs when the focus is to create equal, active and motivating learning experiences for in-class and at-home students?

1) **Synchronous learning designs**. According to the findings, one characteristic of the hybrid synchronous video-mediated learning environment was a synchronous teaching approach. Because the students were together in the classroom full-time, either remotely or in person, it became natural to conduct synchronous teaching in all lessons, similar to traditional brick-and-mortar learning environments. Asynchronous collaboration, traditionally used in other hybrid learning environments, was not a chosen alternative.

Figure 36: Metaphor of remote student sitting and looking into the classroom.

The metaphor of sitting behind a window, looking into the classroom, able to see and hear but not participate bodily (Figure 36; section 7.2.3), can help teachers as they consider which specific learning designs, actions and tools are needed for remote students to participate under equal conditions in the classroom.

2) **Platform for sharing content.** Students and teachers must be able to exchange materials and have a place to store them, equivalent to desks and shelves in a traditional classroom. In learning design #1, the Learning Management System used by students and teachers was a necessary component for sharing and exchanging content in the Global Classroom, as it was equally accessible for in-class students and teachers and at-home students.

[20] To the best of my knowledge, the teachers have not yet put these designs into practice, but this is an example of a good idea that has not yet turned into a new innovation.

3) **Web-based collaborative construction software**. Learning practices often take place through the use of materials and tools in collaborative processes. Students sit together and collaborate with materials in reification processes (Wenger, 1998, 2010). Because the remote students could not interact with physical materials in the classroom, the collaborative environment had to provide tools for working and learning that were equally accessible for students in class and at home. This was accomplished with a variety of web-based collaborative construction software. The common features in learning designs #2, #4 and #5 included the following:

- Students had access to a collaborative construction environment.
- Multiple students could work with the technology at the same time.
- The technology was equally accessible from different locations.
- Students could see the other collaborators – depending on the software it was possible to se “where” they were in the software and/or what actions they performed – within the software.
- When combined with connecting audio (and video), the collaboration software could contribute to a feeling of working together under equal conditions, more closely approaching the experience of sitting in the same room.
- The technologies were easy to access (one-click or one-link access), easy to use (high usability) and stable. This ease of use minimised the number of tasks and actions students had to perform in addition to controlling the videoconference system, allowing them more time to focus on the learning processes.

Teachers reported that some of these tools became “one of the tools in the toolbox.” This could be interpreted to mean that these tools had become entangled in practice and were used with ease in various learning designs designed into various contexts. These tools enabled students in class and at home to interact despite the “window” between them.

4) **“Unequal” learning designs for experiments.** In some classes, students had to participate in experiments using relevant materials and tools provided by the teacher. According to the findings, it was motivating for students to engage in experiments with the materials. Some teachers abandoned their previous in-class experimental learning designs in order to provide equal access for all students. This led, in some cases, to longer slide-based presentations with less engaging learning designs, causing students to lose concentration. In such cases, the teachers’ focus on providing equal access resulted in poorer learning designs for all students. Learning design #3C did not provide equal access to the chemistry class experiments for all students, but it nevertheless allowed the students at home to become actively engaged in the learning experiences. The teacher made sure that camera angles were in place for remote students to follow the experiments and explicitly described details that were difficult for the remote students to see. It re-mediated traditional chemistry experiments by offering carefully designed, video-mediated, bodily performed experiments and reflective discussions, making the experience interesting for the at-home students as well as the in-class students. Such “unequal” learning designs, with common experimental activities involving artefacts in the classroom, may be the best possible motivating learning

design solution for both student groups in the hybrid synchronous video-mediated learning environment.

5) **Collaborative workarounds and technological bricolage**. Learning design #6, which involved students making films, exemplified a motivating learning design that made equal collaborative access difficult for remote students. This was a typical learning design in the Global Classroom. The fact that a collaborative learning design involved the use of a technology that was not accessible by more than one person created a need for collaborative workarounds and bricolage. Collaborative workarounds took place when collaborative assignments were turned into cooperative assignments by distributing tasks among group members and combining their individual results later. The choice was often that the in-class students, able to look over each other's shoulders and discuss, worked with the technology while the at-home students collected information or contributed with written work.

> Bricolage is about the particular and the particularities, and in the case of learning technologies it helps explain the relationship between practice-as-designed and practice-as-practiced or emergent. The concept of bricolage shifts focus away from technology design as usually understood as the design of an artefact towards emergent design of technology-in-use, particularly by the users (Johri, 2011, p. 212).

Bricolage occurs when students engage in action and activity work with the (digital) tools at hand to the best of their ability, developing a new practice involving these tools (Johri, 2011; Baker & Nelson, 2005). Bricolage was used when the students used the tools at hand to combine various technologies to make the collaboration work – for example, using a screen sharing technology to enable all students in a cross-over group see a film creation tool; or, when recording video at one of the locations, uploading it to the LMS for sharing and further collaboration in a film edit tool at another location. These processes sometimes became so complicated that in-class students preferred to work without the remote students in a group. Sometimes, however, remote students "gave up" and came to class, which teachers saw as a positive development. The teachers reported that they regarded a project as successfully motivating when students became so engaged that they chose to drive to school after the first lesson of the day because they could not make their current learning design work when participating remotely.

6) **Hybrid synchronous mobile learning designs**. In the general upper secondary classes, many teachers used a "change of learning environment" approach by creating learning designs for outside the classroom and bringing students out into the fresh air at the end of the day. For students "sitting behind their windows," participation was difficult. The teachers began to develop hybrid synchronous mobile learning designs so all students could participate in learning designs outside the classroom.

7) **Virtual guest teachers.** Learning design #7 involved interaction with relevant virtual guest teachers who could make real-world contributions in the Global Classroom. This was a new opportunity and an obvious way to make use of the video-mediated possibilities.

According to both students and teachers, each of the seven pedagogically innovative learning designs described in this chapter contributed to the creation of motivating learning experiences in the hybrid synchronous video-mediated context. Each design's combination of elements, processes and products of the specific subject matter, its related learning goals, learning activities, relevant pedagogical approach and choice of educational technology were thought out carefully and qualified by the individual teachers. But many of the learning designs were also inspired by, developed and discussed together with their colleagues from the IT-Pedagogical Think Tank.

C

8.5.1.1. ARTICLE C: LEARNING AND MOTIVATIONAL PROCESSES WHEN STUDENTS DESIGN CURRICULUM-BASED DIGITAL LEARNING GAMES

Author: Charlotte Lærke Weitze

The paper was published in the Proceedings of the 9th European Conference on Games Based Learning - ECGBL 2015, Nord-Trondelag University College, Steinkjer, Norway, 8-9 October 2015.

This article describes the third iteration of an overall gamified learning design (the big Game) that facilitates the learning process for adult students by inviting them to be their own learning designers through designing digital learning games (small games) in cross-disciplinary subject matters.

The DBR project investigated and experimented with which elements, methods and processes are important when aiming to create a cognitive complex (Anderson & Krathwohl, 2001) and motivating learning process within a reusable game-based learning design. This project took place in a co-design process with teachers and students.

Learning and Motivational Processes When Students Design Curriculum-Based Digital Learning Games

Charlotte Lærke Weitze[1+2]
[1]ResearchLab: IT and Learning Design, Aalborg University, Denmark
[2]VUC Storstrøm, Denmark
cw@learning.aau.dk

Abstract: This design-based research (DBR) project has developed an overall gamified learning design (big Game) to facilitate the learning process for adult students by inviting them to be their own learning designers through designing digital learning games (small games) in cross-disciplinary subject matters. The DBR project has investigated and experimented with which elements, methods, and processes are important when aiming at creating a cognitive complex (Anderson & Krathwohl, 2001) and motivating learning process within a reusable game-based learning design. This project took place in a co-design process with teachers and students. The learning approach was founded in problem-based learning (PBL) and constructionist pedagogical methodology, building on the thesis that there is a strong connection between designing and learning. The belief is that activities that involve making, building, or programming provide a rich context for learning, since the construction of artefacts, in this case learning games, enables reflection and new ways of thinking. The students learned from reflection and interaction with the tools alone as well as in collaboration with peers. After analysing the students' learning trajectories within this method of learning, this study describes seven areas of the iterative learning and game design process. The analysis also shows that the current learning design is constructed as a hierarchy supported through different roles as learning designers contained within one another. The study found that the students benefitted from this way of learning as a valid variation to more conventional teaching approaches, and teachers found that the students learned at least the same amount or more compared to traditional teaching processes. The students were able to think outside the box and experienced hard fun (Papert, 2002) - the phenomena that everyone likes challenging things to do, as long as they are the right things matched to the individual. They were motivated by hands-on work and succeeded in developing four very different and meaningful learning games and game concepts, which contributed to achieving their learning goals.

Keywords: Students as learning game designers, learning game design, game design models, constructionism, PBL, students as learning designers.

1. Introduction – a need for motivating learning processes

Motivation to learn decreases from the beginning of school age and becomes lowest upon entering the work force. In American elementary schools, 76% of students feel engaged, in middle school this figure falls to 61%, in high school 44%, and in workplaces worldwide as low as 13% of employees feel engaged in their jobs (Gallup, 2012; Gallup, 2013). Some researchers consider this a sign of a motivational crisis in the educational system (Sørensen et al., 2013). Since motivation to learn has an effect on students' ability to complete an education as well as on the quality of their results in school, this calls for new knowledge about increasing students' motivation to learn. The following is an example of how a student has trouble maintaining motivation:

> People "die" really quickly . . . there are some teachers who are really good at involving us and there are others who are not – we also have that experience here in the class, where there are some lessons where we are just falling totally out, because the teachers are just too good to stand and talk a little by themselves. Then they just from time to time ask: Well what do you say? [Student changing tone of voice:] I don't really know, because you have talked for 2 hours, and I have not kept up [with what you are saying] half of the time because it was boring. (Interview with a student in the research project class concerning a lesson with little student activity.)

You can bring a horse to water, but you cannot force it to drink. Similarly, you can seek to create a learning process for students, but you cannot force them to learn. So since the ability to facilitate the learning process is at the core of every teacher's duty, motivation becomes central as well. Motivation is thus part of every teacher's responsibility when creating activities and facilitating learning, but the will to learn is also something that students can be educated to choose and take responsibility for (Illeris, 2007; Bruner, 1966). The interest, will, and desire to learn are important parts of the learning process – a student's attention must be placed on what is to be learned, otherwise what they learn will be shallow at best. Motivation can also influence when individuals choose to learn, as well as what and how they learn. When people are motivated, they are more likely to undertake challenging activities and be actively engaged. Students who are motivated enjoy adopting a deep approach to learning and also tend to exhibit enhanced performance, persistence, and creativity (Schunk, 2012). Consequently, motivation becomes an important part of the learning design and we have to develop conscious strategies for creating motivating learning situations.

Is it for instance possible to learn by using elements from games in our teaching approaches, using these elements to aid motivation in our education system? Fifty-nine percent of Americans play videogames, the average player is 31 years old, and half of the players are women (ESA, 2014). Seventy percent of teachers who use video games in their classes claim that the games increase students' motivation and engagement levels. This wide use of games – also among adults – invites continual investigation of how the use of games or game elements may open possibilities for merging motivational and engaging playful systems with traditional learning processes in formal education settings.

Many studies have supported the potential of using games in education as a means for learning (Gee, 2003; Barab, Gresalfi, and Ingram-Goble, 2010; Tobias and Fletcher, 2011). The use of games for learning is an active teaching approach, in which students are learning by doing, compared to a more traditional monologue form in which the teacher stands by a blackboard and talks about what is to be learned. Active teaching approaches can take on many shapes, and though evidence-based educational science is a difficult art (Biesta and Burbules, 2003), there is a variety of evidence supporting the idea that students will experience the learning process at a high level of cognitive complexity (Anderson and Krathwohl, 2001, pp. 67–68) through active learning (Michael, 2006). In this experiment, the goal was to turn the use of learning games into an even more active approach. If, instead of simply playing games, students are supported in building learning experiences into games – designing the games themselves – this may empower them as learners, teach them problem-solving skills, and enable a deeper understanding of the subject matter. The goal of this experiment was to enable a cognitive complex, motivating, and conscious learning process by letting students build learning games for fellow-students. The hypothesis was that this process would require the students to become very familiar with the curriculum that would be taught through the games. The questions investigated were: 1) What elements, practices, and processes are essential when creating sustainable, innovative, and motivating learning designs for teachers and adult students? 2) How does the learning design contribute to enabling a motivating and deep learning process?

2. Methodology and research project

This study is focused on the creation of an innovative and engaging gamified learning design in order to create motivating learning processes for adult students. The project was the result of three iterations of an on-going experiment. The investigation was conducted as a design-based research (DBR) study, in which the teachers and students were co-designers in the development and testing process. The study used mixed methods to investigate how the learning game design experiments answered the research questions. The collected data included field notes, video and audio recordings of actions and dialogs, observations from the workshops, semi-structured interviews with the teachers after each workshop, semi-structured interviews with the students after the last workshop, informal meetings, evaluation documents written by the students, questionnaires, videos of students' games being discussed and play tested, and the games themselves. The analysis took place by coding the transcribed data with an informed grounded theory approach (Thornberg, 2012), carried out as both a concept-driven and data driven coding process. Concept-driven coding uses concepts from theories and previous empirical data to find themes in reviewed data, whereas data-driven coding involves reading the data and searching for new phenomena that were not previously known (Kvale, 2007).

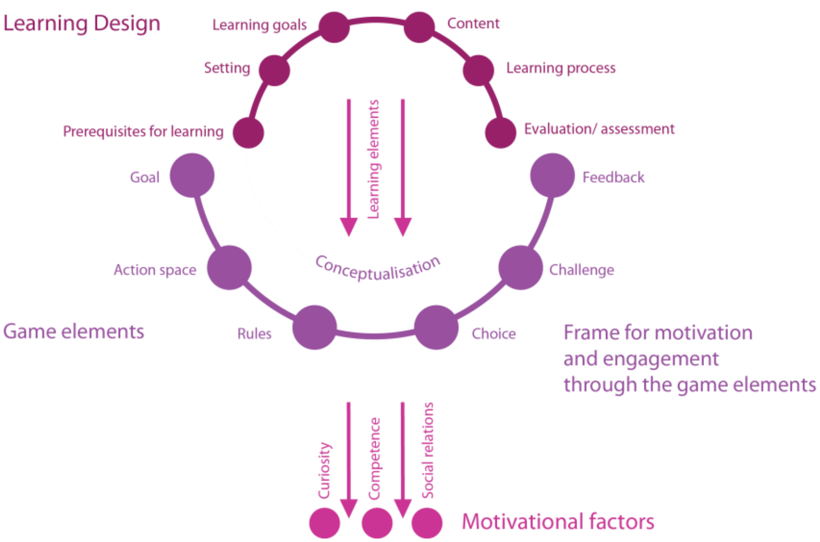
The experiment took place at VUC Storstrøm, an adult learning centre in Denmark. VUC Storstrøm offers the Global Classroom (GC) concept — a hybrid synchronous virtual and campus-based videoconference concept — to students attending an upper-secondary general education program, which is a full-time education program that lasts two years. The aim of this flexible class is to break down the walls of the classroom and offer a learning environment that responds to the needs of young adult learners (20–30 years old) to complete an education while fitting it into family and work life. Although teachers can ask their students to attend in person on specific days, the teachers generally prepare their daily teaching without knowing how many students will be in class versus how many will attend online. The students have different academic levels and different reasons for attending adult education classes, as well as different life situations and experiences. Furthermore, many students (60%) who attend VUC have at least one other discontinued education program in their pasts. This often influences their motivation to learn (Pless and Hansen, 2010; Sørensen et al., 2013). Therefore, the teachers in upper secondary classes at VUC strive to create a motivating learning environment for their diverse student groups. Recent reports have found that adult students enjoy activities with playful elements and that these elements help engage and motivate the students (EVA2, 2014).

2.1 Research design

James Paul Gee (2011), a literacy and learning game theorist, defined the terms of little "g" game and big "G" Game. These terms are used to distinguish between what happens inside small digital games and "outside" these digital games — in the big Game where interactions between the players/learners take place as they discuss and negotiate the content, intention, and meanings of the small games - learning during this process. In spring 2015, two teachers and 19 students from Global Classroom participated in an experiment in which the overall learning design was made into a big Game while students designed learning goals for specific subject matters – history and English as a second language – into small digital games. The learning goals were focused on the American Civil War, human rights, and the liberation of the slaves. The sources the students used, as well as the game dialog, were expected to be in English. Teachers initially participated in a workshop, were introduced to the overall learning design, and tried some of the learning game design methods. Before the student workshops started, the teachers briefly introduced students to the subject matter, showed a film about the subject area, and introduced a few texts. The teachers and students then participated in three five-hour workshops once a week for three weeks that involved creating learning game concepts, making paper prototypes, and building digital learning games (Scratch and RGB-Maker) in a gamified learning environment. The teachers led the learning process while the researcher primarily observed.

3. Learning design and game design approaches – theoretical foundation

Because the design of learning games is a complex process, this project used different frameworks to support the students' development of learning games. The Smiley Model (Figure 1) was used as a heuristic for building learning games, and the overall learning design model (Figure 2) illustrates the intention behind the gamified learning design for students. The term learning design describes how the teacher shapes social processes and creates conditions for learning as well as the phenomenon of the individual student constantly re-creating or re-designing information through his or her own meaning-creation processes (Laurillard, 2012; Selander and Kress, 2012, p. 2).



Article C Figure 1: The Smiley Model (Weitze & Ørngreen, 2012).

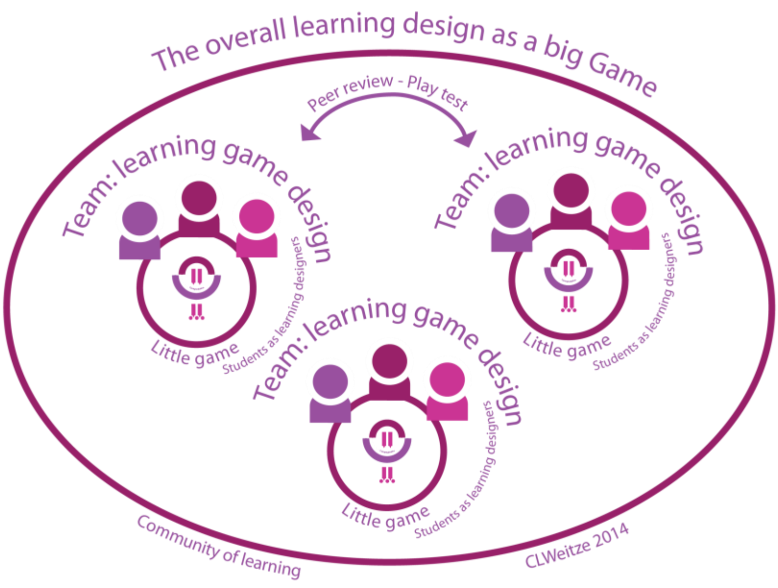
3.1 The Smiley Model

The Smiley Model (Figure 1) is a learning game design model for building engaging learning games (Weitze and Ørngreen, 2012). The model was used to inspire and scaffold gamified learning processes in the current learning design. The Smiley Model addresses how to design the learning process and how to implement learning elements into the game while also considering ways to make the game motivating and engaging. The Smiley Model uses a learning design framework that considers the following elements: designing for the students' prerequisites for learning, the setting or learning situation, the learning goals, content selection, creation of relevant learning processes, and evaluation processes. The six game elements that can be used to set the learning design into play are: game goals, action space or narrative, rules, choices, challenges, and feedback. Each of the game elements are intertwined.

The Smiley Model addresses the need to design the learning process, to set the learning elements into play through traditional game-elements, and to design for motivational factors. The three main underlying driving forces for our intrinsic motivation to learn are: 1) curiosity, 2) the feeling of achieving competence, and 3) reciprocity (Bruner 1966). These driving forces are further elaborated in Section 5.

3.2 The big Game and the small games

The goal for this experiment was to facilitate a motivating learning experience by making the whole learning design into a game. Inside this overall game, the students worked in teams and created digital learning games, while they embedded learning goals from the curriculum into each game (Figure 2) (Weitze, 2014a,b)



Article C Figure 2: The gamified learning design.

The big Game for this project was designed in 25 levels, encompassing tasks for building learning games; the framework was presented in a Google document for each of the teams. The Smiley Model inspired the learning design of both the big and the small games. In addition to the motivational purpose of gamifying the learning game design process, another goal was structuring and scaffolding the learning process to help novice students and teachers create the small games (Weitze, 2014a,b). Therefore, the aim of this learning project was that the students would discuss, negotiate, and finally master the intended learning goals while building and implementing these learning goals into their little games. In other words: the student-game-designers were learning inside the big Game while designing the small games. Another ambitious sub-goal was that students from other teams would be able to learn by playing different the small games and discussing game concepts, thus gaining knowledge, skills, and competence during this process.

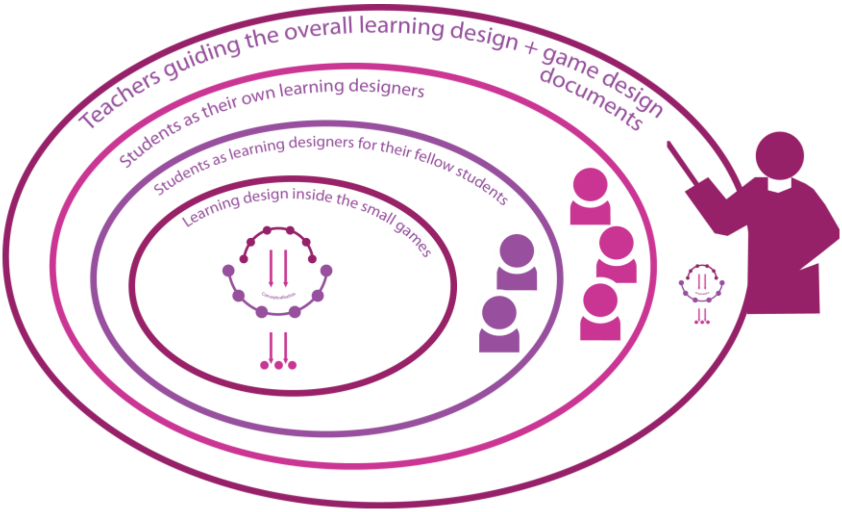
4. Theoretical and grounded analysis of the empirical data

To analyse whether the gamified learning design process can facilitate motivating learning processes for students, the project used the Danish learning theorist Knud Illeris' theoretical framework for learning processes. Illeris (2007) argued that every learning process involves the following three dimensions: 1) the inner psychological process of acquisition (the content dimension), 2) the interpersonal interaction dimension, and 3) willingness and desire to learn (the incentive-driven dimension) (Illeris, 2007). The first two dimensions are important in teaching and learning because they involve the cognitive (content) learning and collaborative learning domains, emphasizing that both individual learning processes and social learning processes should be supported. However, the third motivational dimension is equally important in this case, since the target group in VUC's Global Classroom often possesses a weak motivation to learn. Therefore, the learning design has been focused on establishing individual, collaborative, and motivational learning processes for students.

The following sections will first analyse the students learning processes and trajectories in this project (4.1–4.4) and then analyse the motivating learning processes in the experiment (5–5.3). The purpose is twofold: to identify the facilitated learning and motivating processes taking place, and to find patterns that can be supported in future gamified teaching situations to enable motivational and deep learning processes for students.

4.1 Learning in the big Game

In the overall learning design – the big Game – the learning processes were facilitated by a problem-based learning approach (PBL). The students engaged in a learning process involving the development of a digital learning game. These small games then facilitated learning processes for their fellow students, by presenting and inviting interaction with game content that was relevant within the given learning goals. In order to find a solution to this problem and develop the project, teachers facilitated the learning process; the students were self-directed learners, and they dealt with problems as the driving force for inquiry corresponding to the principles of PBL (Savery, 2015). To assess what the students learned in this experiment, the project analysed what students and teachers said and did during pre- and post-experiment interviews and on-task activities. Furthermore, the main way the teachers evaluated students was through formative evaluative conversations and on-going discussions, as well as by asking each student to answer questions in Google docs about how well they understood the day's learning goals. This class is given an examination covering all subjects at the end of the year, and they do not have any formal marks before that day. Therefore, the students were generally very open concerning their understanding of the subjects, since the only purpose of the teachers' questions was to find out how they could support each student in the learning process. According to the teachers' analysis and evaluations of dialogues with the students, the conclusion was that the students learned the same amount or more, as compared with traditional lessons. Several students stated that the project required them to dive deep into the subject area, when building learning games, this resulted in memorable learning experiences.



Article C Figure 3: Learning designers in the game development process.

4.2 Students as learning designers

One way to involve students in the learning process is to design learning processes in a way that enables the students to be self-directed learners. The process of students directing their own learning processes allows them to become their own learning designers.In order to activate the students as their own learning designers and also allow them to reach their learning goals, the process must be facilitated and guided by a teacher. In this experiment, the teachers were learning designers for the students, assisted by the game design assignments in the big Game. Additionally, the students were their own learning designers, both individually and in collaboration, as they discussed the subject matter, found content, and negotiated how to implement learning into the small digital games.

The students planned ways to develop and implement relevant content into their own small learning games. By experiencing innovative learning processes, students developed knowledge about and an understanding of facilitating learning processes inside their prototype games. Students were empowered to choose the specific learning goals that players of their games should master as well as how these goals should be facilitated in their games. The students thus planned ways to facilitate both the learning process and the evaluative process inside their small games within specific subject matters. They also continuously discussed and evaluated their projects, aided by feedback from the teachers and playtests performed by their fellow students. Therefore, the students not only acted as their own learning designers and led their own learning process, but they also acted as learning designers for their fellow students – as they worked to facilitate learning activities and learning trajectories inside the small games. This process can be illustrated as different levels of responsibility for acting as learning designers and creating learning designs in a game development process (Figure 3).

4.3 The students learning trajectories when building the small games

This research project used grounded theoretical methods to investigate and differentiate between the learning processes that took place while students designed learning games. The analysis showed that while the students built the learning games, they went through an iterative process consisting of seven areas, in the learning-game design process, including conceptualising and building the games (Figure 4). These areas were not visited in a specific order, but rather arose when relevant. The students were self-directed learners as they chose how to solve the problem of developing a game, but they were scaffolded by the Smiley Model when solving tasks in the big Game. Therefore, the following learning trajectories also encompass elements from the Smiley Model.

Conceptualizing and building small learning games. The focus on the learning game prototypes and discussions about building these games was an important overall goal. The prototypes became materials for learning and enhanced the students' ability to conceptualize and create their learning ideas in the following ways:

a) For individual students: The materials talked back (Schön, 1992), allowing students to become aware of gaps in their learning ideas or adaptions that may be required for specific learning situations and materials (Löwgren and Stolterman, 2007).

b) For teams: The materials could be used in learning design and game design discussions between students, and between students and teachers. This is equivalent to a constructionism approach to learning through design, in which the construction of artefacts enables reflection and new ways of thinking, based on the tools students use alone as well as in collaboration with peers (Kafai and Resnick, 1996).

Article C Figure 4: Learning trajectories when building small digital learning games.

The students learning trajectories when conceptualizing and building small learning games were:

1) Studying and re-studying the learning goals and deciding their specific take on them. This process made the students conscious of what they were expected to learn. This topic was also continuously discussed with the teachers.

2) Researching reliable sources in textbooks and on the Internet. For example, texts, videos, and sources from the Library of Congress were used as reliable sources. One of the learning goals involved being able to determine whether the historical sources were valid; therefore, this was an important focus for the students as well. In this learning situation – making learning games – assessing the validity of sources became meaningful for the students, since they sought to create good learning games for their fellow students, ensuring that the learning experiences were relevant and authentic.

3) Content for story environment. Because the subject of the games was focused on history, students looked for relevant content to develop a story environment. This is an important part of developing a game equivalent to the narrative and action scene in the Smiley Model.

4) Matching storyline and learning situations in the game design. The students searched for relevant historical material that would make a coherent story and create a learning environment for characters inside the little game – specific learning situations inside the little game that would create learning possibilities for the player. This was also supported by the teachers' formative evaluations, which

encouraged the creation of small communities of practice in the games to enable learning situations.

5) Systems thinking. One of the advantages of using games and game design as learning tools is the possibility to show cause and effect as well as providing multiple learning paths from which to choose (Meadows and Wright, 2008). These conditions will engage the player of the game, as he or she experiences the freedom to choose and learn from his or her own path (Bruner, 1966). As an example, one of the teams developed a game concept in which the player/learner could choose to be either Abraham Lincoln or Jefferson Davis in the American Civil War. The team conducted thorough research on how the different actions in the war resulted in different consequences. They debated heavily on how they could allow the player choose to see these consequences from the perspective of either the Northern or Southern states. After these conducting research and debates, the students mastered this aspect of the topic and were able to discuss it in great detail with their fellow students. Findings from the first iteration of this experiment (Spring 2014) showed that it would enable higher levels of cognitive complexity in the learning process for students to develop learning games that were more complex than simple quiz games (Weitze, 2014a,b). This is due to the fact that quiz games often only require memorizing specific facts and therefore only achieve the remembering level of cognitive complexity (Anderson and Krathwohl, 2001, pp. 67–68). The teachers also facilitated thinking in terms of cause and effect during the game design.

6) Designing specific game mechanics and facilitating learning and evaluation processes. The teachers encouraged students to facilitate both learning and evaluation processes in and around the small games. They also discussed how game mechanics – what the players/students could DO in the little game – were connected to specific learning goals that should be facilitated in the game. This resulted in many interesting and important findings that will be further described in a future article. As a single example, one of the teams created a story line inside the game and later invited the player to choose between different alternative solutions connected to the story. These alternatives or choices had different consequences, similar to the real life consequences that would have occurred at the time of the American Civil War. In this way, the players were educated by listening to the storyline and by the consequences of their own choices while playing the game. These game mechanics were also guided by the game elements in the Smiley Model: facilitation of goals, choices, challenges, rules, and feedback.

In summary, while teams worked through each of the previously mentioned learning trajectories, they reflected on and developed academic knowledge; more than one student stated that they would be able to remember details about the historical period they worked on for the rest of their lives. The concept of learning by doing – working through different learning trajectories while building games and being one's own learning designer – was successful for the students' learning processes both individually and collaboratively. The process offered a good alternative to being told about this historical period using a monologue-based pedagogical approach.

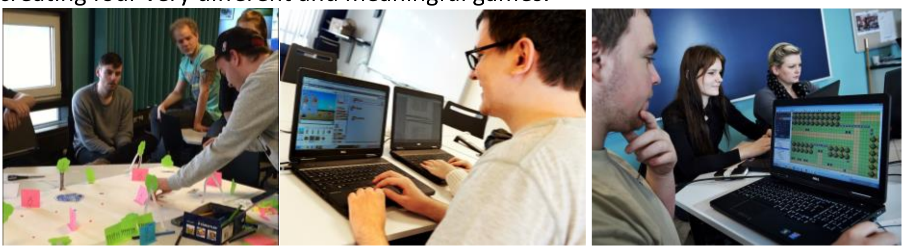
5. Motivation in the learning design

As stated in the introduction, motivation is an important part of learning. Jerome Bruner (1966), a noted educational psychologist, has a learning theorist approach to motivation. He believes that our intrinsic motivation to learn consists of three main underlying forces: 1) curiosity: the desire and freedom to explore things and the agency to decide for oneself – being in a playful and investigative mood; 2) achieving competence: the desire to show that we can do things and therefore are independent individuals; mastering a subject creates joy and pride and is motivating; and 3) reciprocity and relatedness: the desire to be an indispensable part of the community. People like to achieve goals with others, learning as part of a community of practice (Wenger, 1998). It is argued that if learning is planned in a way that enables students to achieve one or more of the three motives described above, students will be more likely to feel an inner motivation to learn (Bruner, 1966). Deci and Ryans' self-determination theory (2000) argued that in order to achieve inner motivation, you should be reinforced in autonomy, competence, and relatedness, and that these concepts are vital to cover essential psychological needs (Deci and Ryan, 2000). The three main keys to motivation described by Deci and Ryan strongly resemble Bruner's three driving forces.

In this VUC class, the teachers experienced problems creating social learning processes for their students. According to feedback from teachers, the students still had very few interactions with each other after five months – in class as well as during breaks. The students were quiet and reserved, and often only contributed minimally during the facilitated teamwork in class. Therefore, one of the goals of this study was to enable motivating social and collaborative learning processes. In the first workshop, the teachers agreed that they had not previously seen a similar level of active participation from their students. After the last workshop, one teacher stated, "…it has obviously been working miracles for the social environment in class. Almost everyone worked hard and … I think that many of the quiet students really brightened up in this period. We have previously faced a real struggle creating a good social atmosphere" [translation by author]. The teachers also reported that the new positive social learning habits still remained two months after the experiment. This raises a question regarding what part of the learning design caused these improvements in the social learning processes, which can be difficult to assess in the "messy setting" of a learning situation. However, when seeking to understand how a motivating learning situation arose, it is relevant to examine both the characteristics of the learners and the learning design. Seventy percent of the students in this class played games on a daily basis, which may have contributed to their positive attitude towards creating games in class. According to interviews and observations, the students were more motivated and engaged than normal. The teachers observed that almost everyone participated actively – generally only three or four students showed this level of participation. The teachers were also surprised that students worked for five hours in a row, choosing to neglect their breaks. This was considered a further sign of engagement in the learning process. Bruner’s three motivational forces (1966) were used as lenses when analysing motivational processes in this project, as detailed below.

5.1 Facilitating curiosity

Curiosity is fundamental to learning – it is innate. Curiosity makes us investigate our surroundings in a playful way, looking for the borders of our knowledge and experiences. Curiosity also makes us challenge ourselves to go out into the unknown, where we are novices (Bruner, 1966; Illeris, 2007). Curiosity is part of the inner motivation to learn (Deci and Ryan, 2000). The adult students worked hard to create their learning games and were generally very engaged in the process. Even when they struggled with the concept of developing a learning game – a new endeavour for them – they carried on, often due to good advice and guidance from their encouraging teachers (Weitze, 2016). Papert (2002) coined an expression called hard fun that describes the phenomena that everyone enjoys having challenging things to do, as long as the challenges are properly matched to each individual, their developmental states, and the current culture. One goal of this iteration of the learning design project was establishing a feeling of hard fun in the digital game design phase, as well as in the conceptual development phase (Weitze, 2014a). The students experienced a level of hard fun when designing; they struggled with their assignments to design learning games, and they succeeded in creating four very different and meaningful games.



Article C Figure 5: Prototypes - materials for learning.

5.2 Creating the feeling of competence

Apart from small periods of uncertainty regarding their next steps, the students worked very diligently to create good learning games. They were enthusiastic when they explained the games that they were creating, and they thoroughly described the details and how they were trying to think outside the box to avoid simple quiz games (Weitze, 2014b). During the second and third workshops, the students expressed a feeling of pride for their games and a will to master the challenge of creating a learning game. The overall learning design process enabled them to gain many additional competences: gathering knowledge to meet learning goals, creating a storyline and English dialogues for characters in the games, building paper prototypes while discussing learning goals, and coding the digital games while implementing learning objects. According to the teachers, this new variety of tasks and the opportunity for hands-on work while developing the small learning games appealed to a group of students who had previously been quiet and inactive. The students developed detailed prototypes (Figure 5) that they used to discuss how learning should be implemented in the game. It was clear that the students enjoyed making these prototypes, and the teachers witnessed the emergence of new competences among many of the students and also noted that they were generally more enthusiastic and willing to participate.

5.3 Making reciprocity and relatedness possible

One of the teachers' main goals for this experiment was to create a more engaging social environment for their adult students. This goal was achieved to a great extent, and the effect lasted after the workshops ended. The big Game was designed, so students were able to collaborate and compete in a friendly way on teams. There were many observations of engaging collaborative processes. These processes allowed the students to learn from each other and to create knowledge together: they read aloud for each other from the sources and discussed and negotiated what content to implement in the games and how to create historically realistic learning game experiences for their fellow students. The students explicitly expressed that they enjoyed working on their teams because their specific group had good teamwork. This teamwork could be readily observed as the ability to work together, solve problems, and discuss relevant matters. It was also evident in their ability to divide the workload in ways that acknowledged each group members' strengths – for example, being good at coding versus being good at writing dialogues. As mentioned earlier, the teachers expressed that it had previously been difficult to create a good sense of collaboration in the class. The big Game had explicit rules for gaining Social Experience points (SXP). To gain SXP, you could help other teams, ask the other teams for help, or make sure that everyone in the team participated equally on each level. This rule regarding SXP was stated from the start, and the students joked about it throughout the workshops. The existence of the SXP points system may have contributed to the students' enhanced attention towards creating a good working environment.

By using Bruner's (1966) three motivational forces as analytical tools, this study suggests that the students and teachers experienced many different motivational learning processes in this learning design; the analysis also indicates that the motivational learning processes were supported by the overall learning design – the big Game – and by building the small games. This is an important finding because creating a motivating learning process capable of supporting a cognitive complex learning process for the students was the primary aim of the study.

6. Conclusion

This study experimented with creating a reusable, innovative, and motivational learning design for adult student-game-designers, allowing them to learn inside a big Game while designing small digital learning games in cross-disciplinary subject matters. The findings have shown that this learning design contributed to a motivating and deep learning process for the students. This was facilitated by both individual and collaborative learning processes. Using learning game design – an activity with playful elements – as a learning method was engaging for this adult audience, who found the task both challenging and motivational. The learning approach was a combination of problem-based learning and constructionism and the students were implementing history and English as a second language into the games. The overall learning design used the Smiley Model as a framework for the big Game, to guide the learning and game design processes for the students and teachers. The findings showed that the central theme of the learning process was conceptualizing and building small learning games by building upon the following six areas in the iterative learning-game design process: 1) studying learning goals; 2) researching authentic and relevant sources; 3) choosing relevant content for the story environment; 4) matching content with a storyline and learning environment in game design; 5) systems thinking – looking for cause and effect relationships and providing multiple paths; and 6) designing game mechanics – learning and evaluation. During the analysis, it was determined that the following learning design processes were contained within one another: the teachers guided the overall learning design assisted by the game design document; the students acted as their own learning designers leading their own learning process, but were also learning designers for their fellow students. Finally, learning processes were facilitated inside the small games.

Because motivation is an important part of learning, it was an important finding that many of the quiet students became more actively involved – according to the teachers, this experimental learning process greatly improved the social environment in class and everyone was actively involved. When using Bruner's (1966) three motivational forces as analytic tools (curiosity, the feeling of achieving competence, and reciprocity-relatedness) the findings were: 1) the students experienced inner motivation and hard fun and succeeded in making four very different and meaningful learning games; 2) the students tried to think "outside the box" and expressed a feeling of pride for their games and a will to master the challenge of making a learning game. The learning design enabled the students to develop many kinds of competences and work actively hands on, which seemed to appeal to a new group of traditionally quiet students; 3) there were many observations of engaging collaborative processes that allowed the students to learn from each other and to create knowledge together. The increase in these social learning processes may have been supported by specific social rules in the big game.

This DBR project used mixed methods and informed grounded theory to investigate and analyse the students' level of motivation and engagement in their learning processes. The analysis found signs of learning and motivation among the students and in co-design processes developed knowledge about how to refine this learning design.

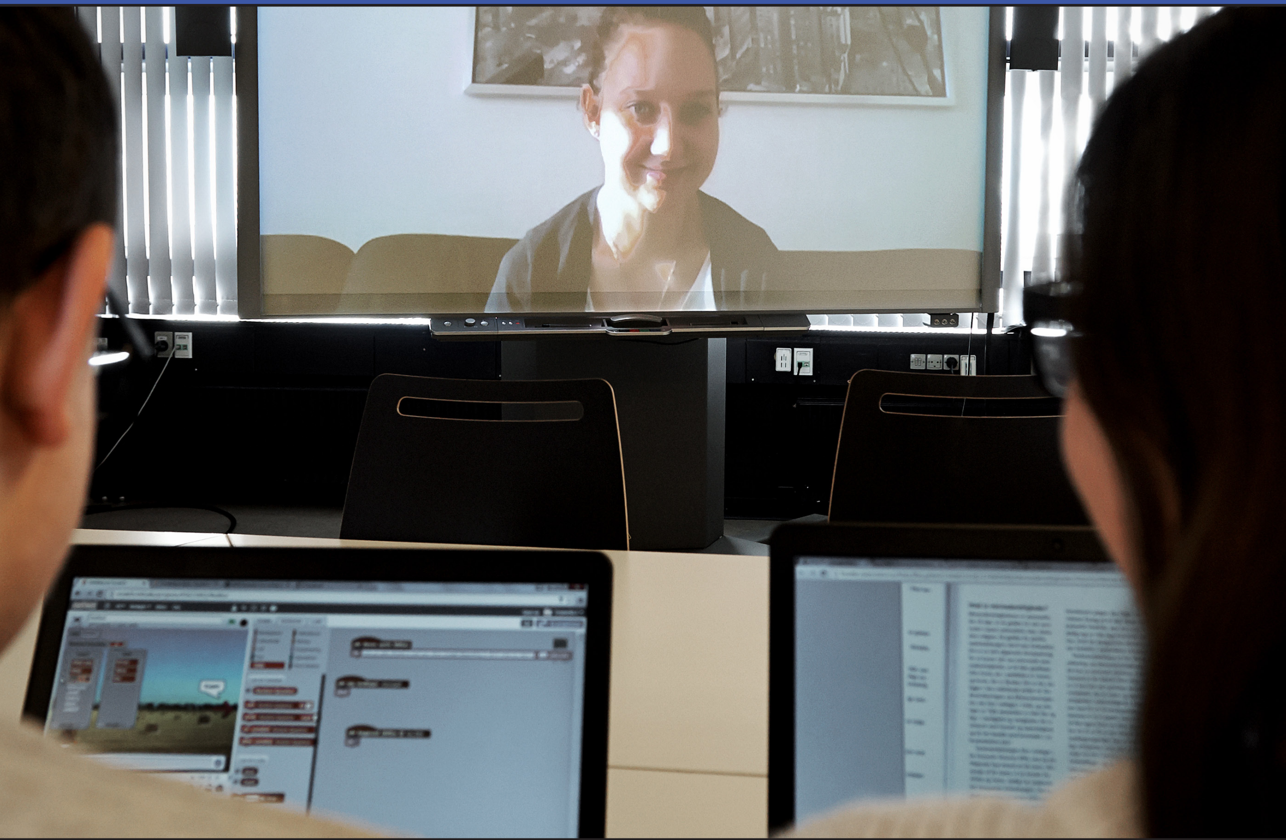
Though DBR takes place in the complex setting of a classroom, this iterative experiment has created knowledge about a problem area and made important contributions to the researchers' and the teachers' learning processes. Future goals include continuing the development of this new way of learning, to further refine it and to disseminate it to interested teachers and students.

END ARTICLE C

D

1.1. ARTICLE D: LEARNING AND DESIGN PROCESSES IN A GAMIFIED LEARNING DESIGN IN WHICH STUDENTS CREATE CURRICULUM-BASED DIGITAL LEARNING GAMES

Author: Charlotte Lærke Weitze
The article is a manuscript that has been sent to the anthology NORDGOLD, Ild-Lab – Nordisk Antologi. Submitted 1st September 2015; if accepted, it will be published in 2016.



This article describes the learning design, how the teachers contributed to the students' deep learning processes and how four parallel processes for designing and learning support this gamified learning design. The findings were that the students experienced deep and motivating learning and that the teachers found it inspiring and easy to use this innovative learning design as an alternative to more traditional approaches.

Learning and Design Processes in a Gamified Learning Design in which Students Create Curriculum-Based Digital Learning Games

Charlotte Lærke Weitze1+2
1ResearchLab: IT and Learning Design, Aalborg University, Denmark
2VUC Storstrøm, Denmark
cw@learning.aau.dk

Abstract: This research project experimented with a gamified learning design enabling adult learners to design digital games while implementing learning goals from their curriculum. The aim was to develop a reusable learning design for upper secondary teachers and students who are game design novices. The gamified learning design supported the innovative learning processes for the students, and the teacher participated as an inspirational guide for the students as they designed curriculum-based learning games. This article describes the learning design, how the teachers contributed to the students' cognitively complex learning processes, and how four parallel types of processes for designing and learning supported this gamified learning design. The experiment took place in a hybrid synchronous learning environment. The project found that the students experienced deep and motivating learning and that the teachers found this problem-based and activating learning design inspiring and easy to use as a variation to more traditional teaching approaches.

Keywords: Learning-game design, teacher's role in gamified learning, gamifying education, game design models, students as learning game designers.

1. Introduction

This introduction will briefly describe the field of gamification and how gamification is used and developed within education; the materials and approaches appropriate for a gamified learning environment; and the teacher's role in this alternative environment, including what to plan for and what to expect.

Gamification is a debated concept. One definition of gamification is "the use of game design elements in non-game contexts" (Deterding et al., 2011, p.1). Seaborn and Fels (2015) have extended this definition as follows: "The intentional use of game elements for a gameful experience of non-game tasks and contexts. Game elements are patterns, objects, principles, models and methods directly inspired by games". In the gamification debate some scholars praise the use of gamification and game-like elements to make educational situations more engaging, with a better learning outcome (Kapp, 2012). Others are wary of and criticize the negative and hidden persuasive influence gamification may have when implemented within existing systems (Bogost, 2011).

The positions for this debate find their beginnings in the various contexts and intentions for gamification. Scholars have used a number of alternate terms for gamification to express their interpretation of the nuances of its meaning, intention, content, use, and context; for example, John Ferrara (2012) talks about playful design, Ian Bogost about exploitationware (2011), and Jane McGonigal (2011) about alternate reality games. Therefore, the concept of gamification and the dissonance among scholars in connected fields makes it worth studying as an object, as an approach to design, and as a human–computer mediated phenomenon (Seaborn & Fels, 2015). The gamification debate thus is an ongoing one, with many good questions but no final answers.

Parallel to this debate, the concept of gamification keeps evolving and being refined in educational contexts. This happens digitally, for example, in Khan Academy’s gamified math and computer programming learning environments (https://www.khanacademy.org), which enable students to follow their own progress, earn badges (Morrison & DiSalvo, 2014), and receive help at the right time and place, assisted in this process by the system itself as a kind of technical mentor or adaptive problem-solving support provider (Nash & Shaffer, 2011; Weber, 2012). In SimCityEdu, an online educational community, the learning experience is supported by the combination of a game and a gamified learning environment involving the students and the teacher. The students, challenged to reduce air pollution, experience the complex consequences of their choices within a complex game system, while the teacher follows and contributes to this gamified learning process (www.instituteofplay.org/work/projects/simcityedu-games). Another example is the game DragonBox for tablet, where students learn concepts and rules of math in an intuitive way. Provided with a practice space in which they can gradually move through challenges, students explore and solve puzzles, reaching the game and learning goals of each level (www.dragonboxapp.com/index.html). DragonBox is a learning game, but when implemented in the classroom context, it can become part of a gamified learning experience as the teacher and students discuss how the math concepts from the game can be understood and connected with more traditional math assignments. Gamification in education is debated and criticised, but it continues to be experimented with and explored. The current research project experimented with analogue and digital elements as well as design and learning processes to create games and gamified learning experiences.

According to a study conducted among 2,200 households, 59% of Americans play videogames. The average player is 31 years old, and half of the players are women (ESA, 2014). Teachers who use videogames as part of the class experience agree that video games significantly increase students’ motivation and engagement levels

(Takeuchi & Vaala, 2014). This wide use of games by students as well as adults invites continuing research into how the use of games or other playful elements can open up opportunities for merging motivational and engaging playful systems with the learning processes taking place in formal education.

What materials may be useful in creating motivating gamified learning environments for students? One emerging trend within learning and technology is teaching students to code and create with technology. This movement was started by Seymour Papert at the MIT lab in the 1960s and has been evolving since developed the constructionist approach: learning by creating (Harel & Papert, 1991; Kafai & Resnick, 1996; Papert, 1980). The learning by creating approach began with software tools as Logo and Lego Mindstorms, recently developed into the programming environment Scratch by the Lifelong Kindergarten Research group at the MIT Media Lab, launched in 2007 (Brennan, 2014). This so-called "maker movement" is undergoing a revival at the moment (Hatch, 2013; Honey & Kanter, 2013), perhaps because many of the coding software products have reached more advanced levels; the newer software is web-based, with user-friendly, intuitive designs. An example of an intuitive creation tool can be experienced in the worldwide initiative, The Hour of Code (http://hourofcode.com/dk/en). These coding-software products and other maker-tools assist students in learning to code and also support the development of other innovative skills. As students learn to design with these tools (Koh, Chai, Wong, & Hong, 2015), they are also enabled to move from the role of technological consumer to the role of producer of digital content. The ability to code and to achieve an understanding of the logic of the technology behind the interface—to develop computational thinking (Brennan & Resnick, 2012)—may present new possibilities for creative and innovative expressions, empowering students to create their own ideas and worlds through these technological tools (Kafai, 2006).

The question is this: How should a teacher who is a novice in the creative and productive use of technology approach a teaching situation if she or he wants to let students create and learn with and through technology? If he or she intends to implement cross-disciplinary subject matters into this learning process in order to use the technology as material for learning and conceptualisation, how should she or he create the learning design? This learning approach has its origins in a constructionist pedagogical methodology built upon the thesis that there is a strong connection between design and learning, and that activity that involves making, building, or programming provides a rich context for learning (Papert, 1980; Kafai & Resnick, 1996). The present experiment aimed to create an overall gamified learning design (big Game) facilitating the learning process for adult students by letting them be their own learning designers through designing their own digital learning games (small games) in cross-disciplinary subject matters. Since 80% of teachers that use games in class wish that it was easier to find curriculum aligned games (Takeuchi & Vaala, 2014), the current experiment offers a new way to create game based learning designs that are designed and aligned to curriculum.

2. The students and teachers in the experiment

The participants in this experiment were adult students studying at VUC Storstrøm (hereafter, VUC), an adult learning centre in Denmark. The students were participating in an upper-secondary general education program, a full-time education lasting two years. At VUC, many students (60%) attending the upper-secondary class have at least one instance of discontinued education in their past. This is often due to lack of motivation to learn (Pless & Hansen, 2010; Hutters et al., 2013). Part of the aim of this experiment was therefore to experiment with and examine how teachers can create innovative and motivating learning for the students. The group of VUC students was diverse, with a variety of academic levels and reasons for being in adult education, as well as varying ages, life situations, and experiences. An earlier iteration of this experiment (Iteration 1, Spring 2014; Weitze, 2014a,b) with a similar audience found that it was important to scaffold and support the students in their learning path cautiously, staying within their zone of proximate development (ZPD), the zone between the student's actual level of development in individual problem solving and the potential development when being guided by a teacher or collaborating with more skilled peers (Vygotsky, 1980). Certain students are at high risk of giving up if they reach their limits in the ZPD because of their previous negative experiences with the school system, which has led to low self-efficacy (a belief in one's own capability to perform a task successfully at designated levels; Liu, 2006). Therefore, the teachers at VUC generally use a number of strategies as they strive to create a motivating and supportive learning environment for the students. An extended aspect of this experiment, one that this article will not have room to address, was that the learning took place in Global Classroom (Weitze, 2014a,b). The Global Classroom concept is a hybrid synchronous virtual and campus-based videoconference concept. In this learning environment, students can choose on a daily basis whether they want to participate on campus or from home. This has forced many of the teachers to alter their previous motivational pedagogical strategies to match the hybrid synchronous learning environment. Therefore, this experiment also aimed to develop new motivational pedagogical strategies for this type of learning environment. Along with an analysis of the game-based environment, the study also describes potentials and barriers for conducting this kind of teaching in a hybrid synchronous learning environment. This is new research regarding the combination of the target group, the learning environment, the gamified learning game design, and the students implementing curricular learning goals into digital games.

3. Research objective and methodology

This study was part of an iterative project that experimented to create innovative and engaging learning designs for students. The investigation was conducted as a design-based research (DBR) study, in which the teachers and students are important co-designers in the development and test process. To investigate how the learning-game design experiments answer the research questions, the study used mixed methods. The data (Table 1) included field notes, audio- and videotaped actions and utterances, observations from the workshops, semi-structured interviews with teachers after each workshop, semi-structured interviews with students after the final workshop, informal meetings, evaluation documents written by the students, questionnaires, videos of students' games being discussed and playtested, and the students' digital games themselves. The analysis was made by coding the transcribed data with an informed grounded theory approach (Thornberg, 2012), carried out as concept-driven (using concepts from the theory and previous empirical data to find themes in the data) and as data-driven coding (reading the data and searching for new phenomena which are not known from previous preconceptions of the subject) (Kvale 2009; Charmaz, 2006). The questions for the research process were as follows: 1) Which elements, practices, and processes are essential when creating sustainable, innovative, and motivating learning designs for teachers and adult students engaged in learning by building games 2) How does the gamified learning design contribute to enable a motivating learning process? 3) How can learning-game design be used as a means of learning by teachers and students who are game design novices? 4) What are the potentials and barriers for using the current learning design in a hybrid synchronous learning environment? The experiment developed through three iterations from Spring 2014 to Spring 2015; Table 1 describes the data collection from the third experiment.

Table 1: Data material from the research process, Spring 2015

1) Observations of teaching practices in a Global Classroom
2) Questionnaire surveys of students and teachers from a Global Classroom
3) One workshop and three meetings: Continuous interviews with teacher team and debriefing
4) Three five-hour learning-game design workshops with students
5) Material from student workshops, game concepts, playtest videos, game-homepage, playtest questionnaires, and learning-design documentation

1) Observations of teaching practices in a Global Classroom
2) Questionnaire surveys of students and teachers from a Global Classroom
3) One workshop and three meetings: Continuous interviews with teacher team and debriefing
4) Three five-hour learning-game design workshops with students

5) Material from student workshops, game concepts, playtest videos, game-homepage, playtest questionnaires, and learning-design documentation

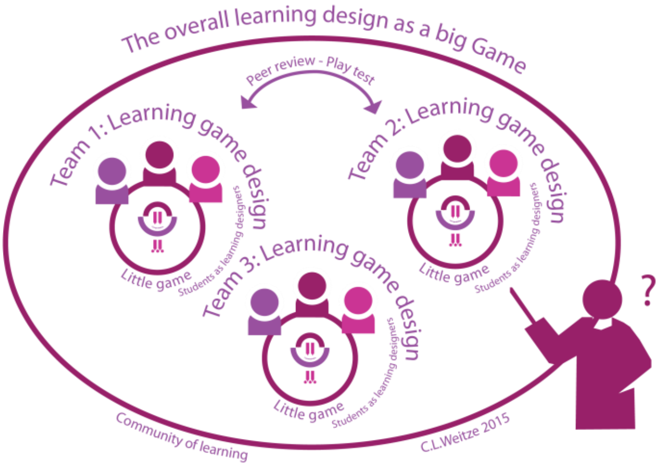
4. Research design

The research has been a DBR experiment in three iterations, with two iterations at VUC taking place in Spring 2014 and Spring 2015. A smaller iteration in the Fall 2014 experimented with a specific part of the learning design: the conceptualisation of what a learning design is and how to help students imagine how to implement learning into a game beyond the quiz-level. However, the current article narrows the focus to a description of the findings in the third iteration.

In Spring 2015, two teachers and 19 students from Global Classroom participated in an experiment on designing learning games that implemented specific subject matters: history and English as a second language. The learning goals focused on the American Civil War, human rights, and the emancipation of the slaves; the sources used and the game dialogue were expected to be in English. The teachers initially participated in a workshop with the researcher. They were introduced to the overall learning design and tried some of the methods. Before the student workshops, the teachers briefly introduced the students to the subject matters, showed a film about the subject, and introduced a few relevant texts. The teachers and students then participated in three five-hour workshops. The researcher presented the initial ideas about learning by creating games for the students participating in class as well as online. The students conceptualised the learning games, built paper prototypes, and transformed them into digital learning games supported by the overall gamified learning environment. The students formed teams that collaborated and competed in a friendly way.

5. Learning design and game design approaches

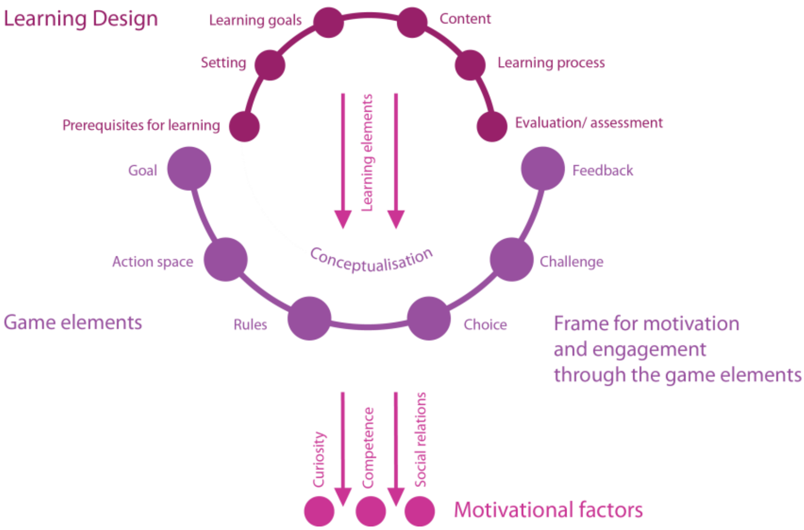
The big Game and the small games: In this experiment, the goal was to create a motivating learning experience for the students. The overall learning design was made into a game in which the students formed teams and created digital learning games that encompassed learning goals from the curriculum (Weitze, 2014a,b). The term learning design describes how a teacher shapes social processes and creates conditions for learning, as well as the phenomenon of the individual student constantly re-creating or redesigning information in his own meaning-creating processes (Selander & Kress, 2012, p. 2; Laurillard, 2012). In this experiment, the teacher was the learning designer, but the students were also their own learning designers as they discussed the subject matter, found content, and negotiated how to implement learning into the small digital games. The literacy and learning game theorist James Paul Gee uses the terms little “g” game and big “G” Game. By using these expressions, he distinguishes between learning and play processes that takes place inside the little digital game; versus “outside”—in the big Game in all the interactions between the players/learners as they discuss and negotiate the content, intention, and meanings in the little game—learning during this process (Gee, 2011). The purpose of gamifying the learning-game design process is to engage the students but also to structure and scaffold the students’ creation of the small games (Weitze, 2014a,b). This is necessary to be able to guide game-design novices—students and teachers—through the learning process.



Article D Figure 1: The gamified learning design and considerations about the teacher's role.

The aim of the learning project was thus that students would discuss, negotiate, and finally master the intended learning goals while building and implementing these learning goals into the little game. In other words, the student game-designers are learning inside the big Game while the designing the small games (Figure 1). As in the first iteration of this experiment (Spring 2014), the goal was that the students afterwards should be able to play each other’s digital games while learning and being evaluated in the relevant subject matters in and around these learning games. In this third iteration (Spring 2015), three out of four teams reached this goal; it was possible to learn about the subject matter by playing the digital games. However, the learning process and experience of building the games—the big Game—was a more cognitively complex learning experience for the students (see also Weitze, 2015a). In the first iteration (Spring 2014), the teachers were hesitant and left the teaching process to the scaffolded learning design document; they did not participate actively in the students’ learning process. On the basis of these previous findings, one of the goals for this third iteration was to facilitate teachers’ participation in the big Game (Figure 1) as a way to qualify and deepen students’ learning processes.

The Smiley Model: In order to inspire and scaffold the gamified learning process in both the big Game and the small games, this research project used the Smiley Model (Figure 2), a learning-game design model for creating engaging learning games (see Weitze 2014a,b, 2012, for a more elaborate explanation of this model and its implementation).



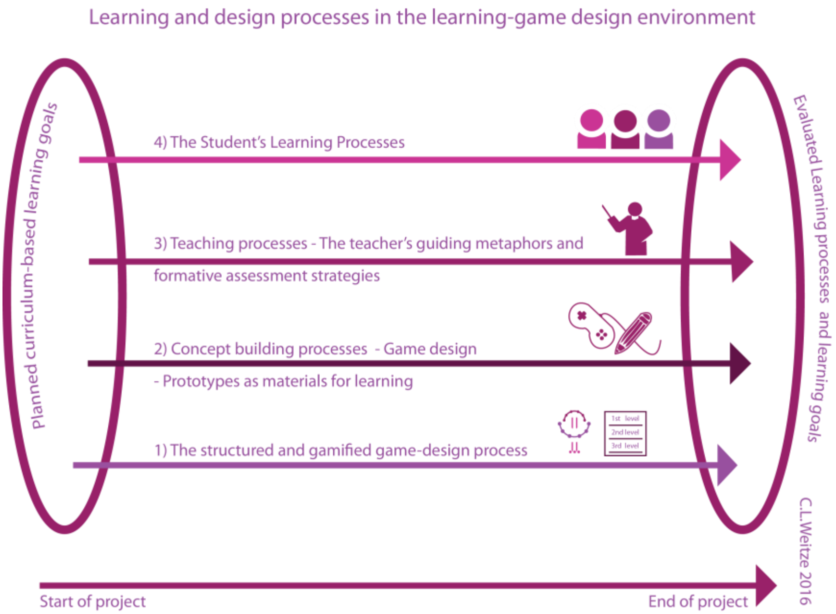
Article D Figure 2: The Smiley Model (Weitze & Ørngreen, 2012).

The Smiley Model starts out by describing the learning design of the game (Figure 2, top). Learning elements from the learning design are then set into play by using traditional game elements (goals, action space, rules, choice, challenge, feedback) (Figure 2) while also considering and designing for the motivational factors—the three main underlying forces that drive our intrinsic motivation to learn: 1) curiosity: the desire and freedom to explore things and decide for yourself, 2) the feeling of achieving competence, and 3) reciprocity: the desire to be an indispensable part of the community (Bruner, 1966). These three main motivations to a great extent resemble Deci and Ryan's self-determination theory (SDT), as SDT argues that in order to achieve inner motivation, an individual should be reinforced in autonomy, competence, and relatedness, and that these are vital to cover the essential psychological needs (Deci & Ryan, 2000).

6. Theoretical and grounded analysis of the empirical data

The empirical analysis of the overall learning design in this experiment found four parallel types of processes for designing and learning in the big Game (Figure 3): 1) the structured game-design process with carefully designed assignments for the students (with the Smiley Model as frame), described in an online Google

Document for each team, making it accessible for students participating in class as well as from home; 2) concept-building processes: the use of prototype materials for conceptualisation and learning, changing through the learning process; 3) teaching processes: the teachers' involvement points and strategies as they supported, guided, and qualified the learning processes and provided formative assessment; and, most important, 4) the students' individual (acquisition), collaborative (social) and motivational (incentive) learning processes when negotiating about and creating the conceptual and physical/digital learning games (Illeris, 2007).



Article D Figure 3: Various process types of learning and designing in the learning-game design environment.

This is an artificial division, but an elaboration of these four areas will increase knowledge about how learning design works as well as how and where the teacher can support students' learning processes in this reusable learning-game design environment. The processes are explained below.

6.1 The structured game design process

Building a learning game can be a challenge for novices, so the learning design was scaffolded into a big Game with 25 levels for the teams, with 3–5 questions or assignments at each level (Weitze, 2014a,b). The goal was to create a sustainable learning design that could be used by students and teacher—all novices to learning-game design. The levels were established to create a logical progression and to break the assignments down into easily understandable tasks in order to keep and guide the students within the ZPD. The overall inspirational framework for the big Game was, as noted earlier, the Smiley Model (Weitze & Ørngreen, 2012). The big Game was designed to engage and motivate the students, inspired by Bruners' (1966) motivational forces. The intention was threefold: 1) to spark curiosity by introducing students to this new way of learning and by letting them choose how to design their own games and their own learning paths; 2) to enable the feeling of achieving competence by asking students to develop the small games and by having them move through the levels of the big Game, gaining experience points (EXP); 3) to enable the feeling of reciprocity by letting students work together on a team and compete with other teams, gaining social points (SXP) for working together and for asking other teams for help. In addition to the Smiley Model, the project used innovative methods from Design Thinking (Brown, 2009) and other interaction design methods in the assignments and invited students to sketch and prototype the small games. The current iteration of the big Game was altered according to previous findings (Weitze, 2014a,b). For example, the teams were invited to playtest or peer-review each other's games in every workshop in order to deepen the learning process; this had been an engaging experience for the students in the first iteration. The students also were introduced to an example of a learning game in the chosen software (Scratch, 2015), and from the beginning of the workshops students carried out small tutorials for using the software as part of the assignments. The levels and assignments for the big Game were presented in an online Google Document for each team, and here they could also write down the points they earned in the process. This offered equal access for students in class and students at home. The overall scoreboard for the teams was presented on a webpage for the big Game. As part of the assignment, students working in groups divided between classroom and home participants were expected to arrange how, when, and where to meet for their group sessions, including whether they preferred to collaborate through a digital platform other than their usual video conference platform.

In the first workshop, the individual teams worked diligently through the levels in the big Game. Students found it easy to understand and move through the levels. It worked well to introduce the teams to the game design tool Scratch (2015) in some of the first assignments. This gave them a feeling for how this tool might prove helpful in the final learning-game version. As recommended from the first iteration (Spring 2014), the levels had both mandatory and voluntary tasks. The voluntary tasks gradually became more demanding in order to encourage teams to compete by going deeper into the learning process of each assignment instead of racing superficially through the levels in order to win. However, the finding in this iteration was that the big Game still needed tweaking to find that delicate balance between keeping levels simple and challenging the teams to engage deeply in the process of learning-game design and provide good learning experiences to the teams themselves as well as to those who will eventually play them.

In the second and third workshops, the teams took more differentiated and individual paths (the rules of the big Game allowed this). Two teams completed almost all of the levels, whereas the other two teams worked more freely on their learning games without collecting EXP. This independent way of working may have been caused by this second pair of teams working so well and intensely together. These teams worked with the concept development phases in a very effortless way and according to the observations and the teachers utterances achieved a feeling of being on the right track, heading towards their end goal: the finished digital learning game. These two teams thus solved the learning-game design assignments in a more self-driven manner. This movement from the rule-based big Game, solving every assignment, to a more sandbox-like big Game, where the teams were more self-directed and decided which task to solve next, can be seen as a movement between the two poles in the spectrum of human play: from the concept Ludus (game-like structured activities with rule-based goals) to Paidia (play-like, player-led activities with open goals) (Caillois, 2001; Walz & Deterding, 2015; Weitze, 2014c). The Paidia end of the spectrum emphasises opportunities to let students decide their own learning goals, which harmonises well with constructionist pedagogies. The observed movement away from more structured assignments can also be interpreted as moving from extrinsic motivated learning processes, with fixed assignments and points, to more intrinsic motivated processes (Deci & Ryan, 2000), with students taking responsibility for the progression of the project. That said, the learning situation still took place within a formal learning environment in which students had to attend to pass. The structure of the big Game worked well, especially in the first two workshops. But there were also findings that will inform further modifications; for example, limiting the number of assignments in the big Game design.

According to the teachers, the students working in the teams that remained in the Ludus (rule-based) end of the human play spectrum in the big Game were students who often found more traditional teaching situations difficult. Their choice of the more scaffolded and rule-based path in the big Game may indicate that they felt more comfortable solving assignments that were broken down into smaller tasks. The study therefore suggests that the big Game allowed flexibility for students to work according to their own preferences in the Ludus or Paidia end of the human play spectrum, depending on the amount of support they required to have an experience of a successful learning process.

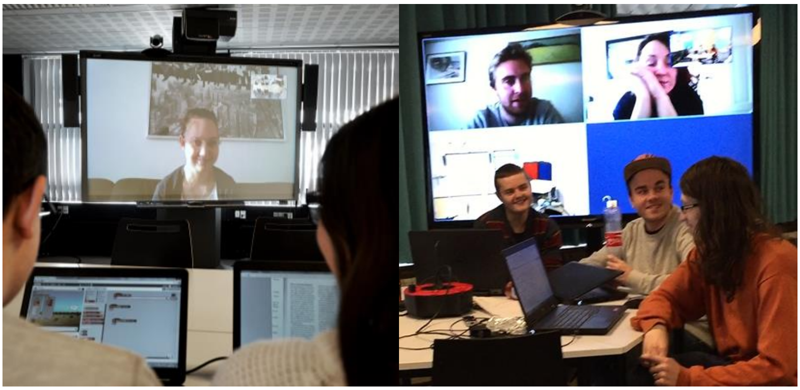
6.2 Concept-building processes, prototypes as materials for learning, and learning by creating

In the structure for the big Game, certain assignments were designed so students would use a variety of prototype materials as means for learning (Schön, 1992). The use of paper and other materials for prototypes enabled a fast iterative process, making the materials a visual and tangible language to discuss ideas for the learning games (Buxton, 2007). The teams chose many different types of materials: old-fashioned blackboard, whiteboard with sticky notes, and large prototype landscapes; some students chose to begin working in the software parallel to the sketches they made (Figure 4). This was a fertile and useful process for all the teams. They had the opportunity to conceptualise and externalise their visions (Papert, 1980; Harel & Papert, 1991). This gave them a concrete sensory language that enabled them to project their ideas into the materials and discuss a variety of ideas for implementing the learning goals into the learning games in a way that integrated a learning process and an evaluation process for future players of their games. The prototypes were also helpful as discussion partners when conceptualising system thinking for the games. For example members of one team, with the help of the elements in the prototypes, discussed their game's storyline and game-mechanics by demonstrating and telling what should happen in the game. This gave the team opportunity to discover blind spots and missing connections when developing the game. The use of prototypes as discussion partners helped them to learn about historical correlations, conditionality and causalities. Systems thinking could thus be used and developed if there were contingent relations between things happening in the game (correlations), or if a situation was conditioned by another situation (conditionality), or if one thing in the game produced a change in another part (causality). In this particular game, the actions of the northern U.S. states influenced the enemy in the southern states to take new actions; and the students learned very much from their thorough investigations of the actions and reactions between the northern and the southern states when creating the concept for the game.

Article D Figure 4: Prototypes: Materials for learning.

One important finding from the first iteration (Spring 2014) was that the game-design software was too difficult; for some students, this stopped the whole game-design process. In this iteration (Spring 2015), we used Scratch (Scratch, 2014) and the built-in tutorials in the Scratch software. The learning community around Scratch and the opportunity to be inspired by and learn from other games made a significant positive difference. Scratch's training assignments were also tasks in the big Game, and all students were able to use the software. Some of the students looked for alternative software with more advanced game-design features or more aesthetically pleasing graphics. One team chose to use RGBMaker (a good but somewhat more difficult alternative; (RPGMaker, 2015), but all other teams decided to create their games using Scratch.

In the first iteration (Spring 2014), some of the students in the cross-over groups (those that included both in-class and at-home students) collaborated by sharing the computer screen using TeamViewer (2015). This enabled all of the students to watch and discuss the game development from their own devices as one student began to create the digital game. In the third iteration (Spring 2015), the teachers advised the classroom students in the cross-over groups to move into a room with a large video screen (Figure 5). This reduced noise distraction from other groups and enabled students to work on their laptop-screens instead of using them for the videoconference communication with other team members. In general, the classroom students handled the material development phase, and the at-home students took part in the collaborative discussions or participated in the group work by searching the Internet for information for the learning-game design. Though a variety of interactive collaborative tools have been used throughout these iterations, it has been difficult to find tools that can replace the physical materials for students working remotely. There were, however, no limitations in working with the web-based Scratch game design software for the at-home students.



Article D Figure 5: Students collaborate over videoconference with additional larger screens.

6.3 Teaching processes: The teacher's guiding metaphors and formative assessment strategies

In this experiment, there was a strong focus on involving the teachers in the learning situation to enable a cognitively complex and motivating learning process for the students. In the first iteration in Spring 2014, many of the students produced quiz games. The learning process facilitated in these quiz games was shallow; the player would not learn inside the game but had to know the answers in advance to be able to solve and win the game. Therefore, the accomplished knowledge remained at the lowest level of cognitive complexity: remembrance (Bloom, 1956). The learning processes that took place in the big Game as students designed the small games was limited to searching for questions and answers in the text. The teachers also found it difficult to identify their role in the process as students worked their way through the structured game design process. In the Spring 2015 iteration, however, the teachers were instructed by findings from the previous research and co-designed a new teaching approach. This resulted in the development and use of various concepts or metaphors (Hammer and Høpner, 2014) to guide the students in their learning-game development process. The concepts or metaphors used by the teachers as they held discussions with students can be divided into these four areas:

1) Scratch software and mind map. The teachers were introduced to (and later used) an example of a learning game in the Scratch software (Weitze, 2015b). This was supplemented with a mind map to illustrate how the learning goals were designed into the game. The game and the mind map conceptualised an example of how to enable a learning process as well as an evaluation process in a small game (equivalent to the learning design in the upper part of the Smiley Model, Figure 2). The teachers also discussed how learning goals could be implemented in game mechanics and game goals (Weitze, 2014c).

2) Narrative building and community of practice. The teachers discussed with the students how to build a narrative inside the game, represented in the small games as a small community of practice (Wenger, 2004). This simulates real-life learning situations in the small games. In the small game, the learner (through a game character) is able to learn about the learning goals in the ‘real’ (game) learning situations. This concept builds on findings from the first iteration (Weitze, 2014a), where this metaphor helped students create learning situations inside the small games.

3) Discussions about systems thinking and game elements. In the big Game, the teachers participated in discussions with the students about system-thinking/cause and effects (Meadows, 2008). In these discussions, prototypes were used to discuss how various choices in the game would have various consequences; which goals, challenges, rules and feedback would be relevant to create in the games; and how to evaluate inside the game (the game elements from the lower part of the Smiley Model, Figure 2).

4) Meta-reflections about learning goals, formative assessment and support of learning processes. Throughout the process, the teachers continually returned to the stated learning goals. They discussed and made formative assessments in collaboration with the students. According to observations and the teachers’ utterances, this facilitated a cognitively complex learning process, making the

students more conscious of the learning goals and more meta-reflective about whether they were reaching them. It also gave the students an opportunity for self-assessment: How much were they actually learning while they were engaged in this innovative learning process, designing learning games as a means for learning? Did they achieve their learning goals? The observations showed that the teacher supported the students in all three dimensions of the learning process: 1) the inner psychological process of acquisition (content dimension), 2) the interpersonal interaction dimension (collaborative learning), and 3) the willingness and desire to deal with what should be learned (the motivational dimension) (Illeris, 2007). The teachers found it easy to guide the students. They used the same approach to guide and evaluate that they would have used in traditional project/problem-based learning (PBL). Their experience and opinion was that the students had learned at least as much, but in most cases more, as they would have learned with the more traditional learning approaches the teachers normally used. The teachers found that it was easy to teach in this game-based approach and have already decided on new subject matters and themes for the next experiments. The teachers directed their attention equally to the students in class and the students at home.

6.4 The students' learning processes

The students were involved in both individual (acquisition) and collaborative learning processes. At times, the students cooperatively (Dillenbourg, 1999) divided the tasks among themselves; and at other times, they discussed and carried out the steps in a process of collaboration. According to the teachers' utterances and the observations, the work was divided among group members to a greater extent in the groups that included at-home students, whereas the in-class groups demonstrated higher levels of collaboration with more coordinated, synchronous group activity. However, according to the teachers, one notable advantage of this learning design was that students had high levels of collaboration and discussion and were involved in social interaction and learning processes with each other to a much greater extent than they had previously demonstrated (the students had been in this class for five months). Normally, the students only conversed with a few other students in class, and in the breaks they frequently sat by their computers without talking. This social development was a positive gain that contributed to a deeper learning process, based on the observation that the students had previously been quiet and did not contribute during the lessons. This enhanced engagement in social interaction in other words gave the students new opportunities to engage in conversations and debates and thereby learn with and from each other. Since some of these students had motivational issues in formal learning situations, this was an important result and finding. This high level of collaboration was the same in all three iterations of the experiment (Spring 2014–2015).

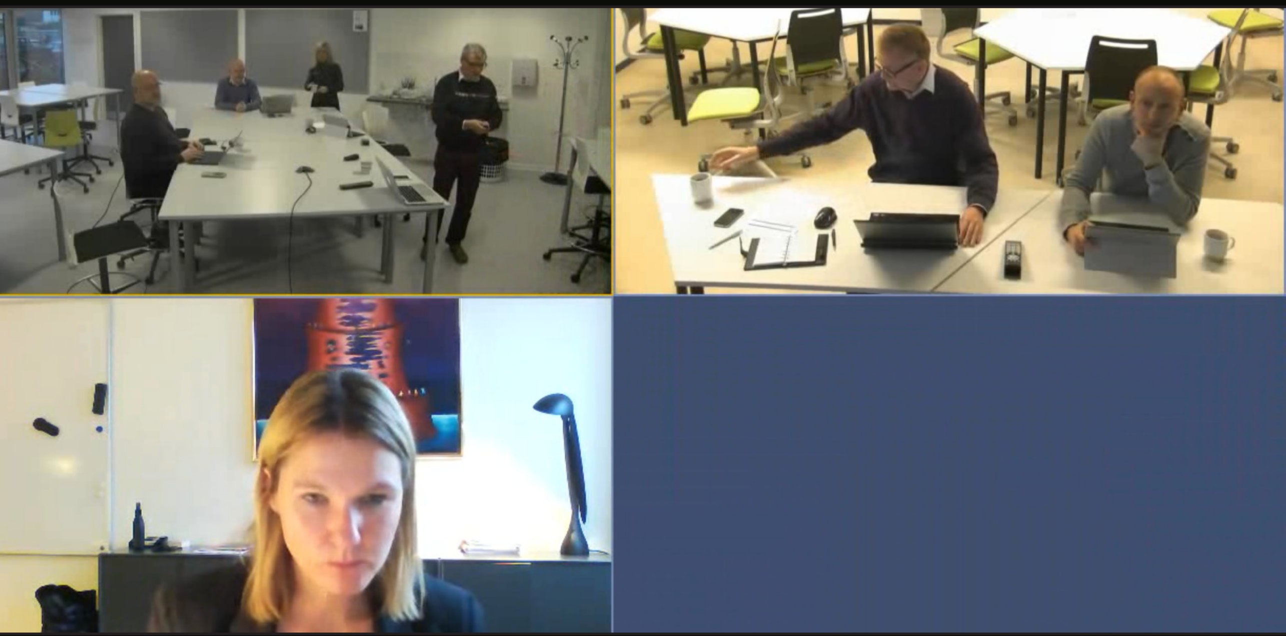
Pedagogical approach: In the first iteration (Spring 2014), students worked with the game design process as an evaluation of subjects from prior lectures. In this third iteration, the teachers agreed on a project-based learning approach (PBL) in which students engaged in a learning process: students were presented with a problem and asked to apply reasoning, questioning, research, and critical thinking to find a solution to the problem (Liu, 2006). The PBL approach resulted in a more cognitively complex learning process for the students, as they spent a great deal of time searching for reliable and relevant sources and thus learned about the subject in the process. Students also discussed how to implement their research in appropriate learning situations and trajectories inside the small games; this was, according to the teachers and the students themselves, a vital contribution to their deep learning process. In this process, the students became their own learning designers (Selander & Kress, 2012), and the analysis of the students and teachers utterances suggests that these meta-discussions about learning design contributed to their understanding of their own learning processes as self-directed learners (Weitze, 2015a).

7. Conclusion

This design-based research experiment brings us one step closer toward creating a reusable gamified learning design for adult students working in teams to create curriculum-based digital learning games. The goals for this learning design was to provide the teams themselves with a good learning experience by challenging them to design learning games as well as to challenge the teams to design games that provide good learning experiences to those who will eventually play them. Consequently, the maker-culture and its potential constructionist pedagogical approach learning-by-creating can also be used in formal learning situations with adult students, enabling motivating and cognitively complex learning processes. The big Game - the gamified learning design - supported the students as well as the teachers through four parallel types of processes for designing and learning: 1) the structured game-design process, 2) concept-building processes in which prototypes served as materials for learning, 3) teaching processes in which the teacher’s learning- and game-inspired metaphors were used to support the learning processes in the big and small gamified learning designs, and 4) the students’ individual, collaborative, and motivational learning processes. The teachers found it easy to support and evaluate the student’s learning processes with the help of concepts and metaphors guiding the students in their learning game development process. The teachers observed an increase in socially engaged interactions among the students, a fact that contributed to more cognitive complexity and learning processes with more collaborative activity. The students’ movement through the big Game evolved from a rule-based approach (Ludus), sticking to the rules and levels, towards a more sandbox-like approach (Paidia), with some of the teams moving more freely and taking their own paths while creating the small games. This suggests a movement away from a more extrinsic motivation to participate in the gamified learning process among some of the students towards a more intrinsic motivation to design learning games. The learning design corresponds well with a constructionist and project-based pedagogical approach. Parts of the gamified learning design still need tweaking, and future studies could examine whether this design can be scaled up and reused with new students and teachers. It would be interesting to test in the future. Smaller experiments with younger children already indicate that they, too, can benefit from learning through designing curriculum-based digital learning games. This learning design can work in a hybrid synchronous learning environment, as the project has demonstrated. There have, however, been limitations in the work regarding access to physical materials for students participating from home; the classroom students have primarily conducted work requiring the use of physical prototypes. It is nevertheless equally possible for students in class and at home to work with the game design software. That said, though Scratch (2015) gives possibilities for sharing content and copying each others projects in order to learn, development of game-design software that afforded extended types of co-creation would have potential in this hybrid synchronous learning environment, since this would give opportunity for more collaborative learning processes for students in class and students at home.

END ARTICLE D

Pedagogical Innovation in the Organisation



10

CHAPTER 10. PEDAGOGICAL INNOVATION IN THE ORGANISATION

This chapter presents theoretical and empirical perspectives on how VUC Storstrøm as an educational organisation engaged in the development and implementation of the Global Classroom and supported this pedagogical innovative learning environment over the three years of the design-based research project. In this chapter the sub-question for the organisation was investigated:

> **Q3:** What are the educational organisation's opportunities and responsibilities in relation to change, implementation and anchoring of IT-based and digital-video-mediated educational programs?

The question was examined through the design-based research project in numerous formal and informal interviews with the administration, teachers and students, as well as through workshops (Appendix A).

10.1. THEORETICAL AND EMPIRICAL BACKGROUND FOR RESEARCH ON THE ORGANISATIONAL SUPPORT FOR THE INNOVATIVE LEARNING ENVIRONMENT

According to the findings in Chapter 7, pedagogical innovation was important for the educational institution when it introduced educational technology that challenged existing pedagogical approaches and motivating learning strategies. But the project also found that an educational institution consists of many small communities of practice, and the goals (reached with the help of tools, rules and division of labour) that were meaningful for one group were not necessarily meaningful in the same way for another group. However, since goals are objects of interpretation, sense making, ambiguity and surprise, the goals for the various groups could potentially be changed, and the goals were negotiated in and between the groups (Engeström, 2001, p. 134).

To return briefly to the connection between work, innovation and learning in the teacher's daily practices, innovation on a small scale is a part of the teacher's daily practice, as discussed in section 8.1.5; teachers must constantly improvise in teaching situations that turn out differently than planned (Schön, 1983; Dewey, [1933] 2009). Teachers go through assimilative and accommodative learning processes as they adapt their teaching approaches (Piaget, [1952]1965). If the adaptation to the new situation is so big that it changes the teacher's worldview, it may involve transformative learning processes. Therefore innovation and learning are inherently part of the individual teacher's daily practice whenever unplanned events occur. These small-scale (incremental) innovation processes traditionally take place at the individual level in most educational institutions, and though they may not be written in the job description, they are part of the administration's expectations for the teacher. As discussed in Article B, the innovation turns back to being knowledge for the teacher when he or she "think backwards" and *unravels the learning trajectory* to the new solution or invention. This "unravelling" will, most likely, make the new strategy possible to repeat and thus turn it into knowledge again.

The teachers' experiences in this project were that these traditional individual learning processes were not enough. Lacking support for the pedagogical innovation process when teaching in the hybrid synchronous learning environment, they co-developed the IT-pedagogical Think Tank for Teacher Teams. As they worked within this thinking and acting technology, the teachers developed a common theoretical/conceptual pedagogical language and conducted informed ideation processes and experiments. The Think Tank functioned as a new organisational learning design promoting structured pedagogical innovation. The teachers managed to transform non-knowledge or problems into ideas and pedagogical innovation and then back into new anchored knowledge for the team. The remaining challenge was to create support for this to continue – to anchor this new community of practice and to create a structured means of disseminating the new knowledge to the entire educational organisation. The crux was this: "*The means to harness innovative energy in any […] organization must ultimately be considered in the design of organizational architecture and the ways communities are linked to each other*" (Brown & Duguid, 1991).

10.1.1. EDUCATIONAL POLICY

In order to discuss how pedagogical innovation can be designed into the organisation, it is relevant to briefly define *policy*. Policy can be understood as intentional attempts by members of one group to influence the practices of members of another group; this can occur at the federal, state and local levels (Coburn & Stein, 2006). Within the context of the educational institution, policies can be imposed by legislators, for example, or by a particular school administration. When the researcher looks for signs of policy, he or she will look for phenomena that are intended, created, enacted or implemented, and these phenomena will be studied in reported intentions, actions, processes and texts (Gulson, Clarke & Petersen, 2015). Policies can be analysed as simple methods or metaphors, depending on which theories are used for the analysis. The result of someone's intentional educational policies and practices can therefore be considered a product of design like other artefacts, and *education* can be regarded as a collectively designed human system (Koh, Chai, Wong & Hong, 2015). Schools are designed for functionality; their goal is to provide fertile learning environments for students. Educational policies can therefore be viewed as learning designs that envision forms of desirable practices that, when used by administrators, will provide support for teachers and provide the backdrop for students' learning goals (Cobb & Jackson, 2012).

In some cases, political and value-based considerations are behind the decision to invest in technology. The politician or decision-maker who envisions which educational issues the technology will resolve may, however, be out of step with the experiences and needs of the professional practitioner who will actually use the technology. Therefore decisions about technological investments are not always attuned between the group deciding to invest and the group that has the daily responsibility to (re)design the practices and assignments in the profession influenced by this technology. The lack of attunement can create effective new visions and possibilities, but it can also create conflicting interests and understanding, resulting in inexpedient investments in technology that end up creating more work without creating more value (Hasse & Storgaard Brok, 2015). Because politicians and decision-makers do not always have the same understanding of the context as the teacher at school, the logical solution is to establish a procedure to discuss these investments with practitioners and test them in small pilot projects before deciding upon a major investment and thereby changing a profession's working conditions.

The groups in an educational institution (teachers, administrators, IT-Pedagogical team) are small communities of practice with different relationships and dependencies (Wenger, 1998). Learning, interpretation of meaning and accepted policies are negotiated within and between these communities of practice. As learning and interpretation take place not only inside an individual's head (Piaget, [1952]1965) but also among the actors in the communities of practice, learning and negotiation enter into an area of potential conflict (Elkjær, 2012, p. 327). The social structures in a community of practice – its power relations and its conditions for legitimacy – therefore define the opportunities for learning and interpretation (Gherardi, 1998). This means that the opportunity for the whole organisation to learn from its various small communities of practice and make common decisions – about innovative learning practices and investment in technology, for example – depends on these power relations and conditions for legitimacy and the will to listen, learn and act.

10.1.2. MANAGING CHANGE AND ANCHORING

VUC Storstrøm has a bright and active project management team. A continuous stream of new ideas are visualised, initiated and effectuated. This was the case before the Global Classroom project began and continues to be true. In addition to other government-initiated changes, these projects, large and small, affect the whole organisation, meaning that VUC Storstrøm is an educational institution in constant change. This demands *change management* (Lewin, 1958). In relatively stable organisations that face episodic changes, the focus of change management is to prepare the organisation so it is ready for the changes (Weick & Quinn, 1999). But in most organisations today, the permanent condition is one of continuous change. This demands a different kind of focus in change management, or perhaps this should be called *anchoring management* (Høpner, Jørgensen, Andersen & Sørensen, 2010). Traditional change management works with the condition that every social system has structured systems and norms that can be experienced as barriers that hinder necessary changes in an organisation. Although to some extent this still may be the case, it is important to be aware that members of an organisation in continuous change have gradually come to regard change as part of their jobs. Therefore, the managerial assignment now becomes to focus on transparency and clarity and to create and disseminate a common picture of what is going on (Høpner et al., 2010; Weick & Quinn, 1999). This demands managerial awareness and communication about what has changed, or what new innovations have been developed by teachers and other staff members, in order for the entire organisation to benefit from these new initiatives. Management must take responsibility for coordinating these changes or innovations across the different communities of practice and providing a common transparency, clarity and a shared outlook. The creation of this kind of dialogue and transparency calls for a manager who demonstrates great respect for and trust in the members' own judgment (Høpner et al., 2010). The manager's role therefore changes from being the primary force behind the changes to being the listener and the communicator who creates meaning, common direction and anchoring for the changes. The change and anchoring manager must detect, locate and interpret the new patterns that emerge from the innovative practices and devise ways to implement small changes in the rest of the organisation (Weinreich, 2014). The common understanding can be modified through new language, an improved dialogue and removal of potential barriers to improvisation, knowledge transfer and learning (Høpner et al., 2010). One way to anchor changes can be though new educational policies.

10.1.3. THE LEARNING ORGANISATION – EDUCATIONAL POLICY AS SUPPORTIVE LEARNING DESIGNS

Based on previous research and their own studies, Cobb and Jackson (2012) suggested approaching educational policy from a learning design perspective. If a new policy is proposed as a desirable change for the educational institution, administrators can regard that policy as a learning goal for its members. The task is then to create learning designs as a means and an analytical strategy for bringing about and anchoring the desired change. These learning designs thus facilitate formal *professional learning* for teachers and administrators through the teaching and learning practices in the educational organisation. This approach shares similarities with the processes of planning learning goals, learning processes and evaluation processes in traditional learning designs for students (Hiim & Hippe, 1997).

Cobb and Jackson (2012) focus on three components of a policy that can support changes in practice through the planning and evaluation of the interventions: 1) the *what* of policy: learning goals for the learning of members of the target group; 2) the *how* of policy: what kind of support is provided for that learning; and 3) the *why* of policy: making explicit an often implicit rationale for why the support might prove effective (Cobb & Jackson, 2012).

So *how* can the implementation and anchoring of change/policy be supported? If new policies or learning designs for the educational institution are to be effective in supporting consequential professional learning, the policies often will involve combinations of the following: 1) New positions: new positions in the organisation that provide expert guidance, perhaps also in the form of shared responsibility as members receive new responsibilities and other responsibilities are positioned differently. 2) Learning Events: professional development characterised by ongoing, intentional learning designed as a series of meetings with extended duration that build on one another. These events should offer collective participation and active learning opportunities with more knowledgeable others, and the focus should be kept on problems and issues that are close to practice. 3) The introduction of carefully designed organisational routines: this can be an important means of supporting learning and turning the new practices into part of daily life. 4) Attention to the use of tools: tools can be used to bridge to practice (that is, material entities used instrumentally to achieve a goal or purpose) in a process of reification (Wenger, 1998, 2010; Section 6.2.3).

This learning design approach also makes it possible to identify potential limitations of educational policies before they are implemented and to inform the formulation of empirically testable recommendations that suggest how policies could be adjusted to make them more effective (Cobb & Jackson, 2012).

10.1.4. LEADING THE ORGANISATION THROUGH INNOVATIVE TEAMS

For example, one mission of an organisational policy might be to create an educational environment that is agile and continuously innovative (the *what* of policy). According to research from this project, this would involve creating an organisational learning design in which teachers and administration implemented the IT-Pedagogical Think Tank for Teacher Teams and disseminated the teacher teams' continuous innovations for the hybrid synchronous video-mediated learning environment. To reach this learning goal, the administration would have to create new practices, such as leading innovative teams or innovative communities of practice in the organisation.

One key point when leading these teams was to consider how the organisation could benefit from the new knowledge the teams created (Brown & Duguid, 1991). The knowledge that was created in the teams working in the IT-pedagogical Think Tank was partly tacit knowledge, and tacit knowledge is not an object that can be stored, owned or moved around like a piece of equipment or a document. But communities of practice provide "a social forum that supports the living nature of knowledge" (Wenger, McDermott & Snyder, 2002, p. 12). If the whole organisation is to benefit from the knowledge in its communities of practice, those communities need to be cultivated actively and systematically (Wenger, McDermott & Snyder, 2002). An organisation's administration can do a lot to create an environment that helps communities of practice grow and prosper. This includes explicitly valuing what the communities of practice do, encouraging participation and removing barriers for participation, and allocating the time, scheduling, space and other resources needed for their work (Wenger, McDermott & Snyder, 2002). This also involves considering ways in which these communities can be integrated into the organisation by "giving them a voice in decisions and legitimacy in influencing operating units, and developing internal processes for managing the value they create" (Wenger, McDermott & Snyder, 2002, p. 13). These communities may still exist even when an organisation fails to take active steps to cultivate and support them, but they will have less impact and will fail to contribute all they could.

10.1.5. IS THE NEW KNOWLEDGE TAKEN INTO USE – AND SHOULD IT BE?

Alvesson and Spicer (2012, p. 1213) wrote provokingly about how it is *assumed* that putting knowledge to work intelligently is the essence of what organisations do in order to succeed. Institutions are interested in improving through innovation and the creation of new knowledge, and some claim that the tacit and local knowledge of all members of the organisation is the most important factor in success and that creativity creates its own prerogative (Clegg, Courpasson & Phillips, 2006, p. 205). For an educational institution, this means creating better and more motivating learning possibilities for students and working possibilities for teachers and administration. The question is whether the new knowledge is actually used by the organisations or if it becomes a victim of *functional stupidity* (Alvesson & Spicer, 2012). Functional stupidity occurs when an organisation ignores or works against better or newly created knowledge. The term is contradictory; *functional* indicates the potential benefits. When we fail to recognise the incompleteness and uncertainty of our knowledge in dealing with new or complex tasks, the *functional* aspect comes into play as a mechanism for controlling doubt and coping with uncertainty. Functional stupidity can be used to make things work the way they always have, facilitating smooth interactions within the organisation. “Being clever and knowledgeable is fine and necessary, but so is refraining from being reflexive, avoiding asking for justifications for decisions and structures, and minimizing substantive reasoning about values and goals” (Alvesson & Spicer, 2012, p. 1213). Functional stupidity can help the organisation and individuals produce known results. But if the gap between existing knowledge and new knowledge – how things could be done more effectively and with better outcomes – becomes too wide, there is a risk of creating a sense of dissonance, and problems can occur. According to Alvesson and Spicer (2012), functional stupidity is not created through intellectual deficits; it is created as a result of political expediency and the operation of power. This can happen, for example, if one group within an organisation intentionally does not listen to other groups’ knowledge about problems that need to be addressed, or how things could be done in better ways with the new knowledge at hand. This can also happen if new knowledge is intentionally not disseminated and incorporated into daily practices, thereby preventing the results that the innovation and knowledge creation initiatives were intended to achieve. In this sense, structures of control “can work by limiting or constraining the use of knowledge and rationality” rather than “producing” knowledge (Alvesson & Spicer, 2012, p. 1214). Therefore the task for many managers is “to strike a balance between the intelligent use of knowledge,” encouraging reflexivity, substantive reasoning and justification on the one hand, and “propagation of functional stupidity on the other” in order to facilitate “smooth interactions in the organization” (Alvesson & Spicer, 2012, p. 1216).

This theoretical concept of functional stupidity is, of course, a provocation; it should be viewed within the context of the preceding discussion of how to create transparency, clarity and a common picture of what is going on in an institution and in the context of the theories of how to create policies as learning designs that enables implementation of new knowledge. Conscious and continuous change and anchoring can be difficult to effectuate in an educational institution. But if the administration is willing to analyse the organisation, looking for patterns of inertia or difficulties in applying new knowledge, they may find "blind spots" in the organisation and contemplate on whether elements of functional stupidity also are part of the game.

10.2. THEORETICAL AND GROUNDED ANALYSIS OF KNOWLEDGE DEVELOPMENT THROUGH INNOVATION, LEARNING AND ANCHORING IN THE ORGANISATION

The following analysis is based on empirical data from observations and co-design processes with teachers and students and more than 250 formal and informal interviews with participants from all three actor groups during the three years of the project (Appendix A). Furthermore, a final workshop, organised with the IT-Pedagogical Think Tank as a framework, was conducted in December 2015 with representatives from the various groups or communities of practice: teachers, the involved principals (the heads of education and development at Næstved and Nykøbing VUCs), the IT-Pedagogical team, the project development head, the development consultant, the chief operating officer (responsible for pedagogical development at VUC Storstrøm) and the IT-support staff (interviewed before the workshop). The workshop addressed the question: What are the educational organisation's opportunities and responsibilities in relation to change, implementation and anchoring of IT-based and digital-video-mediated educational programs? VUC Storstrøm had considered this question in depth throughout the project. They had created a vision for a three-step teacher professional development process for the Global Classroom teachers in co-design processes with the PhD project, and the first two steps of this vision had been carried out with two groups of teachers. VUC had come a long way in change processes, creating new knowledge about how VUC Storstrøm enacted the Global Classroom. This workshop aimed to clarify and create new cross-disciplinary knowledge about the participating actors' experiences of the new knowledge that had been created and the strategies VUC had used to anchor the project; the workshop also aimed to investigate whether further steps could be taken. Individual participants were initially asked to contribute to the creation of a shared "resource and problem bank" in the agile software development tool Trello (2016) by writing up their individual experiences before discussing them in the cross-disciplinary group at the workshop (point S, Article B Figure 2).

10.2.1. CHALLENGES FOR THE ORGANISATION

> The Global Classroom is the largest project that has been initiated at VUC in all the time I have worked on projects here. Besides being a huge project, it has also ivolved so many procedures – if we had known this in advance, we might have stayed away! […] We did not know the needs for competence development in advance. I am not sure that VUC Storstrøm, and myself in particular, were entirely able to anticipate the types and quantities of competence development we needed when formulating the Global Classroom project. We walked, as you know, on untrodden ground. […] It's also about asking the right questions –

> otherwise, we don't know what we're doing, or what we should be doing. (Head of project development at VUC Storstrøm)

The reason for creating the Global Classroom project was introduced in Chapter 1, but there were also personal reasons and beliefs behind the aims of the project at VUC Storstrøm. The head of project development desired to create a school that was more interesting and fun than the "boring" school he had attended as a child, and all the projects he planned had this positive vision as background. The administration at VUC Storstrøm decided to aim high and buy equipment for the Global Classroom project. Therefore, this project was initiated by the administration, as are many other educational technology projects (Hasse & Storgaard Brok, 2015). Having the Global Classroom as a new learning environment had an impact for almost all of the actors at VUC, with the consequence that pedagogical innovation became a premise of daily life in the organisation. This change required an internal policy or strategy inviting a different view in which learning and innovation were more in focus. The institutional policy statement therefore also encompassed aims to "ensure VUC Storstrøm employees have updated skills so they can match their assigned tasks" (VUC Storstrøm, 2014, p. 15).

10.2.2. LOSS AND GAIN OF COMPETENCE

When starting a project with many new demands, an organisation will initially experience a drop in competence; this was especially challenging for the VUC teachers but also, to a considerable extent, for the IT department. Many employees put a great deal of effort into getting the Global Classroom to work. The changes were demanding, and the new learning environment impaired teachers' and technicians' professional competences and daily practices, leading to frustration (Laurillard, Oliver, Wasson & Hoppe, 2009). This PhD project worked primarily with the teachers' professional development, but, according to interviews, the IT-support team also needed time and support for innovation and competence development with regard to the Global Classroom. The teachers, management, IT-support team and IT-pedagogical personnel experienced this competence gap differently in their individual communities of practice (Wenger, McDermott & Snyder, 2002). According to the interviews, the administration experienced that the teachers, to some extent, resisted change, and that many teachers did not use their professionalism to develop new pedagogies for the new learning environment. The teachers experienced a top-down, administration-mandated change that incorporated educational technology to which they had to adapt. In spite of the competence development offered, the teachers often found it overwhelming to experiment with and change their learning designs on their own and felt that they did not have the time and knowledge to do so. The teachers were also disappointed that they were not involved in the professional discussion that led to the procurement of the expensive equipment. The IT-pedagogical team and the IT-support team felt that their hard work in creating courses for teachers and supporting the Global Classroom was not appreciated.

Although there are still difficulties, the impression when talking to organisation members after three years with the project is that many new competences have been developed. According to the interviews with teachers and administration, integrating educational technology into the teaching practices is no longer a major problem; technology has become a natural tool, though it still offers intense challenges now and then. One Global Classroom teacher described the experience as follows:

> After having been involved in the development of the Global Classroom, there is no doubt that I, as a teacher, am well equipped in a time with lots of changes in the world of education. I think the interconnection between technology and education has, to a large degree, been made possible – and not just superficially, but as an integral part.

The head of education and development at Næstved summed up the experience from an administrator's perspective: "We have obtained a lot of new knowledge about how to implement new teaching methods here at VUC Storstrøm."

The development consultant described several of the project's accomplishments:

> We have created a systematic competence development, Step One, for new teachers in classes that use Global Classroom, and we have experience in some teams with use of the innovation model [Step Two[21]] with a series of workshops for competence development that we would otherwise not have held in-house with our own instructors. […] The IT-pedagogical team has acquired deep knowledge about the complexity of video conferencing and "translation" of the same to a usable user-interface. In addition, the teachers have several years of experience in the planning and execution of teaching in Global Classroom.

Finally, a member of the IT-pedagogical team that participated in the IT-Pedagogical Think Tank meetings/practices made this observation:

> It is important to have structured "reflection on action" methods and time to capture and adjust the competence development needed. Some competence development needs become apparent only after a teacher is in practice. Many projects work in the same way. So perhaps the teachers' preparation should specifically deal with how best to navigate the unknown and how to use team or partner structures for support. In addition, they should learn how to conceptualise the challenges encountered and how to move between the meta-level and practice so they can be more specific in terms of what kind of help they need. Through the expanded common conceptual and theoretical starting point [in the IT-Pedagogical Think Tank], the teachers could better formulate new ideas and be innovative. This creates "walls" that the brain can play ball up against – a ball which can be caught by others.

---

[21] At VUC Storstrøm, the IT-Pedagogical Think Tank framework also had other names: Step Two, innovative teams and reflexive teams.

10.2.3. NEW CROSS-DISCIPLINARY PRACTICES

The hybrid synchronous video-mediated learning environment created bigger changes in cross-disciplinary practices between various groups in the organisation than previous projects had done. In studying the elements that were part of the learning designs for a hybrid synchronous video-mediated learning environment (section 9.4.8; and Table 3: Bower et al., 2015), it was clear that the traditional educational encounter between the teacher at the blackboard and the students with paper and pencils at their desks had changed. The learning design now involved a re-design of pedagogical approaches, new movement patterns in the classroom, various types of hardware and software, administrative booking of specific rooms, maintenance, prompt error corrections from the IT-support team and communication and competence development with the IT-pedagogical team. Since the Global Classroom was untrodden ground, it was difficult to predict what was needed. Existing research presents many examples of educational situations in which a “technology navigator” is permanently dedicated to video-mediated lessons and is present or nearby at all times (Cain, 2015; Bell, Cain & Sawaya, 2013; Hedestig & Kaptelinin, 2005). Reasons for this are many, but one major reason is that “if the light goes out there is no show”; if the videoconference equipment fails, the students at home cannot participate in the learning situation. The teacher must then decide whether the students in class will have to wait while the technical error is addressed in order to help the remote students. At VUC Storstrøm, the intention was that the Global Classroom would be integrated into the organisation’s daily work processes after the project period, with extended attention and support, expired. This meant that many of the practices in and around the Global Classroom became one of many other tasks the various communities of practice had to deal with as part of their jobs; there were no longer specifically dedicated personnel. Though teachers and administration had become experienced with the practices, the turning back and becoming part of daily practice revealed that the practices in and around Global Classroom needed an extended kind of cross-disciplinary understanding from many of the actors. These cross-disciplinary practices still had to be traced, pointed out and re-designed.

> [You say that] the teacher should expect the technology to work when she enters the room – but in fact, I think in a project like this, all teachers need to be partly technicians, and IT technicians have to be teachers – you will need to enter each other's areas to understand this strange organism that is quite different from the projects we are used to work on together. (IT-pedagogical personnel, on the Global Classroom)

The roles or positions of the communities of practice are thus redefined by the means of the technology, and it is vital for all involved parties to become knowledgeable about what this may demand of them. Though the main goal for all communities of practice at an educational institution is to create or support motivating learning experiences, this means different things for the various actors. For the hybrid synchronous video-mediated learning environment to be a successful support for students’ learning, this meant that many actors synchronously had to become aware of new cross-disciplinary responsibilities.

10.2.4. TECHNOLOGY FATIGUE - A CROSS-DISCIPLINARY RESPONSIBILITY

Stopping the innovative and inquiring approach too early and failing to identify and re-design "missing links" in the practices may lead to, what can be termed as, "technology fatigue." The teachers and students in the first Global Classroom class experienced this in 2011. Sporadic but significant technological problems in the start-up phase led to the students being so tired of videoconferencing and other educational technologies that teachers trying to experiment with new learning designs were met with technology fatigue. After this initial problematic period, students were wary of any new technology, with the result that teachers often resorted to monologue-based learning designs. Students in successive classes did not experience the same level of technical problems, and a comparison of survey results reveals that they were much more open to the teachers' experiments in creating motivating and effective learning designs. Periodic problems did continue to occur, however – for example, when videoconference equipment software was updated. The result of major technological problems can be that students and teachers lose trust in the technology, similar to losing trust in an unreliable person. Minor flaws are accepted among friends, but if your friend (the technology) lets you down again and again, you lose trust, and it can take a long time to regain that trust. Two Global Classroom teachers discussed technical flaws in the videoconference system and the inadequate support they received from the administration:

> T1: It is always like that when you talk and no one listens. Then you sometimes end up not caring!
> T2: That's terrible. We can't let that happen!
> T1: It *is* terrible, but it happens automatically if you do not get any response when you report that there is a problem and you are told, "No, it's no problem" by the administration.

It is vital to establish a cross-disciplinary understanding of the importance of prioritising to keep these technologically challenging periods as infrequent as possible. This demands a high level of responsibility, communication and action between the various involved communities of practice in the educational organisation.

10.2.5. RED BATONS, INVISIBLE GLASS ELEPHANTS AND WHITE STONES

Red batons[22]**:** The workshop with the teachers and the administration in December 2015 aimed at creating new cross-disciplinary knowledge. Participants were introduced to theories about change implementation and anchoring of new initiatives in organisations (We were

---

[22] **The red baton in cross-disciplinary practices explained:** Is the red baton handed over? In other words, how do we make something work in cross-disciplinary practices in our organisation? Examples of interconnected practices: From idea – to decision – to planning in a tool – to scheduling – to communication through technological tools – to formal expressions of interest – to collaboration through tools – to negotiation and discussion – to documentation in tools – to new action – to evaluation in a tool – to anchoring by illustrating evidence in a tool – to a new decision – and more. Or is the red baton dropped along the way?

working at Point A, [Article B Figure 2] in the IT-Pedagogical Think Tank). As a supplement to metaphoric and value-based discussions about organisations, a concept termed *the red baton* was created, inspired by practice theory that regards organisations as being built by interdependent and connected practices (Nicolini, 2012; Schatzki, 2002). The red baton concept was a practical way to focus on relationships between entities when observing dynamic, continuous and processual practices (Gherardi, 2012). Discussion of interdisciplinary practices was legitimised by having participants determine whether the metaphoric red baton had been handed over and caught by the next community of practices or whether it “fell down between two chairs” – that is, whether a task was completed successfully or was dropped before it reached its final destination. The concept encouraged the different communities of practices to reach a consensus on whether, how and when the final destination was reached, and what quality the assigned task or solution had to demonstrate in order to be evaluated as having reached the final destination. Examples of red batons dropped on the way to their final destinations included the teachers’ desire for the administration to take more control and to help schedule the innovative teams (IT-Pedagogical Think Tanks) so their meetings could be continuously effectuated; the IT-support teams’ need to be called immediately when an error was experienced in order to localise specific flaws in the system; decisions and agreements between the various management systems that were not effectuated because of missing communication within and between systems; and diverging understandings of the issues and their final destinations. Examples of red batons that were picked up and successfully delivered to their destinations included the IT-support team’s establishment of a new communication system for reporting errors, with immediate feedback on reception, improving overview of IT-error assignments and reducing repair time; and the IT-pedagogical team’s establishment of a new user-friendly webpage with pictures and clear instructions on how to use the different technologies in the Global Classroom, as well as an invitation for users to ask if more instructions were needed. The webpage made it easier to find instructions and also reduced the needed support time, as the IT-pedagogical team could answer some questions by sending teachers a link to this webpage.

Invisible glass elephants: In the many interviews during the project, a recurring theme was the disagreements that were avoided between the various communities of practice. In the workshop this phenomenon was termed “an invisible glass elephant moving around in the glass-shop.” This was meant to illustrate that though no one talked directly about this phenomenon, it was real, it was big, and it disturbed the trust and communication between the actors. The invisible glass elephant legitimised talk about issues on which the different communities of practices did not agree, perhaps due to conflicting interests in solving these matters, or perhaps because an issue was invisible for one of the communities of practice but not for another. Such discussions can also be important because invisible (though hard) work seldom is appreciated by others (Nicolini, 2012). One of the glass elephants experienced was *time*. Time in many shapes: how it was used, how much was needed, what could be expected to be done within the job’s time constrains. Time is a typical issue to negotiate between different communities of practice, but when pedagogical innovation is expected to be a daily part of working life, these additional continuous innovative practices demand additional time, and this time has to be negotiated, accepted, planned for and not suppressed.

White stones/ I dare you: The concept “I dare you” (Point E, Article B Figure 2) had become a part of the daily conceptual language for teachers and administrators who had participated in the IT-Pedagogical Think Tank. In Danish, this was termed “the white stone,” stemming from an old children’s programme in which two children continuously challenge each other – in a friendly atmosphere – to win back a white stone by undertaking difficult tasks that demand courage. This concept had become an accepted part of practice and was used to indicate that one person challenged someone else – in a friendly and perhaps slightly provoking atmosphere – to do, explore, investigate, redesign or innovate for a common cause. In the current workshop, all participants received a white stone or “I dare you” challenge to write down and mail back thoughts and issues sparked by concepts and theories from the workshop in order to further develop the common cross-disciplinary knowledge.

Cross-disciplinary discussions about redesigns of practice can aid an organisation if it wishes to use new knowledge created in innovative team processes (Alvesson & Spicer, 2012). The three concepts of the red baton, the invisible glass elephant and the white stone or “I dare you” were used to discuss, develop and re-design cross-disciplinary practices for teachers and administration in and around the Global Classroom. Though not completely unfolded through all points because of time-constraints, this workshop used part of the IT-Pedagogical Think Tank as a framework for discussions in the cross-disciplinary communities of practice. This was, therefore an example of how the IT-Pedagogical Think Tank could create new paths for collaboration in the organisation fulfilling the administrations visions for future cross-disciplinary work.

10.2.6. FIRST, SECOND AND THIRD STEPS IN BECOMING A GLOBAL CLASSROOM TEACHER

VUC Storstrøm’s administration and teachers developed guidelines and practices for studying and working in the Global Classroom. They introduced new students to the technologies and skills needed in the Global Classroom. This introduction could be repeated and adapted for use with new students. In another initiative, when the second teacher team started at a new location, the administration and the IT-pedagogical team arranged an introductory day. The new teachers learned about previous experiences in the Global Classroom and met with three experienced Global Classroom teachers who introduced potentials and barriers when teaching in the Global Classroom. Other initiatives and visions led to a three-step training process for Global Classroom teachers. Some of the Global Classroom teachers at the first school (Nykøbing) contributed to the development of the three steps through their daily experiences in the Global Classroom (a bottom-up approach), by participating in various courses and in co-design processes within the DBR project. The teachers from the second school (Næstved) completed the first two steps and disseminated their knowledge in informal ways (Step Three). The fourth step, in which the organisation designs intentional innovative learning experiences for Global Classroom teachers, had to some extent been taking place with both teacher groups, but this step was not yet effectuated as a consistent formal policy within the organisation.

Global Classroom teacher education

Step One: TPD. Step One was a traditional Teachers' Professional Development course consisting of four or five meetings planned over four to eight weeks as an introduction for teachers prior to teaching in the Global Classroom. The first step was based on the organisation's previous knowledge from video-mediated synchronous teaching in parallel classrooms, from asynchronous distance learning experiences (both started in 2009), from the Global Classroom teachers experiences, and involved the IT-pedagogical team, the development consultant and the PhD project co-designing a "Step One Global Classroom teacher education" with learning goals, learning activities and an evaluation component (Hiim & Hippe, 1997). Step One's learning goals focused on these areas:

- **Technical skills**. Teachers learned to operate various aspects of the equipment, how to move around in the room during videoconference and were asked to document these procedures for personal memorisation.
- **Pedagogical approaches.** Teachers planned short lessons for each other and took turns playing the roles of teacher, in-class student and at-home-student. Teachers created subject-specific learning designs for the new environment with a variety of pedagogical approaches: a) creation of synchronous activities for students in class and at home, b) discussions, c) group-work, and d) activities involving tools designed to provide equal working conditions for students in class and at home. Teachers reflected on potential subject-specific pedagogical challenges and considered ways to support the social climate in the hybrid synchronous video-mediated learning environment. Teachers were also encouraged to learn through observation by observing experienced Global Classroom teachers.
- **Student guidelines.** Development of guidelines for students studying in the learning environment.
- **LMS strategies.** Teachers were assigned to create strategies for using the learning management system (LMS) and the screen sharing system.
- **Communication planning.** Teachers met with the IT-support team to create shared rules for handling communication and responsibilities in case of system errors.

These learning goals and activities were intentionally designed to address the challenges that had been experienced in the new learning environment (Chapter 8). This Step One course is an example of how complex problems experienced by the organisation early in the project were turned into new knowledge that could be disseminated to new Global Classroom teachers. As the organisation will continue to have new experiences and will continue to develop innovative uses of technologies in the Global Classroom, Step One will continue evolving along with this new knowledge, making this training even more effective for teachers new to the Global Classroom. The PhD-project was involved in the planning of this course based on the previous research, but was not involved in the IT-pedagogical team's conduction of the course with the teachers.

Even with the Step One training, a need for further competence development became evident as new problems arose in practice (Chapter 7). Those problems led to the formation of the Think Tank, which constituted "Step Two". The IT-pedagogical team member who followed the Step Two education (The IT-Pedagogical Think Tank) formulated the characteristics of Step Two like this:

> It is both problem-solving and qualifying to work with the pedagogical think tank – in a reflexive team. Learning from your colleagues in an inquiring community is a very strong and promising tool. It is not expert knowledge from above but instead draws on and develops from the teachers' existing skills and experience. A movement between the general and the specific – some common cause that forces participants to see others' perspectives, and then something specific which both requires that the teachers internalize their knowledge and also transforms new knowledge into negotiable practice competence. It is important to have a shared conceptual world to be able to talk about new knowledge and/or discuss/explore issues and thereby achieve new skills. That is, it is important that the community learns about the same concepts.

This quote emphasises that the characteristics of this new community of practice differed from those of a traditional teacher team. Competences were developed, but not through the help of a more knowledgeable other, as in traditional teacher professional development courses. The teachers created new knowledge together in practical, subject-specific and individual learning processes as well as through discussions of more general pedagogical issues (Illeris, 2007). The teams' creation of common theoretical concepts contributed to the development of new relevant skills and the opportunity to explore problematic issues.

Step Two: ITP4T. The IT-Pedagogical Think Tank for teacher teams (Chapter 8, Article B Figure 2) was the second step in the Global Classroom teachers' training. This was a new kind of competence development in which the teachers, in a structured and continuous way, were supported in developing their own competences, bringing their professional competences into use in a shared new practice. Step Two answered the need for adaptation to continuous changes in the organisation by offering an opportunity to innovate and create new knowledge in a community of practice. This new community created new knowledge about general and subject-specific pedagogical issues involving educational technology with the purpose of creating effective and equitable learning possibilities for students in class and at home. The teachers used a flexible teamwork format which allowed for to participation at school or from home over videoconference; this made it easier to meet. A potential weakness of the Step Two competence development is the time commitment required. According to Næstved's Head of Education and Development, however, the time investment was well worth the value the organisation experienced from the creation of these innovative teams.

> For me it has been quite another thing to observe this space than to look into regular team meetings. A *completely* different dynamic. It is a feeling that some pieces are really being moved, not just moved around on the table and ending up in the same place. I really think so. Not to belittle our other meetings, because

> people are conducting them in goodwill, but I just think – because I have been observing here, therefore I think there is a difference. […] The reflexive teams have really made imprints on my/our way of thinking about competence development. We have been provided with theoretical frameworks when we've discussed competence development or development in general. Theoretical considerations are traditionally something that moves into the background among those of us who have to "make it run." But it really enriches work with exactly that – that one gets wider frames of reference, and it means that we can develop further in a more serious way. I am talking about both teachers and management!

This quotation indicates that in working with these innovative and reflective practices (ITP4T), the educational institution experienced efficient new methods for dealing with relevant challenges that had previously been difficult to master.

Step Three: Expert workshops and guidance. This step, involving teacher workshops in which experts from the Think Tanks would disseminate their new knowledge, had taken place in informal ways. Establishing this step as a new routine in the organisation, however, was still at the conceptual level. If the organisation is to benefit from the new innovative, theoretical and practical knowledge created in the innovative teams, it must create clear strategies for how the knowledge can be intentionally disseminated to other relevant members of the organisation (Brown & Duguid, 1991; Cobb & Jackson, 2012; Nonaka & Takeuchi, 1995). The knowledge created by the teachers in the IT-Pedagogical Think Tank was relevant not only for other Global Classroom teachers, but also for all other teachers in the organisation; many of the new learning designs involved educational technology that could also be used in traditional brick-and-mortar teaching situations (Lowes, 2008). But the teachers also had a new approach concerning how to involve technology in their teaching practice from which other teachers and the IT-pedagogical team could be inspired. According to the administration, team development was on their agenda for the future. The head of Education and Development, Næstved, talked to the teachers in the evaluation following the IT-Pedagogical Think Tank workshops.

> The reflexive team conquers the galaxy! This technique can be used for everything; the skills that you have can continue to grow and be used for all sorts of things. The only constraint is that we have just 24 hours a day and you have to teach as well. That's the limitation that restricts what the innovative teams can be used for [...] Your skills will reach far into the many different tasks that we have as focus areas in our strategies for teaching. VUC can set you [the teachers from ITP4T] in everywhere, not only for the electronic and IT-related things you have discussed. What you have talked about gives suggestions for everything. The next step will be to answer the question: How do we proceed?

Several of the teachers identified a need to anchor and disseminate the new knowledge at VUC. The teachers' suggestion was to establish open workshops for one hour a week at a specific time (Fridays from 8–9). Here all teachers would have the opportunity to meet and learn from each other. A continuous practice like this, with various participating teacher teams, could establish common ground and create foundation for a community of practice for community of practices. Since well-designed communities of practice are forums that support the "living nature of knowledge," these types of new practices could support sharing of tacit and explicit knowledge (Wenger, McDermott & Snyder, 2002). One suggestion about how to disseminate the new knowledge in Step Three was to make the individual teachers experts in the subjects for which they had been "primary investigators" in the IT-Pedagogical Think Tank. "We could, for example, document and disseminate this by making small videos with each individual teacher's new innovations and ideas. Then it would also be available for everyone to be inspired by, independently of time and place" (IT-Pedagogical Team member). These suggestions were approaches to anchor, document, disseminate and share the new knowledge created by the teachers in the organisation (as described in Point D, Article B Figure 2).

10.2.7. THE NEED FOR A FOURTH STEP TO ANCHOR PEDAGOGICAL INNOVATION

> The administration should also have a white stone ["I dare you"] from us. When we are asked to do something, we do it. Then, when we have done something, no one knows. This is disheartening. The administration should also be involved in this. I have a great desire for the new things being developed in the projects to become generally known and embedded in the organisation (Teacher participating in the IT-Pedagogical Think Tank).

The administration at VUC Storstrøm initiated the innovative hybrid synchronous video-meditated learning environment, making pedagogical innovation a necessary part of teacher's daily work and demanding new types of competence development. The teachers had embraced this innovative attitude, as they felt empowered by working in the new innovative community of practice. But this meant that the change initiated by the administration when they introduced the Global Classroom project now returned to the administration in the form of a need for a Step Four. If the administration's aim was to support the new innovative communities of practice, their assignment in the fourth step was to take the initiative in structuring, nurturing and leading the three other steps (Wenger, McDermott & Snyder, 2002). This fourth step would be necessary to answer the research question in the PhD thesis in order to support the new innovative practices that had been co-designed with the teachers. In their evaluations, several of the administrators at VUC Storstrøm expressed an intention to support the development of more teamwork at VUC in the future.

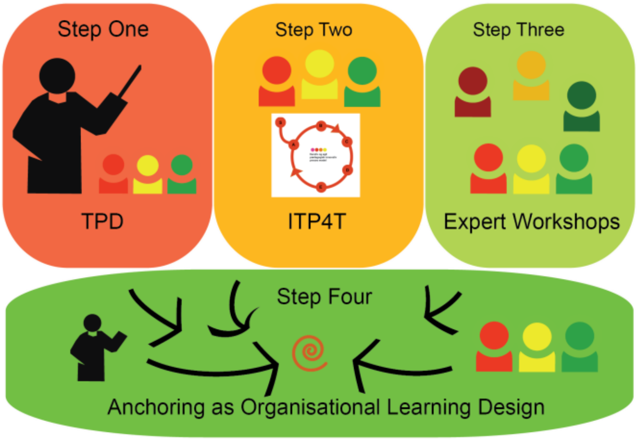


Figure 37: Four Step Organisational Learning Design.

If this fourth step was effectuated to permanently support Steps One through Three, it would be an example of how the administration in an educational organisation that is undergoing continuous change has an altered role that goes beyond merely initiating changes. The administration would become an *anchoring management* that detected, located and interpreted the new patterns that emerged from the innovative practices (Høpner et al., 2010). The teachers' current practices did not allow them to establish and prioritise innovative teams on their own initiative; this was a management decision and required administration-directed prioritisation. For this four-step organisational learning design to become a reality, the administration must enable knowledge creation and knowledge sharing by providing the necessary scheduling, time resources and attention; administrators must also nurture and value what the teachers create within these innovative practices (Wenger, McDermott & Snyder, 2002). New practices (Steps One to Four) must be designed to fit with existing practices (Schlager & Fusco, 2003). In VUC's case, this design element was inherent, as the new practices had been co-designed by teachers who were already part of the existing practices.

The study used Cobb & Jackson's framework (2012) to analyse how Step Four could be introduced into the organisation as a learning design or a policy, which revealed that many elements had already been proposed in the competence development experiments (section 10.1.3). To elaborate upon how all three steps could become part of the Fourth Step of competence development in an organisational learning design would require considerable space, but in brief, Step One was a more traditional Teacher Professional Development (TPD) course of the type the IT-Pedagogical Team was used to conducting, so this step was already part of the organisation's practice. Step Three, the one-hour weekly workshops, could be developed in co-design processes between teachers and administration and implemented. Step Two could become a continuous practice that is anchored and nurtured within the organisation, but the administration would have to propose how this new policy or organisational learning design would work. This would include the following components (Cobb & Jackson, 2012; section 10.1.3):

1. **Expert guidance, new positions and responsibilities:** In the development of the IT-Pedagogical Think Tank (ITP4T; Step Two), two different approaches were tried to educate experts who could then provide future guidance. 1) The first teacher team were given a test after the workshops. In this test, they introduced new teachers to their own version of the IT-Pedagogical Think Tank. Letting teachers teach other teachers in this manner would be an authentic way to disseminate the model. 2) In the second iteration of the Think Tank, a member of the IT-pedagogical team participated in order to be able to disseminate the model to new teacher teams. For this expert guidance to be effectuated would demand that these teachers and/or the member of the IT-pedagogical team be assigned new positions and responsibilities. Both parties were interested in and qualified to do this. Neither of these strategies was re-used by the management.
2. **Learning Events:** The IT-Pedagogical Think Tank was already constructed as a series of teacher professional development (TPD) events or, perhaps more precisely, Teachers' Professional Innovation Development (TPID) events, with extended duration, collective participation, active innovation and learning opportunities with more knowledgeable others (the team itself) and with focus on problems and issues close to practice, as advised by Cobb and Jackson (2012).
3. **Organisational routines:** The IT-Pedagogical Think Tank was carefully designed in co-design processes with the teachers. The thinking and acting technology was designed as an organisational routine that could support innovation and learning in the organisation and be turned into new practices as part of daily life. The teachers suggested that the workshops be held 4-5 times twice a year, this would require scheduling and prioritisation. When participating in the teams, the teachers held new positions as "students" in the organisation; enabling them to attend the two-hour meetings required the administration to practice the same type of scheduling and prioritisation they used for other students. The routines would have to encompass training new teachers in the model as well as maintaining the existing teams. In the experiments, the principal participated for ten minutes in each team meeting. This enabled the principal to have access to and benefit from the tacit and explicit knowledge created and shared in the innovative team; and the principal nurtured the team by explicitly valuing what they did. The principal was in a position that enabled him to decide whether the new knowledge and innovations should be introduced and integrated in the rest of the organisation (Wenger, McDermott & Snyder, 2002).
4. **Tools to bridge to practice:** As presented in Chapter 8 and Article B, the teachers used various tools for conceptualisation and memorisation in the IT-Pedagogical Think Tank. A public web-page was constructed to offer easily accessible instructional materials. The web-page included instructions for the IT-Pedagogical Think Tank and examples of the teachers' work in this practice as an aid when training future teams (Clarke & Dede, 2009). One member of the administration made the following observation about anchoring the IT-Pedagogical Think Tank:

> The subject must be put on the agenda, and the management and staff must decide together and then develop models for anchoring. Otherwise we will not have a good model but rather 17 new small anchoring models, which therefore also end up being person-dependent. The management must learn to delegate responsibility and set goals for innovation and creative processes.

10.2.8. FREEDOM AND TRANQUILLITY FOR ORGANISATIONAL LEARNING

The demands for change in today’s workspace are more a premise than an exception, the innovative use of educational technology being one example. Organisations must deal with restructuring, new technology and changing trends. As educational institutions struggle to be innovative and progressive (Collins & Halverson, 2010; Laurillard, 2012), concepts like competence development and lifelong learning have become key terms in the field of education (Brinkmann, 2013). It can be challenging for teachers and administrators to keep their feet on the ground and meet the expectations that go along with this continuous change. It is therefore essential to search for an organisational learning design and developmental strategy for pedagogical innovation that is useful and efficient. This study discovered that providing a solid and qualified structure for teachers that offered time, space and methods for pedagogical innovation could support and motivate teachers and make them experience freedom and tranquillity necessary for their organisational learning processes. The aim was therefore to contribute to create an experience of support for the teachers. This can be expressed by a manager saying to the teachers, “We want you to be able to do this, and we are confident that by working and innovating in this way you will achieve this competence.” Part of the aim with the Steps One through Four educations for the Global Classroom teachers has therefore been to create a new organisational learning design that provides an atmosphere of freedom and tranquillity.

10.3. ORGANISATIONAL LEARNING DESIGN FOR PEDAGOGICAL INNOVATION SUMMARISED

What are the educational organisation's opportunities and responsibilities in relation to change, implementation and anchoring of IT-based and digital video-mediated educational programs? In this DBR project, the empirical answer co-designed with VUC was a vision for and experiments with a new four-step organisational learning design.

Like many other educational technology projects, the Global Classroom project was initiated by the administration. The implementation of the project, however, impacted almost all of actors at VUC, and the consequences were that pedagogical innovation became a daily premise for all of them (students, teachers and administration). The initial experience of teachers and administration was that the project impaired their professional competences. But through systematic competence development, innovative teams and daily experience while working in and around the hybrid synchronous video-mediated learning environment, they succeeded in developing new competences. The teachers had developed new competences to integrate educational technology into the teaching practices, and though educational technology still offered intense challenges at times, it had become a natural tool and integral part of teaching. Furthermore, the administration reported that its members had obtained new knowledge about how to implement new teaching methods at VUC Storstrøm.

Regarding the responsibilities of the organisation in relation to change when implementing and anchoring the learning environment, the findings were that this hybrid synchronous video-mediated learning environment created greater changes in the cross-disciplinary practices between various groups in the organisation than previous educational technology projects had done. Roles within and between the communities of practice were redefined by the means of the technology, and it was therefore important for all involved parties to understand their changing roles and cross-disciplinary responsibilities. Failure to establish these new simultaneous cross-disciplinary collaborations could result in ongoing technological challenges, and the ensuing frustration and "technology fatigue" can lead students and teachers to give up on technology and settle for poor quality learning designs.

Other projects involving hybrid synchronous video-mediated learning environments found that the presence of a technology facilitator allowed teachers to concentrate on their teaching processes and aided in the co-design of innovative technological–pedagogical approaches (Bell, Cain & Sawaya, 2013; Cain, 2015; Hedestig & Kaptelinin, 2005). The current project chose another approach, placing a greater responsibility for technology on the teacher. This approach creates a need for extended cross-disciplinary understanding and synchronous collaboration between the organisation's groups or communities of practice and requires high levels of responsibility, communication and action.

To trace, point out and re-design the necessary cross-disciplinary practices, this project proposed the use of various concepts or metaphors that could be used to legitimise discussions about cross-disciplinary practices that were lacking. The three concepts were the *red baton* (employed to discuss the establishment of relationships between entities in a dynamic, continuous and processual cross-disciplinary practice, and qualification of how and when a final destination for a shared assignment was reached); the *glass elephant* (employed to discuss points or phenomena of disagreement between the various communities; the phenomena were real, big, and disturbed the trust and communication processes between the actors) and *the white stone*, or "*I dare you*" (a challenge given to someone else to do, explore, investigate, redesign or innovate upon something for a common cause of the cross-disciplinary community). These cross-disciplinary discussions about redesigns of practice benefited the organisation, as they provided a non-threatening way to discuss, decide upon and implement new knowledge that was created in innovative team processes. The IT-Pedagogical Think Tank model was used as frame for these discussions.

To develop competences and create a practice for continuous innovation, the teachers and administration at VUC Storstrøm co-developed the four-step organisational learning design outlined in sections 10.2.6-10.2.8: **Step One:** Teacher Professional Development course for new Global Classroom teachers. **Step Two:** IT-Pedagogical Think Tank for teacher teams, enabling pedagogical innovation in the continuously changing organisation. **Step Three:**

Expert Workshops disseminating the new knowledge. **Step Four:** Anchoring as Organisational Learning Design, enabling Steps One through Three to become part of the organisation's daily innovation and learning practices.

Working in educational institutions with continuous demands for competence development and pedagogical innovation with technology can be difficult. Therefore, it was crucial to create a new continuous practice or organisational learning design that both enabled continuous change and used a continuous structure to provide the teachers with space, freedom and tranquillity to develop their competences in innovative teams. But it is necessary that the administration make decisions and actions if the innovative pedagogical practices are to be anchored continuously.

CHAPTER 11. RESEARCH QUESTIONS, FINDINGS AND VALIDITY

11.1. ANSWERING NORMATIVE QUESTIONS IN THE PROJECT

This study investigated normative questions. Research questions can be categorised as descriptive, comparative, explanatory and normative (Alvesson & Sandberg, 2013). The questions are hierarchically related to each other “in the sense that descriptive questions are the most basic, followed by comparative questions, and then explanatory and normative questions” (Alvesson & Sandberg, 2013, p. 14). Descriptive questions produce knowledge about what characterises a phenomenon, whereas comparative questions generate knowledge about the relationships among phenomena. Explanatory questions generate knowledge about the contingent relationships between phenomena, incorporating correlations, conditionality and causality; and in order to ask meaningful explanatory questions we must have knowledge about the characteristics of the compared phenomena. Finally, normative questions aim to produce knowledge about how something should be done in order to improve something. To ask and answer normative questions, one must first be able to answer the previous types of questions (descriptive, comparative and explanatory).

The research question and sub-questions in this thesis can be categorised as normative questions. Therefore, to be able to answer the research question and the sub-questions, the thesis also investigated questions from other places in the hierarchy. The thesis investigated the phenomena the questions encompassed (e.g., What are *innovative pedagogical processes* among teachers [Article B]? How can organisation members conceptualise real and disturbing phenomena that must be discussed in order to develop relevant new cross-disciplinary practices [*glass elephants*, section 10.2.5]? What does it mean that the “bodily transparency” is broken? [7.2.3]). The thesis also examined the relationships between the phenomena (e.g., that a too-strong focus on creating *equal* learning designs for students could result in the creation of less motivating learning designs [section 9.4.8, point 4]). Explanatory questions were explored (e.g., How can specific details in a learning design facilitate pedagogical innovative processes [section 8.4.3]? How can specific affordances of web-based collaborative construction software contribute to the design of equally accessible, activating and motivating learning designs contingent on teachers’ thoughtful design processes?).

By combining answers to these “lower order questions” (Alvesson & Sandberg, 2013), it was possible to answer the research question and the sub-questions and create new normative knowledge through the DBR experiments. The research question was also answered through analysis of the relationships between specific activities and specific changes in students’ and teachers’ reasoning, examining the learning trajectories involving interactions and transactions between and among learners, teachers and elements, in processes and practices (Kelly, 2004; Reimann, 2011). An example of this was the analysis of the students' learning trajectories within the gamified learning design. The project examined how students successfully learned through interaction with the materials, and how they conceptualised and build games by going through an iterative process consisting of seven areas of learning activities while being supported by the teachers' use of learning- and game-inspired metaphors (Article C, figure 4).

11.2. PRAGMATIC VALIDITY AND TRANSFERABILITY

Along with its theoretical contributions, a DBR project aims to have validity for its users (VUC Storstrøm) – a "pragmatic validity" (Kvale & Brinkmann, 2009). The quality of the DBR should be evaluated by whether it generates new, useful learning or learning design theories that have utility for resolving relevant problems that correspond to the normative and value-based pragmatic paradigm (Biesta & Burbules, 2003; Edelson, 2002; Goldkuhl, 2012). Both before and during the entire PhD study, the agreement with VUC Storstrøm has been to work with the development and qualification of teachers' innovative competences and to develop and experiment with teaching methods which used other IT products, processes and teaching materials in addition to the video conference system in the Global Classroom. The researcher followed the teachers in their daily teaching and competence development practices and had access to observe, interview, co-create and experiment together with teachers and students. The researcher was also privy to the organisation's daily administration and competence development practices in investigating the project's problem area. This provided a greater understanding of the organisation, its culture and learning environment, as well as its normal operations and competency development practices – all contexts relevant to the project's research area.

In order for the organisation to benefit from the research results and for the research results to have an effect in this longitudinal project, it was important for the organisation to follow the PhD project's ongoing analyses and recommendations. Therefore, the researcher participated in a pedagogical-IT development group, which had the objective of securing and supporting the progress of the development of educational technology at VUC Storstrøm, including the PhD project. A number of meetings, conversations, presentations and workshops took place over the three-year life of the project (Appendix A). The researcher's role – asking for development input and suggesting new practices from a position "outside the organisation" – proved a difficult one at times. That said, the organisation was very interested in new views and new ways of doing things; the Global Classroom project is proof of this.

11.3. CRITERIA FOR SUCCESS, AND OTHER CONSIDERATIONS

In investigating the three actors' practices, I have aimed at maintaining a constructively critical research perspective. One point of attention in this research project concerned the teachers' criteria for success in the co-design processes. These criteria can influence the quality and direction of the results of these processes. In the experiment "Students Producing Films" (section 9.4.6: Learning Design #6), the teachers regarded it as a success when students gave up participating over videoconference and came to the brick-and-mortar classroom in order to participate in the collaborative learning designs. This indicates that the main success criterion for the teachers was the creation of motivating and effective learning experiences for the students (as it should be); creating effective hybrid synchronous video-mediated learning experiences came second. This mirrors the aim of this study, for which the success criterion was the creation of activating, motivating and efficient innovation and learning processes for the students, teachers and administration. Consideration of the hybrid synchronous learning environment sometimes came second, although it was the context for these investigations and experiments.

The study was conducted with an appreciative and design-focused research approach in the investigations (Mejlvig, 2012; Amiel, T. & Reeves, 2008). Therefore I, as researcher, have been critical when evaluating the learning designs that did not work. But the primary focus has been on the learning designs and innovative processes that did work, and on investigations of the elements, processes and practices that were fundamental in providing new and useful knowledge and practices for the users. The study investigated the three actors – students, teachers and administration – and found that these actors' practices were deeply interconnected and dependent on each other. An analysis of the final results shows that special attention was given to the teachers; as important actors of innovation, learning and anchoring, they were key participants, contributing professional knowledge to discover what was important when creating new motivating learning designs for this environment. The study investigated the case from all three actors' positions in order to achieve a fuller picture of what the creation of innovative learning designs in this new learning environment demands.

Completion Rates in the Global Classroom

This study was not intended as an investigation or comparison of Global Classroom students' grades or completion rates. However, a comparison of VUC Storstrøm's Global Classroom students' completion rates and grades with those of students in VUC Storstrøm's traditional upper secondary general classes for adults revealed that the difference was very small. This can be interpreted positively, as the percentage of Global Classroom students with personal challenges (e.g., social phobias and other diagnoses) was higher than that of other classes. Tables are included in Appendix C.

CHAPTER 12. SUMMARISING CONCLUSION

This PhD project conducted educational research and developed knowledge through design within the pragmatic paradigm (Dewey, [1933] 2009; Elkjær, 2012; Gimmler, 2014; Goldkuhl, 2012). It used design-based research (DBR), a practice-theoretical approach to practice and qualitative analysis (Amiel and Reeves, 2008; Charmaz, 2006; Creswell, 2014; Kvale & Brinkmann, 2009; Nicolini, 2012; Thornberg, 2012) to investigate the research question: “How should pedagogical innovation be designed in order to contribute to the creation of motivating learning for students and teachers in a hybrid synchronous video-mediated learning environment?” The theoretical analysis was based on learning and learning design theory (Bruner, 1966; Hiim & Hippe, 1997; Illeris, 2007; Lave & Wenger, 1991; Piaget, [1968] 2006) as well as theory about educational technology (Dede, 2008; Dourish, 2004; Friesen, 2014; Gheradi, 2012; Harel & Papert, 1991; Hasse & Storgaard Brok, 2015; Orlikowski, 2010; Resnick et al., 2009; Somekh, 2007).

An investigation of literature in the field reveals a need for experimentation and creation of new knowledge regarding the development of innovative pedagogical competences for creating learning designs that involve educational technology (Darsø, 2011; Hasse & Storgaard Brock, 2015). Teachers need to learn to work with educational technology and develop technological literacy and innovative thinking, and organisations need to know how to support innovative pedagogical processes (Hasse & Storgaard Brock, 2015; Laurillard, 2012; Law, 2008; Somekh, 2008). There is also a need to contribute new knowledge to the body of research on extending game-based learning to creation of games for learning; learning-game creation enables the student to have a more active role as game designer instead of a less active role as game player (Earp, 2015; Kafai & Burke, 2015; Whitton, 2014).

The aim of the study was to form theory and develop guidelines for the elements, methods, processes and practices that could contribute to the creation of reflective, innovative and motivating learning designs for teachers and students. The purpose was also to form theory and develop guidelines for how, and by what means, pedagogical innovation and competence development could change and anchor IT-based and digital-video-mediated educational programs. The investigations took place in a hybrid synchronous video-mediated teaching context, the Global Classroom at VUC Storstrøm. In the Global Classroom, adult students studying full-time in a two-year upper secondary general education programme on a daily basis could choose between participating in class on campus or from home via videoconference. The educational actors (students, teachers, administration) were examined individually and relationally. The following four sections summarise the theoretical and empirical findings in the PhD project as presented in Chapters 7–10 and Articles A–D. In this concluding summary, the theoretical models are displayed in a reduced size. For better readability, the previous larger models numbers are provided for each figure.

12.1. LONGITUDINAL STUDIES AND EVALUATIONS IN THE HYBRID SYNCHRONOUS VIDEO-MEDIATED LEARNING ENVIRONMENT

The research project continuously investigated the hybrid synchronous video-mediated learning environment during the three-year PhD project period to provide insight into the emergent teaching and learning processes and practices in and around this new learning environment, investigating the situation as it currently existed; this was referred to as “what is.” These investigations formed the foundation for the explorative DBR sub-projects investigating “what will be” in the future.

The analysis found that teaching could be carried out in a fairly traditional way in the Global Classroom. The teachers, however, reported an increase in the use of lecturing and a decreased use of previous motivating teaching strategies that could not be used in the new environment, with the consequence that their teaching approach became less engaging and less varied. When creating learning designs, teachers had to be conscious that the videoconference system was a medium that interfered with the message (McLuhan, 1964). The remote students sat in their homes “behind the window.” They could see and hear teachers and students in the brick-and-mortar classroom, but they could not access the classroom with their bodies (Friesen, 2014; Merleau-Ponty, 1964). This hindered their participation in classroom learning activities that involved using and creating physical artefacts, a traditional component of learning-by-creating processes (Harel & Papert, 1991).

The teachers found it difficult to create efficient new motivating learning designs for the learning environment on their own, and they used fewer collaborative learning designs (Lave & Wenger, 1991). VUC established booths inside one of the Global Classrooms to enable more frequent use of cross-over group work and easier access for supervision during group work, thereby improving the quality of group-work conditions.

Many of the adult students were unmotivated learners, and VUC Storstrøm’s teachers and administrators aimed at embracing these motivational issues. Findings indicate that many students were motivated by the freedom and opportunity to participate from home. The Global Classroom was also motivating for students experiencing off-days, because it allowed them to participate quietly from home. The challenges involved in the creation of active, varied and motivating new learning designs for the new learning environment highlighted a demand for the teachers to develop innovative pedagogical competences. The PhD study encouraged teachers to experiment with play and gamification and bodily activation with the purpose of creating new motivating learning designs for the students through DBR. Essentially, creating equal working conditions for remote and in-class students in a hybrid synchronous video-mediated environment is an illusion, as the working conditions are inherently unequal. But the focus for this study and for the teachers working in this environment was to examine what might contribute to the establishment of learning conditions that perhaps would never become equal, but which could be almost *as good as* being together in the same room. The challenging transition to the Global Classroom Model contributed to VUC Storstrøm’s awareness of the need for skills and support for teachers' innovative competences in order to develop new motivating learning designs for the teaching and learning environment.

12.2. DEVELOPMENT OF A NEW PRACTICE FOR PEDAGOCICAL INNOVATION

The study investigated how pedagogical innovation could become a new practice for teachers through a reflective, innovative and competence-developing tool/method or practice (Sub-question Q1 – The Teachers). Based on their subject-specific pedagogical approaches, this tool or practice should enable teachers to carry out appropriate planning, execution and theorising on their own teaching in IT-based and video-mediated teaching programs. The tool/practice should also enable teachers to make informed and relevant choices in the use of educational technology for their learning designs in a professional academic context. The focus of the new practices was to contribute to the creation of motivating learning experiences for students in the hybrid synchronous video-mediated learning environment. There was also a need to investigate what it took to achieve a well-functioning knowledge sharing, communication and decision flow between the administration and the teachers. This was examined through the design-based research project in co-design processes with the teachers. This led to the development of the IT-Pedagogical Think Tank for Teacher Teams (ITP4T). The ITP4T was a new practice in which a group of teachers met for a two-hour period to follow a specific procedure to address a chosen issue. The ITP4T was a combination of the concept, the process and the group enacting the process using the model – that is, a new innovative practice in the organisation.

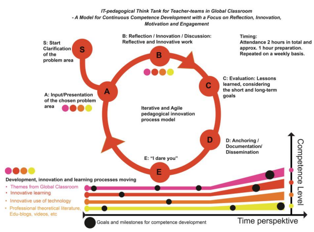


Figure 38: IT-Pedagogical Think Tank for Teacher Teams (ITP4T). Also Article B figure 2.

In this new practice, the teacher teams worked through a weekly process (Figure 38). Based on their own issues with designing new learning designs for the hybrid synchronous video-mediated learning environment, the teachers determined goals and milestones for their own continuous competence development. They collaborated on reaching these goals by working through five points (A-E) at every meeting. This structure had been developed in a "bottom-up" approach in co-design processes with the teachers. Teachers reported that working within this structure/practice provided the support they needed to achieve pedagogically innovative results. They had not experienced this in previous team work.

The study examined the innovation, knowledge-development and knowledge-sharing processes that took place when teachers created innovative learning designs in the ITP4T model with their team and how this contributed to the organisational learning process (Article B). When using this new practice, the teachers became innovative learning designers developing new knowledge about learning designs, new use of technology and new ways of sharing knowledge in their educational institution. The teachers acted as team managers for each other and were able to design and create innovative pedagogical processes with collective reflection using relevant tools and methods to facilitate the common ideation phases for the team, leading to individual as well as team-based goals for innovation (Brown, 2009; Dale, 1998, Darsø, 2011). When the teachers found a satisfactory solution (a new innovation), they could unravel how they had arrived there, tracing the learning trajectory to their solution (Dewey, [1933] 2009). By “thinking backwards” in this way, the innovation turned into knowledge again, making the new learning design, the new learning process or the new way of sharing knowledge in the organisation possible to repeat. By working in this model, the teachers developed new innovation competences that they were able to transfer to their teaching practice. Their technological literacy (Hasse & Storgaard Brok, 2015), that is, their ability to choose and use and evaluate specific technologies for specific pedagogical approaches in specific learning designs, was developed though experiments, theory and practice-based discussions with peers. The teachers became able to identify and formulate possible problem areas in their educational context, always with the central aim of creating motivating learning designs for the students. The teachers and principal found it motivating and effective to work in ITP4T; it provided them with a new framework and the support needed to take responsibility for their own learning processes. The ITP4T experience showed that teachers and organisations must develop an understanding of the need to allocate resources for ideating and developing new learning designs.

The contribution of the IT-Pedagogical Think Tank model was its ability to provide a theory-based learning design that supported a continuous practice and a structure focused on pedagogical innovation and reflection, with a foundation in teachers’ and organisations’ relevant professional issues and challenges. This enabled change and structured anchoring of the new innovative concepts and resulted in a visionary contribution to the educational institution. The use of this new practice inside the school empowered the teachers in the organisation and created a new organisational learning design which could support innovation, help unravel complex questions, create new organisational knowledge and anchor new knowledge and practices. These findings answer the need for new knowledge in this area (section 2.3; Hasse & Storgaard Brok, 2015; Laurillard, 2012; Law, 2008; Law, Kankaanranta & Chow, 2005; Somekh, 2007). The new team practice gave teachers an identity not only as teachers but also as (self-regulated) learners. The findings indicated that the teachers had a more positive perspective of their own abilities to create change after participating in the workshops. In addition, they valued the professional support they gave and received when developing new learning designs in the team. Though it was a small-scale DBR experiment, the pace at which the teachers moved through the issues and came up with new pedagogical innovations indicated the great potential for use of the model in other new educational environments involving technology.

12.3. INNOVATIVE AND MOTIVATING LEARNING DESIGNS

Through DBR, the study investigated how an educational organisation could create activating and motivating learning designs for adult students when they learn with and through educational technology. The study also explored to what extent it was possible to measure how learning with and through educational technology affects student learning and motivation. Finally, the study investigated whether students could help in further innovative integration of educational technology in their learning processes, and if so, how this could take place (Sub-question Q2 – The Students). The study developed new knowledge presented as new conceptual models and learning design patterns incorporating relevant elements, processes and interactions in order to clarify ideas, processes and relationships in the learning design processes for the hybrid synchronous video-mediated learning environment. As stated in the literature review, when designing for this environment, it is essential for teachers to develop theoretical knowledge about learning designs involving technologies and to develop individualised learning design patterns with relevant subject-specific pedagogical dimensions and use of technologies (McKenney et al., 2015; Persico et al., 2013; Somekh, 2007, 2008; Webb, 2010).

The study investigated and created new knowledge about common guidelines in the teachers' new learning designs that focused on how to create equal, activating and motivating learning experiences for the in-class and at-home students (section 12.3.1); and experimented with and created new knowledge about how to create a reusable, innovative, and motivational learning design for adult-student game designers, allowing them to learn inside a big Game while designing small digital learning games in cross-disciplinary subject matters in the Global Classroom (section 12.3.2).

12.3.1. EQUAL, ACTIVATING AND MOTIVATING LEARNING DESIGNS FOR THE GLOBAL CLASSROOM

When the focus was to create equal, activating and motivating learning experiences for the in-class and at-home students, the common guidelines in the new learning designs according to the findings were:

1) **Synchronous learning designs**. A characteristic of the hybrid synchronous video-mediated learning environment was that teaching was conducted synchronously, similar to traditional brick-and-mortar learning environments.
2) **Platform for sharing content.** A necessary component for sharing and exchanging content was a web-based learning management system that was equally accessible for students and teachers in class and for remote students.
3) **Web-based collaborative construction software**. When using materials and tools for collaborative learning practices, the tools that were equally accessible for in-class and at-home students to work in, learn with and through shared several characteristics. The collaborative construction software was web-based, and multiple students could access it synchronously from different locations. Within the software, students could see where

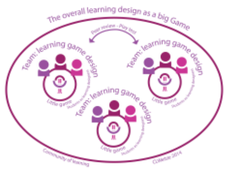
the other collaborators "where" and what actions they performed. When combined with connecting audio (and video), the collaborative construction could contribute to a feeling of working together under equal conditions, thereby moving closer to the experience of sitting in the same room. The technologies were easy to access (one-click or one-link access), easy to use (high usability) and stable. These tools became entangled in practice (Orlikowski, 2010) and were used with ease in various learning designs in various types of contexts.

4) **"Unequal" learning designs for experiments.** Traditional (chemistry) experiments in class could be re-mediated in the hybrid environment by offering carefully designed, video-mediated, bodily performed experiments and reflective discussions in the brick-and-mortar classroom, making the experience interesting for the at-home students as well as the in-class students. The study therefore found that "unequal" learning designs with common experimental activities involving artefacts in the classroom were the best possible motivating learning design solutions for both involved student groups. In contrast, teachers' attempts to provide equal access by relying on learning designs that incorporated lectures and slideshows instead of active experiments resulted in poorer learning designs for all students.
5) **Collaborative workarounds and technological bricolage**. Some collaborative learning designs made it difficult for remote students to have equal access in cross-over group work. These learning designs often involved use of a PC-based technology designed for a single user rather than for collaboration among multiple users. In these learning designs, collaboration often turned into cooperation as students created workarounds altering the intended collaborative learning design (Dillenbourg 1999), distributing tasks between group members and combining their individual results later. In pursuing ways to make the collaboration work, students constructed collaboration practices with the tools at hand (bricolage; section 9.4.8, point 5); Johri, 2011) by combining various technologies.
6) **Hybrid synchronous mobile learning designs**. Teachers developed hybrid synchronous mobile learning designs that allowed all students to participate in learning designs outside the classroom.
7) **Virtual guest teachers.** The hybrid synchronous video-mediated learning environment also enabled completely new learning designs; an obvious new possibility entailed using video-mediated opportunities to interact with relevant virtual guest teachers.

Many of the teachers' learning designs were inspired by, developed and discussed together with their colleagues from the IT-Pedagogical Think Tank.

12.3.2. GAMIFIED LEARNING DESIGNS

Part of the research question focused on generating knowledge about how to create motivating learning designs for students in a hybrid video-mediated learning environment (Articles C & D). An extreme case was investigated through co-design processes in DBR to examine potentials and help break through the barriers involved in creating learning designs for the Global Classroom. The purpose of these experiments was twofold: 1) to develop a reusable learning design for upper secondary teachers and students who were game design novices; 2) to investigate potentials and barriers and how this game design emerged in the hybrid video-mediated learning environment.



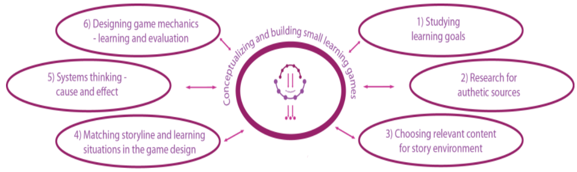
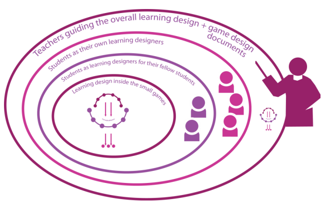


Figure 39 (left): Overall gamified learning design. Also Article C figure 2.

Figure 40 (middle): Seven areas of building small digital learning games. Also Article C figure 4.

1) An overall gamified learning design (big Game; Gee, 2011; Weitze, 2014a,b) was developed to facilitate the learning process for adult students by inviting them to be their own learning designers through designing digital learning games (small games) while implementing learning goals from their curriculum in cross-disciplinary subject matters (figure 39). The learning approach was founded in problem-based learning (PBL; Savery, 2015), constructionist pedagogical methodology (Harel & Papert, 1991; Kafai & Resnick, 1996; Papert, 1980) and design thinking (Brown, 2009; Hasso Plattner Institute of Design, 2016), building on the thesis that there is a strong connection between designing and learning. The findings were that activities that involved making, building or programming provided a rich context for learning, as the construction of artefacts, in this case learning games, enabled reflection and new ways of thinking. The students learned from reflection and interaction with the tools, both individually and in collaboration with peers. In analysing the students' learning trajectories within this method of learning, this study found that during the learning-game design process, students went through an iterative process consisting of seven areas, including conceptualising and building the games (Figure 40). Other findings were that the learning design was constructed as a hierarchy supported by various learning-designer roles contained within one another (Figure 41). In this process, the students became their own learning designers, leading their own innovative learning processes with educational technology. They also acted as learning designers for their fellow students when they worked to facilitate learning activities and learning trajectories inside the small games.



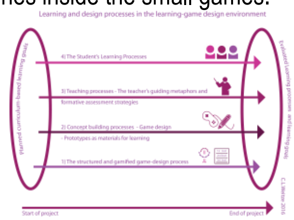


Figure 41 (left): Learning designers in the game development process. Also Article C Figure 3.

Figure 42 (right): Four parallel types of processes for designing and learning supported the gamified learning design. Also Article D Figure 3.

The gamified learning design supported the innovative learning processes for the students. The teacher participated as an inspirational guide and contributed to the students' cognitively complex learning processes as they designed curriculum-based learning games (Anderson and Krathwohl, 2001; Illeris, 2007). Four parallel types of processes for designing and learning supported the gamified learning design: 1) the structured game-design process, 2) concept-building processes in which prototypes served as materials for learning, 3) teaching processes in which the teacher's learning- and game-inspired metaphors were used to support the learning processes in the big and small gamified learning designs, and 4) the students' individual, collaborative and motivational learning processes (figure 42). The teachers found it easy to support and evaluate the student's learning processes with the help of concepts and metaphors guiding the students in their learning game development process. Bruner's (1966) three motivational forces were used as analytic tools, and the findings were that students experienced motivation within all three areas (curiosity, the feeling of achieving competence, and reciprocity-relatedness). The teachers observed an increase in socially engaged interactions among the students which contributed to more complex cognitive learning processes with more collaborative activity. The study found that the students experienced deep and motivating learning and that the teachers found this problem-based and activating learning design inspiring and easy to use as a variation to more traditional teaching approaches. The students benefitted from this way of learning as a valid variation to more conventional teaching approaches, and teachers found that the students learned at least the same amount or more compared with traditional teaching processes. Consequently, the maker-culture (Hatch, 2013; Honey & Kanter, 2013) and its potential constructionist pedagogical approach – learning by creating – can also be used in formal learning situations with adult students, enabling motivating and cognitively complex learning processes.

2) This gamified learning design could be used in the Global Classroom, and it was motivating and created complex cognitive learning processes, but there were limitations in access to physical materials for students participating from home. It was equally possible for students in class and at home to work with the web-based game design software Scratch (2015). Scratch makes it possible to share content and copy others' projects in order to learn. But Scratch did not enable multiple students to access it synchronously from different locations or to observe visualisations of other students and their actions within the software. The students therefore created collaborative workarounds (dividing the work into cooperative processes) and technological bricolage (e.g. using screen sharing, videoconferencing, chat, while using a game design software and talking on the phone, all in combination), and teachers used "unequal" learning design experiments when working with physical artefacts in the class that could not be reached by the remote students.

12.4. PEDAGOGICAL INNOVATION IN THE EDUCATIONAL ORGANISATION

The study investigated the educational organisation's opportunities and responsibilities regarding change, implementation and anchoring of IT-based and video-mediated educational programs (Sub-question Q3 – The Organisation). The implementation of the Global Classroom project impacted almost all of the actors in the three actor groups at VUC (students, teachers and administration), with the consequence that pedagogical innovation became a daily premise for all of the involved actors. VUC teachers and administration reported that the changes were more substantial than in VUC Storstrøm's previous educational technology projects. The cross-disciplinary practices, roles or positions in and between the communities of practice (teachers, IT-pedagogical personnel, IT-support team, principals, development consultants and others) were redefined by the means of the technology. Failure to establish new simultaneous cross-disciplinary collaborations could result in ongoing technological challenges, and the ensuing frustration and what could be termed as "technology fatigue" could lead students and teachers to give up on technology and settle for poor quality learning designs. This created a need for extended cross-disciplinary understanding and synchronous collaboration between the groups or communities of practice in the organisation, calling for high levels of responsibility, communication and action. To trace, point out and redesign the needed cross-disciplinary practices, this project proposed various concepts or metaphors that could be used to legitimise discussions about missing and problematic practices (Section 10.2.5).

To develop competences and create a practice for continuous pedagogical innovation, VUC Storstrøm co-developed a four-step organisational learning design (section 10.2.7).

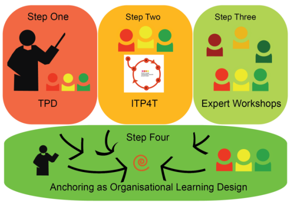


Figure 43: Four-step organisational learning design. Also section 10.2.7.

1) **Step One: TPD.** A traditional teachers' professional development course was created to address the complex problems VUC Storstrøm experienced at the beginning of the project.
2) **Step Two: IT-Pedagogical Think Tank (ITP4T).** ITP4T was developed because pedagogical innovation had become necessary in the continuously changing organisation. The teachers and administration experienced that the theoretical discussions created a common conceptual language and understanding and gave the organisation wider frames of reference, enabling them to create innovative pedagogical processes involving educational technology. This contributed to Teachers' Professional Innovation Development (**TPID**) as the teachers developed competences in pedagogical innovation.
3) **Step Three: Expert Workshops.** A need to anchor and disseminate the new knowledge at VUC was identified. The teachers and the IT-pedagogical team suggested establishing open workshops for one hour a week and having individual teachers serve as experts in the subjects for which they had been "primary investigators" in the IT-Pedagogical Think Tank. Another suggestion for knowledge sharing practices was to document and disseminate the new knowledge by making short videos featuring each

teacher's new innovations and ideas. These processes had to be built into the organisational learning design in order to take place.

4) **Step Four: Anchoring as Organisational Learning Design.** Step four was the organisational anchoring strategy that enabled Steps One, Two and Three to become part of the organisation's daily innovation and learning practices by implementing them as new learning designs for the organisation. Step Four was a necessary stabilising step to answer the research question of how pedagogical innovation should be designed in order to contribute to the creation of motivating learning for students and teachers in a hybrid synchronous video-mediated learning environment. In particular, the IT-Pedagogical Think Tank (ITP4T), which could be characterised as a series of innovation and learning events, needed thoughtful anchoring into the organisation. At VUC, experienced Think Tank teachers and members of the IT-Pedagogical Team were assigned as ”experts” to guide new Think Tank teams. The administration made these workshops a priority. The principal participated in the meetings and benefitted from the tacit and explicit knowledge created and shared in the innovative team.

The findings revealed several factors essential to the successful creation of a new continuous practice or organisational learning design. The new practice or design must enable ongoing change; a consistent and continuous structure or practice is required to provide teachers with space, freedom and tranquillity to develop their competences in innovative teams; and finally, for the new organisational learning design to be anchored continuously, the decisions and actions must be initiated by the administration.

The four-step organisational learning design contributes with new knowledge about how an educational institution can design pedagogical innovation into the architecture of the organisation. This can be accomplished by developing new cross-disciplinary practices and empowering teachers to improve the quality of teaching and learning with technology (Brown & Duguid, 1991).

12.5. RESEARCH CONTRIBUTIONS

This cross-disciplinary design-based research (DBR) study investigated the complex learning environment of an educational institution that had decided to implement new educational technology to create motivating learning designs for the students. The study observed and co-designed with three actor groups – students, teachers and administration. The findings showed that these actors were deeply interdependent, and the findings also revealed a need to establish new cross-disciplinary practices between the small communities of practices in the educational institution if the implementation of the hybrid synchronous video-mediated learning environment was to be successful. The study further found that changing and anchoring new practices in one community of practice demanded alterations in and actions from other communities of practice within the institution. If an educational institution as a whole is to change and benefit from the new innovations and anchor them as new knowledge within the organisation, each community of practice must be prepared to embrace these changes and take the necessary actions.

The DBR study developed new knowledge in several areas. It demonstrated a) how pedagogical innovation can be designed into an educational organisation through a four-step organisational learning design, enabling the creation of motivating learning designs for students and teachers in a hybrid synchronous video-mediated learning environment (Chapter 10); b) how teachers, combining their own professional knowledge and new theory, can create innovative learning designs involving educational technology by ideating and collaborating together in teams supported by the continuous competence development practice termed the IT-Pedagogical Think Tank model (Chapter 8); and c) how students can help in the further innovative integration of educational technology by using a constructionist pedagogical approach – in this case, by using game design software to build digital learning games and thereby acting as their own (and fellow students') learning designers (Articles C & D). The study also developed knowledge about emerging learning design patterns when the aim is to create equal, activating and motivating learning experiences for in-class and at-home students in a hybrid synchronous video-mediated learning environment (Chapter 9 & 7). This DBR study has therefore contributed to the body of knowledge surrounding the development of innovative pedagogical competences for the creation of new learning designs involving the use of educational technology for students, teachers and administration in an educational institution.

The guidelines and theories developed in the present study could serve as useful frameworks of reference for those investigating how to effectively design pedagogically innovative practices for an educational institution that is facing a need for continuous change. The discussion and findings could also be helpful for researchers studying how teachers' common ideation processes for creating motivating learning designs can be supported and turned back into new organisational knowledge. The study may also prove useful for researchers exploring how student-designed digital learning games allow students to become their own learning designers while reaching curriculum learning goals. Finally, the study contributes with knowledge within the newly developing research field of learning designs for hybrid synchronous video-mediated learning environments.

12.6. FUTURE WORK

VUC Storstrøm will continue operating the Global Classroom; the school plans to investigate and experiment with inviting virtual teachers into the Global Classroom and extending its borders to include other countries. The IT-Pedagogical Think Tank and the four-step organisational learning design developed in this project have the potential to be used in other educational institutions for the creation of pedagogical innovation, not only with educational technology but also in other relevant pedagogical areas. When tested in this study, the IT-Pedagogical Think Tank was found to be flexible enough to be used in different contexts and robust enough to be used with minimal guidance (Clarke & Dede, 2009). It will be relevant to try the model in new learning environments; for example, in the Danish Primary Schools or Danish Music Schools, where new governmental legislation has created a need to extend teachers' innovative pedagogical competences. It would also be interesting to transform the

IT-Pedagogical Think Tank model into an interactive tool, supporting goal setting and the collaboration through the points (A-E) making it easy to be guided and to compare and discuss common innovative pedagogical initiatives.

The gamified learning design indicated a great potential for future use, as students experienced deep and motivating learning and a significant increase in collaborative activities. New experiments are therefore planned at VUC Storstrøm for game-based learning designs in which student game designers learn from making digital learning games. These new experiments will involve a teachers' group and students and will enhance further study of how to create sustainable learning designs with students learning from designing games. These game-based learning designs have been tried in the primary school with good results; in the future, the learning designs will be further developed for the primary school.

CONCEPTS

At-home students: The terms “at-home students” or “students attending remotely” are used interchangeably to describe participation from outside the brick-and-mortar classroom. The at-home students are not necessarily at home; they could be using PCs from any off-campus location.

Global Classroom: The hybrid synchronous video-mediated learning environment that is the context of the investigations in this project. The two terms are used interchangeably in the thesis.

Educational technology and educational IT: The terms *educational technology* and *educational IT* are used interchangeably in the thesis. The terms are used to describe digital information and communication technologies used in educational contexts.

Innovation/innovative: The actions required to create and use new ideas and turn them into processes or products that, once implemented, lead to positive, useful change. Innovation may start from using new knowledge or from reusing and combining existing knowledge. A new invention can be innovative in relation to the individual, a specific culture or the world. In this thesis, actions, processes and products are considered innovative if 1) the actor has never tried it before; 2) the actor is not just imitating what he/she has read or heard from another source; and/or 3) the actor has created this new invention by taking part in a development process.

IT-Pedagogical Think Tank: During the final writing process, I have been considering how to name the new teacher team practice that enables teachers to collaborate and be pedagogically innovative. If the purpose of the Think Tank is to discuss the concept of “IT Pedagogy,” it might make sense to call it the *IT-Pedagogy Think Tank*. But if the Think Tank itself is pedagogical, then perhaps its name should be the *IT-Pedagogical Think Tank*, where *pedagogical* is an adjective describing the Think Tank. The teachers in the Think Tank did indeed discuss innovative pedagogy involving the use of technology, but I have primarily regarded the Think Tank *itself* as a thinking and acting technology (Footnote 14) as well as a new practice. Because I see this new practice as a pedagogically innovative practice, I have come to regard it as an IT-Pedagogical Think Tank.

Motivation to learn: This is discussed further in section 6.2.2, but in short, *motivation* can be defined as “the process whereby goal-directed activity is instigated and sustained” (Schunk, Meece & Pintrich, 2010, p. 6), and *motivation to learn* is defined as “the tendency to find learning activities meaningful and worthwhile and to benefit from them – to try to make sense of the information available, relate this information to prior knowledge and attempt to gain the knowledge and skills the activity develops” (Wlodkowski, 2011, p. 5).

Pedagogy: *Pedagogy* is the discipline that deals with the principles, practice and profession of teaching. In Denmark, it is common to conceptualise pedagogy as teaching, education and upbringing or guidance (Jank & Meyer, 2006; Juul, 2010). Murphy (2008) considers pedagogy an art and defines it as “the relations and interactions between teachers, students and the learning environment and the learning tasks” (p. 35). The concept of pedagogy has a broad definition and can involve a range of elements, from attitudes and assumptions to the design of the learning processes, and the presentation of the content as well as the implementation of the teaching (Darsø, 2011). Pedagogy encompasses the Scandinavian word *didaktik,* or learning design, but the difference between learning design and pedagogy is that the concept of *pedagogy* often encompasses a normative direction. That is, within the chosen pedagogy, there is a certain belief about what the purpose of the student’s education should be. This will often be independence, enlightenment and developing one’s own authority (Jank & Meyer, 2006, 121-122), but also the ability to control one’s own learning process by self-monitoring and thereby learning to learn (Tanggaard & Brinkmann, 2008). The pedagogical normativity also often encompasses specific theoretical beliefs about learning (Juul, 2010).

Think Tank: The relevance of choosing the name Think Tank for the new practice is ripe for discussion, as the term “think tank” has many connotations. With the aim of defining the term, Pautz (2011) suggests: “[T]hink-tanks are non-governmental institutions; intellectually, organizationally and financially autonomous from government, political parties or organized interests; and set up with the aim of influencing policy” (p. 423). He continues: “Think-tanks want to change policy through intellectual argument […]. They employ rhetoric of public spirit and of the ‘common good’. They advocate ideas, develop and maintain policy networks, and provide expertise to policymakers. […] They develop ideas into products, disseminate them to an ‘effective public’ […] and participate in strategic communication with […] decision makers. […] They build bridges between different policy field stakeholders not as passive intermediaries but as providers of conceptual discourses for policy-making. [… Therefore] think-tanks (can) become effective agents of change” (Pautz, 2011, 2011, p. 423). This thesis is not attempting to advocate a new meaning of the term “think tank”. The phrase has, however, been useful for describing a new practice of teacher teams. When the IT-Pedagogical Think Tank was used in the educational institution, the idea was to influence the institution’s policy or organizational learning design by proposing new ways of creating and sharing innovative pedagogical knowledge and new common ideas for the institution. It has also been strategically providing and communicating expertise to policymakers (principals). Finally, the IT-Pedagogical Think Tank has been an effective agent of change in the educational institution.

REFERENCES

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, 107-136.

Allen, M. Omori, K., Burrell, N. Mabry, E. & Timmerman, E. (2013). Satisfaction with distance education. In *Handbook of Distance Education 3rd edition*, Editor Moore, M.G. New York: Routledge.

Alvesson, M. & Sandberg, J. (2013). *Constructing research questions: Doing interesting research*. London: Sage.

Alvesson, M. & Sköldberg, K. (2009). *Reflexive methodology: New vistas for qualitative research*. London: Sage.

Alvesson, M., & Spicer, A. (2012). A Stupidity- Based theory of organizations. *Journal of management studies*, *49*(7), 1194-1220.

Amiel, T., & Reeves, T. C. (2008). Design-based research and educational technology: Rethinking technology and the research agenda. *Journal of Educational Technology & Society*, *11*(4), 29–40.

Andersen, I. (2008). *Den skinbarlige virkelighed*, Copenhagen: Samfundslitteratur.

Anderson, L. W. & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching and assessing: a revision of Bloom's Taxonomy of educational objectives: Complete edition*. New York: Longman.

Anderson, T., & Shattuck, J. (2012). Design-Based Research: A Decade of Progress in Education Research? *Educational Researcher*, (41)1, 16–25.

Andrews, T. & Klease, G. (1998). Challenges of multisite video conferencing: The development of an alternative teaching/learning model, *Australian Journal of Educational Technology*, 14(2), 88-97.

Argyris, C. (2012/1992). Organisatorisk læring Single- og double-loop. In K. Illeris (Ed.), *49 tekster om læring,* (pp. 437-442). Copenhagen: Samfundslitteratur.

Arstorp, A-T. & Schrøder, V. (2012). Læreres teknologiforståelse – anskueliggjort gennem fire teknologi-perspektiver. In Hasse, C. & Dupret, K. (Eds.).*Teknologiforståelse - på skoler og hospitaler*, (pp. 43-63). Århus: Aarhus Universitetsforlag.

Atkin, A. (2013). Peirce's Theory of Signs, The Stanford Encyclopedia of Philosophy (Summer 2013 Edition), Edward N. Zalta (ed.), Retrieved from http://plato.stanford.edu/archives/sum2013/entries/peirce-semiotics/

Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. *Academy of management review*, 14(4), 496-515.

Bailey, C., Zalfan, M. T., Davis, H. C., Fill, K., & Conole, G. (2006). Panning for gold: Designing pedagogically-inspired learning nuggets. *Educational Technology and Society – Special Issue (January 2006), Theme: Learning Design,* 9(1), 113–122. Retrieved from http://www.ifets.info/journals/9_1/10.pdf

Baker, T., & Nelson, R. E. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. Administrative science quarterly, 50(3), 329-366.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Barab, S., & Dede, C. (2007). Games and immersive participatory simulations for science education: an emerging type of curricula. *Journal of Science Education and Technology*, 16(1), 1-3.

Barab, S., & Squire, B. (2004). Design-based research: Putting a stake in the ground. *Journal of the Learning Sciences*, 13(1), 1–14.

Barab, S.A., Gresalfi, M., & Ingram-Goble, A. (2010). Transformational play using games to position person, content, and context. *Educational Researcher*, *39*(7), 525-536.

Baran, E., Correia, A. P., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education*, *32*(3), 421-439.

Barbour, M. K. (2014, January). A history of international K-12 online and blended instruction. In Ferdig, R. E., & Kennedy, K. (Eds.). *Handbook of research on K-12 online and blended learning* (pp. 25-49). Pittsburgh: Carnegie Mellon University ETC Press.

Barrows, H.S. (1986). A Taxonomy of Problem Based Learning Methods. *Medical Education*, (20)6, 481-486.

Barthes, R. (1980/2004). *Det lysende kammer (Camera Lucida: Reflections on photography*), København: Gyldendals Bogklubber.

Beetham, H. & Sharpe, R. (2013). *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*, Rutledge. New York.

Bell, J., Cain, W., & Sawaya, S. (2013, June). Introducing the role of technology navigator in a synchromodal learning environment. *In Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 1629-1634.

Bell, J., Sawaya, S., & Cain, W. (2014). Synchromodal classes: Designing for shared learning experiences between face-to-face and online students. *International Journal of Designs for Learning*, 5(1), pp.68-82.

Biesta, G. J. (2010). Why 'what works' still won't work: From evidence-based education to value-based education. *Studies in Philosophy and Education*, *29*(5), 491–503. Rotterdam: Springer Netherlands.

Biesta, G., & Burbules, N.C. (2003). *Pragmatism and educational research*. New York: Rowman & Littlefield.

Biggs, J. (1989). Approaches to the enhancement of tertiary teaching. *Higher Education Research and Development, 8*(1), 7-25.

Blomberg, J., Giacomi, J., Mosher, A. & Swenton-Wall, P. (1993). Ethnographic Feld methods and their relation to design. In D. Schuler & A. Namioka (Eds.), *Participatory design: Principles and practices*. (pp.123-155). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bloom, B.S. (1956). *Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners. Handbook 1: cognitive domain.* New York: Longman.

Boekaerts, M. (2010). The crucial role of motivation and emotion in classroom learning. The nature of learning: Using research to inspire practice. In Hanna, D., David, I., & Francisco, B. (Eds.), *Educational Research and Innovation - The Nature of Learning Using Research to Inspire Practice*, (pp. 91-111). OECD Publishing.

Bogost, I. (2011). *Gamification is bullshit*. Retrieved from http://bogost.com/writing/blog/gamification_is_bullshit/S

Bolter, J. D. (2007). Remediation and the language of new media. *Northern Lights: Film & Media Studies Yearbook*, *5*(1), 25-37.

Borghäll, J. (2007). *Kropssproget.* Odense: DR Multimedie og Syddansk Universitetsforlag.

Bower, M., Kennedy, G., Dalgano, B., Lee, M. J., Kenney, J., & de Barba, P. (2012). Use of media-rich real-time collaboration tools for learning and teaching in Australian and New Zealand universities. In *ASCILITE*, 133-144.

Bower, M., Dalgarno, B., Kennedy, G. E., Lee, M. J., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers & Education*, 86, 1-17.

Bower, M., Dalgarno, B., Kennedy, G., Lee, M. J., & Kenney, J. (2014a). *Blended synchronous learning: A handbook for educators*. Retrieved from: https://blendsync.org/handbook

Bower, M., Kenney, J., Dalgarno, B., Lee, M. J., & Kennedy, G. E. (2014b). Patterns and principles for blended synchronous learning: Engaging remote and face-to-face learners in rich-media real-time collaborative activities. *Australasian Journal of Educational Technology*, 30(3).

Brennan, K. (2014). Social dimensions of computing education. Presented at the *Future Directions in Computing Education Summit*. January 8.-9.,Orlando, FL.

Brennan, K., & Resnick, M. (2012). New frameworks for studying and assessing the development of computational thinking, *Proceedings of the 2012 annual meeting of the American Educational Research Association*, April 13-17, Vancouver, Canada. Retrieved from http://web.media.mit.edu/~kbrennan/files/Brennan_Resnick_AERA2012_CT.pdf

Brinkmann, S. (2013). *Qualitative interviewing*. Oxford: Oxford University Press.

Brinkmann, S., & Tanggaard, L. (2015). *Kvalitative metoder: En grundbog.* Copenhagen: Hans Reitzel.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions. *The Journal of the Learning Sciences*, (2), 141–178.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization science*, 2(1), 40-57.

Brown, T. (2008). *Design thinking*, Harvard business review, (86)6, 84.

Brown, T. (2009). *Change by design*. New York: Harper Collins.

Bruner, J. S. (1966). *Toward a theory of instruction*. Cambridge, MA: Harvard University Press.

Bryman, A. (2012). *Social research methods.* Oxford: Oxford University Press.

Buch, A. (2015). Studying engineering practice. In Hyldgaard Christensen, S., Didier, C.,Jamison, A. Meganck, M. Mitcham, C. & Newberry, B. (Eds.). *Engineering identities, epistemologies and values,* (21) 129–145. Cham: Springer International Publishing.

Buxton, B. (2005). Experience Design vs. Interface Design, *Rotman Magazine Winter 2005.* Retrieved from http://www.billbuxton.com/experienceDesign.pdf

Buxton, B. (2007). *Sketching user experiences: getting the design right and the right design*. San Francisco: Morgan Kaufmann.

Cadle, J., & Yeates, D. (2007). *Project management for information systems.* New York: Pearson Education.

Caillois, R. (2001). *Man, play and games*. Chicago: University of Illinois Press.

Cain, W. (2015). Technology Navigators: An Innovative Role in Pedagogy, Design and Instructional Support. In *Educational Innovations and Contemporary Technologies*, pp. 21-35. Palgrave Macmillan UK.

Cain, W., & Henriksen, D. (2013, March). Pedagogy and situational creativity in synchronous hybrid learning: Descriptions of three models. *In Society for Information Technology & Teacher Education International Conference*, (SITE). (2013)1, 291-297, New Orleans.

Cain, W., Sawaya, S., & Bell, J. (2013, June). Innovating the hybrid small group model in a synchromodal learning environment. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 1333-1339.

Carroll, M., Goldman, S., Britos, L., Koh, J., Royalty, A., & Hornstein, M. (2010). Destination, imagination and the fires within: Design thinking in a middle school classroom. *International Journal of Art & Design Education*, 29(1), 37–53.

Carroll, M. P., & Carroll, M. P. (2014). Shoot For The Moon! The Mentors and the Middle Schoolers Explore the Intersection of Design Thinking and STEM. *Journal of Pre-College Engineering Education Research*, *4*(1), 14-30.

Cator, K., & Adams, B. (2013). Expanding evidence approaches for learning in a digital world. Washington, DC: *U.S. Department of Education, Office of Educational Technology*.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative research*. London: Sage Publications Ltd.

Chatfield, T. (2010). 7 ways games reward the brain. *TED talk* Retrieved from *http://www.ted.com/talks/tom_chatfield_7_ ways_games_reward_the_brain.html*

Cho, J., & Trent, A. (2006). Validity in qualitative research revisited. *Qualitative research*, 6(3), 319-340.

Christensen, C. M., Horn, M. B., & Johnson, C. W. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York, NY: McGraw-Hill.

Clarke, J., & Dede, C. (2009). Design for scalability: A case study of the River City curriculum. *Journal of Science Education and Technology*, 18, 353–365.

Clegg, S. R., Courpasson, D., & Phillips, N. (2006). Power and organizations. London: Sage.

Cobb, P., & Gravemeijer, K. (2008). Experimenting to support and understand learning processes. In A. E. Kelly, R. A. Lesh & J. Y. Baek (Eds.), *Handbook of design research methods in education* (pp. 68–95). New York: Routledge.

Cobb, P., & Jackson, K. (2012). Analyzing educational policies: A learning design perspective. *Journal of the Learning Sciences*, 21(4), 487-521.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in education research. *Educational Researcher*, *32*(1), 9–13.

Coburn, C. E., & Stein, M. K. (2006). Communities of practice theory and the role of teacher professional community in policy implementation. In Honig, M. I. (Ed.). *New directions in education policy implementation, Confronting complexity. 25-46.* NY: State University of New York Press.

Collins, A. (1992). Toward a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15–22). Berlin: Springer.

Collins, A., & Halverson, R. (2010). The second educational revolution: Rethinking education in the age of technology. *Journal of Computer Assisted Learning* (2010), *26*, 18–27.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences*, *13*(1), 15–42.

Connolly, T.M., Boyle, E.A., MacArthur, E., Hainey, T. & Boyle, J.M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, *59*(2), 661-686. Elsevier.

Conole, G. (2012). *Designing for learning in an open world* (Vol. 4). London: Springer Science & Business Media.

Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research (3rd ed.). Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, CA: Sage Publications, Inc.

Corpus, J. H., Haimovitz, K., & Wormington, S. V. (2012). Understanding Intrinsic and Extrinsic Motivation: Age Differences and Meaningful Correlates. In *Encyclopedia of the Sciences of Learning,* (pp. 3372-3374). Springer US.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches.* Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W. (2014). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. New York: Pearson Education.

Creswell, J. W. & Clark, V. L. P. (2011). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice*, 39(3), 124-130.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Cambridge: Harvard

Dale, E.L. (1998). *Pædagogik og Professionalitet.* Århus: Forlaget Klim.

Darsø, L. (2007). *Is There a Formula for Innovation?* Emdrup: Learning Lab Denmark, Aarhus School of Education.

Darsø, L. (2011). *Innovationspædagogik. Kunsten at fremelske innovationskompetence* Copenhagen: Samfundslitteratur.

Darsø, L. (2002). *Innovation in the making.* København: Samfundslitteratur.

De Bono, E. (1999). *Six Thinking Hats*. Florida, Black Bay Books.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68-78.

Dede, C (2007). *Unlearning: The Key Dimension of Professional Development for Technology-Enhanced Transformation.* In *Obstacles to Online Teacher Professional, Development Changing teachers beliefs and Practices* in National Academies Teacher Advisory Council, Committee on Enhancing Professional Development for Teachers, Center for Education, Division of Behavioral and Social Sciences and Education, National Research Council. (p.21) Washington, DC.: *The National Academies Press*. ISBN: 13: 978-0-309-11111-9.

Dede, C. (1996). The evolution of distance education: Emerging technologies and distributed learning. *American Journal of Distance Education*, *10*(2), 4-36.

Dede, C. (2004). If design-based research is the answer, what is the question? A commentary on Collins, Joseph, and Bielaczyc; diSessa and Cobb; and Fishman, Marx, Blumenthal, Krajcik, and Soloway in the *JLS special issue on design-based research. The Journal of the Learning Sciences*, 13(1), 105-114.

Dede, C. (2008). Theoretical perspectives influencing the use of information technology in teaching and learning. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*, (pp. 43-62), New York: Springer.

Dede, C. (2011). Developing a research agenda for educational games and simulations. In Tobias, S. and Fletcher, J. 2011, *Computer games and instruction*, (pp.233-250), Charlotte: IAP.

Dede, C., Ketelhut, D. J., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education* , 60 (1), 8–19. doi:10.1177/0022487108327554

Demirbilek, M. (2010). Digital Games for Online Adult Education: Trends and Issues in Kidd, T. T. (Ed.). *Online Education and Adult Learning: New Frontiers for Teaching Practices*. Hershey, PA: Information Science.

Deterding, S. (2011). *Don't Play Games With Me! Promises and pitfalls of gameful design*, web directions @media, London, May 27, 2011. Retrieved from http://codingconduct.cc/1523514/Don-t-Play-Games-With-Me

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. *Proceedings of the Academic MindTrek Conference.* Tampere, Finland — September 28 - 30, 2011, 9-15.

Dewey, J. ([1933]2009). *Hvordan vi tænker. en reformulering af forholdet mellem reflektiv tænkning og uddannelsesprocessen*, translation [How we think]. Århus: Forlaget Klim.

Dewey, J. (1922). *Human nature and conduct. An introduction to Social Psychology.* New York: Henry Holt and Company.

Dewey, J. (1929). The sources of a science of education (Vol. 17). New York: Horace Liveright.

Dewey, J., & Bentley, A. F. (1960). *Knowing and the known* (No. 111). Boston: Beacon Press.

Dewey, J., Rorty, R. (2008), *The Later Works of John Dewey, Volume 8, 1925-1953: 1933, Essays and How We Think*. Southern Illinois University Press.

Dillenbourg, P. (1999). What do you mean by collaborative learning? In Dillenbourg, P. (Ed.). *Collaborative learning: Cognitive and computational approaches*, (pp. 1–19). Oxford: Elsevier.

Dirckinck-Holmfeld, L. (2009). Innovation of problem based learning through ICT: linking local and global experiences. *International Journal of Education and Development using ICT*, *5*(1).

DiSessa, A. A., & Cobb, P. (2004). Ontological innovation and the role of theory in design experiments. *The Journal of the Learning Sciences*, *13*(1), 77–103.

Dolezal, L. (2009). The Remote Body: The Phenomenology of Telepresence and Re-Embodiment, *Human Technology*, (5)2, 208-226.

Dourish, P. (2001/2004). *Where the Action Is: The Foundations of Embodied Interaction*, MIT press, Cambridge, MA.

Dourish, P. (2006a, November). Re-space-ing place: place and space ten years on. In *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work* (pp. 299-308). ACM.

Dourish, P. (2006b). Implications for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 541-550), New York: ACM.

Draper, J. V., Kaber, D. B., & Usher, J. M. (1998). Telepresence. Human Factors: *The journal of the human factors and ergonomics society*, 40(3), 354-375.

Dreyfus, H. L. & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York: Free Press.

Dreyfus, H.L. (2001). *Livet på nettet*, translated by Ole Lindegård Henriksen after "*On the Internet*", Copenhagen: Hans Reitzels Forlag.

Duncan, I., Miller, A., & Jiang, S. (2012). A taxonomy of virtual worlds usage in education. *British Journal of Educational Technology*, 43(6), 949-964.

Duus, G. (2009).Validitet. In Duus, G., Husted, M., Kildedal, K., Laursen, E., & Tofteng, D. (2012). *Aktionsforskning*. Copenhagen: Samfundslitteratur.

Earp, J. (2015). Game making for learning: A systematic review of the research literature. In *Proceedings of 8th International Conference of Education, Research and Innovation* (ICERI2015), (pp. 6426–6435). Seville, Spain: International.

Edelson, D. C. (2002). Design research: What we learn when we engage in design. *The Journal of the Learning Sciences*, *11*(1), 105–121.

Ehn, P. (2008). Participation in design things. In *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008* (pp. 92-101). Indiana University.

Elkjær, B. (2012). Et indblik I pragmatisk læringsteori – med udsigt til fremtiden. In K. Illeris (Ed.), *49 tekster om læring*. Copenhagen: Samfundslitteratur.

Elkjær, B. & Wiberg, M. (2013). Pragmatismens læringssyn og pragmatisk læringsteori. In Qvortrup, A., & Wiberg, M. (Eds.), *Læringsteori og didaktik*. (pp. 124-143). Copenhagen: Hans Reitzel.

Ellingson, D. A., and Notbohm, M. (2012). Synchronous distance education: Using web-conferencing in an MBA accounting course, *American Journal of Business Education* (AJBE), 5(5), 555-562.

Elliot, A. J., & Dweck, C. S. (Eds.).(2005). *Handbook of competence and motivation*. London: Guilford Publications.

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2011). *Writing ethnographic fieldnotes*. Chicago: University of Chicago Press.

Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, *43*(7), 960–974.

Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of education and work*, 14(1), 133-156.

Engeström, Y., & Sannino, A. (2010). Studies of expansive learning: Foundations, findings and future challenges. *Educational Research Review*, 5(1), 1–24.

Eraut, M. (2008). Learning from other people in the workplace. In Hall, K., Murphy, P., & Soler, J. (Eds.). *Pedagogy and practice: Culture and identities*, (pp. 40-57), London: Sage.

ESA (Entertainment Software Association) (2014). *The 2014 Essential Facts About the Computer and Video Game Industry*, Retrieved from http://www.theesa.com/wpcontent/uploads/2014/10/ESA_EF_2014.pdf

EVA (2012). *Skoler skal hæve ambitionerne*. Retrieved from http://bit.ly/17y1hUC.

EVA (2013). *Almen Voksenuddannelse, evaluering af reformen fra 2009*, Retrieved from http://bit.ly/1ecG2Mn

EVA1 (Evaluation Institute of Denmark) Danmarks Evalueringsinstitut (2011). *Guide til selv evaluering*: Retrieved from https://www.eva.dk/projekter/2008/it-i-folkeskolen/materiale-til-selvevaluering/Bedre%20udbytte%20af%20it%20-%20Guide%20til%20selvevaluering.pdf

EVA2 (Evaluation Institute of Denmark) (2014). *Voksenpædagogiske læringsmiljøer på VUC, Fokus på avu og hf-enkeltfag*, København: Danmarks Evalueringsinstitut.

EVA3 (Evaluation Institute of Denmark) Danmarks Evalueringsinstitut (2011). *Skoler skal hæve IT-ambitionerne*, Retrieved from http://www.eva.dk/presse/debatindlaeg-fra-eva/2010/skoler-skal-haeve-it-ambitionerne

EVA4 (Evaluation Institute of Denmark) Danmarks Evalueringsinstitut (2008). *IT i folkeskolen,* Retrieved from http://www.eva.dk/projekter/2008/it-i-folkeskolen

EVA5 (Evaluation Institute of Denmark) Danmarks Evalueringsinstitut (2009). *It i skolen - erfaringer og perspektiver*. Retrieved from https://www.eva.dk/projekter/2008/it-i-folkeskolen/projektprodukter/it-i-skolen-erfaringer-og-perspektiver/view

Fantl, J. (2014). Knowledge how. *The Stanford Encyclopedia of Philosophy* (Fall 2014 Edn.), Edward N. Zalta (Ed.). Retrieved from http://plato.stanford.edu/archives/fall2014/entries/knowledge-how

Ferrara, J. (2012). *Playful Design*. Brooklyn, New York: Rosenfeld Media.

Flanagan, M., Hash, C., & Isbister, K. (2010). Designing Games for Learning: Insights from Conversations with Designers, *CHI 2010*, Atlanta, Georgia, USA.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, (12)2, April 2006, 219-245.

Frederiksen, M., Gundelach, P., & Skovgaard Nielsen, R. (2014). *Mixed Methods Forskning*. København: Hans Reitzel.

Freeman, M. (1998). Video Conferencing: a Solution to the Multi-campus Large Classes Problem. *British Journal of Educational Technology*, (29) 3, pp. 197-210, Chichester, Wiley Online Library.

Friesen, N. (2009). *Re-thinking e-learning research: Foundations, methods and practice.* New York, NY: Peter Lang.

Friesen, N. (2011). *The Place of the Classroom and the Space of the Screen: Relational Pedagogy and Internet Technology. New Literacies and Digital Epistemologies, (50)*. Peter Lang New York. 29 Broadway 18th Floor, New York, NY 10006.

Friesen, N., (2014). Telepresence and Tele-absence: A Phenomenology of the (In)visible Alien Online, *Phenomenology & Practice*, (8; 2014)1, 17-31.

Fullerton, T. (2008). *Game Design Workshop*, San Francisco: Morgan Kaufmann

Gallup (2012). *The Gallup Student Poll*, Gallup, Inc.

Gallup (2013). *State of the Global Workplace, Employee Engagement Insights for Business Leaders Worldwide*, Gallup

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gee, J.P. (2005). Learning by Design: Good Video Games as Learning Machines. *E–Learning and Digital Media*, (2)1, 5–16, *Symposium Journals*.

Gee, J. P. (2011). Reflections on empirical evidence on games and learning. In S. Tobias & J. D. Fletcher. (Eds). *Computer games and instruction* (pp. 223-232). Charlotte, NC: Information Age Publishing.

Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.

Gherardi, S. (2012). *How to conduct a practice-based study: Problems and methods*. Camberley Surrey: Edward Elgar Publishing.

Gherardi, S., Nicolini, D., & Odella, F. (1998). Toward a social understanding of how people learn in organizations the notion of situated curriculum. *Management learning*, 29(3), 273-297.

Gillies, D. (2008). Student perspectives on videoconferencing in teacher education at a distance. In *Distance Education*, (29)1, 107-118, New York: Taylor & Francis.

Gimmler, A. (2014). *Amerikansk pragmatisme – hverdagslivets kreativitet*. In Jacobsen, H. M. & Kristiansen, S: (Eds.), *Hverdagslivet – Sociologien om det upåagtede*. Copenhagen: Hans Reitzels Forlag.

Glaser, B. G., & Strauss, A. L. (2009/1967). *The discovery of grounded theory: Strategies for qualitative research*. New Jersey: Transaction Publishers.

Goldkuhl, G. (2012). Design research in search for a paradigm: Pragmatism is the answer. In M. Helfert & B. Donnellan (Eds.), *Practical aspects of design science* (pp. 84–95). Berlin and Heidelberg: Springer.

Goldkuhl, G., & Cronholm, S. (2003). Multi-Grounded Theory–adding theoretical grounding to grounded theory. In *Proceedings of the 2nd European Conference on Research Methodology for Business and Management Studies*. Reading, UK.

Goodyear, P. (2005). Educational design and networked learning: patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21(1), 82–101.*

Gravemeijer, K., & Cobb, P. (2013). Design research from a learning design perspective. In T. Plomp & N. Nieveen (Eds.), *Educational design research* (pp. 72–113). Enschede: Netherlands Institute for Curriculum Development (SLO).

Greenberg, A. (2004). *Navigating the sea of research on video conferencing-based distance education: A platform for understanding research into the technology's effectiveness and value*. Duxbury, MA: Wainhouse Research. Retrieved from http://wainhouse.com/files/papers/wr-navseadistedu.pdf

Greenberg, A. (2009). *Mapping the Latest Research into Video-Based Distance Education.* The 2009 Updated, Expanded Analysis Navigating the Sea of Research, Wainhouse Research.

Groff, J., Clarke-Midura, J., Owen, V. E., Rosenheck, L., & Beall, M. (2015). Better Learning in Games: A Balanced Design Lens for a New Generation of Learning Games. Cambridge: MA: *MIT Education Arcade and Learning Games Network*.

Groundwater-Smith, S., & Irwin, J. (2011). Chapter 5: Action Research in Education and Social Work. In L. Markauskaite et al. (Eds.), *Methodological Choice and Design* (pp. 57-69). Dordrecht: Springer Netherlands.

Gulson, K. N., Clarke, M., & Petersen, E. B. (2015). Education policy and contemporary theory: implications for research. London: Routledge.

Gundelach, P., & Skovgaard Nielsen, R. (2014). *Mixed Methods Forskning, Principper og praksis*. København: Hans Reitzel.

Gärdenfors, P. (2010). *Lusten att förstå, - om lärende på människans villkor*. Stockholm: Natur & Kultur.

Halverson, R., & Smith, A. (2009). How new technologies have (and have not) changed teaching and learning in schools. *Journal of Computing in Teacher Education*, 26(2), 49-54.

Hammer, S., & Høpner, J. (2014). *Meningsskabelse, organisering og ledelse – en introduktion til Weicks univers*. Copenhagen: Forlaget Samfundslitteratur.

Harasim, L. (2011). L*earning Theory and Online Technologies*. New York: Routledge.

Harel, I. E., & Papert, S. E. (1991). *Constructionism*. New York: Ablex Publishing.

Harris & Morrison (2011). Through the looking glass: adult education through the lens of the Australian, *Journal of Adult Learning over fifty years*. Retrieved from: http://www.eric.ed.gov/PDFS/EJ973620.pdf

Hartnett, M.; George, A. & Dron, J. (2011). Examining motivation in online distance learning environments: Complex, multifaceted and situation-dependent. *In The International Review of Research in Open and Distance Learning*, (12)6, 20-38.

Hasse, C. & Dupret, K. (2012). *Teknologiforståelse - på skoler og hospitaler*. Århus: Aarhus Universitetsforlag.

Hasse, C. & Storgaard Brok, L. (2015). *TEKU- modellen – Teknologiforståelse i professionerne*. Copenhagen: Upress.

Hasso Plattner Institute of Design at Stanford (2016). *Design Thinking Process*. Palo Alto, CA: Stanford University.

Hastrup, K. (2003). *Ind i verden. En grundbog i antropologisk metode.* Copenhagen: Hans Reitzels Forlag.

Hastrup, K. (2015). Feltarbejde. In Brinkmann, S. & Tanggaard, L. (Eds.). *Kvalitative metoder*. København: Hans Reitzels Forlag.

Hatch, M. (2013). *The Maker Movement manifesto: Rules for innovation in the new world of crafters, hackers, and tinkerers.* New York, McGraw-Hill.

Hedestig, U. & Kaptelinin, V. (2005). Facilitator's roles in a videoconference learning environment. In *Information Systems Frontiers*, (7)1, 71- 83.

Henriksen, T., Buhl, M., Misfeldt, M., & Hanghøj, T. (2011). Har projekter et liv efter deadline? [Do projects have a life after their deadline?] Skoleudvikling fra Projekt til Forankring, *Cursiv, (8)*, 83–102.

Herrington, J., McKenney, S., Reeves, T., & Oliver, R. (2007). *Design-based research and doctoral students: Guidelines for preparing a dissertation proposal.* In: World Conference on Educational Multimedia, Hypermedia and Telecommunications (EDMEDIA). 2007, 25–29 June 2007, Vancouver, Canada, pp. 4089–4097.

Hiim, H. & Hippe, E., (1997). *Læring gennem oplevelse, forståelse og handling*. København: Gyldendals uddannelse.

Hiim, H., & Hippe, E. (2003). *Undervisningsplanlægning for faglærere*. København: Gyldendal Uddannelse.

Honey, M. & Kanter, D. (2013). *Design, make, play: Growing the next generation of STEM innovators.* New York, NY: Routledge.

Huizinga, T., Handelzalts, A., Nieveen, N., & Voogt, J. M. (2014). Teacher involvement in curriculum design: Need for support to enhance teachers' design expertise. *Journal of curriculum studies*, 46(1), 33-57.

Hutters, C., Katznelson, N., Sørensen, N. U., & Juul, T. M. (2013). *Unges motivation og læring: 12 eksperter om motivationskrisen i uddannelsessystemet*. Copenhagen: Hans Reitzels Forlag.

Høpner, J., Jørgensen, T. B., Andersen, T., & Sørensen, H. B. (2010). *Modstillinger i organisations-og ledelsesteori.* Copenhagen: Hans Reitzels Forlag.

Ihde, D. (1990). *Technology and the lifeworld: From garden to earth* (No. 560). Indiana: Indiana University Press.

Ihde, D. (2002). *Bodies in technology* (Vol. 5). Minnesota: University of Minnesota Press.

Illeris, K. (2007). *Læring*. Roskilde: Roskilde Universitetsforlag.

Illeris, K. (2007b). *How We Learn: Learning and Non-Learning in School and Beyond*, New York, NY: Routledge.

Illeris, K. (2012). Hvad er det særlige ved voksnes læring? In Illeris, K, (Ed.). *49 tekster om læring*, 557-572. København: Samfundslitteratur.

Illeris, K. (2013). *Transformativ læring og identitet*. København: Samfundslitteratur.

Illeris, K., (2000). *Læring – aktuel læringsteori mellem Freud, Piaget og Marx*, Roskilde: Roskilde Universitetsforlag.

Illeris, K. (2009). *Contemporary theories of learning: learning theorists... in their own words*. New York: Routledge.

iNacol (International Association for K-12 Online Learning) (2011). *National Standards for Quality Online Programs*, p. 7, Retrieved from http://www.inacol.org/resource/inacol-national-standards-for-quality-online-courses-v2/

Jacobsen, D.I. & Thorsvik, J. (2008). *Hvordan organisationer fungerer*. København: Hans Reitzels Forlag.

Jahnke, I., Svendsen, N. V., Johansen, S. K., & Zander, P. O. (2014, November). The Dream About the Magic Silver Bullet: The Complexity of Designing for Tablet-Mediated Learning. In *Proceedings of the 18th International Conference on Supporting Group Work*, 100-110. ACM.

Jank, W. & Meyer, H. (2006). Dannelsesteoretisk og kritisk konstruktiv didaktik. In *Didaktiske modeller, - grundbog i didaktik*, København: Gyldendals lærerbibliotek.

Johri, A. (2011). The Socio-Materiality of Learning Practices and Implications for the Field of Learning Technology. *Research in Learning Technology*, *19*(3), 207-217.

Jones, G., & Sallis, E. (2013). *Knowledge management in education: Enhancing learning & education*. Routledge, New York.

Justesen, L. & Mik-Meyer, N. (2010). *Kvalitative metoder i organisations-og ledelsesstudier.* København: Hans Reitzels Forlag.

Juul, H. (2010). *Pædagogik-et overblik.* København: Gyldendal Uddannelse.

Kafai, Y. B., & Burke, Q. (2015). Constructionist gaming: Understanding the benefits of making games for learning. *Educational Psychologist*, *50*(4), 313-334.

Kafai, Y. B. (2006). Playing and making games for learning instructionist and constructionist perspectives for game studies. *Games and Culture 1*(1), 36–40.

Kafai, Y. B. (2006b). Constructionism. In K. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 35–46). New York, NY: Cambridge University Press.

Kafai, Y. B., & Resnick, M. (1996). *Constructionism in practice: Designing, thinking, and learning in a digital world*. New York, NY: Routledge.

Kafyulilo, A., Fisser, P., & Voogt, J. (2014). Teacher design in teams as a professional development arrangement for developing technology integration knowledge and skills of science teachers in Tanzania. *Education and Information Technologies*, 1-18.

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. San Francisco: Pfeiffer.

Karabulut, A. & Correia, A. (2008). Skype, Elluminate, Adobe Connect, Ivisit: A comparison of Web-Based Video Conferencing Systems for Learning and Teaching. In K. McFerrin et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2008* (pp. 481-484). Chesapeake, VA: AACE.

Kauffmann, O. (2013). Kognitive læringsteorier. In Qvortrup, A., & Wiberg, M. (Eds.). *Læringsteori og didaktik* (pp.123). Copenhagen: Hans Reitzel.

Keller, J. M (2008). First principles of motivation to learn and e3- learning, *Distance Education*, (29) 2, 175 -185. New York: Taylor & Francis.

Kelly, A. E. (2004). Design research in education: Yes, but is it methodological? *The Journal of the Learning Sciences*, *13*(1), 115–128.

Kelly, A. E. (2013). When is Design Research Appropriate? In Plomp, T. & Nieveen, N. (Eds.), *Educational Design Research* (pp. 73 – 88). Enschede: SLO, Netherlands institute for curriculum development.

Kierkegaard, S. (1906). *Af en endnu levendes papirer: udgivet mod hans villie*. Copenhagen: Gyldendalske boghandel.

Kim, N., Han, J., & Ju, W. (2014, March). Is a robot better than video for initiating remote social connections among children? In *Proceedings of the 2014 ACM/IEEE international conference on Human-robot interaction,* 208-209

Kirschner, P., Wubbels, T., & Brekelmans, M. (2008). Benchmarks for teacher education programs in the pedagogical use of ICT. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. New York: Springer.

Kjær, C., Christensen, I. M. F., Blok, R., & Petersen, L. (2009). Anvendelse af webkonference på Syddansk Universitet–Erfaringer fra tre pilotprojekter. *Tidsskriftet Læring og Medier (LOM)*, *2*(2).

Klafki, W. (1983/1974). Kategorial dannelse. Bidrag til en dannelsesteoretisk fortolkning av moderne didaktikk. In Klafki, W., & Nordenbo, S. E. (Eds.) (1983). *Kategorial dannelse og kritisk-konstruktiv pædagogik*. Nyt Nordisk Forlag.

Knoop, H. H. (2004). Om kunsten at finde flow i en verden, der ofte forhindrer det. In *Kognition og didaktik*, (52), juli 2004, 14.årgang.

Knowles, M. S., Holton III, E. F., & Swanson, R. A. (2014). *The adult learner: The definitive classic in adult education and human resource development.* (6th ed.). New York: Routledge.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. *Contemporary issues in technology and teacher education*, 9(1), 60-70.

Koh, J. H. L., Chai, C. S., Wong, B., & Hong, H. Y. (2015). *Design thinking for education: Conceptions and applications in teaching and learning*. Singapore: Springer.

Kolb, D. (1984). *Experiential learning as the science of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Koster, R. (2005). *A Theory of Fun for Game Design*, Paraglyph Press, Scottsdale, Arizona.

Kristiansen, S., & Krogstrup, H. K. (2015). *Deltagende observation: introduktion til en samfundsvidenskabelig metode.* Copenhagen: Hans Reitzel.

Kvale, S. (2007). *Doing interviews.* London: Sage Publications.

Kvale, S. & Brinkmann, S. (2009).*Interview, Introduktion til et håndværk*, København: Hans Reitzels Forlag,

Laurillard, D. (2008). Open teaching: The key to sustainable and effective open education. In T. Iiyoshi & M. S. Vijay Kumar (Eds.), *Opening up education: The collective advancement of education through open technology, open content, and open knowledge*. Boston, MA: MIT Press.

Laurillard, D. (2011). *Supporting teachers in optimizing technologies for open learning*, Institute for Adult Learning Singapore. Retrieved from http://www.ialsymposium.com.sg/pdf/Publication8.pdf

Laurillard, D. (2012). *Teaching as a design science: Building pedagogical patterns for learning and technology*. New York, NY: Routledge.

Laurillard, D. (2014). *Thinking about blended learning*. Brussels: Royal Flemish Academy of Belgium for Science and the Arts.

Laurillard, D., Charlton, P., Craft, B., Dimakopoulos, D., Ljubojevic, D., Magoulas, G., ... & Whittlestone, K. (2013). A constructionist learning environment for teachers to model learning designs. *Journal of Computer Assisted Learning*, 29(1), 15-30.

Laurillard, D., Oliver, M., Wasson, B., & Hoppe, U. (2009). Implementing technology-enhanced learning. In *Technology-Enhanced Learning*, 289-306, Dordrecht: Springer Netherlands.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Law, N. (2008). Teacher learning beyond knowledge for pedagogical innovations with ICT. In J. Voogt, G. Knezek (Eds.). *International Handbook of Information Technology in Primary and Secondary Education*, (pp.425-434). New York: Springer, Science & Business Media, LLC.

Law, N., Kankaanranta, M., & Chow, A. (2005). Technology-supported educational innovations in Finland and Hong Kong: A tale of two systems. Human Technology: An Interdisciplinary *Journal on Humans in ICT Environments*, 1, 176–201.

Lawson, T., Comber, C., Gage, J., & Cullum Hanshaw, A. (2010). Images of the future for education? Videoconferencing: A literature review. *Technology, Pedagogy and Education*, *19*(3), 295-314.

LCL (2014). Learning creative learning. Retrieved from http://learn.media.mit.edu/lcl/index.html.

Lee, M. K., & Takayama, L. (2011, May). Now, I have a body: Uses and social norms for mobile remote presence in the workplace. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 33-42). ACM.

Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: age differences and academic correlates. *Journal of educational psychology*, 97(2), 184.

Levinsen, K. T., Ørngreen, R., & Buhl, M. (2013, January). Telepresence as Educational Practice in the Third Teaching- Room–a Study in Advanced Music Education. In Proceedings of the 12th European Conference of E-learning. Sonning Common: Academic Conferences and Publishing International Limited, 250-257.

Lewin, K. (1958). Group decision and social change. In Maccoby, E.L., Newcomb, T.M., Hartley, E.E. (Eds.). *Readings in Social Psychology*. (pp. 197–211). New York: Holt, Rinehart and Winston.

Liu, M., Hsieh, P., Cho, Y., & Schallert, D. (2006). Middle school students' self-efficacy, attitudes, and achievement in a computer-enhanced problem-based learning environment. *Journal of Interactive Learning Research*, *17*(3), 225–242.

Lowes, S. (2008). Online Teaching and Classroom Change: The Trans-Classroom Teacher in the Age of the Internet, *Innovate: Journal of Online Education*: (4)3, Article 1. Retrived from http://nsuworks.nova.edu/innovate/vol4/iss3/1

Löwgren, J., & Stolterman, E. (2007). *Thoughtful interaction design: A design perspective on information technology.* Cambridge, MA: MIT Press.

Luckin, R., Bligh, B., Manches, A., Ainsworth, S., Crook, C. and Noss, R. (2012). *Decoding learning: The proof, promise and potential of digital education*, Nesta, innovation foundation.

Lundgren, Dennis D. (2007). Perceived Barriers to the Adoption of Videoconferencing and Recommendations to Reduce Concerns. *Andrews University, 2007*. Retrieved from http://www.ibrarian.net/navon/paper/A_Qualitative_Study.pdf?paperid=11151616.

Lykins, C. (2012). Why 'what works' still doesn't work: How to improve research syntheses at the What Works Clearinghouse. *Peabody Journal of Education*, *87*(4), 500–509.

Lykke, N., Markussen, R., & Olesen, F. (2004). There are always more things going on than you thought! Methodologies as thinking technologies. Interview with Donna Haraway, 2nd. Part. in Haraway, D. J. (Ed.). *The Haraway reader*. New York: Routledge.

Majgaard, G., Misfeldt, M., & Nielsen, J. (2011). How design-based research, action research and interaction design contributes to the development of designs for learning. *Designs for learning*, 4(2), 8-21.

Majid, O., Rahman, Z. A., Ghani, N. A., Guan, S. K., Idrus, R. M., & Atan, H (2006). The Video Conferencing Learning Environment in Distance Education: A Study of the Interaction Pattern. *Proceeding: Advanced Learning Technologies,* 2006. Sixth International Conference pp.992-996, IEEE

Malone, T.W. (1980). *What Makes Things Fun to Learn? Heuristics for Designing Instructional Computer Games*. Xerox Palo Alto Research Center.

Manovich, L. (2007). Alan Kay's universal media machine, in A. Fetveit, & G. Stald (eds.). *Northern Lights Film and Media Studies Yearbook 2007*, (5), 39-56. Digital Aestetics and Communication.

Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research.* Thousand Oaks, CA: Sage Publications, Inc.

MBUL: Ministeriet for Børn, unge og Ligestilling (2015). *95-procent målsætning*. Retrieved from http://www.uvm.dk/I-fokus/95-procent-maalsaetning

McCue, L., & Scales, G. R. (2007). *Embracing the middle ground: Engaging on- and off-campus students within the same 'classroom'.* In Proceedings, ASEE Southeast Section Conference, Louisville, KY.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world.* New York, NY: Penguin Books.

McKenney, S., & Reeves, T.C. (2012). *Conducting educational design research*. London: Routledge.

McKenney, S.E., Kali, Y., Markauskaite, L. & Voogt, J.M. (2015). Teacher design knowledge for technology enhanced learning: A framework for investigating assets and needs. In: *Interactive poster symposium at the annual meeting of the American Educational Research Association*, April 2015, Chicago.

McLuhan, M. (1964). *Understanding Media: The Extensions of Man*. New York: The New American Library.

Meadows, D.H. & Wright, D. (2008). *Thinking in Systems: A Primer*, Earthscan, London.

Mejlvig, K. (2012). Appreciative Inquiry – anerkendende udforskning. In Duus, G. et al. (Eds.). *Aktionsforskning - en grundbog*, (pp. 215-227). København: Samfundslitteratur,.

Merleau-Ponty, M. (1962). *Phenomenology of Perception*. London: Routledge & Keagan Paul.

Merleau-Ponty, M. (1964). *Signs.* Northwestern University Press.

Merriam-Webster Online Dictionary (2016) Retrieved from: http://www.merriam-webster.com/dictionary. Springfield, MA.

Mezirow, J. (1991). *Transformative dimensions of adult learning*. San Francisco: Jossey-Bass.

Michael, J. (2006). Where's the Evidence that Active Learning Works? *Advances in Physiology Education*, (30)4, 159.

Milana (2008). Initial education and training pathways for Danish adult educators. *ASEM conference 25 November 2008*, Beijing, Retrieved from https://pure.au.dk/portal/files/286/Milana-Marcella-ASEMworkshopDpaper.pdf

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook. 3rd ed*. Thousand Oaks, CA: Sage Publications, Inc.

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

Mitra, S., Dangwal, R., Chatterjee, S., Jha, S., Bisht, R. S., & Kapur, P. (2005). Acquisition of computing literacy on shared public computers: Children and the" hole in the wall". *Australasian Journal of Educational Technology*, 21(3).

Molka-Danielsen, J., & Deutschmann, M. (2009). *Learning and teaching in the virtual world of Second Life*. Tapir Academic Press.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1), 48-76.

Morrison, B. B., & DiSalvo, B. (2014). Khan academy gamifies computer science. In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education* (SIGCSE '14). ACM, New York, NY, USA, 39-44.

Murphy, P. (2008). Defining Pedagogy. In K. Hall, P. Murphy & J. Soler (Eds.), *Pedagogy and practice: culture and identities* (pp. 28 – 39). London: SAGE publications.

Nash, P., & Shaffer, D. W. (2011). Mentor modeling: The internalization of modeled professional thinking in an epistemic game. *Journal of Computer Assisted Learning*, *27*(2), 173–189.

Nelson, B. C., & Erlandson, B. E. (2012). *Design for learning in virtual worlds.* New York: Routledge.

Nelson, B., Ketelhut, D. J., Clarke, J., Bowman, C., & Dede, C. (2005). Design-based research strategies for developing a scientific inquiry curriculum in a multi-user virtual environment. *Educational Technology*, 45(1), 21-27.

Nicolini, D. (2012). *Practice theory, work, & organization: An introduction*. Oxford: Oxford University Press.

Nielsen, F. (2013). Global Classroom-videokonference i undervisning. *Tidsskriftet Læring og Medier* (LOM), 6(11).

Nielsen, F. V. (2012). Fagdidaktik som integrativt relationsfelt: om fagdidaktikkens udvikling i Danmark med særligt henblik på en teori om forholdet mellem faglige og pædagogiske hensyn. Konsekvenser for en sammenlignende fagdidaktik. *Cursiv*, (9), 11-32.

Nielsen, K. & Kvale, S. (1999). *Mesterlære, læring som social praksis*, København: Hans Reitzels Forlag.

Nielsen, K.Aa. (2012). Aktionsforskningens historie på vej til et refleksivt akademisk selskab. In Duus, G., Husted, M., Kildedal, K., Laursen, E., & Tofteng, D. (Eds.). *Aktionsforskning*. København: Samfundslitteratur.

Nielsen, K.Aa. & Nielsen, B.S. (2015). Aktionsforskning. In Brinkmann, S. & Tanggaard, L. (Eds.). *Kvalitative metoder*. København: Hans Reitzels Forlag.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: a unified model of dynamic knowledge creation. *Long range planning*, 33(1), 5-34.

Norberg, A. (2012). Blended learning and new education logistics in Northern Sweden. In D. G. Oblinger (Ed.), *Game changers: Education and information technologies* (pp. 327-330). Boulder, CO: EDUCAUSE.

Norman, D. (2004). *Affordances and design*. Unpublished article, Retrieved from http://www. jnd. org/dn. mss/affordances-and-design.html

Nortvig, A.M. (2016). *At sidde på skolebænken i egen sofa. En undersøgelse af hvordan e-læring ses at have indflydelse på muligheder for deltagelse og tilstedevær i undervisning og dermed udvikling af professionel identitet i relation til professionsuddannelse.* Aalborg Universitetsforlag. (Ph.d.-serien for Det Humanistiske Fakultet, Aalborg Universitet).

O'Conaill, B., Whittaker, S., & Wilbur, S. (1993). Conversations over video conferences: An evaluation of the spoken aspects of video-mediated communication. *Human-computer interaction*, 8(4), 389-428.

Okita, S. Y., Turkay, S., Kim, M., & Murai, Y. (2013). Learning by teaching with virtual peers and the effects of technological design choices on learning. *Computers & Education*, 63, 176-196.

Orlikowski, W.J. (2010). The Sociomateriality of Organisational Life: Considering Technology in Management Research. *Cambridge Journal of Economics*, (34)1, 125-141.

Oygardslia, K. (2015). Students as Game Designers: Learning by Creating Game Narratives in the Classroom. In *Interactive Storytelling* (pp. 341-344). Springer International Publishing.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Papert, S. (2002). *Hard fun.* Bangor Daily News. Retrieved from http://www.papert.org/articles/HardFun.html

Papert, S., & Harel, I. (1991). *Constructionism*. Norwood, NJ: Alex Publishing.

Patton, MQ. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research*. 34 (5) Part II, 1189-1208.

Pautz, H. (2011). Revisiting the think-tank phenomenon. *Public Policy and Administration*, 26(4), 419-435.

Pea, R. D. (1993). Practices of distributed intelligence and designs for education. *Distributed cognitions: Psychological and educational considerations*, 47-87.

Perlman, D. J. (2015). Help motivate the amotivated by being a supportive teacher. *Physical Education and Sport Pedagogy,* 20(2), 204-214.

Persico, D., Pozzi, F., Anastopoulou, S., Conole, G., Craft, B., Dimitriadis, Y., ... & Walmsley, H. (2013). Learning design Rashomon I-supporting the design of one lesson through different approaches. *Research in Learning Technology*, (21).

Peters, M. & Robinson, V. (1984). The Origins and Status of Action Research in *The Journal of Applied Behavioral Science*, 1984 20(2), 113-124, New York: Sage Publications.

Petersen, K. B., Reimer, D., & Qvortrup, A. (2014). Evidence and evidence-based education: The current debate. *Cursiv* (14). Copenhagen: Institut for uddannelse og Pædagogik,(DPU).

Piaget, J. (1952/1965). *The Origin of Intelligence in Children*. New York: International University Press.

Piaget, J. (1953). *Genetic psychology and epistemology*. In Diogenes, 1(1), 49-63.

Piaget, J. (2006/1968). Genetic Epistemology, a series of lectures delivered by Piaget at Columbia University, translated by Eleanor Duckworth. In Andersen, P. & Madsen, C.(Eds.). *Konstruktivistiske rødder og grene–en antologi*. København: Unge Pædagoger.

Pless, M., & Hansen, N. H. M. (2010). *Hf på VUC-et andet valg*. Center for Ungdomsforskning, Emdrup: DPU, Aarhus Universitet.

Plomp, T. (2013). Educational design research: An introduction. In Plomp, T. & Nieveen, N. (Eds.). *Educational design research*, Enschede: SLO, Netherlands institute for curriculum development, 11-50.

Polanyi, M. (1966). *The tacit dimension*. Garden City, NY: Doubleday.

Popov, O. (2009). Teachers' and students' experiences of simultaneous teaching in an international distance and on-campus master's programme in engineering. *The International Review of Research in Open and Distance Learning,* 10(3), 1-17.

Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of innovative knowledge communities and three metaphors of learning. *Review of educational research*, 74(4), 557-576.

Quintane, E., Casselman, R. M., Reiche, B. S., & Nylund, P. A. (2011). Innovation as a knowledge-based outcome. *Journal of Knowledge Management*, *15*(6), 928–947.

Qvortrup, A., & Wiberg, M. (2013). *Læringsteori og didaktik*. Copenhagen: Hans Reitzel.

Rabardel, P. & Bourmaud, G. (2003). From computer to instrument system: a developmental perspective. *Interacting with Computers,* (15)5, 665-691.

Ratan, R. & Ritterfeld, U., (2009). Classifying Serious Games. In Ritterfeld, U. et al. (Eds.) *Serious Games, - Mechanics and Effects*, New York: Routledge.

Reeves, T. (2006). Design-based research from a technology perspective. In Akker, J. V. D., Gravemeijer, K., McKenney, S. & Nieveen, N. (Eds.), *Educational Design-based Research*. (pp. 52–66). New York: Routledge.

Regeringen, K. L., & Regioner, D. (2013). *Digital velfærd. En lettere hverdag. Fællesoffentlig strategi for digital velfærd*, 213-220.

Regeringen, K. L., Danske regioner (2011). *Den digitale vej til fremtidens velfærd, den fællesoffentlige digitaliseringsstrategi 2011–2015.* (p.22). Retrieved from http://www.digst.dk/Digitaliseringsstrategi/~/media/Digitaliseringsstrategi/Digitalevejtilfremtidensvelfærd.ashx

Reimann, P. (2011). Design-based research. In L. Markauskaite et al. (Eds.), *Methodological Choice and Design* (chapter 3), (pp. 37-50)Dordrecht: Springer Netherlands.

Resnick, M., Maloney, J., Monroy-Hernández, A., Rusk, N., Eastmond, E., Brennan, K., ... & Kafai, Y. (2009). Scratch: programming for all. *Communications of the ACM*, 52(11), 60-67.

Rice, K (2012). *Making the Move to K-12 Online Teaching: Research-Based Strategies and Practices*, New York: Pearson.

Riis, S. (2012). Klasseværelset som eksperimentarium for nye teknologier. In C. Hasse & K. Dupret (Eds.), *Teknologiforståelse – på skoler og hospitaler*. (pp. 87–110). Aarhus: Aarhus Universitetsforlag.

Roberts, R. (2009). Video Conferencing in Distance Learning: A New Zealand Schools' Perspective. In *Journal of distance learning*, (13), 91-107.

Robinson, K. (2011). *Out of our minds: Learning to be creative*. Chichester: John Wiley & Sons

Rogers, P. C., Graham, C. R., Rasmussen, R., Campbell, J. O., & Ure, D. M. (2003). Case 2: Blending Face-to-Face and Distance Learners in a Synchronous Class: Instructor and Learner Experiences. *Quarterly Review of Distance Education*, 4(3), 245-251.

Rogers,Y., Sharp, H., Preece, J., (2011). *Interaction Design, - beyond human computer interaction, 3*rd. ed., Chichester: Wiley.

Roseth, C., Akcaoglu, M., & Zellner, A. (2013). Blending synchronous face-to-face and computer-supported cooperative learning in a hybrid doctoral seminar*. TechTrends*, 57(3), 54-59.

Ruhleder, K., & Jordan, B. (2001). Co-constructing non-mutual realities: Delay-generated trouble in distributed interaction. *Computer Supported Cooperative Work* (CSCW), 10(1), 113-138.

Runco, M. A. (2005). Motivation, Competence, and Creativity. In Elliot, A. J., & Dweck, C. S. (Eds.). *Handbook of competence and motivation*. London: Guilford Publications.

Salen, K. (2011). *Quest to learn: developing the school for digital kids*. MIT Press.

Sanchez, A., Cannon-Bowers, J., Bowers, C., (2010). Establishing a Science of Game Based Learning. In *Serious Game Design and Development, - Technologies for Training and Learning*, Information Science Reference.

Sanders & Stappers, 2008; Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-design*, 4(1), 5-18.

Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1).

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. In Walker, A., Leary, H., Hmelo-Silver, C. E., & Ertmer, P. (Eds.). *Essential Readings in Problem-Based Learning: Exploring and Extending the Legacy of Howard S. Barrows*. (pp. 5-15). Lafayette, Purdue University Press.

Scardamalia, M., & Bereiter, C. (2003). Knowledge building. In J. W. Guthrie (Ed.), *Encyclopedia of education* (2nd ed.). New York: Macmillan Reference

Schatzki, T. (2002). *The site of the social: A philosophical account of the constitution of social life and change.* University Park, PA: Pennsylvania State Press.

Schell, J., (2008). *The Art of Game Design*, Elsevier.

Schell, J. (2012). Learning is Beautiful, *Learning Without Frontiers Conference*, London, January 26th, 2012. Retrieved from http://youtu.be/-IbllMjkIIM

Schlager, M. S., & Fusco, J. (2003). Teacher professional development, technology, and communities of practice: Are we putting the cart before the horse? *The information society*, 19(3), 203-220.

Schön, D. (1983). *The Reflective Practitioner: How professionals think in action*. London: Temple Smith, 1983.

Schön, D. A. (1992). Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems*, *5*(1), 3–14.

Schön, D.A. & Bennet, J. (1996). Reflective Conversation with Materials (Interview). In Winograd,T. *Bringing Software to Design* (pp.171-184). New York: ACM Press.

Schunk, D. H., Meece, J. R., & Pintrich, P. R. (2010). *Motivation in education: Theory, research, and applications.* (3rd ed.) New Jersey: Pearson Ed.

Schurz, G. (2008). Patterns of abduction. *Synthese*, 164(2), 201-234.

Schwaber, Ken (1997). *Scrum development process in Business Object Design and Implementation,* Springer, pp.117-134.

Schwarz, N., (1999). Self-Reports, How the Questions Shape the Answers. In *American Psychologist*, februar 1999, 54(2), 93-105.

SD – Statistics Denmark (2015). *Denmark in figures 2015.* Retrieved from http://www.dst.dk/pukora/epub/upload/19006/denmark2015.pdf

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human Computer Studies*. 74 (February) 14-31.

Selander, S., & Kress, G. (2012). *Læringsdesign i et multimodalt perspektiv*. Copenhagen: Frydenlund.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational researcher*, 27(2), 4-13.

Sharp, H., Rogers,Y., Preece, J. (2011). *Interaction Design, - beyond human computer interaction* (3rd. ed.). Chichester: Wiley.

Short, D. (2012). Teaching scientific concepts using a virtual world—Minecraft. Teaching Science. *The Journal of the Australian Science Teachers Association*, 58(3), 55.

Shove, E., Pantzar, M., & Watson, M. (2012). *The dynamics of social practice: Everyday life and how it changes*. London: Sage Publications.

Sjørslev, I. (2013). *Ting: I nære og fjerne verdener*. Aarhus Universitetsforlag.

Smyth, R., & Zanetis, J. (2007). Internet-based videoconferencing for teaching and learning: A Cinderella story. *Distance Learning*, 4(2), 61.

Somekh, B. (2007). *Pedagogy and learning with ICT: Researching the art of innovation*. New York: Routledge.

Somekh, B. (2008). Factors Affecting Teachers' Pedagogical Adoption of Ict. In J. Voogt, G. Knezek (Eds.). *International Handbook of Information Technology in Primary and Secondary Education*, (pp.449–460). New York: Springer Science & Business Media, LLC.

Søndergaard, K.D. & Hasse, C. 2012, *Teknologiforståelse: på skoler og hospitaler,* Aarhus Universitetsforlag

Sørensen, N.U., Hutters, C., Katznelson, N., and Juul, T.M. (2013). *Unges Motivation og læring*. Hans Reitzels Forlag.

Spector, J.M., Merrill, M.D., Elen, J. & Bishop, M. (2008). *Handbook of Research on Educational Communications and Technology*. London: Springer.

Squire, K. (2011). *Video Games and Learning: Teaching and Participatory Culture in the Digital Age. Technology, Education--Connections (the TEC Series)*. Teachers College Press. 1234 Amsterdam Avenue, New York, NY 10027.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. *Cambridge handbook of the learning sciences*, *2006*, 409-426.

Stensgaard, P. (2015). *Kort over ubekvem sandhed*, Weekendavisen, Samfund 20. Marts 2015

Stewart, A. R., Harlow, D. B., & DeBacco, K. (2011). Students' experience of synchronous learning in distributed environments. *Distance Education, 32*(3), 357-381.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research*. Newbury Park: Sage.

Susman, GI. & Evered, RD. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly*, (23), 582-603.

Suzuki, K. & Tada, N. (2009). A Layers-of-Quality Model in Online Course Design: The Five-E Model. In *International Journal for Educational Media and Technology*, 2009, (3)1, 92-103.

Svinicki, M. D., & Vogler, J. S. (2012). Motivation and Learning: Modern Theories. In *Encyclopedia of the Sciences of Learning* (pp. 2336-2339). Springer US.

SWOT personal (2013). Retrieved from http://www.teachingexpertise.com/articles/swot-analysis-personal-note-489.

Szeto, E., & Cheng, A. Y. (2014). Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students' social presence experience? *Interactive Learning Environments,* Advance online publication, 1-17.

Takeuchi, L. M., & Vaala, S. (2014). *Level up learning: A national survey on teaching with digital games.* New York: The Joan Ganz Cooney Center at Sesame Workshop.

Tanggaard, L., & Brinkmann, S. (2008). *Til forsvar for en uren pædagogik*. Nordisk Pedagogik, 28(4), 303-314.

TDGME - The Danish Government, Ministry of Education (2011). *En digital folkeskole, - national strategi for it i folkeskolen*, August 2011. Retrieved from http://bit.ly/Iq0Z21

The Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 5-8.

Thornberg, R. (2012). Informed grounded theory. *Scandinavian Journal of Educational Research*, *56*(3), 243–259.

Tingleff Nielsen, L. (2012), *Teamsamarbejdets Dynamiske Stabilitet: En Kulturhistorisk Analyse af Læreres Læring i Teams*. København: Forlaget UCC.

Tobias, S. & Fletcher, J. (2011*). Computer games and instruction*. Charlotte: Information Age Publishing.

Torrisi, G. (2011). This thing called blended learning–a definition and planning approach. In ed. Krause, K.; Grimmer, C., and Purbrick-Illek, S. (Eds.), *Research and Development in Higher Education: Reshaping Higher Education,* 34. HERDSA 2011 Higher Education On The Edge, Gold Coast, QLD

Turkay, S. (2014). S*etting Goals: Who, Why, How?* Retrieved on http://hilt.harvard.edu/files/hilt/files/settinggoals.pdf

Usher, E. L., & Morris, D. B. (2012). Academic motivation. In *Encyclopedia of the Sciences of Learning* (pp. 36-39). Springer US.

UVM - Ministeriet for børn unge og undervisning (2012). 50 millioner kroner uddeles til digitale læremidler i folkeskolen i 2012. Pressemeddelselse. Ministeriet for Børn, Undervisning og Ligestilling, København. Retrieved from http://www.uvm.dk/Aktuelt/~/UVM-DK/Content/News/Udd/Folke/2012/Jun/120614-50-millioner-kroner-uddeles-til-digitale-laeremidler-i-folkeskolen-i-2012

Verbeek, P.P. (2015). Reframing Design: 'Design as a mediating activity'. In *Proceedings of the 4th Participatory Innovation Conference 2015*. The Hague University of Applied Sciences.

Vojinović, Z. & Abbott, M.B. (2012). Fl*ood risk and social justice: from quantitative to qualitative flood risk assessment and mitigation.* London: IWA Publishing.

Von Krogh, G. (1998). Care in knowledge creation. *California Management Review*. Spring 1998. (40)3, 133-153.

Von Krogh, G., Nonaka, I., & Rechsteiner, L. (2012). Leadership in organizational knowledge creation: A review and framework. *Journal of Management Studies*, 49(1), 240-277.

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge–a review of the literature. *Journal of Computer Assisted Learning*, *29*(2), 109-121.

Voogt, J., Laferrière, T., Breuleux, A., Itow, R. C., Hickey, D. T., & McKenney, S. (2015). Collaborative design as a form of professional development. *Instructional science*, *43*(2), 259-282.

VUC (2009).*VUC og Unge – Politikpapir fra VUC lederforeningen*, VUC Storstrøm

VUC (2011).*VUC Årsrapporten 2010 June 2011*, VUC Storstrøm

VUC (2013). *Årsskrift 2012, Marts 2013*, VUC Storstrøm.

VUC Storstrøm (2014). *VUC Storstrøm Årsrapport 2014*, VUC Storstrøm. Retrieved from http://vucstor.dk/fileadmin/user_upload/pdffer/Regnskab/AArsrapport_2014_-_Revisor.pdf

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Walz, S. P., & Deterding, S. (2015). *The gameful world: Approaches, issues, applications*. Cambridge, MA: MIT Press.

Wang, F., & Hannafin, M. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology, Research and Development*, *53*(4), 5–23.

Webb, M. (2010). Models for exploring and characterising pedagogy with information technology. In McDougall, A., Murnane, J., Jones, A., & Reynolds, N. (Eds.). *Researching IT in education: Theory, practice and future directions.* London: Routledge. pp 91-111.

Weber, G. (2012). Adaptive learning systems. In Seel, N. M. (Ed.). *Encyclopedia of the sciences of learning*. Springer Science & Business Media, 3372–3374.

Weick, K. E., & Quinn, R. E. (1999). Organizational change and development. *Annual review of psychology*, 50(1), 361-386.

Weinreich, E. (2014). *Hvilke offentlige ledere er der brug for når velfærdstænkningen flytter sig: Er Diplomuddannelsens lederprofil svaret?* Copenhagen Business School, Institut for Produktion og Erhvervsøkonomi, Department of Operations Management.

Weitze, C.L. (2016). Learning and Design Processes in a Gamified Learning Design in which Students Create Curriculum-Based Digital Learning Games; *Nordgold, Ild-Lab – Nordisk Antologi*, - Submitted 1st September 2015 (Article D)

Weitze, C.L. (2015a). Learning and Motivational Processes When Students Design Curriculum-Based Digital Learning Games, *Proceedings of the 9th European Conference on Games Based Learning* (ECGBL), Nord-Trondelag University College, Steinkjer, Norway, 8–9 October 2015. Academic Conferences and Publishing International Limited (Article C)

Weitze, C.L. (2015b). Designing for Learning and Play - The Smiley model as framework, CHItaly 2015 - Public, private and community-based interaction, Paper presented at: *PALX – Player And Learner Experience – Can We Design For Both?* Rome, Italy, 28. September 2015. Retrieved from http://palx.inf.unibz.it/papers/Weitze.pdf

Weitze, C.L. (2015c). Pedagogical Innovation in Teacher Teams – An Organisational Learning Design Model for Continuous Competence Development, ECEL 2015. *Proceedings of the 14th European Conference on e-Learning* ECEL-2015. University of Hertfordshire, Hatfield, UK, 29-30 October 2015, 629-638. (Article B)

Weitze, C.L. (2015d). What is the teachers' role when students learn through design of learning games in a scaffolded gamified learning environment? Abstract from *NERA* Conference 2015, Gothenburg, Sweden.

Weitze, C.L. (2014a). An Experiment on How Adult Students Can Learn by Designing Engaging Learning Games. *Meaningful Play 2014*, 16-18 October 2014: Conference Proceedings. Michigan: University of Michigan Press.

Weitze, C.L. (2014b). Experimenting on How to Create a Sustainable Gamified Learning Design That Supports Adult Students When Learning Through Designing Learning Games. (ECGBL 2014) *Proceedings of the 8th European Conference on Games Based Learning*. Berlin, Germany, 9–10 October 2014. (2) 594–603. Academic Conferences and Publishing International Limited.

Weitze, C.L. (2014c). Developing Goals and Objectives for Gameplay and Learning (Chapter 12). In Shrier, K. (Ed.). *Learning, Education and Games: Volume One: Curricular and Design Considerations*, pp. 225–249. Pittsburgh: Carnegie Mellon University ETC Press.

Weitze, C.L. (2014d). Continuous Competence Development Model for Teacher Teams: The IT-Pedagogical Think Tank for Teacher Teams (ITP4T) in Global Classroom. *Proceedings of the 13th European Conference on e-Learning* ECEL-2014. Copenhagen: Academic Conferences and Publishing International Limited, 2014. p. 578-588.

Weitze, C.L. (2014e). IT-pedagogical Think Tank for Teacher-teams in Global Classroom, A Model for Continuous Competence Development with a Focus on Reflection, Innovation, Motivation and Engagement. *Designs for learning 2014*, 4th International Conference, Expanding the Field, 6-9 May 2014, Stockholm, Sweden: Conference Proceedings. 2014.

Weitze, C.L. (2011). *Concept development of a motivating and engaging game for learning music*, Unpublished Master's Thesis in Digital Design and Communication, IT-University, Copenhagen, Denmark. Retrieved from: http://bit.ly/HBeSuf (in Danish) and Appendix: http://bit.ly/HESEX4

Weitze, C.L. & Ørngreen, R. (2012). Concept Model for Designing Engaging and Motivating Games for Learning: The Smiley-model. *Proceedings in Meaningful Play Conference 2012*, Cathegory: Innovation in Game Design, Michigan State University, University of Michigan Press. Retrieved from http://meaningfulplay.msu.edu/proceedings2012/mp2012submission148.pdf

Weitze, C.L. & Ørngreen, R. (2012b). A Learning and Interaction design framework, from a study on formulating principles for the design of engaging music learning games. *Designs for learning 2012*, 3rd International Conference Exploring Learning Environments, 25-27 April 2012, Copenhagen, Denmark: Conference Proceedings. pp. 125-127.

Weitze, C.L. & Ørngreen, R. (2014). The Global Classroom Model Simultaneous Campus-and Home-Based Education using Videoconferencing, *EJEL, The Electronic Journal of e-Learning*, vol. *12*(2), 215-226. (Article A)

Weitze, C.L., Ørngreen, R. & Levinsen, K. (2013). The Global Classroom Video Conferencing Model and First Evaluations in Ciussi, M.; Augier, M. (Ed.). *Proceedings of the 12th European Conference on E-Learning*: SKEMA Business School, Sophia Antipolis France, 30-31 October 2013. Vol. 2, Academic Conferences and Publishing International Limited, pp. 503-510.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.

Wenger, E. (2000). Communities of practice and social learning systems. *Organization*, May 2000, (7)2, 225-246.

Wenger, E. (2004). *Praksisfællesskaber: Læring, mening og identitet*. Copenhagen: Hans Reitzel.

Wenger, E. (2007). Social læringsteori–aktuelle temaer og udfordringer. I. K. Illeris, K.(Ed.). *Læringsteorier–Seks aktuelle forståelser*, (pp. 61-79). Roskilde Universitets Forlag.

Wenger, E. (2010). Communities of practice and social learning systems: the career of a concept. In *Social learning systems and communities of practice* (pp. 179-198). Springer London.

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge.* Harvard Business Press.

White, C. P., Ramirez, R., Smith, J. G., & Plonowski, L. (2010). Simultaneous delivery of a face-to-face course to on-campus and remote off-campus students. *TechTrends, 54*(4), 34-40.

Whitton, N. (2010). *Learning with digital games: A practical guide to engaging students in higher education*. New York: Routledge.

Whitton, N. (2014). *Digital Games and Learning: Research and Theory*. New York: Routledge.

Wiborg, A. (2009).*Varme og beslutsomhed.* Retrieved from http://bit.ly/19T02yI

Wlodkowski, R. J. (2011). *Enhancing adult motivation to learn: A comprehensive guide for teaching all adults*. Chichester: John Wiley & Sons.

WWC (2015). What Works Clearinghouse. Retrieved from http://ies.ed.gov/ncee/wwc/

Yin, R. K. (2014). *Case study research: Design and methods.* Thousand Oaks, CA: Sage Publications, Inc.

Ørngreen, R., Levinsen, K., Jelsbak, V., Bendsen, T., & Møller, K. (2013). Live videotransmitteret undervisning, *Tidsskriftet Læring og Medier (LOM),* 6(11).

Ørngreen, R., Levinsen, K., Jelsbak, V., Møller, K. L., & Bendsen, T. (2015, October). Simultaneous Class-Based and Live Video Streamed Teaching: Experiences and Derived Principles From the Bachelor Programme in Biomedical Laboratory Analysis. In ECEL2015-14th European Conference on e-Learning: ECEl2015 (p. 451). Academic Conferences and publishing limited.

Ørngreen, R., Nielsen, J. & Levinsen, K. (2004). Client Centred Design: A collaborative case study of the feasibility of e-learning. *Proceedings of OZCHI 2004*, 22-24th November, University of Wollongong, Australia.

Homepages

Center for Puppetry Arts (2016) Retrieved from http://www.centerforpuppetryarts.com/edu/dis_programs-videoconferencing.shtml

Cloudworks (2016). By Institute of Educational Technology at The Open University. Retrieved from http://cloudworks.ac.uk

Weitze, C.L. (2016b) Global Classroom teacher. Retrieved from https://globalclassroomteacher.wordpress.com

Weitze, C.L. (2016c) Design af lærings spil i global classroom. Retrieved from https://designlaeringsspilglobalclassroom.wordpress.com

Weitze, C.L. (2016d) IT-Pædagogisk Tænketank Retrieved from https://itpaedagogisktaenketank.wordpress.com

Software

Adobe Connect [Computer software] (2016). Retrieved from http://connect-innovation.com

AudioNote [Computer software] (2016). Retrieved from https://itunes.apple.com/us/app/audionote-notepad-voice-recorder/id406393290?mt=12

Bridgited [Computer software] (2016). Retrieved from http://www.smarttech.com/bridgited

Fronter [Computer software]. (2016). Retrieved from http://www.itslearning.eu/about-fronter

Google Docs [Computer software]. (2016). Retrieved from https://www.google.com/docs/about/

Google Hangout [Computer software]. (2016). Retrieved from https://hangouts.google.com

Kahoot [Computer software]. (2016). Retrieved from https://getkahoot.com

Learning designer [Computer software]. (2016). Retrieved from http://learningdesigner.org/index.php

Minecraft [Computer software] (2016). Retrieved from https://minecraft.net

Nvivo [Computer software] (2016). Retrieved from http://www.qsrinternational.com/product

Padlet [Computer software]. (2016). Retrieved from https://padlet.com

Polycom [Computer software]. (2016). Retrieved from http://www.polycom.com

RPGMaker [Computer software]. (2016). Retrieved from http://www.rpgmakerweb.com

Scratch [Computer software]. (2015). Developed by the Lifelong Kindergarten Group, the MIT Media Lab, Retrieved from http://scratch.mit.edu

Screencast-O-Matic [Computer software]. (2016). Retrieved from https://screencast-o-matic.com/home

Skype [Computer software]. (2016). Retrieved from http://www.skype.com/en/about/

Teamviewer [Computer software] (2016). Retrieved from https://www.teamviewer.com/da/index.aspx

TodaysMeet [Computer software] (2016). Retrieved from https://todaysmeet.com

Trello [Computer software] (2016). Retrieved from www.trello.com

FIGURES AND TABLES LISTS

List of Figures

List of Figures Article A

List of Figures Article B

List of Figures Article C

List of Figures Article D

List of Tables

TABLE OF CONTENTS APPENDICES

Appendix A. Research and Concept Development Phases and Processes

The DBR phases and iterations depicted in Table 7 are described in the PhD thesis. Articles in the table are shown as in-text citations; please see the references for full titles. The following abbreviations are used in the table: Global Classroom (GC); VUC Storstrøm (VUC); Hybrid synchronous, video-mediated learning environment (HSVLE); Design-based research (DBR); IT-Pedagogical Think Tank for Teacher Teams (ITP4T). There is a distinction between the IT-Pedagogical Team members that are administration staff members and the teachers that are participating in the IT-Pedagogical Think Tank. All participants are from VUC Storstrøm and Global Classroom unless otherwise stated.

Table 7: Overview of the purpose, methods, participants and products of the research phases in the PhD project

When: Dates	**Why: Purpose**	**How: Methods**	**Who: Participants**	**Results: Articles, reports, contributions to further research, findings**
February 2013 - February 2016	Longitudinal study: research of experience of GC. DBR experiments. How the competence development is received and implemented, dissemination of research results and more	More than 250 formal and informal meetings, talks, interviews, observations, workshops, competence development, email correspondence, knowledge dissemination, conferences and more	Teachers, students and administration from VUC Storstrøm 2 departments: Nykøbing and Næstved	11 papers and thesis
				Contributed to the longitudinal study and used as input for DBR workshops
February 2013	Exploring the students' experience of the HSVLE/GC	Workshop: evaluation of studying in GC through summative and formative questions	1 teacher and 14 students with half a year's experience from GC	2 reports about the students' experiences and 2 presentations of results for new teachers and administration at VUC
				Contributed to longitudinal study

				and forms input for DBR workshops
Spring 2013	Exploring the teachers' experiences of teaching in GC and observing teaching and learning in the HSVLE	8 semi-structured interviews with teachers (4 before, and 4 after, observations). Observation of teachers and students in class (35 lessons in class and a few online) for various types of subject matters	4 teachers with experience from the Global Classroom	Article A and (Weitze, Ørngreen & Levinsen, 2013) Contributed to longitudinal study and forms input for DBR workshops
Spring 2013 until February 2016	Exploration of the administration's experiences in and around GC	Interviews and meetings, single person meetings and meetings with various teams in the organisation (IT-Pedagogical team), development group, managers and more	IT-Pedagogical Team members (from administration), IT-support member, management, project management and more	Contributed to longitudinal study and forms input for DBR workshops
Fall 2013	Development of relevant competence development for teachers in GC. 1st iteration of the IT-Pedagogical Think Tank for teacher teams (ITP4T), resulting in a continuous competence development model for pedagogical innovative practices	8 Workshops with teacher team and a final test with a new teacher team workshop; teachers' and researchers' presentations at conference presenting the new practice (ITP4T)	3 teachers, development consultant, manager, Nykøbing and 4 new team members at final workshop, Nykøbing F	2 articles (Weitze, 2014d&e), Homepage for Global Classroom teachers as inspiration for pedagogical and innovative use of technology (Weitze, 2016b), small education (learning goals) and test for IT-pedagogical Think Tank teachers' development, 1st iteration (encompassing 8 workshops, but each workshop also

				contributed to the next workshop in smaller iterations). Examination/evaluation of the teachers.
February 2014 - December 2015	Investigation about students' experience of studying in the HSVLE	Online survey with 26 questions based on theories and initial workshop with students (February 2013)	58 students from 4 different classes in the Global Classroom	Contributed to longitudinal study and forms input for DBR workshops
May 2014 - August 2015	Investigation about the teachers' experience of studying in the HSVLE	Online survey with 30 questions based on theories, initial workshops and interviews with teachers (Spring 2013)	11 GC teachers from two departments (Næstved & Nykøbing)	Contributed to longitudinal study and forms input for DBR workshops
Spring 2014	Introduction to collaboration in the ITP4T	Two 8-hour workshops	8 teachers from Næstved department that would start as new GC teachers in Fall 2014	Contributed to longitudinal study and yields input for DBR workshops
Spring 2014	Developing learning games in Global Classroom 1st iteration. Experimenting with students by making games for learning in the HSVLE On the subjects of history, social science and religion	4 workshops, 1 with teachers, 3 with students and teachers. Interviews with students. Interviews before and after each workshop with teachers. Observations of classes before. Questionnaires with students and teachers	22 students from GC and 3 teachers from Nykøbing F	2 articles (Weitze, 2014a&b). Homepage for game workshops (Weitze, 2016c) Contributed to longitudinal study, forms input for next DBR workshops
Spring 2014	Presentation at management seminar at VUC of the ITP4T, with positive response	Presentation and discussion	Managers from VUC Storstrøm's 5 departments	Contributed to longitudinal study, allows input for next DBR workshops
Summer - Fall 2014	Co-design of Step One, Global	Meetings, discussions and analysis of VUC's	IT-Pedagogical team,	Step One Education TPD document with

	Classroom teacher TPD course	previous experiences as well as analysis of research from PhD project	development consultant	activities and learning goals New education/training for new GC teachers
February - April 2014	Ongoing studies	Observations and interviews	IT-pedagogical team and teachers	Contributed to longitudinal study
Fall 2014	2nd iteration of the ITP4T. Test and refinement of the ITP4T, competence development of teachers	Before workshops: observations of 2 traditional team meetings. 6 workshops, followed by an interview-based evaluation with teachers and principal	5 teachers, 1 IT-Pedagogical team member, 1 principal, Næstved	Article B, homepage about IT-Pedagogical Think Tank, with methods and examples. (Weitze, 2016d)
Winter 2014	Follow-up after 2nd iteration of the ITP4T, discussion of the effects of this practice, and whether the competence development has contributed to the creation of motivating learning designs for students	Interviews after competence development, ITP4T	5 teachers	
Fall 2014	Game design workshop – testing the new learning design for gamified learning design. Specifically dealing with creating a learning design that supports achievement of higher levels of cognitive	1 gamified workshop	17 students from 7th and 8th grade in primary school	

	complexity when learning with this method			
Spring 2015	Developing learning games in Global Classroom 3rd iteration. Experimenting with students making games for learning in the HSVLE. Subjects: History, Social Science, English as 2nd language	4 Workshops. 1 with teachers, 3 with students and teachers. Interviews with students. Interviews before and after each workshop with teachers. Observations of classes before. Questionnaires with students and teachers	19 Students from GC and 2 teachers, Næstved.	Article C and D (Weitze, 2015a,b,d, 2016) Continuing homepage for game workshops
Spring 2015	Testing ITP4T with "no support", - no guide on the side, used for pedagogical innovation assignments	Presentation from researcher, followed by 3 workshops with 4 teacher teams (researcher absent). Emailed reports about the experiences with working in the model	5 teacher teams from laboratory technician education, VIA University College, Århus, also working in hybrid synchronous video-mediated contexts	Teachers used the model and its concepts to obtain more theoretically based and clearer results of development work in teams
Spring 2015	ITP4T with the IT-Pedagogical team. Purpose was to develop an understanding of how to work in the model and to develop relevant issues through the work in the model	2 workshops	2 members of IT-Pedagogical Team and development consultant	Contributed to longitudinal study
December 2015	The objective was to develop knowledge on the resources that were developed in the PhD-project regarding competence	Presentation and workshop	Representatives from teachers, IT-support, IT-Pedagogical Team, project management, educational management and	Chapter 10

	development for the HSVLE, and which areas VUC could still develop		department management at VUC Storstrøm	
February 2013 - March 2016	Investigating the research question, studying theories from research area, and planning, conducting and analysing the data from the project	Many forms	Researcher	Products: 11 papers, thesis, 6 reports, 50+ presentations, 4 homepages, blog posts about the project, 3-step education to GC teacher

Appendix B. Methods

B1: From Transcription to Article: Thick Descriptions

The following is an example of how an interview with a teacher from the Global Classroom was transformed into a finding. Due to word count limitations, it is difficult to include many *thick descriptions* (The Design-Based Research Collective, 2003; Gravemeijer & Cobb, 2013; Geertz, 1973) in the arguments, not only in the enclosed articles but also in the thesis. These examples show how I used the data in the articles (translated from the Danish).

Original Interview (translated from Danish)

Teacher: "The secret to learning chemistry is to attend all of the classes. We of course had a period in which homework was assigned. But it made no real difference to me whether they read or did not read; the point is whether they come and pay attention. And bother to ask the questions, so you can get a debate started. There are often 10 students in the class who cannot understand the material. This is the debate [...] we need to get going. At home, they can more easily hide. I cannot really read their facial expressions to understand whether they can answer, whether it just becomes a humiliation for the student, or whether there is something to gain [from the student]. You can see the facial expressions much better when they sit in class."

Researcher (Charlotte): "But of course that is important!"

Teacher: "[Y]ou often see a silhouette [when a student participates over videoconference]; I cannot see him. When they sit in class – when a student has a completely blank expression on his face – then I think I am not getting a damn thing out of asking that student… It's aggravated assault if I bother that student. Whereas, if I bother the student over there, then I get something good out of it. This is something you have learned over time [as a teacher], like seeing what I can get out of approaching them. And this is where this new learning environment has its limitations…"
Researcher (Charlotte): "I am thinking of something practical: 'Your face needs to be clearly visible in order for us to be able to communicate.' Should it say in the school's rules and recommendations that this is important?" [This was later made into a recommendation.]
Teacher: "I haven't read them – but it is important that you can see [the students] clearly."
Researcher (Charlotte): "It must be important for the communication?"
Teacher: "Some time ago, there was someone who was not allowed to [participate] in his pyjamas. I don't care, as long as I can see their facial expressions. There was one student who joined the videoconference an hour and a half after the class had started, and then he lay in his bed – but he was also a true provo [provocateur] [teacher laughing].

Description of Interview in Article A

Here is the text from the article. In Article A (Weitze & Ørngreen, 2014), this conversation and finding was described in this way:

(Ibid., p. 8) *"Facial decoding and visual attendance*: Another problem occurs when the teacher cannot read students' facial expressions or they "disappear" from the screen. Sometimes the teacher can only see the student's silhouette if he sits with the light coming from behind. By reading facial expressions the teacher evaluate whether the student does not know the answer, or if he's shy and the teacher just needs to ask."

B2: Examples from the Analysis

This section aims to exemplify, clarify and explain how I worked with induction, deduction and abduction (Charmaz, 2006; Miles, Hubermann & Saldana, 2014; Thornberg, 2012) by reading theory, collecting data, analysing, interpreting and creating DBR innovation proposals in the PhD project. Theory has informed the research's empirical findings as a "conversational partner – inspirer – mentor" in the research project (Alvesson & Sandberg, 2013). The following examples come from **Article A** (Weitze & Ørngreen, 2014) and were originally written by me. This example was chosen because the Methods chapter focused primarily on the DBR experiments that followed this article's initial findings.

A – Initial explorative phase: Background and research area

The research project's initial purpose was to investigate the problem area in order to be able to be based in the actor-groups' experiences in and around the hybrid synchronous video-mediated learning environment. Relevant questions included: *Which teaching practices are* *sustained or emerge? How do the students perceive the learning situation and the motivational aspects? Can any guidelines and/or future steps be derived from these first experiences?* The following empirical data was gathered in the initial part of the project:

Table 8: Empirical data from A - Initial Explorative Phase

1) Meetings and ongoing conversations with project owners, management and (IT) pedagogical consultants at VUC	Early Autumn 2012–Spring 2013
2) Teacher workshop, including project managers and pedagogical consultants	26 November 2012
3) Written input from teachers: challenges and future plans	December 2012 and January 2013
4) Formal conversations between teachers and researchers – i.e., scheduled and planned activity	29 January 2013
5) Student evaluation workshop: qualitative workshop, 14 participants	22 February 2013
6) Informal conversations with teachers	Spring 2013
7) Interviews with teachers (based on semi-structured interviews)	15 April–8 May 2013
8) Observation of Global Classroom teaching	Spring 2013

Theory that supported the empirical findings

(From Article A, p. 5): "The Global Classroom Model consist of the videoconference as a mediated learning process, and also comprises the use of other forms of IT in education including digital materials, software, and processes because of the changed environment for the learning design. For example, all the instructional materials should be accessible online (Rice, 2012)" (supports the findings).

Theory that suggested potential in the empirical findings

(Ibid, p. 5) "In this way, the Global Classroom concept has inspired some of the teachers to implement new kinds of IT in their teaching practice. These new ways of involving IT in the teaching may, together with the Global Classroom concept, potentially help to create a more relevant and motivating learning for the students appealing to the students' curiosity (Gärdenfors, 2010; Somekh, 2008)" (findings that may suggest potential).

From theory to empirical studies to theory

> **Theoretical contribution:** (Ibid, p. 1) **"**According to the literature videoconferencing has "promised benefits of real-time interaction, immediacy, motivation, and collaborative learning" (Gillies, 2008, p.108). Though the literature gives examples of these benefits, many also points to technical problems, difficulties in adapting to new teacher roles and functions, and critical challenges to adapting and developing learning designs (e.g. Hedestig & Kapetilinin, 2005; Kjær et al., 2010)".

This is followed by a description of empirical findings that exemplify the above theory:

> **Empirical findings: Learning Design:** (Ibid, p. 6) "The students experience that the teachers are very different in their approach when activating the students at home.

> Some teachers are very aware of home-students asking them very directly to participate in the debate, while other teachers hardly pay any attention to the students at home. "

This is compared to earlier theoretical findings emphasising what has been found important:

> **Theoretical contribution:** (Ibid, p. 6) "This finding is well in line with previous findings in the videoconference and online learning literature, where one of the mayor emphasis and keys to success are on how the teachers has to develop strategies in their learning design for activating and creating collaboration with the online learners (Majid, 2006; Baran et al., 2011; Bower 2012; Gillies, 2008; Kjær 2009; Lawson 2010; Laurillard, 2011). "

The empirical findings add nuances and suggestions from the users on how to solve the issues:

> **Empirical findings:** (Ibid, p. 6) "Some students find it difficult to make the teacher aware that they want to answer a question. This makes the students at home frustrated and uninvolved. Therefore, the students feel it is important for teachers to take this issue into consideration in the learning design and to be aware that the students at home would like to be invited more into the class activity. The students at home are using different strategies to solve this problem like writing to the campus-students on Facebook etc. In our dialogues with the teachers we have also found that the class from August 12 who participated in the qualitative student evaluation is very different from the class from August 11. In the 2011-class the students at home are always very active and also often the "diligent" ones in the class."

Though the previous examples give other researchers (and users) a voice, the examples have been chosen by the researcher and can therefore be regarded as the researcher's evaluation and validation of what is important, or what can contribute to clarification and development of the relevant problem area. The following is, however, a more explicit example of interpretation of the learning situation in question, with an added support from Lawson (2010):

> **Theory/analysis:** (p. 6) **"**Consequently, it might not be the teachers that ignore the students at home, it may also be that students at home are less active, hiding a bit and not so easy to activate (Lawson, 2010).

B3: Categorisation of Problems for the DBR Interventions

In order to create a systematic contribution from the initial explorative empirical findings to inform the following interventions with the actor-groups, a categorisation was formulated. The following categorisations are two examples from a 75-page analysis I created for VUC Storstrøm after the first explorative phase of the PhD project in Spring 2013. The purpose of the report was twofold: 1) As a product: to inform teachers, students and administration and give suggestions about areas in the Global Classroom teaching environment they could discuss and improve. 2) As research: the most problematic findings could then inform the ensuing DBR process. Since the findings were grounded in the experiences of all three actor-groups, this established a valid position from which to determine what needed to be either improved of innovated upon. This then became evaluative, critical, appreciative and conceptualising knowledge (section 4.5; Goldkuhl, 2012). The categories were as follows (Table 9):

1) Actors (can be students, teachers, and administrators)

2) Interaction in or with the Global Classroom in order to understand in which learning situations the problem was relevant

3) Problem (the researcher's interpretation of what the problem could be after listening to the actors' comments or observing the actors' actions)

4) Researcher's suggestions for solutions. In a DBR approach, it is relevant to improve the area of research by taking a stance [position] toward the problem area on the basis of users' experiences combined with previous research.

5) Empirical citations illustrating the problem

Tabel 9: Categories for the analysis of the initial explorative phase

Examples	Actor-groups	Interaction	Problem	Researcher's suggestions for intervention/ solution	Empirical citations
Ex.1	Students participating from home discuss the teacher's role	The students would like the teacher to call on them/ask them questions when they participate from home	Some teachers have not established a habit of remembering to call on students participating from home	The teacher should notice when at-home participants raise their hands and should also actively call on at-home students (even if they do not volunteer to answer questions)	[The teachers] need to ask questions as if I was sitting in class [...]. [Y]ou feel a little like an alien once you get to say something, because then the teacher looks, like, 'Oh, was there a sound from out there?' and then you [think], 'Oh, then I don't want to say anything.' But I don't think that the way of teaching should be different from when I sit there [in class]."

Ex.2	Students participating from home talk about the teacher's role	The students believe that, in general, they must participate in the debate more actively when they sit at home in order to learn at the same level as if they were sitting in class.	The students call for an awareness and debate in this area of the teaching and learning process.	It seems as if there is a debate about whether the students are responsible for their own learning or the teacher is responsible for student learning. It may be beneficial to make these areas clearer through debate and guidelines for training at VUC.	This was a much debated subject.

The researcher presented reports, articles and talks to VUC Storstrøm administrators and teachers in order to disseminate and discuss the findings (Spring 2013). The researcher sent out both a long version and a short version of the report, held meetings and workshops with the administration, and presented and discussed the findings with teachers and students. These research products gave VUC Storstrøm opportunities to improve relevant points when managing, teaching and learning in the Global Classroom. In order to use these findings in the further development of the research project, the researcher created workshops for teachers, students and administrators. The specific purpose of these workshops is described in Chapter 8-10 and Articles B, C and D.

Appendix C. Completion Rates in the Global Classroom

The following table of completion rates and grades does, provide a small-scale illustration of VUC Storstrøm's Global Classroom experiences. Table 10 compares one Global Classroom class (GC) and one traditional adult upper secondary class (T). Keeping in mind the limited number of representative participants, this example can be seen as an expression of the general tendencies in the completion rates for Global Classroom students according to VUC Storstrøm.

Tabel 10: Comparison of completion rates of Global Classroom students and traditional students.

Completion statistics				
Number of students	After Year 1	After Year 2	Dropout number	Dropout %
GC-class 2014/2015	18	15	3	17 %

(Global Classroom)				
T-class 2014/2015	21	17	4	19 %

The Danish grade scale is a 7-point grading scale (Table 12). A comparison of grades in the two classes reveals certain deviations from subject to subject, although they almost even out (table 11; in some subjects, Global Classroom grades are higher than traditional classroom grades; in others, lower). If you look at the large deviation (the two characters from the summarised part), then the Global Classroom stands out positively. The summarised marks are 2.2 higher in the Global Classroom class compared to the traditional class. This is equivalent to the Global Classroom Class scoring 4% higher marks.

Tabel 11: Grade statistics – comparing a Global Classroom class and a traditional class.

Grade statistics – comparing two Classes	**GC-class** 2014/2015 (Global Classroom)	Traditional class 2014/2015	Difference
Math	8.6	5.4	
English 2nd language	5.8	7.5	
Biology	6.1	5.9	
Mother tongue	8.2	7.1	
Culture	6.3	5.9	
Eng. 2nd language, writing	6.8	6.6	
Mother tongue, writing	5.3	6.4	
Math writing	7.3	7.3	
Summarised	54.4	52.2	2.2

Tabel 12: The Danish marking scale is a 7-point grading scale.

Danish mark	Explanation of the mark	Equivalent ECTS mark
12	For an excellent performance	A
10	For a very good performance	B
7	For a good performance	C
4	For a fair performance	D
02	For an adequate performance	E
00	For an inadequate performance	Fx
-3	For an unacceptable performance	F

Appendix D. PhD Courses, Visits to other Research Institutions, Knowledge Dissemination

PHD COURSES

Title	ECTS
Basic course in University Pedagogy	2
Library Information Management	1
An Introduction to Qualitative Methods	3
Lecturing in English	2
Academic Writing in English	3
Design based research and PBL - combining research and change of educational practice	4
The Philosophy of the Human and Social Sciences	5
Practice Theory – A New Research Agenda – and its Implications	7,5
Writing Interpretive Research Papers	3
Reflexive Methodology	1
Conference for PhD students on work and career paths	0,3
Embedded Conceptualizations of Learning Within (Shared) Innovation Processes	2
Flow writing	1
Information’s media school	Course certificate

Quality teaching at the university: being an excellent teacher	Course certificate
Doctoral Consortium: Games Learning Society GLS 2015, Madison.	
	34,8 ECTS

VISITS TO OTHER RESEARCH INSTITUTIONS

During the project I had the advantage and pleasure to meet and discuss themes related to the Thesis with the following people:

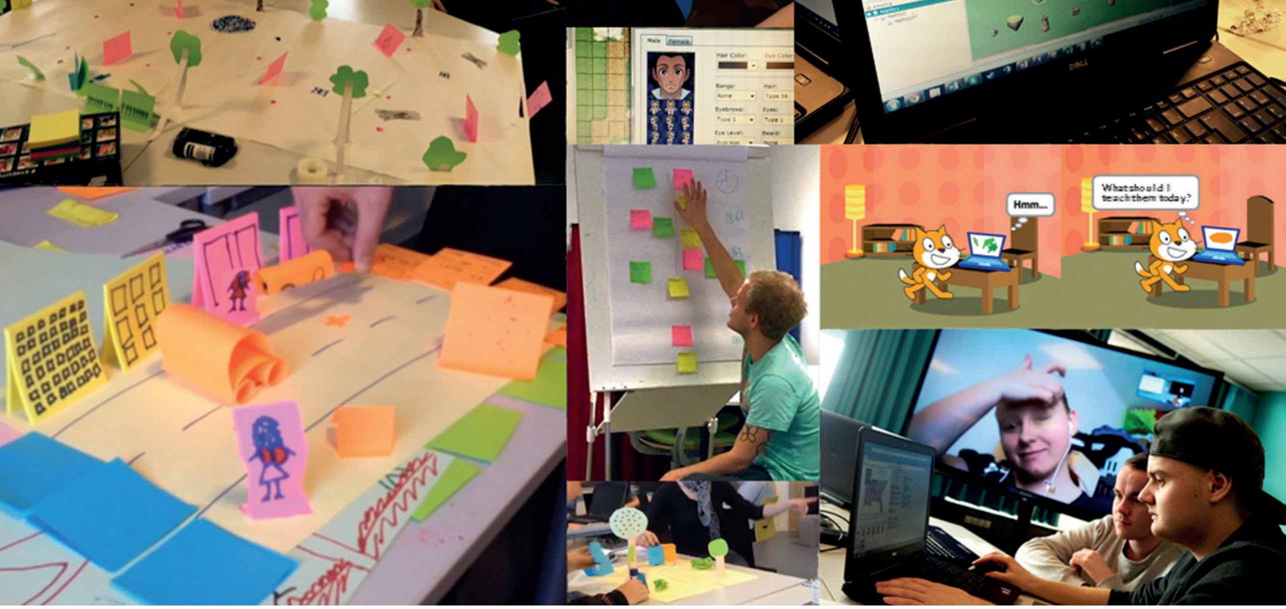
- Chris Dede, Timothy E. Wirth Professor in Learning Technologies and Karen Brennan, Assistant Professor, Harvard School of Education. Selen Turkay, Post Doc, Harvard initiative for Learning and Teaching. Cambridge, Boston, USA.
- Natalie Rusk, Research Scientist, Lifelong Kindergarten, MIT media lab; Jennifer Groff, research assistant, the Education Arcade, MIT Media lab. Scot Osterweil, Director at Education Arcade and research director in the MIT Comparative Media Studies/Writing Program.
- Michelle Schira Hagerman, Assistant Professor and Leigh Graves Wolf, Program Coordinator for the MSU Master's in Educational Technology, Graduate Certificate Programs in Educational Technology and Online Teaching, Learning Michigan State University College of Education.
- William Caine, PhD Student, Educational Design Studio, department of Educational Psychology & Educational Technology, College of Education, Michigan State University.
- Marshall Chambers, founder of Direct to Discovery, Learning Technologies, Georgia Institute of Technology, Atlanta.
- Joe Cozart, Ph.D. Associate Director of Strategic Planning, Georgia Virtual School, Georgia Department of Education, Atlanta.
- Susan Lowes, Director, Research and Evaluation, Institute for Learning Technologies, Teachers College/ Columbia University, New York.
- Richard Noss, Professor and Director of London Knowledge Lab. Diane Laurillard, Professor. Eileen Kennedy, Research Officer. All from London Knowledge lab.
- Kristine Oygardslia, PhD-fellow, Norwegian University of Science and Technology, Trondheim, Norway
- Inge Wilms, Associate Professor, Institute of psychology, BRATLab, University of Copenhagen, Copenhagen
- Rosella Gennari, Professor, Gabriella Dodero, Professor, Alessandra Melonio, PhD-student, Free University of Bozen-Bolzano; and Donatella Persico, Senior researcher, Istituto per le Tecnologie Didattiche, Genoa.

LIST OF KNOWLEDGE DISSEMINATION

This list presents part of the knowledge dissemination that took place in order to share new knowledge from the project

- Presentation ECGBL (European Conference on Games Based Learning) Conference October 2015 Steinkjer, Norway.
- Conducting workshop: Player and Learner eXperience workshop (Students Learning from Creating Digital Learning Games), invited by the Computer Science Faculty, Free University of Bozen-Bolzano (UniBZ). Link: http://palx.inf.unibz.it/unibz/ Cooperation with: Gabriella Dodero, Rosella Gennari (Free University of Bozen-Bolzano) and Donatella Persico (Istituto per le Tecnologie Didattiche, Genoa).
- Presentation ECEL (European Conference on e-Learning), in October 2015, University of Hertfordshire, Hatfield, UK.
- Conducting workshop: in collaboration with Villain, A., at IASCE 2015 Conference, Cooperative Learning: Meeting the Challenges of the 21st Century, Odense, 1-3 October: "Design of collaborative learning in synchronous online learning environments Facilitated by web conferencing or video conferencing technologies - Using the innovative IT-pedagogical Think Tank model for learning design reflections".
- Presentation at workshop CHItaly 2015 - Public, private and community-based interaction, workshop: PALX - Player And Learner Experience - Can We Design For Both? Rome, Italy.
- Predefense of PhD thesis in ILD-lab, with Rikke Ørngreen (supervisor) and Bente Meyer (opponent) 09.16.2015.
- Presentation at PhD course, at Games Learning Society Conference 11, 7-10. July 2015, Wisconsin Madison, USA.
- Presentation of IT-pedagogical Think Tank and research on Global Classroom for teachers in social and health care Zealand educational day. Approximately 200 participants, social and health care Zealand. 04.22.2015.
- Presentation at NERA Conference 2015 4.- 6.03.2015 (Nordic Educational Research Association), Gothenburg, Sweden: "What is the teachers' role when students learn through design of learning games in a scaffolded gamified learning environment?"
- Presentation: "Can you become smarter from playing? How can we create motivating and engaging learning by letting students create their own digital learning games?" At the event: "Order a Scientist" www.forsk.dk, Spring 2015
- Presentation PreBett "Can you transform learning into a game? - Lessons learned from VUC Storstrøm. We made the learning environment into a game while students learned by creating games." Polycom (UK) Ltd. Dashwood House 69 Old Broad Street, London. January 20, 2015.
- Presentation Meaningful Play Conference, Michigan, USA, October 2014. http://meaningfulplay.msu.edu
- Presentation ECEL (European Conference on e-Learning), in October 2014, Copenhagen.

- Presentation ECGBL (European Conference on Games Based Learning) conference October 2014, Berlin.
- Presentation about IT-Pedagogical Think Tank, at Lillebælt Erhvervs skole, Svendborg Erhvervs skole og Greve MIT-Ældre-digitalisering. 2014 At the event: ”Order a Scientist” www.forsk.dk, (3 presentations).
- Presentation Designs for Learning conference, may 2014, Stockholm
- Presentation “IT-Pedagogical Think Tank” at Knowledge Center for Applied ICT 15.15.; March 2014.
- Presentation ECEL “The Global Classroom Video Conferencing Model and First Evaluations”, at 12th European Conference on e-Learning ECEL-2013, Sophia Antipolis, Frankrig. 29. October 2013.
- Two various presentations at VUC’s Global Classroom conference: “A voyage of discovery towards the future of learning, Pedagogical development potential of video mediated learning.” Associate Professor Rikke Ørngreen and PhD Student Charlotte Lærke Weitze, Aalborg University. 24. October 2013.
- CEDEFOP: Conducting international workshop for VUC Storstrøm with Rikke Ørngreen: ”Tomorrow’s teaching with virtual media. - Experiences from the Global Classroom model, Activating Activities in Video Conferencing – dialog and workshop-oriented activities within the areas of: Motivation and Engagement, Foreign teaching assistance, Problem and Project oriented pedagogies and Learning design and Interaction forms.” 3. October 2013.
- Presentation “How has the Global Classroom project, VUC and the PhD project collaborated - lessons learned”. VUC Knowledge Canter’s conference "VUC shares knowledge 2013 - results and knowledge sharing regarding important developments and projects in and around the adult education centers." 3rd Sept 2013.



SUMMARY

This design-based research project investigates the elements, methods, processes and practices that can contribute to the creation of reflected, innovative and motivating learning designs for teachers and students in a hybrid synchronous video-mediated teaching context, with a focus on how to create motivating learning for the students. This was done by examining the three actors in the educational institution (students, teachers and the surrounding organisation) individually and relationally. The design-based research project developed knowledge in co-design processes with the three actors about how design and learning processes can support continuous pedagogical innovation and competence development. The objective of the learning designs was to create motivating learning experiences for the students in the hybrid synchronous video-mediated learning environment, to which end it experimented with gamified learning designs. This involved the students designing digital games while implementing learning goals from their curriculum. The project thus created knowledge about which learning designs and competence development models were possible in this environment, which learning designs emerged and where difficulties were experienced.

ISSN (online): 2246-123X
ISBN (online): 978-87-7112-530-6

AALBORG UNIVERSITY PRESS