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AALBORG UNIVERSITY
DENMARK

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Editorial / Welcome statement

Dear reader,

You are now reading the proceedings from the fifth Designs for Learning Conference – DfL 2016, taking place 18-20th May 2016 in Copenhagen, Denmark.

At past Designs for learning conferences, the proceedings consisted of extended abstracts. We have this year introduced new formats for papers, containing both full papers and short papers. In this process we have heightened the academic standard of review for full papers and have at the same time kept the possibility for submitting a more open and work-in-progress type of work through the short papers. As the requirements for the two forms have been a little different, the proceedings therefore consist of two publications this year: One contains the full papers and is published by Aalborg University Press in their e-book series, the other is the collection of short papers, together with information on keynotes and accepted panels/workshop. Both are published via open access.

The conference theme this year is: designing new learning ecologies. This theme includes areas such as designs for learning and change, connecting design, theory and practice, and reconceptualising learning. A total of 35 papers have been accepted for the conference: 18 full papers and 17 short papers. The accepted papers revolve around a broad range of research subjects and practices within the conference theme. These include methodological questions, discussions of design-based research, presentations of educational designs and discussions of perspectives on designs for learning as self-regulated learning or social semiotics explorations, and so forth.The overall Designs for learning community is facilitated through a collaboration between three Scandinavian universities (Stockholm University, Aalborg University and the University of Bergen). This year the organizing committee at Aalborg University, both hosts the biannual conference as well as the double blind peer-reviewed international online journal, published by Stockholm University Press, Designs for Learning (http://www.designsforlearning.nu/)

We hope these proceedings will bring you enjoyment and inspiration!

From the organizing committee:

Anne-Mette Nortvig, Birgitte Holm Sørensen, Morten Misfeldt, Rikke Ørngreen, Benjamin Allsopp, Birgitte Henningsen and Heidi Hautopp

Designing for Ba: knowledge creation in a university classroom

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The aim of the present study was to design a university classroom as a learning environment that promotes knowledge creation. An exploratory study, which used images and Lego serious play materials, was designed and implemented at the Universidad Nacional in Costa Rica. The study uses serious play and flow theory as principles to create a learning space where students interact with each other and with the subject in order to create and share knowledge. The main data collected were videos with audios showing the interaction between students while participating in four different learning activities. The results indicated that the designed activities had the potential to promote the interaction between tacit and explicit knowledge, which support the knowledge creation process. The "World Café" activity contributed to the Originating Ba from which the knowledge creation process begins. The "Drawing a Poster" and "Constructing theories with Legos" activities were key in promoting the interaction between tacit and explicit knowledge. In addition, the fact that students had to translate their knowledge into concrete and understandable models strongly support the Dialoguing Ba. The Lego activity was fundamental in providing the Systemizing Ba. Furthermore, the use of drawings and Lego materials allow more embodiment participation and flow experience, which support the knowledge sharing.

Keywords: *Ba*, knowledge creation, flow experience, serious play

INTRODUCTION

In the last decades the research community has been developing theoretical and empirical evidence of incorporating the knowledge creation in the classroom (Tan, So, & Yeo, 2014). As Scardamalia and Bereiter (2006) suggest, there is a need to change the focus of construction of knowledge from the individual to the collective. They argue that education needs to be refashioned in a fundamental way so that students are initiated into a knowledge creating culture and see themselves as part of a global effort to advance knowledge.

There are different perspectives of knowledge creation that have been developed from different contexts and research communities, for example knowledge building (Scardamalia & Bereiter, 2006), expansive learning (Engeström & Sannino, 2010) and organizational knowledge creation (Nonaka & Takeuchi, 1995). In this paper we have chosen to work with Nonaka and Takeuchi's model.

The research question of the study was: *how to design university classrooms as environments to promote knowledge creation*? We take as a starting point that learning experiences can be enjoyable and designed a exploratory study to promote knowledge creation using design principles borrowed from the theories of serious play (Hinthorne & Schneider, 2012) and flow (Csikszentmihalyi, Abuhamdesh, & Nakamura, 2014) These theories address how students experience educational contexts and how this affects the learning experience and motivation. The study took place at the School of Informatics, Universidad Nacional, Costa Rica.

The following section will review the main theoretical tenets, while section III will provide an overview of the study methodology and the learning design. Section IV presents the results and discusses the findings. The paper closes with concluding remarks in section V.

THEORETICAL FRAMEWORK

Knowledge creation

According to Nonaka and Takeuchi (1995) the creation of knowledge is a spiral process of interactions between explicit and tacit knowledge, where "tacit knowledge is personal, context-specific, and therefore hard to formalize and communicate", and "explicit knowledge refers to knowledge that is transmittable in formal, systematic language" (p. 59).

This interaction between tacit and explicit knowledge is represented by the SECI model (Socialization-Externalization-Combination-Internalization):

Socialization refers to the transfer of tacit knowledge between individuals through interaction and shared experiences.

Externalization refers to the conversion of tacit knowledge to explicit knowledge. Involves the articulation of tacit knowledge in an explicit and consistent way, so that it can be understood by other individuals.

Combination refers to the process of converting explicit knowledge into more complex explicit knowledge. It involves reconfiguring the existing explicit knowledge, which is completed, orderly, re-categorized or re-contextualized for the creation of new and more complex explicit knowledge.

I*nternalization* refers to the conversion of explicit knowledge into tacit knowledge. It consists in understanding and incorporating explicit knowledge as tacit knowledge.

Another important concept introduced by Nonaka and Konno (1998), is the concept of *Ba* as a means of describing where and how knowledge is created. According to the authors, the process of knowledge creation cannot be free from context. It is context-specific in terms of who participates and how they participate and *Ba* offers such a context (Nonaka, Toyama, & Konno, 2000). *Ba* can be thought of as a shared space for emerging relationships where information is interpreted to become knowledge, and it is a concept that unifies physical space (office), virtual space (e-mail) and mental space (shared ideals). In that sense, *Ba* should be considered a framework in which knowledge is activated as a resource for the creation of new knowledge. To Nonaka et al. (2000), the key concept in understanding *Ba* is *interaction*, because it is in the interactions amongst individuals or between individuals and their contexts where knowledge is created.

There are four types of *Ba* which are related to the four stages of the SECI model (Nonaka & Konno, 1998; Nonaka et al., 2000) and which are related to two dimensions: type of interaction (whether the interaction takes place individually or collectively) and media (whether the interaction is face-to-face or through virtual media).

Originating Ba: defined by individual and face-to-face interactions. It is a place where individuals share feelings, experiences and mental models. It offers a context for socialization.

Dialoguing Ba: defined by collective and face-to-face interactions. It is a place where tacit knowledge (mental models and skills) is shared through dialogues amongst participants. It offers a context for externalization.

Systemizing Ba: defined by collective and virtual interactions. It is a place where explicit knowledge can be transmitted to a large number of people. It offers a context for combination.

Exercising Ba: defined by individual and virtual interactions. It is a place where individuals embody explicit knowledge. It offers a context for internalization.

In this paper, we are mainly concerned in how to design for *Ba*, in the sense of creating a learning context where students interact amongst them and with the content to create, share and utilize knowledge.

In order to design for *Ba* we drawn in two other theoretical backgrounds: the Serious Play theory (Hinthorne & Schneider, 2012) and Flow theory (Nakamura & Csikszentmihalyi, 2014), which are presented in the following sections.

Serious play

The serious play perspective was inspired by Lego serious play (LSP) methodology. It is a methodology that encourages creativity, sharing and reflection. Key elements of LSP are the use of metaphors, storytelling and creation of meaning and understanding of a problematic situation with peers. In this methodology, people use Lego bricks to make a series of structured exercises during which they build models that metaphorically represent their personal, educational or organizational challenges. These 3D models serve as a basis for group discussion, knowledge sharing, problem solving and decision making. (Kristiansen, Rasmussen, & Wallace, 2014).

The philosophy behind the creation of LSP was to change the constraints of mode (from work mode - cognitive experiences and deliberate intentions – to a play mode - cognitive, social, and emotional experiences and emergent intentions) and media (from two-dimensional, text and computer-based verbal and graphical to Legos bricks, a three-dimensional and tactile media) when developing business strategies in order to get a more innovative and creative content (Roos, Victor, & Statler, 2004).

Roos et al (2004) define serious play as “a mode of activity that draws on the imagination, integrates cognitive, social and emotional dimensions of experience and intentionally brings the emergent benefits of play to bear on organizational challenges.” (p. 563)

Serious play creates opportunities for imagination and creative thinking. By participating in serious play, people have the opportunity to imagine and use new frameworks for decision-meaning, expression and interaction. Such imaginative function helps participants to think outside the box and find innovative solutions to complex challenges. Besides, the creative process of collaboration between participants facilitates communication and allows the development of shared meaning (Statler et al., 2009, cited by Hinthorne & Schneider, 2012). Rieber, Smith & Noah (1998) propose serious play as a suitable characteristic for learning situations that demand creative higher-order thinking and a strong sense of personal commitment and engagement.

In this study, we use a serious play perspective to design a playful context aimed to promote creativity and imaginations to promote student's collaborative work and the generation of shared meanings and understandings about the topic of participatory design.

Flow theory

According to Nakamura & Csikszentmihalyi (2014), some activities may be so attractive that our mental focus is shifted away from our environment and allow us to focus exclusively on the task. The term "flow" is used to describe the people experience in these situations. “Flow is a subjective state that people report when they are completely involved in something to the point of forgetting time, fatigue, and everything else but the activity itself” (Csikszentmihalyi et al., 2014, p. 230).

Csikszentmihalyi et al (2014) state that people constantly evaluates the quality of their experiences and often will decide to continue or not an activity based on their evaluations. In that sense, the experience of flow is a powerful motivating force, because when one person is fully involved in an activity, he/she tends to find the activity enjoyable and intrinsically rewarding.

Flow experiences can be reproduced by providing three conditions: (1) there are a clear set of goals for the activity; (2) there is a balance between perceived challenges and perceived skills; and (3) you receive clear and immediate feedback. These three activity features promote the intrinsically rewarding experiential involvement that characterizes flow (Csikszentmihalyi et al., 2014).

According to some researchers (Guo, Klein, Ro, & Rossing, 2007; Ho & Kuo, 2010; Pearce, Ainley, & Howard, 2005), there is a relationship between flow experience and learning outcomes. The Flow experience, characterized by concentration, control and enjoyment, can lead to better learning outcomes, as long as the experience considers the balance of challenge and skill, feedback, and goal clarity.

In this study, we provided the three conditions for flow in order to facilitate learning and engagement of students in the learning activities.

METHODOLOGY

The research question of the paper is: *how to design university classrooms as environments to promote knowledge creation*? In answering the research question there are two objectives, one theoretical and one practical. We need to identify theoretical principles for designing for *Ba* and we want to apply and evaluate them in a real environment. As such, and according to our theoretical background, we designed an exploratory study aimed to learn about the subject of participatory design and with the following main design principles:

1. Promote the interaction between tacit and explicit knowledge, in order to facilitate the creation of knowledge process.
2. Using a playful mode of teaching for facilitating student's collaborative work and the generation of shared meanings and understandings about the topic of participatory design.

3. Provide the three conditions for Flow - clear goals, balance between challenges and skills, and clear and immediate feedback -, in order to facilitate learning and engage students in the learning activities

Within the curriculum of System Engineering at the Universidad Nacional in Costa Rica, students have to learn about the design process of information systems. The study aimed to design a lesson of three hours in a way that was fun and enjoyable for students, but at the same time effective for the creation of knowledge about concepts of participatory design. The educational activity will facilitate students understanding of participatory design approach.

The participants in the study were around 100 students from the 5 groups of the course "Systems Engineering II", from five different class groups (around 15-25 students each one). At the beginning of the class, the students were asked to sign the informed consent form in which they agreed to participate in the study. Three of the groups were video recorded and at the end of the class all the students gave a short feedback about their experience. Thus, qualitative data sources include this "final impression" of the students about the activity and the videos.

Regarding the data analysis we followed the iterative process proposed by Denscombe (2007): preparation of the data, familiar with the data, interpretation of the data (coding, categorizing and conceptualizing), verify the data and representation of the data. First, we watched the videos of the three groups, in some way we let the data "speaks", we did not categorize neither relate the data with the theory. We took notes on interesting behaviour and patterns. We analysed those notes and define some categories, then we watched the videos again to check if some of the patterns and behaviours were present in all the groups or how similar behaviour could be related. After this, we created a final set of categories to look at the data in detail. Those categories were a combination of the first categories and new categories based on the theory. This third round of the process we looked mainly to the videos of the one of the groups, but checking sometimes to the other groups to confirm some aspects. In this step of the data analysis, we captured pictures from the videos, transcript students comments and we took notes that allowed us to interpreted different situations. The aspects of serious play and flow were analysed from students' feedback and the observation of their behaviour in class (during the session and through the videos). Afterwards, we interpreted the data in relation with the design and the knowledge creation process to draw some conclusions.

Designing for *Ba* – design of the classroom

The paper presents the design of three hours class environment as *Ba*. The design aimed to foster mainly three of the steps of the knowledge creation process (socialization, externalization, combination), and for each of them includes diverse activities and the use of 2D and 3D artifacts. Each activity in the design was aimed to facilitate one *Ba* and all together create the general *Ba* for knowledge creation.

The *Ba* can be a physical, virtual and/or mental space. In the design we considered the physical and the mental spaces. In the mental shared space, we tried to develop shared norms and rules among the students. One of those mental spaces was the serious play mode. We clearly explained to the students that the study was aimed to develop knowledge on a specific topic but we also believed that we could do that in a playful atmosphere. Furthermore, we presented the students the rules for the different activities: be open to new ideas and concepts, listen, share knowledge and information, learn with and from peers, be respectful, the opinion of each person is equally important, all ideas are valuable. The three main instructions were: play, enjoy and learn. With these rules we wanted to change the mindset of the students about being in a class.

The physical shared space is composed of diverse face to face activities:
World Café about participatory design: A World Café is defined as "a simple yet powerful conversational process for fostering constructive dialogue, accessing collective intelligence, and creating innovative possibilities for action" (Brown, Isaacs, & Community, 2005, p. 3). World Café is organized around questions and people move from one group to the other. The idea of using World Café was to share and circulate the ideas, thoughts and experiences among students. We aimed at foster as much as possible that the students would have the opportunity to be exposed and share ideas with many peers as possible. This activity was decided to promote socialization in the knowledge creation process and is defined as the Originating Ba.

Drawing a Poster: this activity was considered part of the Dialoguing Ba with the aim of foster externalization. The idea was that the tacit knowledge that students have shared about participatory design during the World Café could be concreted in a drawing where they needed to tell about what is participatory design. For this activity students got papers, color pens, color markets and color chalks. Each group presented their drawing.

Constructing theories with Legos: For this activity each group got two bags of Lego bricks, from the LSP kits. Each group was assigned to use Legos to represent one of the methodologies for participatory design: Design thinking, future workshop, LSP, etc. The argument for using Legos in this activity was that constructing theories on 3D models will help the students to move from abstract to concrete and make the understanding of the concepts more memorable as well as the play element that the Legos imply. This was aimed to promote the phases of externalization and combination in the knowledge creation process, that is Dialoguing and Systemizing Ba.

Lecturing: as each group need to present their Lego model, between each presentation there was a short lecture of 10-15 minutes to reinforce the key aspects of each of the methodologies, as well to complete lack of information in the Lego models. This was designed as a Systemizing Ba.

All activities were designed taking into account the actual skills of the participants. The proposed tasks were easy to reach by them. The activities have clear objectives that were communicated to students before to start and while students were progressing they received feedback from researchers. Hence, we carefully created the three conditions for Flow.

DATA ANALYSIS

In this section we present the results of analyzing the interaction of one group. We decided to focus in just one group due to the big amount of data for each of them and because after viewing several times all the videos we concluded that the behavior of all groups were similar. The group was conformed by 15 students; within the group there were 4 subgroups.

We studied the data to analyze how the different activities promoted the creation of different *Ba* that would foster three of the steps of the knowledge creation process: socialization, externalization, and combination and how the designed class could foster knowledge creation in general. It is important to clarify that one of the process of knowledge conversion could has been fostered for several activities, for example, socialization was fostered during the World café activity, as well during the construction with Legos and drawing.

Originating Ba

Sharing and discussing mental models is a key element for knowledge creation. As the World café is based on questions, and people discuss as if they are in a café, it worked well to introduce the topic and get students to share their thoughts, experiences and mental models around the topic of participatory design. In order to answer some of the questions, they discussed their mental models as computer science students:

"I think that we, as computer engineers, not are used to go beyond ...";

"you know how it works but when the user is there you don't know how to integrate him";

" ... through years one develop its own way of doing things ..."....".

Furthermore, the activity facilitated activating previous knowledge in the students, which could also be understood as an activation of tacit knowledge. As an example, there was a question about which of the participatory design methodologies they considered that it might be more useful to apply in their current design project. Three of the group members seemed to be blank on the response and had no clarity on how the methodologies could relate to their project, but when another student said they had been using similar activities to engage users, not with the names of those methodologies but with similar objectives, suddenly one of the other students said "Now, that you mentioned it, yes, we have used the same activity, but we modified it to capture different details that we were interested on… "

Socialization was also fostered during the Lego and draw activities. In general, the materials infuse emotions in the process of communication (Roos et al., 2004), which is one of the aspects of socialization (Nonaka et al., 2000). Using stickers, draws and Lego bricks helped the students to express, discuss and reflect upon emotions, which may not be so evident in the oral communication. In Figure 4, students draw the user with a happy face and the designer with sad face. When asking why this representation, they expressed their frustrations and challenges to communicate with the user. This opened the opportunity to discuss those kind of challenges and ways to overcome them.

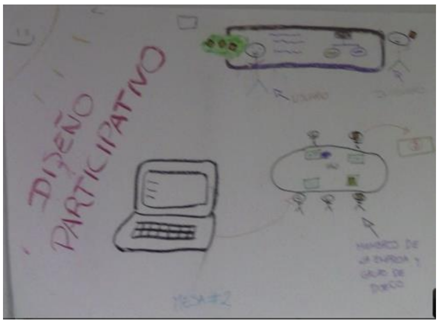

Figure 4: Participatory design poster

Participation is a key aspect of socialization. During the “regular oral activities” that faculty used to promote in class, the only way of participation that students have is voice. They need to fight for participate or if they do not want to participate it is also easier not do that. However, in the drawing and in the Lego activities, the materials become another medium to participate and communicate, it was evidence what Roos has defined as object-mediated communication (2006). As he has stated, object mediated communication becomes deeper because the people involved have constructed their objects. It was noticed in the groups that sometimes one student was drawing something and talking and then another student added something to the drawing while the first student was still talking and drawing. Naturally, students started to discuss how the new object in the drawing connected with the whole idea and this dynamic contributed very much to the spiral process of interactions between explicit and tacit knowledge (Nonaka & Takeuchi, 1995). This phenomena was even more present during the Lego activities, in which the participation was higher because all the students were participating in the construction of the Lego model. They were adding pieces to the model and explaining and giving meaning, this was a way to open a space to participate. This broke the sit back model of the traditional classroom.

Dialoguing Ba

Common characteristics in Dialoguing Ba are the articulation of knowledge, use of metaphors, and common language. The *Dialoguing Ba* was mediated with artifacts as Legos and materials to draw.

The use of materials in the process of knowledge creation helps to simplify complex concepts and concretize abstract knowledge and information allowing students “to see and touch” the concepts.

According to Roos (2006, p. 80), “When we shift our thinking to landscape images we convert our discomfort with time and meaning into familiar world of geographical space. Landscape images can draw on all our senses and thereby allow us to express ourselves in a way more sense for others”.

The construction of the poster about what was participatory design, helped them to shape and form their definition and understanding about the concept. As Nonaka & Konno (1998) expressed, through dialogue student’s mental models and skills were converted into common terms and concepts, and in that sense, the activity had the potential of being the place where tacit knowledge was made explicit (externalization process). Through the poster they externalized their understanding in a tangible and sharable way which was used to discuss with the whole group. Figure 1 shows the externalization of subgroup # 4 about what is participatory design.

Figure 1: Poster of participatory design

The draw is full of metaphors with meaning, it helped them to think and discuss abstract concepts in a more creative way, and at the same time the draw is a medium to give physical form to their thoughts. In summary, they explained that the rainbow represents a bridge between two worlds: computer engineering developers and users. Each colour of the rainbow represents a different aspect of the user centered design process and the heart is the representation of the final software product in a participatory design process. It can be seen, that students involve emotions in their representations, something that is not always easy to achieve only by oral communication.

Continuing with the analysis, the Lego models also become a tangible representation of theories/concepts/experience that can be interpreted, discussed and evolved. With the Legos they created 3D landscapes to represent and discuss their knowledge and understanding. During the construction of this landscape, they defined and agreed upon a common understanding and renamed the concepts while they went through a sense making process to put together their thoughts in a common representation, which has a story to be told.

It is possible to state that 3D artifacts better helped students to externalize tacit knowledge. From Figures 2 and 3 it is possible to see the Lego model of subgrupo#4, which was representing the Design Thinking methodology. When explaining their model, the Lego gives the facility to move and add objects to explain better their meaning. In the image of the right, we can see that the black fence is not any more in the representation, because the students removed it, as the fence represented barriers between the designer and the client (the lion), so the first steps is to remove the barriers and start getting to know the client. Many examples like this are found in the different Lego models that students built.

Figure 2 and 3: Design thinking methodology built in Legos

Systemizing Ba

While students were building their model, they had the opportunity to combine the different bodies of explicit knowledge held by each of them. In addition, they had to sort, add and recontextualize those bodies of knowledge in order to create a new more complex explicit knowledge that could be shared with the other groups. This process of creating explicit knowledge from explicit knowledge is referred to as combination and it is associated to the Systemizing *Ba* (Nonaka & Konno, 1998). This process was supported and built up by the short lectures, where they received new theoretical concepts.

Embodiment, flow experience and serious play

Both, 2D and 3D artifacts allowed embodiment of the students during the class. During the world café activity the students should stand up and change of table each time that the researcher asked for that. In this case, it was demanded that they should move. Once in their new group students would sit. They were talking around the table but they were always in a need to do something with their hands. They were in a constant play with their hands and other materials as post-it, pencils, crossing their hands, etc. In Figure 5, there are three images where we can see this situation.

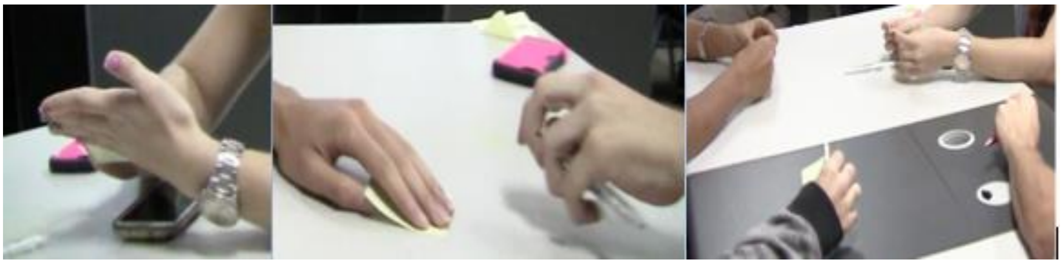

Figure 5: Students playing with their hand while discussing during the World Café activity

The use of the body, during the Drawing a poster and Building with Lego activities is total different. Students are immersed in the activity with mind and body, they were discussing and sharing ideas at the same time that they were building and creating, as we can see in Figure 6.

Figure 6: Embodiment of students when using 2D and 3D materials

In the same line about embodiment, when we look at the data as a movie, we can see that as the activities are progressing, students involved more in the activities with their body. In some groups, when the poster activity started, subgroup#1 for example, all the members were seated, as the activity was progressing, member by member started to stand up. The same phenomenon happened in the other groups. From this behavior we can infer that students experienced high levels of engagement, attention, concentration and interest. This involvement of body and mind can be considered as an expression of Flow because students were fully engaged in the activity (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

Play is a source of creativity (Mainemelis & Ronson, 2006). The poster and Lego construction activity was the opportunity to use and foster creativity. Both 2D and 3D materials promoted the creation and creativity process. One of the students commented at the end of the class, “It opens the mindset when you want to develop an idea. We were allowed to experience the creativity we have, but we do not use very often due to the curriculum's teaching methodology. Thank you very much for reminding us that creativity enables us to understand better the design process”.

From student’s feedback, we can say that students really enjoyed the class and had fun, which created an environment for learning and creation of knowledge. It is also possible to state that the Lego activity was the main element for creating an atmosphere of play and it contributed enormous to the achievement of the Flow experience.

During the class there was a lot of laughs, smiles, engagement, wows expression and jokes. “Interesting” and “entertainment” were the most common adjectives found in students’ feedback.

They said that Lego was the most fun activity, the class was not boring, and even time went faster. There were many comments about the enjoyable of learning while playing. They stated they learned better, still when we did not measure whatever they learnt or not. Participants reported that during the class they felt more involved than in the regular sessions of the course. Many of them mentioned that it was very different from what used to be a regular class. All the above comments refer to the characteristics of a Flow experience. They stated that it was great to see that they could learn in a different way. Some of the students' statements were:

"I liked the activity because you can discuss different aspects and realities of our daily life. Besides, the activities help us to interact more with the topic".

"I found excellent the three methodologies studied, the subject of participatory design, the different activities and dynamics. Truly I learned a lot, and it is a way to not forget things. I wish all classes were like this".

"The class was very interesting, it takes us out of the routine and monotony of regular classes. Learning through play is the best and we could retain more information. Teachers should learn from this".

CONCLUSIONS

The research question of the paper was: *how to design university classrooms as environments to promote knowledge creation*? We were interested in creating a learning environment where students were motivated and engaged and where knowledge could be activated as a resource for creating new knowledge. In order to achieve this, we address three bodies of literature: knowledge creation, serious play and flow, and designed a three hours session that was tested on a real context.

From the data we can infer that the chosen activities had greater potential to activate the creation of knowledge than traditional practice in the course. The "World Café" activity contributed to remove the barriers between the self and others, turning out in the *Originating Ba* from which the knowledge creation process begins and offering a context for socialization. The "Drawing a Poster" and "Constructing theories with Legos" activities fostered a lot of interaction between group members, which is the key concept in *Ba.* Both activities help students to share the mental model of others, but also reflect and analyze their own, the dialogue, use of metaphors and embodiment that took place was key in promoting the interaction between tacit and explicit knowledge. The fact that students had to translate their knowledge into concrete and understandable models strongly support externalization and its corresponding *Dialoguing Ba.* In the combination phase, the key issues were communication and diffusion. The groups had to collect each other's explicit knowledge and integrating and combining it in order to transferring it to the others by using their models. The Lego activity was fundamental in providing this kind of *Systemizing Ba*.

In addition, the serious play perspective allowed us to design a playful context that led to an embodiment cognition and to a flow experience. They participated with mind and body achieving high levels of engagement. From the video analysis, it was possible to see a progressive active participation of the students. The use of questions engaged collaborative thinking in all the activities, it was seen that the questions that matter more to the students, the engagement were higher. From their comments it was clear that they enjoyed the activities very much and would like this to be the normal mode of teaching at the Informatics School.

From the results, we can fully support our initial design principles if faculty members want to create environments that foster knowledge creation and enjoyable learning experiences. The study shows that the designed learning environment can offer the richness and flexibility needed to foster knowledge creation. In addition to the main design principles, we would like to suggest that faculty should consider the following aspects:

1. Knowledge creation includes not only the cognitive, but also the emotional and social aspect.
2. For externalization and combination promote engagement in body and mind. The use of 2D and 3D materials can help to students' embodied experience.
3. Creativity is part of knowledge creation.
4. Ba mediated by objects becomes more meaningful when students have the possibility to construct their own objects.

While the empirical data collected have supported the proposed design, it is necessary to discuss some of the challenges of the design: play seriously – how to avoid to become only a play experience, the teacher as orchestra leader –keeping flow, learning goals, time control, etc.; however because space issues in this paper we cannot elaborate those aspects. We are also clear that we left out the discussion of limitations of this study and future research.

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Learning Design for Efficient Educational Development: Conceptualisation and Assessment

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The 'learning design' approach to educational development is becoming popular among educational developers as a systematic, effective, and potentially also efficient approach to implementing educational technology in higher education. However, in order to assess whether a learning design is efficient a concept of 'efficient learning design' and a methodology for assessing it need to be developed.

This paper presents the provisional answer to the doctoral research question: 'How can efficient learning design for science higher education be conceptualised and assessed?' by developing and providing a concept of 'learning design in practice', providing a provisional understanding of the concept of 'efficient learning design', and a methodology for assessing the efficiency of learning design interventions. The developed concept and assessment methodology are works in progress and form the basis for the future action research on what makes learning design efficient, how, and why, and thus potentially also the development of efficient learning designs.

Keywords: Learning design, learning design efficiency, blended learning, mixed methods, action research.

Introduction

The 'learning design' approach to educational development and introduction of educational technology in higher education is currently gaining footing in a number of countries, including UK, Australia, The Netherlands, Canada, and Spain (Koper & Tattersall, 2010; Lockyer et al., 2009). The approach is characterised by making pedagogical theory practical to educators and support the educational development process by different kinds of tools and aids, and by supporting the educators in sharing and reusing their designs (Britain, 2004; Conole, 2013; Conole & Fill, 2005; Cross et al., 2008; Oliver & Conole, 2000). As such the learning design approach holds a potential to lower the *effort* for educational development due to the reusability of materials and teaching practices and/or increase the impact of the development due to the the introduction of well-founded pedagogical practices and technology in education at the same time (Conole & Fill, 2005). In other words, learning design has the potential to support efficient educational development and transformation of modules. However, in order to fully understand the efforts and impact associated with learning design, a concept for understanding modules that have been learning designed, a concept of ‘efficient learning design’, and a methodology for assessing the actualised efficiency need to be developed.

Research Question and Methodology

The research question for this study is:

> ‘How can *efficient learning design* for science higher education be conceptualised and assessed?’

The study is a part of a doctoral research project on how to efficiently improve science higher education with learning design for blended and online learning. In context of the project, the question is both addressed with regards to learning design for blended learning in general and on the Faculty of Science and Technology, Aarhus University (AU); however, due to the word limit this paper will not include the AU specific findings and stakes. Instead, the general conceptualisation and assessment of learning design and its efficiency is in focus.

The research question is addressed by a literature review on learning design efficiency and on stakes in educational technology and learning design in science higher education. The answer takes the form of a conceptualisation of ‘learning design in practice’ and ‘learning design efficiency’ supplemented with a research matrix of mixed-methods methodology for the actual assessment.

Understanding Learning Design and Efficiency

Though the learning design approach has a build-in potential to lower effort and increase impact of educational initiatives, the stated aims of the different learning design initiatives include highly diverse perceptions of what efficiency actually entails. In some cases, efficiency is associated with the impact on students' learning and others with the amount of effort the educator has to invest in order to transform her/his practice (e.g., UG-Flex, 2012; University of Cambridge, 2013). A common and general understanding of efficiency has to do with the ratio between the time, effort, and/or costs spent on achieving a certain goal (Encyclopaedia Britannica, 2014; Wikipedia, 2016). The less time, effort, and/or costs spent to achieve a goal the more efficient. In context of learning design for educational development, efficiency will then per definition depend on the goals and effort of the involved stakeholders such as the educators, the students, and the institution. A search for 'efficient'/'efficiency' and 'learning design' on Education Resources Information Center (ERIC) and Google Scholar for "efficient learning design" witnesses the complexity in looking at efficiency and reveals that the most common concerns are related to the actual material production, reusability, sustainability, and shareability (Bai & Smith, 2010; Brown & Voltz; 2005; Elliott & Sweeney, 2008; Pankratius et al., 2005), the effectiveness of the materials for learning (Pejuan et al., 2012), and students' learning experience and the usability of materials (Davids et al., 2013; Dawson et al., 2010). Also the introduction of a specific technology, a learning activity, and various subject related characteristics are important efficiency concerns (Mtebe et al., 2011; Thomassen and Ozcan, 2010; Zahn et al., 2010). Nevertheless, in spite of the general acknowledgement that efficiency depends on a variety of factors and that an institutional perspective on 'effectiveness and efficiency ... led to the development of electronic learning environments that often results in disappointed students and instructors, limited motivation, wasted efforts, and ultimately an absence of interesting, meaningful, and engaging learning' (Doering & Veletsianos, 2008; p. 137) only one of the articles adopts a more holistic approach to efficiency by looking at different perspectives (see Atkinson, 2011). An important reminder that *efficiency* is more than addressing institutional needs and involves the perspectives of different stakeholders.

Conceptualising ‘Efficient Learning Design’

An important step in conceptualising and assessing ‘efficient learning design’ is to understand to whom learning design should be efficient, their interests, and their influence. As identified by Sims (2013) learning design may potentially involve a whole range of stakeholders. Sims illustrates the context of learning design with a set diagram of six intersecting stakeholders (Figure 1).

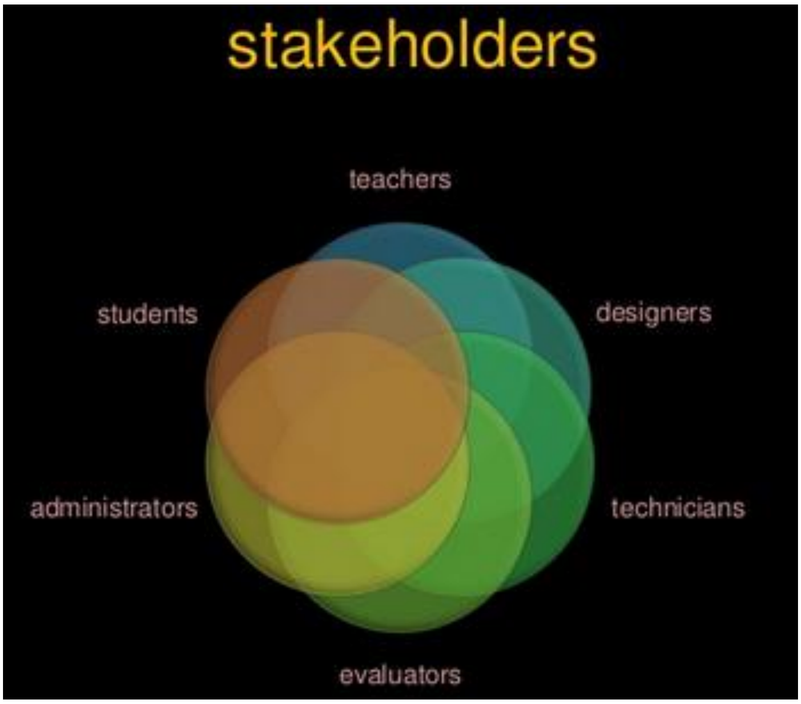

Figure 1: Stakeholders in learning design (Sims, 2013, p. 41).

Some of these stakeholders, e.g., the teachers, designers, and students, usually play an active role in the process as either producers or consumers of the learning design, while others, such as administrators, technicians, and evaluators, may play a more indirect and secondary role as supporter or facilitator. The exact number of stakeholders and their interest in the learning design depends on the setting and should be treated with respect to their influence on the learning design efficiency and only included if they play a significant role. However, at least three primary stakeholders are persistent in formal educational settings and represent different perspectives to learning design. *The students* whose learning will be affected by the technology, *the teacher (or ‘educator’)* who may be the *designer* at the same time and whose teaching will be transformed using learning design, and *the institution*, which usually defines the context, budget, digital strategy, and support. Each of these primary stakeholders has interests in learning design, may be impacted differently, and may have to put effort into either implementing, teaching, or learning with the design. This dependency can be illustrated as in Figure 2.

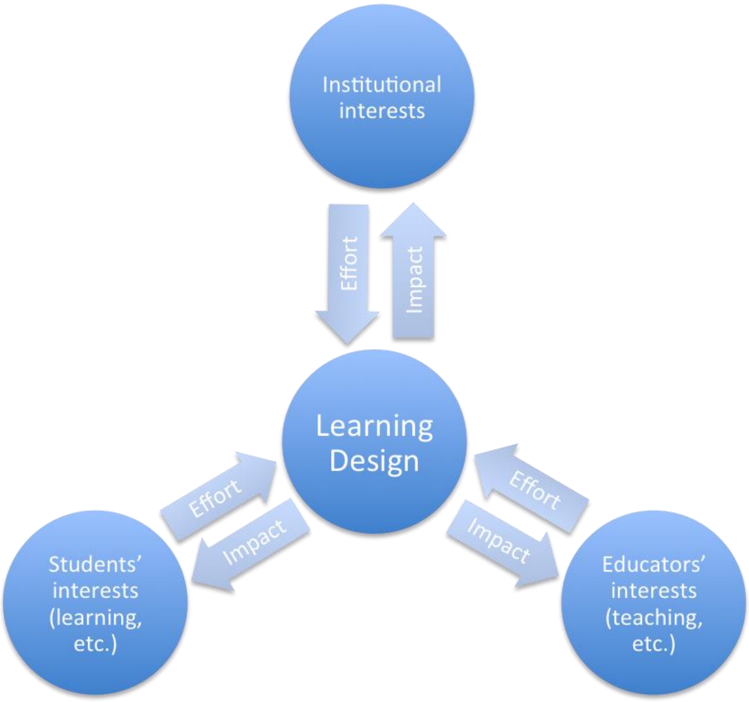

Figure 2: 'Learning Design in Practice' illustrated as a dependency of three primary stakeholders and their stakes.

By considering efficiency as more than merely a calculation of the cost-effectiveness, and, as suggested by Doering and Veletsianos (2008), also pay regard to the student and educator perspectives in terms of their required *effort* and the *impact* it has on their teaching and learning, *learning design efficiency* can be expressed in the following rough formula:

$$Learning\ Design\ Efficiency = \frac{Impact\ (on\ the\ institution,\ educators/teaching,\ and\ students/learning)}{Effort\ (for\ the\ institution,\ educators,\ and\ students)}$$

Basically the formula describes efficiency as a ratio: the lower effort and/or higher impact, the higher *learning design efficiency*. Impact (also referred to as 'effectiveness') may be characterised differently and depends on the interests of the institution, educators, and students, and how it affects their business, teaching, and learning. The effort can be assessed in many currencies, such as costs and funding, time consumption, preferences, strategies and endorsement, and training activities, and likewise may relate to individual stakeholders.

Assessing Learning Design Efficiency

According to the concept, learning design efficiency is assessed as a ratio between the effort and the impact aspect for each stakeholder and understood in context of the actualised learning design. Thus, a total of seven aspects should be analysed. However, analysing these aspects is far from trivial as presumably only few institutions, educators, and students are familiar with the learning design concept and what it means to them. Analysing their interests must then be either related to the characteristics of learning design, the associated effort, and its potential impact, or, when asking stakeholders directly about learning design, include some level of introduction to the concept or its affordances.

The Institutional Perspective

The institutional perspective is defined by the stakes of several players on different levels, such as *government level*, which defines the national budgets and political agendas; *institutional senior management level*, which deals with strategic matters, such as strategies and policies for educational technology, funding for educational development and technology initiatives; and *educational developer level* typically providing the pedagogical, media, and technical support to the educators and thus also facilitating the learning design process.

I.e., the institutional perspective on learning design is characterised by directives, institutional policies, educational strategies, budgets, and other relevant documents at institutional level that explicitly or implicitly express the institutional expectations and stakes in educational technology and learning design, including the associated *effort* and *impact*. In Danish context the ‘study progress reform’ and ‘profile model’, which basically states that more students should complete their studies faster - i.e., cut costs, increase intakes, and increase completion rates (which is typically calculates in ECTS or FTES), plays a dominant role (see The Danish Ministry of Education, 2014a; 2014b). In addition, institutions typically have additional aims such as a high employability of their candidates, effective teacher training, recruitment of best students, good study environment, internationalisation, and declared pedagogical principles as well as specific aims for the role and impact of educational technology.

The Educator Perspective

Teaching with learning design draws attention to the educators and their potential reluctance towards implementing technology in their teaching practice. The reluctance may be due low enthusiasm, a low confidence with technology, the absence of obvious benefits or justifications for using technology (Weller, 2002; Zhao & Cziko, 2001), complexity, or practical barriers associated with the uptake (Godsk, 2009). In addition, and as stressed by Richardson (2005) and Kember (1997), educators' conceptions of teaching and their perceptions of the teaching environment shapes their approaches to teaching and are based on a number of disciplinary characteristics and situational factors. I.e., not only potential barriers and motivational factors may play an important role for the uptake of learning design, also the educators' perception of the concept and various contextual factors are important for the uptake. Thus, the assessment should pay regards to the generic stakes, such as the educators' perception, prior experiences, general attitudes, and other stakes in educational technology and learning design, as well as the learning design intervention specific stakes such as time spent on transforming and teaching the module, the educator experience, the provided flexibility, and other actualised affordances.

The Student Perspective

Students learning with learning design would, most likely, not know or have any particular interest in whether their module is learning designed or not. However, they will, as illustrated in the 'learning design in practice' concept, be interested in the required *effort* for studying in a transformed module and how the learning design actually *impacts* their learning, including the affordances provided by the technology in learning designed interventions. Some studies seem to equate 'student effort' with 'time consumption' (Natriello & McDill, 1986); however, a more exhaustive understanding of 'effort' would need to be taken into account. Assessing student effort is more than merely measuring time and money spent on studying, it is a more subjective and biased measure which depends on the students' *perceived* effort, which again depends on their interest, approaches, and attitudes towards learning, their preferences, engagement, incentives, motivation, and how much effort they are willing to invest on a module. Thus analysing the student perspective requires a look into science students' overall motivations and incentives for studying, their approach to studying, and their preferences.

As pointed out by Brown and Duguid (1996) academic and career aspirations are oftentimes tightly entwined but the incentives and motivations for studying may vary and be many. Some see the 'education' as the end itself, while others see it as a career investment, a way to get social status, a job with a good salary, just a job in general, or as a step in a life-long learning practice and enculturation (Brown & Duguid, 1996). Incentives with a predominant extrinsic motivation for studying science also include family influence and cultural factors, particular occupational interests, gender-related, the salary, and various other career factors and opportunities such as job security and stability, good prospects for promotion, flexibility in terms of work schedule, tasks, business, and opportunities to work abroad (Alexander et al., 2011, Dick & Rallis, 1991, Tang et al., 1999; Woolnough, 1994). However, studies also show that a series of intrinsic factors play an important role for science students. Students are inspired by enthusiastic science teachers in school or by parents engaged in science, they are driven by the satisfaction and the sense of accomplishment related to working with the science area, by their self-efficacy for a specific science career, and by a genuine interest in the topic (Alexander et al., 2011; Dick & Rallis, 1991; Fenning & May, 2013; Tang et al., 1999; Woolnough, 1994).

The student perspective also includes their approaches to learning, their perception of the technological affordances and good learning experience, and their incentives for studying (Richardson, 2005, Price et al., 2007). As documented by Säljö (1979) and further elaborated by Richardson (2005) students' approaches to studying are shaped by a series of factors and should be seen in context of their different conceptions of learning, which are influenced by various demographic factors and their perceptions of the academic context. In practice this also means that obtaining a complete picture is a complex affair and would potentially involve a selection of supplementary methods, such as the 'Approaches to Studying Inventory' (ASI) by Entwistle &

Ramsden (1982) or the 'Approaches and Study Skills Inventory for Students' (ASSIST) by Entwistle (1997), in order to identify the students' approaches to teaching and learning: 'deep', 'surface', and 'strategic' (Price et al., 2007). Inventories like ASI and ASSIST are designed to identify the relative strengths and preferences of the students according to these three main approaches: deep, strategic, and surface (Entwistle et al., 2013) and in particular the ASSIST inventory has demonstrated to be reliable and valid (Byrne et al., 2004; Diseth, 2001; Entwistle et al., 2013).

To further elaborate the students' approach to studying and their attitude towards effort and interest in impact, it is relevant to have a closer look at their perceptions and experiences of good teaching and the relevant criteria to describe this aspect. For more than two decades the 'Course Experience Questionnaire' (CEQ) by Ramsden (1991) has been used to evaluate the students' experiences of higher education and through various studies the method has proven to be both reliable and provide valid results (Graduate Careers Australia, 2010; 2013; Kreber, 2003; Ramsden, 1991). CEQ draws attention to the many important aspects of being a student on a module with regards to the actual teaching, goals, and assessment, but also with regards to qualities such as student confidence, motivation, and experiences, the range and quality of the learning resources and support, the learning community, and collaboration. This further leads to a consideration of the role of the technology and how it may influence the teaching in the specific module in question by providing new affordances such as more flexible access to the teaching materials, support more mobility, support revision, reflection, and feedback as identified by Price & Kirkwood (2011). By combining these potential affordances of educational technology for supporting science teaching and learning practices with the relevant CEQ student experience scales and the aim of this study, a number of additional aspects of the student perspective are identified.

The Module and the Actualised Learning Design

In order to the ratio in context, the characteristics of the module and the actualised learning design should be included in the assessment. A module is typically characterised by a set of formalia such as credits (ECTS), level (under- or postgraduate), duration, and a description with a set of learning goals. The actualised learning design is expressed by the teaching and learning activities and materials, the structure, and the level of transformation. The level of transformation may be assessed according to the degree of technology (blended vs. online learning), the actualised affordances (Kirkwood & Price, 2014), or according to the role-of-technology-oriented substitution-redefinition scale based on the revised SAMR model (Godsk, 2014a). If a specific learning design model has been used for the transformation it would also be useful to include an assessment of the compliance of the actualised learning design with the underlying model.

A Research Matrix of Mixed Methods

Variables that measure or reflect interests, such as learning goals, time consumption, costs, grades, perceived learning outcome, and satisfaction, may be specific to the module in question and the learning design intervention. Others, such as policies for educational technology, funding, technology readiness, and pedagogical principles, may be generic for all modules, the entire institution, and/or the entire educator and student cohort. The generic variables do not need to be analysed for each intervention but they are important for weighting the module specific variables. For instance, an institution may have a generic interest in educating and passing as many students as possible at a low cost at the expense of the learning experience. In this light, the learning design efficiency should be assessed with an accentuation of the module specific variables related to pass rates and scalability, while other variables, such as student satisfaction, evidence of deep learning and higher-order thinking, and perceived learning outcome, may be omitted. In other words, the exact set of variables and their individual weighting depends on the specific context and should regard the aims of introducing technology into a certain module.

In order to address this rich and complex set of variables, a methodology based on a mixed methods approach combining surveys, interviews, observations, and reviews of documents and data with three generic studies and four intervention specific studies has been developed. The three substudies for scrutinising the more generic stakes in learning design are:

- Substudy 1.1: A review of policies, budgets, strategies and other documents that express the institutional stakes in learning design and educational technology. If necessary, this is accompanied by a follow-up interview of the management for further clarification.
- Substudy 1.2: An online educator survey about their prioritisation of the potential affordances of educational technology, their experiences with and perception of educational technology, and factors important to their uptake.
- Substudy 1.3: An online survey of students' general incentives and motivations for studying, their attitude towards technology in education, their common learning approaches, and their teaching preferences.

And the four substudies for scrutinising the learning design intervention specific aspects and stakes are:

- Substudy 2.1: An observation of the teaching practice and the actualised learning design. This includes an observation of the materials and activities in the learning management system (LMS), and an analysis of the actualised learning design and its compliance with the underlying learning design. If applicable, this substudy includes module catalogue lookup for information about formalia.
- Substudy 2.2: A semi-structured interview of the educator about her/his teaching practice and the effort and impact of the intervention such as time consumption, attitude towards the intervention, and actualised affordances.
- Substudy 2.3: An online student survey on their use of materials, satisfaction and preferences, perception of the format and satisfaction and other effort and impact related aspects of the intervention. If necessary, follow-up interviews are conducted in order to elaborate their perceptions and actual use of materials.
- Substudy 2.4: A review of data such as examination scores, statistics on materials and the LMS.

By aggregating the variables of the different perspectives and mapping the substudies to each variable, the research matrix in Table 1 emerges.

Aspect	Variables and stakes	Surveys	Observations	Interviews	Reviews/misc.
The module and learning design	Formalia: credits, level (under/postgraduate), duration, and learning goals.				Substudy 2.1: Module catalogue lookup.
	Teaching materials, learning activities, and structure.		Substudy 2.1: Observation of teaching and learning design.	Substudy 2.2: Educator interview	
	Level of transformation according of the revised SAMR model (see Godsk, 2014a)				
	Compliance with the underlying learning design model and learning design in general				
Institutional effort	National budgets, political agendas, and directives (government level)				Substudy 1.1: Review of documents
	Funding for educational development and technology (strategic level)				
	Strategies and policies on educational technology (strategic level)			(Substudy 1.1: Follow-up interview)	
	Pedagogical, media production, and technical support to interventions (educational developer level)			Substudy 2.2: Educator interview	Substudy 1.1: Review of documents Research diary
	Technical and study administrative support to transformations (administrative level)				Research diary
Institutional impact	Actualised affordances according to digital strategies/aims for educational technology measured in level of transformation and ECTS/FTES.	Substudy 2.3: Student survey	Substudy 2.1: Observation of teaching and learning design		Substudy 2.1: Module catalogue lookup Substudy 2.4: Review of data
	Fulfilment of the 'profile model' (The Danish Ministry of Education, 2014b) - i.e., cut costs, increase intakes, and increase completion rates.				Substudy 2.4: Review of data Data from the study administration
	Fulfilment of other/unofficial institutional aims		(Observation of data and documents)	(Through later follow-up interview with the management)	
Educator effort	Time spent on teaching and transforming the module			Substudy 2.2: Educator interview	
	Uptake of learning design model and defeated barriers.		Substudy 2.1: Observation of teaching and learning design		Research diary
	Attitude, experiences, and perception of learning design and educational technology (incl. 'resistance to change')	Substudy 1.2: Educator survey			
Educator impact	Flexibility in time, place, and pace (incl. time for other duties)				
	Satisfaction and perception of the intervention				
	Other affordances				
Student effort	Time spent on the module	Substudy 2.3: Student survey			Substudy 2.4: Review of data
	Attitude towards technology in education	Substudy 1.3: Student survey			
Student impact	Flexibility in time, place, and pace (incl. support for repetition, distance learning, and flexible studying hours)	Substudy 2.3: Student survey			Substudy 2.4: Review of data
	Satisfaction and teaching preferences				
	Improved learning in terms of more higher-order thinking activities, higher grades, and higher pass rates		Substudy 2.1: Observation of teaching and learning design		Substudy 2.4: Review of data
	Perceived learning outcome (i.e., learning goals accomplishment)				
	Other actualised affordances cf. the incentives for the intervention		Substudy 2.1: Observation of teaching and learning design	Substudy 2.2: Educator interview	

Table 1: The research matrix for assessing learning design interventions.

As illustrated by the research matrix some of the variables are addressed by more than one study. The aim of this methodological triangulation is partly to provide more precise and thorough results and partly to and validate the findings.

Future Work and Conclusions

As illustrated by the literature review and the presented methodology it is far from trivial to conceptualise and assess learning design efficiency. A set of mixed methods is necessary in order to cover and understand the main stakeholders and the actualised learning design. At this point an initial study, which includes the substudies 1.1-1.3, has been carried out addressing the generic stakes in learning design. Furthermore, a series of modules are currently being transformed with the STREAM learning design model (Godsk, 2013) and the substudies 2.1-2.4 are being conducted as a part of an action research setup accompanied by a research diary. Some results are already available (see Godsk, 2014b); however, more data needs to be gathered and analysed in other to refine the methodology.

The provisional results suggest, based on variables such as students' grades, satisfaction, and flexibility with a manageable effort for the institution and educators, that learning design has the potential to be an efficient catalyst for transforming modules into blended learning (Godsk, 2014a; 2014b). However, the results also suggest that the complexity in assessing effort and impact is high and the relevance of the different variables varies. Thus, future research should address this issue and, if viable, simplify the assessment methodology based on a more in-depth analysis of the generic stakes in learning design (Substudy 1.1-1.3), a further refinement of the efficiency concept informed by research on 'effective' blended and online learning in general, and a factor analysis juxtapositioning the data and results of the interventions. This will also help testing the validity and reliability of the methodology and answering the additional research questions on what makes learning design efficient, how, and why.

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Adaptive designs for learning based on MOOCs – *a design framework for personalized learning in teacher professional development.*

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Abstract

Informed by research in MOOCs and adaptive learning systems the project has developed a design framework which can guide the development of SPOCs (Small Private Online Courses), adapted to experienced school teachers' different learning needs. In 2020 it will be a requirement that, Danish school teachers have a bachelor degree in the subjects they teach. More than 10,000 teachers need professional development and municipalities ask for an adaptive teacher development program with personalized learning. The project's research question is the study and development of design principles that can guide the development of adaptive designs for learning on the basis of MOOCs as an overall design framework. The project is methodologically inspired by Design Based Research.

Keywords: *Adaptive design, Personalized learning, MOOC, SPOC, Design Based Research.*

THE RESEARCH PROJECT

In 2020 it will be a requirement that Danish primary school teachers have a bachelor degree in the subjects they teach. More than 10,000 teachers, who for many years have taught a course without being formally qualified, need professional development and therefore municipalities ask for new training concepts. There is a need for educational concepts that are flexible in relation to teachers' work situations and are based on the fact that the teachers already have acquired a number of professional skills. A number of municipalities (the customers) and University College Zealand (UCSJ: the provider) are in the process of examining whether the training format "SPOC" (Small Private Online Course) can solve this training task. As part of this process UCSJ has established a research project with the aim of developing a design framework which can guide the development of SPOCs, adapted to experienced teachers' different learning needs and study the factors affecting the actual realization, legitimacy and efficacy of the design. The concept of SPOC is inspired by MOOCs (Massive Open Online Courses), an educational design which has transformed into a number of different concepts in recent years (Bayne & Ross, 2014).

METHODS

The project is methodologically inspired by Design Based Research (DBR) (Brown, 1992; Collins, 1992) Informed by previous research in MOOCs and adaptive learning systems the design framework has been developed through iterative design experiments (diSessa & Cobb, 2004). Several prototypes have been evaluated and redesigned. We have analyzed interviews with participants and teachers and made observations of the participants' interactions with each other and with the technology (Moodle). Through these design experiments it has been possible to develop a design framework consisting of a set of pedagogical design principles.

ADAPTION – AN INTRODUCTION

In a research field, which grew from an influential study on adaptation by Lee J. Cronbach (Cronbach, 1957), it has been documented by many educational researchers that learning designs which adapt teaching to the individual learner's needs, have an positive effect on the learning outcome (Akbulut & Cardak, 2012). Pre-understanding or prior knowledge is considered as one of the individual factors that has the greatest importance in a learning process (Glaser, 1984). Personalization is therefore particularly important in continuing education for adults, who already have acquired several professional skills. But the concepts ”adaptive designs for learning” and “personalized learning” and are not clear concepts. We define adaption as feedback from an educational system tailored to the needs of learners (Bateson, 1998; Hattie, 2011). We distinguish between different forms of feedback (U.S. Department of Education, 2010):

Differentiation is teaching, where participants have the same learning goals, but the teaching method varies so they adapt to the individual student's needs.

Individualization is teaching, where the participants also have the same learning goals, but participants can move forward at different speed and relate to a particular content area or a given activity in different ways, and teaching is tailored to individual needs.

Personalization is teaching, where participants have *different* learning objectives, depending on their prior knowledge and learning needs. The training is customized, so this is possible, and personalized instruction may also provide opportunities for differentiation and individualization.

PRIOR RESEARCH

MOOCs

Research in MOOCs has until 2012 been scarce (Kennedy, 2014; Liyanagunawardena et al, 2013), which is of no surprise since MOOCs were first offered in 2007/2008. MOOCs are based on previous research in e-learning (King, 2014) and experience from OER, where MOOCs differ by integrating open educational resources in an instructional design with an embedded but mediated teacher presence and clear learning objectives (Liyanagunawardena et al, 2013). The research has been oriented towards only a few topics including MOOC typologies with the dichotomy: C-MOOCs to X-MOOCs and the discussion of connectivism to behavioral and cognitive learning theory (Rodriguez, 2012; Liyanagunawardena et al 2013). However this discussion is not so dominant anymore (Bayne & Ross, 2014), and several MOOC providers are developing MOOCs that integrate several different pedagogical approaches depending on the objectives of the learning e.g. inspired by Laurillards pedagogical framework (Laurillard, 2012; King et al, 2014).

Participant perspectives and especially the high dropout rates among students still have had great attention (Rodriguez, 2012; Kennedy, 2014; Vivian et al, 2014). Hypotheses about how to reduce the dropout rate based on research show that learning is supported if the participants can interact with each other and with the teacher. Social presence and teaching presence, therefore, are important in an educational design (Kop et al., 2011) – forms of presence which particularly have been explored in the context of the COI framework (Garrison & Anderson, 2003). MOOC research has been primarily oriented towards developing social interaction between participants, for example, through peer to peer response methods. However, this has not solved the problem concerning dropouts (Gasevic et al, 2014). In formal education, where high dropout rates are unacceptable, there has been an increasing interest in hybrid educational designs that blend MOOCs with either on-campus teaching or synchronous online teaching and learning environments (Bayne & Ross, 2014; Gasevic et al, 2014). In this process, the concept of MOOCs has been transformed into a series of new training formats including SPOCs (Small Private Online Courses) (Baggaley, 2014). SPOCs are online courses for a small group of students enrolled. But the concept of SPOCs differs from traditional online education by integrating an embedded but mediated teacher presence.

The typical MOOC student is an adult who already has a degree and is fully or partly in job. The participation in a MOOC is for professional development either out of personal intellectual curiosity or in connection with the acquisition of specialized skills related to work (Vivian et al, 2014; Kellogg 2014; King et al, 2014). MOOCs as well as SPOCs can be an effective design for acquiring work specialized skills if the design is competency-based and enables personalized learning that matches the professional's need for additional skills (Norton et al, 2013, Milligan & Littlejohn, 2014; Gasevic et al, 2014). This requires an educational design that can identify an individual's skills, identify skill needs and adaptively design a study for each student (Kostolanyova & Sarmanova, 2014). Personalized learning and adaptive education is a growing field of research (Kinshuk, 2015; Gynther, 2015), also within the field of MOOCs where research, however, has been limited (Gasevic et al., 2014).

Adaptive learning systems

Attempt to individualize instruction with a technical system is an older idea. Frederick Taylor (1911) was interested in the idea of a "teaching machine". In 1958 B.F. Skinner introduced the idea of technology mediated programmed learning (Skinner, 1958), and in the 70s a lot of research in the field of Computer-Assisted Instruction (CAI) took place. The criticism of this approach and especially the radical behaviorism that Skinner developed has been intense in education research for decades.

Adaptive learning systems are this century's attempt to develop an educational technology adapted to users' needs, and Simens et al (2015) refers to this technology as “fifth-generation” educational technologies.

Most adaptive learning systems consist of three components (Natriello, 2011; Oxman & Wong, 2014): A content model, a learner model and an instructional design model which is a strategy for the adaption process. A content model structures the content of learning objectives, sequences and tasks to be solved (Natriello, 2011). A content model divides the subject into smaller elements, which can be associated with different types of learning resources (Talmann, 2014). An adaptive learning system also contains a model of the learner (Wenger, 1987). The model is based on one or both of the following categories: a) the learner's current knowledge, and b) the learner's learning preferences. The model of the learner must visualize the personalized curriculum a given person should be offered in a concrete course. Most adaptive learning systems therefore identify the learner's existing knowledge and compare the learner's knowledge with the knowledge structure or curriculum for a given subject.

The majority of all commercial adaptive learning systems also try to model the learner's preference for certain types of learning processes. Attempts to categorize the learners in cognitive types or learning styles are here very common. In a review of 70 published articles on adaptive learning systems (Akbulut & Cardak, 2012) 81 % of the participating learning systems were using cognitive types or learning styles for modeling learners. Most used were cognitive types based on Kolb (1984) and learning styles based on Felder- Silman (1988) or Dunn and Dunn (1974). Despite the widespread use of models of the learner building on typologies of preferences in terms of learning styles or cognitive types, the same study showed that ”findings on concrete leaning outcomes were not strong enough” (Akbulut & Cardak, 2012 s. 835). It is therefore important to be critical towards adaptive learning systems that emphasize the identification of specific preferences and hypotheses concerning specific learning styles. Especially because the development of a model of the learner on the basis of hypotheses related to the learner's preferences can develop into what is called "stereotype methods" (Shute & Zapata-Rivera, 2010).

The third dimension in an adaptive learning system is the strategy of adaptation. Basically, we can distinguish between two adaptation strategies: recommendation systems and guided navigation (Khribi et al, 2015). In a recommendation system the technology identifies a range of possibilities which the system priorities for the learner on the basis of a learner model or on the basis of the learner’s performance in the system. But the learner is free to choose whether to follow the recommendation. By guided navigation the system hides the links which is not relevant to the learner, either because they do not match the model of the learner or because they do not match the learner's continuous performance in the system. An important design discussion is therefore the question of who should have control of the adaption process. This raises a number of ethical questions and dilemmas of privacy and users' control of their own data. Who owns the data, an adaptive learning system produces, and what can and should this data be used for?

DESIGN CRITERIA FOR AN ADAPTIVE SPOC

Based on research about MOOCs and adaptive learning systems, we have defined a set of design criteria for our development of adaptive learning design for SPOCs:

- Modeling of the learner must be based on documented effects.
- Development of adaptive learning design must be based on a precautionary principle (ethical code) which means that we do not use stereotypical methods for modelling the learner.
- Modeling should (only) visualize a) the learner's professional skills and b) experience and skills to learn in a given training format e.g. MOOCs/SPOCs.
- Adaptation performed by a technical system based on non-transparent algorithms cannot stand alone.
- Adaptation must be a dialogue (negotiation) between the learner and a teacher on the basis of one or more technically-generated information.
- The adaption strategy should be recommendations and the adaptation process must be transparent and controlled by the learner.

THE DESIGN FRAMEWORK

Based on the research review above, a series of design workshops and three iterative design experiments, we have developed a design framework for design of adaptive learning environments in formal education.

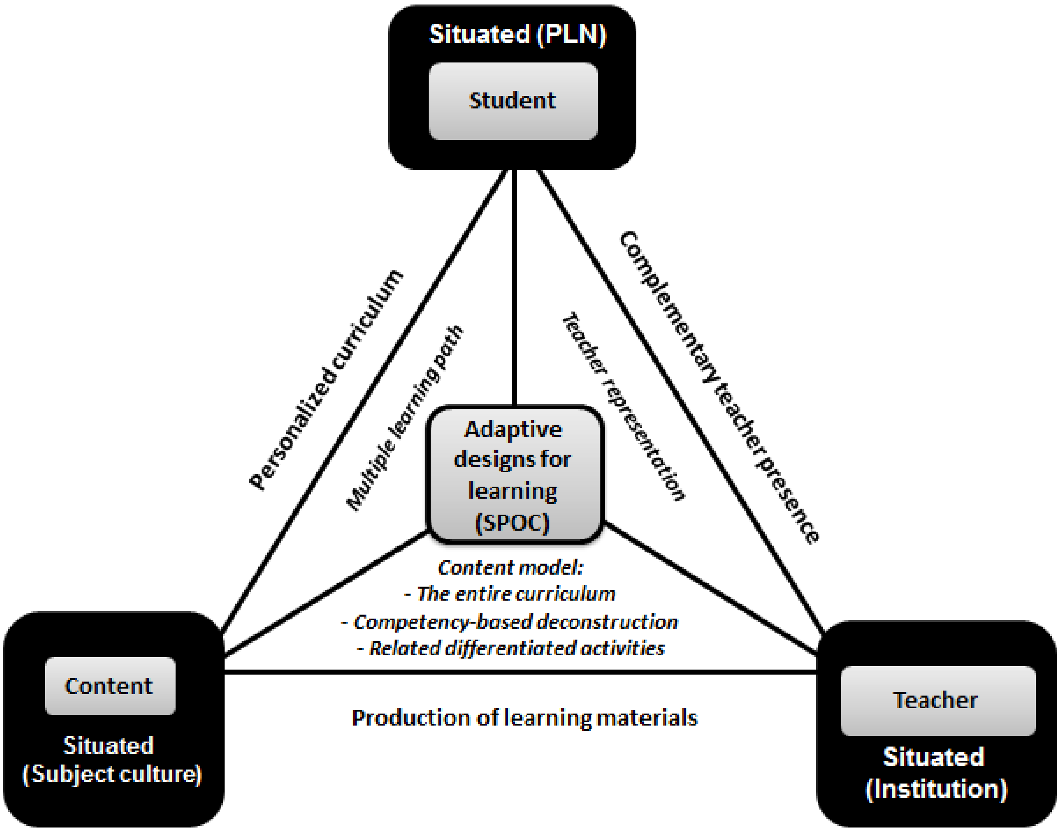

Figure 1: Designframework for an adaptive hybrid SPOC.

The design framework visualizes three design levels:

Setting

The design framework is based on a well-known design model which frames the design as a setting for formal training with a student, a content and a teacher.

But we are following the widespread criticism of this model and situate the three elements of the model in the context they are part of (Garisson & Anderson, 2011).

- The student is part of a personal learning network (PLN).
- The content is part of a broader academic culture and its interpretation of the subject.
- The teacher is situated in an educational institution and more widely in an educational system.

The development of a specific adaptive learning design must be based on the framing and the concrete anchorage of the three elements in their specific contexts.

Relationships

The framework visualizes the characteristics of the relationship between the design elements described above:

a) The relationship between the student and the content is characterized by a personalized curriculum. Each student has their own unique curriculum.
b) The relationship between a student and the teacher is characterized by complementarity. In traditional teaching concepts the relation between a student and the teacher is the core of the instructional design and teacher presence is the starting point for concrete designs for learning. However, this is not possible in an instructional design where all participants have their own personalized curriculum. In a group of students who each have their own curriculum it is not possible to realize a multiple relationship: a student - a content - a teacher. The relationship between student and teacher must be complementary if you want to support that all participants have a personalized curriculum.
c) Finally, the relationship between the teacher and the subject also has a characteristic feature that is far from usual perceptions about being a teacher. The traditional role of the teacher is the lecturer who interprets a subject and mediates the relationship between the student and the subject in a face-to-face setting. The project shows that the relationship between the teacher and the subject must be transformed from a teacher role to an author role. The teacher is rather a designer, an author and a producer of a number of learning resources. A role that also entails that the teacher is part of a larger production team.

Principles

Level 3 in the model visualizes the design principles. These principles relate to each of the three characteristics described above.

Personalized curriculum: Multiple learning path.

The design must be able to:

a) identify the participants current skills - visualized in a competency profile.
b) visualize a competence-gap in terms of a personalized curriculum.
c) recommend a learning path which adaptively matches the learner's personalized curriculum.
d) identify the student's ability to learn in and with a MOOC/SPOC.
e) establish an adaptive scaffolding of the student's learning process in the SPOC.

The principle of multiple learning pathways, we will refer to as the design potential or *affordance* of the design.

Production of learning resources: The content model

In order to realize the principle of multiple pathways of learning, the educational institution in advance has to produce a content model, that:

a) covers the entire curriculum of the subject.
b) includes a deconstruction of the subject to competency units.
c) guides the production of learning resources and forms of participation, which without progression are linked to each unit of competence.

This design principle can be described as a *constraint* for adaptive learning designs.

The design framework includes no constraints regarding the choice of types of activity associated with specific stereotype, learning styles, etc. The framework thus encourages the development of a number of different types of activity associated with each competency.

Complementary teacher presence: Representation of the teacher

The final design principle is a key constraint for the design of MOOCs in general and thus also for an adaptive SPOC on the basis of the MOOC format. Since the teacher cannot be present in a multiple number of learning pathways, the teacher must be represented in the design. The teacher must be mediated in a form that minimizes the disadvantage of a learning design where the teacher cannot be physically present. The principle of complementary teacher presence can be formulated as a scale and an educational institution must in each case decide the extent to which it will complement the asynchronous teacher presence with synchronous presence forms either online or on campus.

EVALUATION

The evaluation of the developed design principles follows methods and guidelines from Design Based Research (Akker et. al., 2006; McKenney & Reeves, 2012). In our evaluation we distinguish between the design principles outlined in the framework above, and *specific* designs for learning developed by individual teachers / authors in a given educational institutionalized context. In a DBR project there is no straight line from the developed theory (design principles) and the actual design solution. “Design principles are not intended as recipes for success, but to help others select and apply the most appropriate substantive and procedural knowledge for specific design and development tasks in their own settings” (McKenney et. al. 2006 p 73). Specific learning designs can therefore easily develop into *mutations* (legitimate or lethal) which research should subsequently study in order to revise the developed theory (Hung et. al., 2010).

The designs developed by teachers/authors, have been evaluated according to *feasibility*, *legitimacy* and *efficacy* (McKenney et al, 2006; McKenney & Reeves, 2012). The degree of feasibility, legitimacy and efficacy affects the *intended* design an educational institution produces and offers to its customers. But the intended design is not the same as the *implemented* and the *attained* design. The intended design is what the design is set out to do. The implemented design is how it is actually used in practice by teachers and students. And the attained design is the specific outcome of the design – in our case the learning outcome (Mckenney & Reaves 2012). An evaluation design must test both, the intended, the implemented and the attained design.

The evaluation was conducted using *alpha* testing and *beta* testing (Mckenney & Reeves 2012). Our alpha trials have been controlled by the research team with maximum support for teachers and students. The aim was to test the designs feasibility in our institution and explore teachers and students assumptions about viability and impact on learning outcome. In our beta test we have tried the SPOC in real life context but still with some support. The goal has been to explore conflicts between the intended design and its implementation according to institutional feasibility and viability, map out fostering and hindering conditions for implementation and measure the initial impact on learning outcome.

RESULTS

The institution's choice of intended design

University College Zealand (UCSJ) has produced SPOCs in seven different subjects, and UCSJ has decided to produce SPOCs for all subjects in the Danish primary school by 2018. The SPOCs are for in-service training for experienced school-teachers without formal qualifications, in the following referred to as “the students”.

The first step in a course is self-assessment. On a scale from 1- 5 the student assesses his qualifications in relation to the objectives of the course - objectives formulated in terms of competencies. The self-assessment is conducted with a tool developed within the project. Based on the student's input the tool generates and visualizes a competence-profile illustrating the percentage of the curriculum, the student must study. The developed tool is also a recommendation and navigation system that generates an adaptive match between the competence-gap and selected study themes. The SPOC platform for each of the 7 subjects is designed so adaptation is possible, no matter what skills the student needs to pass the exam. The curriculum in a subject is divided into a number of themes that are organized so they can be accessed without progression. Each theme is assigned a set of competencies that the students can acquire through study work, by accessing video resources, texts, exercises, quizzes and participation in peer to peer response, collaboration etc. The recommendation system is supplemented by a meeting with a teacher because UCSJ wants to supplement the technical recommendation system with a dialogue with each student. Through a 90 min. dialogue with a teacher, the self-evaluation is reviewed and the teacher provides an additional guidance on the selection of adaptive themes and navigation in the SPOC platform.

The evaluation shows that there is a high degree of fidelity between the design principles and the *intended* design of the 7 SPOCs.

UCSJ has decided to offer a blended learning concept for teacher professional development. The students' interaction in the SPOC is therefore supplemented by face to face instruction on campus. The extent of on-campus training is decided by the municipalities who buy this kind of additional training. An interesting mutation has been identified. One of the municipalities have purchased additional training to such an extent that the concept can be characterized as “SPOC enhanced Classrooms”.

On a pedagogical level the intended design is a result of the teachers' decisions and choices of learning design for the 7 SPOCs. The evaluation shows the following:

- A subject does not determine a specific SPOC-pedagogy and there are more similarities than differences between the seven SPOCs. Even though the framework focuses on the interpretation of how content is situated in a specific subject-culture, a stronger emphasis of this must be done in the future introductions of the framework.
- The frameworks greatest legitimacy problem is related to the breakdown of a subject in competency units without progression. This conflicts with teachers' common conceptions of curriculum design. This key constraint has to be introduced in a better way for SPOC-designers.
- Design choices related to learning processes are very similar in the seven SPOCs who all have many similarities with an X-MOOC. This may be due to learning theory is not explicitly reflected in the framework and the associated design principles. The design framework should at this point be revised in future iterations.

The implemented and attained design

The evaluation of the implemented design shows that there are four different clusters of mechanisms which have significance for the attained design in different local contexts:

- The participants' perception of relevance and usefulness of the intended learning design.
- UCSJs introduction of the intended design for students.
- The student's study conditions granted by their employer.
- The students' academic qualifications.

FURTHER RESEARCH

We are in the process of analyzing the relationships between these four clusters, and the effect of the design in different contexts for implementation. However, it is obvious that one cluster is predominant in relation to the learning potential of the design.

The most saturated category in our evaluation concerns the study conditions. In Denmark, it has been customary that the employer pays for the time employees spend on in-service training activities on campus. The basic design framework, however, can be realized in a design which can be accessed online via asynchronous activities. And only to a limited extent, this design has been supplemented with activities on campus in a blended learning concept. Some municipalities have therefore chosen to implement the design in their local context in a way in which the students get very little or no time to participate in study activities. The consequence has been that several students have seen the concept as a discount solution for teacher professional development. The intended design is in this local context mutated to a ”lethal mutation”.

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MOOCs, From massive to multiple open online courses

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During 2013-2014 University College Zealand (UCSJ) experimented with the development of a Philosophy of Science MOOC. The MOOC was developed at a diploma program level and targeted UCSJ's potential future as well as actual students. The actual MOOC participants' turned out to be highly self-motivated and self-regulated and hence their participation was heavily influenced by their very different interests in the MOOC: e.g. curious about pedagogy, curious about MOOCs, interested in Philosophy of Science. With the ambition of open access for different participants, it became central to work on the question of how future MOOC designs can better include and guide various participants' interests and forms of engagements.

Keywords: MOOC participants, self-motivated, self-regulated, learners.

Partially connecting with MOOCs

During 2008 to 2014 MOOCs (Massive Open Online Courses) have been highlighted in public discourses and by educational institutions worldwide as the new capable educational technologies. MOOCs are envisioned to open up new educational opportunities in manifold ways to various people that need to learn in a globalized and digitalized world. From the first MOOC in 2008 till the end of 2013, MOOCs as a new educational phenomenon were heavily characterized by a technology deterministic and romanticized media discourse, emphasizing MOOCs as an educational revolution – the new black within higher and further education, in the world. In spite of the fact that MOOCs may be viewed as a further development of already existing and relatively old movements within open education and elearning, MOOCs have been cast as a unique new educational technology. In spite of the history of MOOCs being rather short, the so-called MOOC hype has spread world-widely. Already, however, by the end of 2013 various MOOC researchers' blogposts - following the first MOOC Research Initiative (MRI) conference - started engaging differently with the phenomenon of MOOCs. MRI keynote, Bonnie Stewart (2013), for instance, talked about now moving into the post-MOOC-hype landscape. Also Keith Devlin (2013) wrote a blogpost commenting on the MRI conference with the title ”The MOOC Express - Less Hype, More Hope”. Around the same time, the American National Public Radio (NPR.org) published an article (Westervelt, 2013) with the title ”The Online Education Revolution Drifts Off Course”. Westervelt wrote that if 2012 – according to The New York Times – was the year of the MOOC, then 2013 was the year when it fell back to earth.

By the entrance to 2014 MOOC discourses, research and developments were becoming more consolidated, institutionalized and nuanced. Where MOOCs – to begin with and in line with many other educational technologies – were imagined to pave the way to democratization of educational opportunities in the world, the big MOOC providers in 2013-2014 realized manifold different and massive problems: for instance, it appeared that many MOOCs had massive amounts of people signing up, but relatively few participants that actually actively participated and completed MOOCs (see e.g. Perna et al., 2013). This problem has been discussed as (among other) a matter of whether participation in a MOOC should be valued as if it is the same as participation in traditional courses, expecting full participation in the course from start to end. Instead, MOOCs may be understood as uncourses in the sense that many MOOCs are not a part of a formal educational program, and participants may not participate in a MOOC as if it is a course. Furthermore, the so-called radical cMOOC (connectivist MOOC) versions may not even involve a guiding structure and outline of the course for the participants.

This paper deals with this particular challenge of MOOCs: that they represent educational arrangements that will always only partially connect with their participants. Because of this challenge it becomes central for MOOC developers to engage with the many ways in which MOOCs may become partially contained by as well as partially contain particular participants and their individual courses of learning at certain moments in their personal everyday ways of living.

MOOCS and educational design

In a review of the MOOC research conducted from 2008-2012 Liyanagunawardena, Adams and Williams (2013) identify two articles arguing for two main types of MOOCs. The authors point to a need for literature identifying more variations of MOOCs:

Two main types of MOOCs	AI-Stanford like courses (Rodriguez, 2012) xMOOCs (Daniel, 2012)	Connectivist MOOCs (Rodriguez, 2012) cMOOCs (Daniel, 2012)
Educational philosophy	Individual and cognitive-behaviorist approaches (Rodriguez, 2012)	Social and connectivist approaches (Rodriguez, 2012)

Anderson and Dron (2011) and Williams, Mackness and Gumtau (2012) point to the existence of several pedagogical approaches to online education. Furthermore, that different contexts and purposes may be involved in arrangements of online education therefore including several pedagogical approaches at a time. Anderson and Dron identify three generations of online education: 1. cognitivist-behaviorist, 2. social-constructivist and 3. connectivist. The authors suggest that the three approaches each have their different weaknesses and strengths, which calls for inclusion of different combinations in future MOOCs. Williams, Mackness og Gumtau furthermore introduce different topografic zones of learning: prescriptive, emerging and chaotic. Learning scapes can, according to the authors, be organized and experienced as dynamic, and they list more than 20 different factors that can be used to create and acknowledge educational design as "emerging footprints" during participants' courses of engagement. Each footprint will contain certain weaknesses and strengths, and any MOOC course must be balanced between the present purpose and context, and the right combination of the different factors. Shifting between various footprints may be relevant, depending on the learning scape and the dynamics in focus.

The case of the Philosophy of Science MOOC

This paper takes point of departure in the pilot case of developing and researching a particular Danish MOOC - the Philosophy of Science MOOC (see MOOC Zealand's homepage moocz.dk). The development of the Philosophy of Science MOOC began in September 2013. The paper draws on research and development activities related to the first official eight-week version of the MOOC which was launched in the Spring of 2014. The MOOC was launched as a fully open MOOC with the option to buy supervision and examination, in order to gain ECTS credits for the course. The course attempted to mirror the content of the traditional Philosophy of Science diploma courses offered by the University College of Zealand. The paper draws on some of the results of the entry and exit survey conducted in relation to the Philosophy of Science MOOC. It should be noted that this paper empirically draws on an extremely limited experience base, when it comes to MOOCs. 36 participants participated in the entry survey. Merely eleven of these participants also participated in the exit survey. Three of these wrote that they never even logged on to the Philosophy of Science course. In total eight participants out of 36 were active participants during the full eight weeks.

One of the first things encountered when reading into MOOC literature, is that it apparently is the rule more than the exception that there are many more participants who sign up for MOOCs than there are participants who complete MOOCs. This has led to a series of discussions on how to assess dropouts in these courses. There is far from consensus on this issue, but there is by now a number of studies documenting that retention in MOOCs is very much linked with the participants' interests and self-defined learning objectives. Koller and Ng, Do and Chen (2013) suggests, for example, that it is relevant to distinguish between MOOC "browsers" and MOOC "participants". MOOC "participants" represent the dedicated learners. MOOC browsers sign up for MOOCs with an intention to only lurk around for a little bit. The actual participants, on the other hand, are those who dedicate themselves to learning in one form or another. Koller et al. (Ibid.) divide these participants into three different groups:

- Passive participants: watching video, reading and trying out maybe a few assignments / quizzes
- Active participants: engages in the total MOOC offers and will typically be among the participants who complete and achieve a diploma / certificate / badge
- Community Contributing: actively participate by contributing to forum discussions and various other content.

Liyanagunawardena, Adams and William's (2013) review include 21 articles with case studies. According to the authors the case studies mostly engage with multi-method approaches. Most case studies collect data from the participants via online survey tools e.g. entry- and exit surveys. It is, however, particularly interesting that the author's claim that most MOOC case studies (at the time) can be understood as grey zones between the researcher as ”learning” and ”participant”. Referring to the fact that most of the case studies take point of departure in researchers as ”people who participated in the MOOC”.

The Philosophy of Science MOOC project was a subproject within the larger ongoing Project Learning without Boarders (LUG) 2013-2015 (see http://ucsj.dk/forskning/projekter/lug/). The Philosophy of Science MOOC project aimed at developing educational design principles for Massive Open Online Courses (MOOCs) for Danish professional education programs at university colleges (e.g. teacher education, nurse education). With an outset in Liyanagunawardena, Adams and William's review (ibid.), there appeared to exist a need to engage in research which included a view on educational design as emerging in practice in relation to particular persons' heterogeneous trajectories of learning and participation. Furthermore, there seemed (at the time) to lack qualitative research conceptualizing the relationships the learners and MOOCs in practice, in ways that did not only include the (perhaps) few participants actively engaging with a MOOC in the way the MOOC developers imagined it and as if it was a matter of full participation in the course from A-Z.

The development of and research related to the Philosophy of Science MOOC shall be understood with a reference to the post-MOOC-hype landscape. The agencies of the MOOC as an educational technology were neither taken for granted ahead of research nor cast in an a priori positive/negative light. Also the aim with this research and development project was to engage with the development of professional education MOOCs as a phenomenon multiple, that may appear in many different forms and gather participants in many different ways. Neither the abilities of the MOOC nor the people engaging with the MOOC were anticipated ahead of its launch. The ambition was to understand the MOOC as an emerging actor in relationship with the different MOOC participants' lives, concrete and personal interests, proficiency, personal learning and participation objectives.

When engaging with the Philosophy of Science MOOC project in 2013 most of the MOOC literature had focused on university courses, and in a Danish context there was scarcely written about MOOCs. Kjærgaard et al. (2013) published the first Danish article to describe the development of MOOCs and relate it to university colleges and professional education in Denmark. Both in their article and more generally in MOOC literature there was a tendency (at the time) to overlook learning as a central concept and main challenge when dealing with the construction of MOOCs. Fundamental learning theoretical discussions were generally lacking in MOOC literature, often taking for granted that learning is equal to participation or that there exist a 1-1 relationship between intended educational design and ways of learning.

The Philosophy of Science MOOC project was committed to the ambition to produce contextual and qualitative knowledge about the actual trajectories of participation relating to different learners engaging with the Philosophy of Science MOOC. Viewed from a situated and relational perspective of learning (Lave and Wenger, 1991), it is central to understand learning as an ongoing process of participation in and across different communities of practices during everyday living. From this perspective, what is learned hangs closely together with a person's personal trajectories of participation. The Philosophy of Science MOOC was an educational experiment, designed to create a foundation for the generation of knowledge about as well as experiences with MOOCs. The point of departure was an interest in MOOCs as a way to add to the learning ecology of Region Zealand (Denmark). The interest in this paper is *how the MOOC design can include various participants' interests and forms of engagements?*

The educational design of the Philosophy of Science MOOC

The Philosophy of Science MOOC was designed with an outset in 'traditional' diploma program courses on Philosophy of Science. The design principles of the Philosophy of Science MOOC were made with a strong reference to Coursera inspired MOOC courses (i.e. a strongly structured course in time and space, with a clear progression built into the design). Focus was on re-mix and re-use of existing resources on the internet and mirroring the teaching materials engaged in the face-to-face version of the Philosophy of Science diploma program course. The MOOC was engaged as a teacher implying no active teacher presence, except for the presence via video clips, the prearranged MOOC, design of activities etc. The Philosophy of Science MOOC was developed in Moodle, and represented in many ways a knowledge dissemination oriented MOOC.

Who are the Learners?

Mackness, Mak and Williams (2010) point to learners exerting increasing autonomy when it comes to choosing where, when, how, what and with whom they want to learn. According to the authors the trend is growing that learners choose not to use the traditional learning environments or courses an institution offers. Instead they turn to social media such as Facebook, Twitter, wikis and blogs. Conole (2013) also points out that learners today are surrounded by technologies and consider technologies as essential learning resources. They use different strategies to find and collect resources, and to communicate and collaborate with others. Various researchers like Conole, suggest that we in general have reached a point today where we must evaluate educational opportunities and qualities in relation to our concepts of the qualities of good learning. It is no longer naturally given what good education is and how good learning opportunities arise and are supported. There is a need to devote more attention to various learners' purposes and to experiment with different educational paths and formats.

There are many reasons to join a MOOC. Based on the entry survey, we have identified various MOOC participants. An entry survey can provide an opportunity to gain insight into "the current MOOC" and "the current participants" who engage in a MOOC. This knowledge can be used actively to articulate potentially relevant pathways of learning and participation opportunities for "the current participants". In the entry survey for the Philosophy of Science MOOC we included the open question: "What was your motivation for signing up for this MOOC course?".

What was your motivation for signing up for this MOOC course?

The participants gave many different answers to why they enrolled in the Philosophy of Science MOOC. Some were interested in Philosophy of Science and wanted to improve their skills, other wanted to use the MOOC as a supplement that could strengthen their already ongoing training: "*I'm starting to write my thesis at University College Zealand. I am at standstill and need inspiration to get on with writing. I have worked with philosophy of science back in 2001, and my knowledge has become a little rusty. I hope to be updated in relation to new approaches to the subject.* "

Some participants also explained their enrollment to the MOOC as a matter of curiosity towards the MOOC phenomenon: "*I want to learn about MOOCs from a user perspective*", "*I really want to try what it's like to be a student in a MOOC*"," *Interest in MOOCs - especially in a Danish context*", and "*Mainly to test MOOC teaching methods, secondary because the subject interests me*.".

We had anticipated registrations to the MOOC on the basis of an interest in philosophy of science and/or MOOCs. It is a well-known phenomenon that is also mentioned in MOOC literature that some participants in MOOCs are primarily there to lurk and learn about the MOOC as an educational form. Most participants in the Philosophy of Science MOOC have entered with either an academic or professional perspective. What was surprising, however, was that some registered participants attended because they were interested in finding inspiration for how philosophy of science and IT can be used in education, and more specifically in relation to the participants' own teaching activities: "*I also expect to be inspired to use IT in my own teaching*." *"I am* a *Teacher of philosophy of science and therefore I am interested in examining the parts of the module which could be used in the context of my own teaching activities*".

Age and previous experiences with philosophy of science

The participants age was very different. 18 participants were between 41-50 years old. Six participants were between 31-40 years old and six participants were between 51-60 years old. One participant was between 20-30 years old and one between 71-80 years old. Two participants registered "other", implying that they were either younger than 20 or older than 80 years old. The participants also had different professional backgrounds, current employment and very different "former philosophy of science experience." A group of participants stood out by having worked previously with philosophy of science related to education: "*I have at various levels (see education) participated in the teaching philosophy of science, primarily related to pedagogy," "Science is diverse so I am looking forward to broaden my horizons in ways other than I have learned about philosophy of science ". "I've had philosophy of science at the academy". "My knowledge of science comes from my master's degree (MSc.), and is based on philosophy of the social sciences*."

Another group of participants dealt extensively with philosophy of science as part of their everyday: "*As part of my professional field and a major content and basis of my educational background." "I am already working with philosophy of science in a little more applied form, as I have a subject" food and applied science. We are working to find out which sources are the basis for "what we know".* We are working with articles and reports, analysing methods, approaches and the conclusions. We discuss what is true and whether one can find the truth". Additionally, some of the participants were themselves teaching in science.

Another group of participants were concerned with what philosophy of science could contribute to their future activities: *"I work with organizational development. Perhaps it could open new perspectives?! ", " I might later come to teach philosophy of science. ", " Counting on it will benefit my benefit me, when I hope to start in a flexible diploma this spring", "Especially in management subjects, there are many theories and principles, but then when you examine them more closely, you often see that they are not scientifically based. I want to achieve a better ability to distinguish. I intend to read an executive MBA, and I believe theory of science will be an additional strength.* "

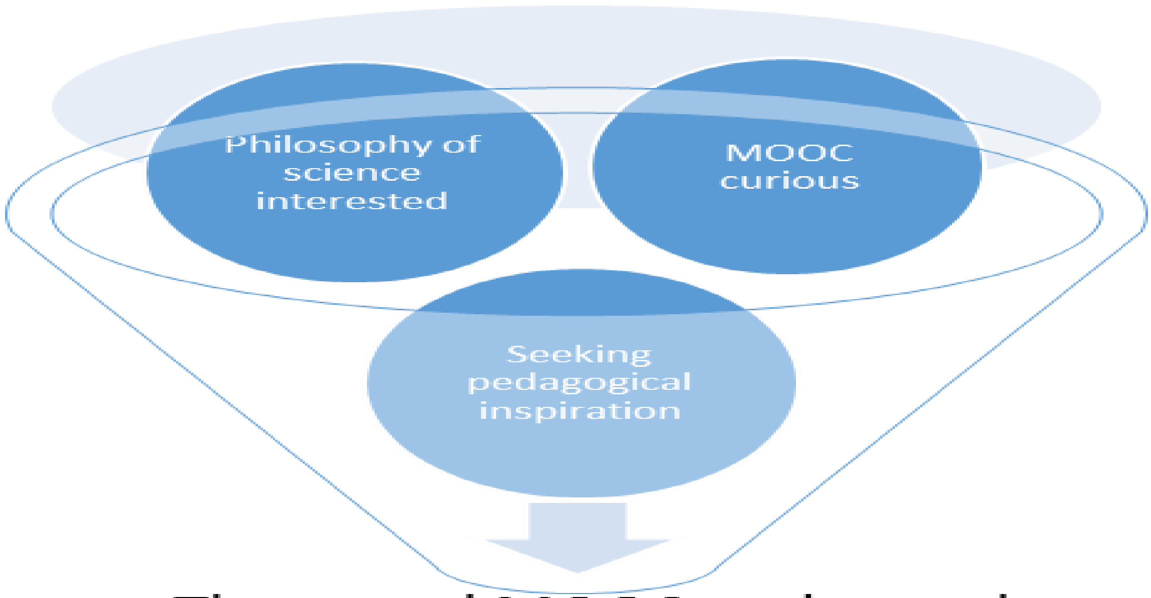
Previous experiences with this form of education

Participants were also asked about their previous experience with this form of education. There is a preponderance of responses indicating that MOOCs were a new phenomenon, but also that e-learning for many was something new: "*I have no experience with a virtual course". "No, has just taken the bus driver's license. I have no previous experience with digital education "," I am highly knowledge-seeking, but never had experiences with this teaching method before* ".

A few had own teaching experiences: "I have been taught distance learning for 10 years", "I teach virtual students myself, but I have never enrolled as a student in such a course." Five of the participants had experiences of participating in MOOCs: "*2 coursera courses*", "*Has previously followed audio-based lectures (not formal nor organized), participated in a course via Coursera", "participated in both virtual courses + 2 MOOCs", "Has participated in several other MOOCs. Teach a virtual course "," Yes, a little from Coursera ... I have previously followed MOOCs via Coursera "*

Some had previous elearning experiences: "*Has completed 5 modules of" media and communication "," "Started studying the social service worker program as e-Learning," "Have not previously taken an entire course. I have experience with the use of e-learning solutions from business and from modules offered by Harvard University in connection with the Certificate of Business Administration* ".

Based on the answers to these questions it became possible to establish situated awareness of the concrete "actual MOOC" and the "actual MOOC participants":



How have you experienced the Philosophy of Science MOOC?

Participants point to different basic aspects of the experience of the Theory of Science MOOC. On the one hand, that this type of educational activity can be perceived as lonely, and, on the other hand, it can simultaneously meet the need for flexibility and freedom to select and deselect when and how: "*It has suited me very well with the e-learning part (not having to appear anywhere). But clearly missed the interaction with teachers and other students. We never got to know each other* ...". One of the participants also explain that solitude is also about not articulating what you learn: "*It has sometimes been a little lonely. It is also strange that there are words, that do not get spoken throughout the course, such as the name of the German philosopher Gadamer - how do you pronounce that?* " The same participant also stresses the discussions envisaged in the MOOC, can be difficult to engage in, because you do not know the other participants. It is not confirmed whether the contribution you make appears relevant: "*Sometimes I sat with a feeling that I was completely on the wrong track where my answer had an entirely different vocabulary than the other participants.*" "*It's also a little anxiety-provoking that you cannot see or know who the other participants are.*"

The flexibility influences the dialogical possibilities, and in addition the participants experienced that the format of the activities required a high level of individually activity, in the form of the weekly tasks: "*The flexibility was good, but at the same time there was a pressure on the tasks that should be returned. The interaction with other students was not so good - all hesitated or delivered very late.*" "*This form of learning is very binding, and put relative high demands on you taking the initiative to get started. Something only happens when you yourself are active.*"

The participants' feedback points to the need for clearer and more meta-communication. The MOOC participants call for more explanations and guidance of the participants' involvement and participation forms. Expectations need to be made more explicit, both in relation to the use of teaching spaces, communication possibilities in a teaching space, and justifications for the choice of learning resources.

The exit survey revealed that from a participant perspective it is also relevant that the entry survey asks about the participants' interests in learning through various forms of participation such as "I want to work autonomously and independently". "I want to participate in virtual discussions and engage in dialogue with the other participants on tasks and professional content". "I'm only interested in actively participating in one sub-element of the MOOC".

Further perspectives

The answers to the entry survey related to the Philosophy of Science MOOC has proven to be quite useful as a point of entrance to accessing "the actual MOOC participants" and "the actual MOOC". This information can be used to guide participants towards their personally appropriate learning pathways. When viewed from the participants' perspectives, the ideal would be to proactively build a MOOC that can identify and scaffold many different learning pathways and learning needs - and related activities, resources and tasks. This could ensure that an appropriate range of options (compared to the actual MOOC and the actual participants) would be available to participants. The entry survey could be used as a means to point out the relevant options to the participants when the course begins. For example, one can imagine some communication activities, and peer-to-peer activities that can best be achieved if there is a certain critical mass of MOOC members with an interest in this present.

In connection with the development of a MOOC for a blended continuing education course for teachers, Buskbjerg, Gissel, Hestbech and Rosenlund (2016) has pointed out that it may also be appropriate to include an eye for whether the participants in a teacher professional continuing education MOOC are respectively academically and / or pedagogically insecure. A teacher professional MOOC should support various participants, e.g. the subject secure, but pedagogically insecure participant, or the subject and pedagogically insecure participant. The authors highlight that the challenges various participants meet and experience in a MOOC are also linked to their proficiency. Thus, it will be advantageous to include various possible participant trajectories in the MOOC design. When working with the fully open Philosophy of Science MOOC Hansbøl, Erkmann and Eilso Munksgaard (2015) likewise highlight that it can be advantageous to incorporate in a design different options depending on whether the participants are in or out of education and work. As with various teachers' academic qualifications, there will be different challenges and opportunities that present themselves within a MOOC, depending on whether the participant is both working and enrolled in an educational program, or perhaps is in the middle of a period of unemployment.

Conclusion

From a participant perspective, the design of a fully open MOOC should include the different starting points that participants join the MOOC with. It may therefore be appropriate to consider whether the development of fully open MOOCs should be more focused on specific target groups. A MOOC could contain a number of variations over the same MOOC, targeted different participants. In other words, when listening to the MOOC participants who enrolled in the

Philosophy of Science MOOC, a need to move from a focus on *massive* open online courses towards *multiple* open online courses was actualized.

The Philosophy of Science MOOC as a research case illuminates further needs to engage with MOOCs that encompass different kinds of learners and passages to sense-making practices. Hence, the case opens up new avenues for approaches to developing MOOCS that take teaching differentiation and inclusion as fundamental building-bricks in the MOOC design. This, of couse, is a call for less industrialized *massive* fabrication approaches to MOOCs and more focus on *multiple* open online approaches.

Learning, as Latour (2004) defines it, is a matter of learning to be affected by, being “aware of” and able to “notice”, “sense”, “realize”, “reflect on”, “see” and “enact”. Hence, learning is always a double matter of becoming affected by and at the same time effectuate. In the Philosophy of Science MOOC case, the research has shed further light on the matter of learning to become affected by and effectuate specific implications of the Philosophy of Science MOOC. These sense-making practices are complex and cannot be taken for granted as naturally enacted in and following from the context of any kind of educational arrangement or singular activity. The cultural contexts of teachers, teaching materials, educational arrangements and activities, and learners, always play important parts in co-constructing sense-making practices and passages for sense-making practices. Learning to be affected by the shifting ‘bodies’ of knowledge as a progressive enterprise requires a sensory medium and a sensitive world. Returning to Williams, Mackness og Gumtau (2012), this paper represents a call for taking more seriously the shifting footprints that may be relevant, depending on the actualized learning scape and dynamics in focus in a MOOC, and related to the actual participants’ interests and motivated engagements. Future MOOC designs could more explicitly guide and integrate variations of possible trajectories of participation.

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Genre pedagogy for digital learning environments – Design patterns for dialogues about texts

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Abstract

The design of digital learning environments is not a neutral enterprise. The design tells about the designers' and developers' view of a learning activity. The main idea in this paper is to map knowledge about genre pedagogy in practice, in prospect of new applications of technology in future teaching practices. The research questions were: How is genre pedagogy implemented in traditional classrooms? How could digital learning environments be designed in order to take advantage of how genre pedagogy is implemented in traditional classrooms? The point of departure for our study is an analysis of three existing case studies of use of genre pedagogy in the classroom. The analysis indicated that genre pedagogy was adapted to the students differing writing experience. Moreover, the different stages of the method could be implemented at various times during the process and they could also be present in varying degrees. On the basis of these results, we argue for certain ways to design digital learning environments based on genre pedagogy. We use design patterns as means for making our design suggestions concrete, and available for communication and development.

Keywords: writing, genre pedagogy, design patterns

INTRODUCTION

Virtual learning environments (Hermans 2014; Tibaut 2014; Uzunboylu 2011), also known as Learning management systems (LMS) or Content managing systems (CMS), are not neutral arenas for just any kind of learning; they are designed with a purpose and from a perspective or view on pedagogy, explicit or implicit manifested in the design of the virtual learning environment (VLE). The type of pedagogical activities the design of these environments makes room for, could be mapped to different pedagogies (Conole, Dyke, Oliver & Seale, 2004). For instance, environments that “guide and inform users through a process of activities could be used to good effect to embed and enable constructivist principles” (ibid, p 19). On the other hand there is perspectives such as the cognitive one, with intelligent systems which should support transformations of the learner’s internal cognitive structures (Conole et al, 2004). Several other pedagogical perspectives are more or less visible and possible in different VLEs. Notably, it is one thing what the design of the VLE aims for, another thing what will happen when teachers and students start using the VLE.

Genre pedagogy is a writing pedagogy model that has gained increased attention amongst educational scientists during the past years. It is an educational method with the aim to support students how to write successfully in different genres by enhancing the metalanguage about linguistic, textual and contextual features. It is founded on Vygotsky’s theories about learning (Vygotsky, 1978), Halliday’s systemic functional linguistic theory (Halliday, 1978) and Bernstein’s theories on sociology of education (Bernstein, 1996). Problems for students and educators with writing have been accentuated since both the social arenas (migration, professional and social complexity etc.) and the communicative arenas (digital media, extensive use of writing in more fields) have developed and merged. The communicative situation for individuals and groups are far more complex than before. Writing and literacy is not just something individuals learn to handle once and for all. This puts new demands on educators and designers to offer resources for learners to use in different situations throughout life (Karlsson, 2009; Lankshear & Knobel, 2006; New London Group, 2000; Selander, 2008). Implementation of genre pedagogy in the classroom requires time and resources. In Australia, where the method was first developed, teacher education and collaboration with scholars and universities has been an apparent part of the implementation of genre pedagogy in the literacy education and teaching in different subjects. In Scandinavia, genre pedagogy has been introduced the latest years, and most teachers have not had the opportunity to adopt the method and the metalanguage that is required.

A digital environment would help teachers to implement genre pedagogy successfully in their teaching. Frequently, teachers have to construct and experiment with their pedagogy in digital environments by themselves although ideas often have been conceptualized elsewhere already (Blåsjö et al, 2012). With the aid of a virtual learning environment designed for genre pedagogy, this design work might be easier to perform. This leads us to the following research questions:

- How is genre pedagogy implemented in traditional classrooms?
- How could VLEs be designed in order to take advantage of how genre pedagogy is implemented in traditional classrooms?

GENRE PEDAGOGY

Genre pedagogy developed in Australia during the 1970s and 1980s. It evolved as a response to the fact that students from non-academic background presented weak results in school (Martin & Rose, 2005). The pedagogical project tended to make different writing norms visible and explicit to students, and to "stress explicit identification and teaching of the stages of the target text or "genre" (Christie & Unsworth; 2005:7). It offered a model that helped teachers to teach not only correct language use, but genres, involving a sequence of steps for the student's progress towards the independent writing of a certain text or genre (ibid.).

The Teaching-Learning Cycle

The most spread model for genre pedagogy is the teaching-learning cycle (Johns, 2002:5). The teaching-learning cycle has been presented in different formats. The main stages are the following according to Holmberg (2009):

1. Setting context and building field, 2. Deconstruction, 3. Joint construction, 4. Independent construction.

The metaphor "teaching learning cycle" indicates that "there are different points of entry for students according to their development in learning and literacy" (Rothery, 1996:102). At stage 1 the focus is set on context; this stage is often characterized by reading and discussing, and may include both "diagnosis" of students' level of knowledge, building new knowledge and learning new words from the studied field, such as electricity or tourism. Stage 2 is based on deconstruction of text. The teacher and students read and discuss texts from the targeted genre with focus on language aspects, such as text-structure, but also the social function of the genre. The scaffolding role of the teacher, supporting students to identify and name different linguistic features, is of key importance. In stage 3, the teacher and the students together produce a text corresponding to the focused genre. Stage 4 consists of individual writing or writing in smaller groups where the teacher's scaffolding is decreasing.

The Contextual Model

In connection with the genre pedagogic model, a contextual model has been developed by Macken-Horarik (1996). Macken-Horarik describes three domains of knowledge where learning takes place: The *everyday domain* is based on language that we use in our everyday life, at home etc. In the *specialized domain* students learn to shape knowledge within different school subjects. In the *reflexive domain* the student "begins to reflect on and question the grounds and assumptions on which specialized knowledge rests" (Macken-Horarik, 1996:237). The students here learn to construct texts with controversial and concurring opinions. Everyday knowledge and language can be described as dialogical, concrete and close to the direct experience, while school language is monologic, specialized and abstract (Painter, 1996).

METHOD

To answer the research questions, the study requires analysis of everyday teaching in real classroom situations. This article is based on published case studies of teaching settings where the teaching learning cycle is more or less applied. The analysis is hence based on analysis of descriptions of observations performed in Australia. The method is inductive, where the published classroom observations are analysed by the means of categories and models, which are relevant to the stated questions. The different stages of the teaching learning cycle are supposed to be carrying different phenomena, possible to transfer to and use in different kinds of digital tools. These stages and how they are performed by the teachers are therefore important for the study.

The stages are analysed in terms of how scaffolding is manifested in the teaching. Scaffolding is seen as a bearing element of genre pedagogy and is supposed to indicate how a VLE could be constructed for different parts of the pedagogic process. Both teacher's scaffolding and peer scaffolding is important to describe since they are both apparent parts of the teaching learning cycle. Hence, Macken-Horarik's contextual model (see above) represents an analytical approach. All these aspects are seen as relevant categories to emphasize for a subsequent description of a potential VLE. The rationale to focus on teachers is that they are the main users of the VLEs when it comes to making design choices from the tools provided by the VLE designers. The method and relevant analytical categories are represented in Figure 1.

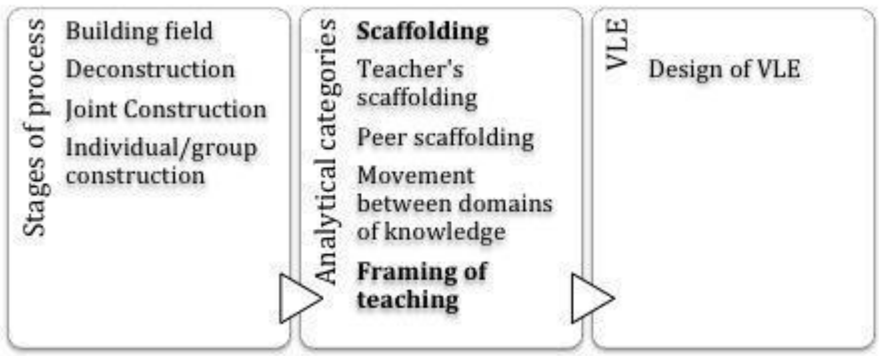

Figure 1. Analytical approach for analysing the case studies and how it feeds the conceptual design of VLEs.

The analysed case studies also contain descriptions and analyses of the student's writing assignments. These results contribute to the study since they could indicate which linguistic challenges the students face in their individual or group writing; therefore they are of importance when developing a VLE for different assignments.

In Human-Computer Interaction there is a strong tradition to do design by empirical studies, with a specific user group and use situation in focus. However, there are other approaches, which are more conceptual and theoretically driven (Stolterman & Wiberg 2010; Gaver & Martin, 2000). The design work presented here uses the analyses of three case studies, published in Macken-Horarik (1996; 2002) and Hedeboe (2002), as input to the VLE design. We present a conceptual design, where the design solutions are on an abstract level, and do not focus on a specific solution in a specific interactive system. The concepts are not only focusing on the design of the interactive system (interaction design), also they aim to capture the pedagogical design, and how the move from classrooms to the virtual learning environments could be arranged. We use sketches for illustrating the concepts, and in addition we have chosen to present our findings as design patterns (Alexander, Ishikawa & Silverstein, 1977; Dearden & Finlay, 2006).

Analysed Case Studies

The analysed case studies were all performed in Australia where the genre-pedagogic method was first developed and where it is most applied and improved (Christie & Unsworth, 2005). The case studies were performed by two different scholars, Mary Macken-Horarik (1996; 2002) and Bodil Hedeboe (2002). Below, we give a brief description of each case study, focusing on the studied teachers: Margaret, Bill and Stella.

Margaret teaches a class of 10-year science. She is an experienced head teacher in science and her teaching is interesting to analyse because it forms an example of genre pedagogic teaching in another subject than language. The class is composed of students who are not from ”disadvantaged socioeconomic backgrounds” (Macken-Horarik, 1996:262). The case study is performed during a period of 10 weeks. Margaret has been taking part of education in the genre pedagogic method lasting for several years. The class focuses at the time of the case study on sexual reproduction and in vitro fertilization (Macken-Horarik 1996; 2002)

Bill is also an experienced teacher. He is teaching English in a high school and has been educated in genre-based approaches. The class is composed of girls “most of whom come from non-English speaking backgrounds” (Macken-Horarik, 1996:251). The case study is performed during a period of 10 weeks and the theme of the classroom practice at the time is the situation comedy of TV (Macken-Horarik, 1996).

Stella teaches English as a second language for adults, at a level equivalent to year eleven. Stella adapts a clearly genre pedagogic structure to her classes. The class focuses at the time for the case study on different kinds of family constellations (Hedeboe, 2002).

RESULTS

The results of the analysis of the published case studies are here presented in the order of the teaching-learning cycle.

Building Field

The phase of the genre pedagogic cycle where the field of subject is built could be seen as present in all three case studies. This stage is starting the process in these cases, but it cannot be said to have a clear beginning and ending phase, as it is, in most cases, present during the whole process. One important part of this stage is for the teacher to evaluate the groups pre-understanding. Margaret's students have been working with the subject before, so she starts out with retelling and summing up what the students are supposed to be familiar with already. The focus is on non-linguistic modalities such as charts and movies. Margaret wants to minimize the semantic burden of the students. The visual aids are used frequently in the beginning but their presence are supposed to be reduced as the process progresses. Margaret is working with the students' everyday knowledge of sexual reproduction and her teaching is grounded in verbal rehearsal, visual representations, movies and some text work. The meaning potential moves, according to Macken-Horarik, primarily between spoken language and written texts that lies in between the everyday and the specialized knowledge (Macken-Horarik, 1996:265). The students do not work individually at this stage. Margret is focusing on targeted work where students can work together with each other and use both each other and the teacher as support.

Deconstruction and Joint Construction

The borders between the two stages deconstruction and joint construction are not clear in the analysed case studies and are therefore described together. The most important feature of both phases is that the teacher and students elaborate with language together. Common for the case studies are that teachers together with the class discuss specific words and concepts. The metalanguage plays an important role. It is also important (as is for the genre pedagogic cycle overall) for the teacher to try to reduce his or hers prominent role in the classroom at this stage.

The students should be responsible for the content and the teacher's role is to develop the language. The dialogue in the classroom is of great importance.

Individual and group construction

The construction phase is based on the former, where the students' knowledge, way of thinking and metalinguistic awareness has been built up so that they are able to write a text, individually or together with peers. The individual writing seems to be easier for students to assimilate when they are more experienced with the genre pedagogic method. Bill's and Margaret's students are working with individual and group construction more often and also earlier in the process than Stella's students, who are less experienced. The individual writing is often preceded by writing in groups. Writing could be a parallel working process, and not necessarily the last step or final task. Margaret's writing tasks are, for instance, smaller in extent, so her students can write several texts during the process.

As in the other stages, the teacher's scaffolding is more present in the beginning, but this role will diminish and could then possibly be taken over by other students. Margaret starts out with an instructive role and she is guiding students with the aid of instructions clearly divided into small components. In the beginning, she does not expect students to write something original, but at the final phase the students will write texts that correspond to the genre in question. Also Bill's students are writing frequently and often together in small groups. The final writing task is demanding since it is forcing the students not only to write in an unfamiliar genre but also to write about an unknown subject. This is not how Bill usually constructs the written assignments. As Macken-Horarik states: ”it is difficult to concentrate on language 'as an object' at the same time as using it 'as the instrument' of learning something new” (Macken-Horarik, 1996:259).

DESIGN PATTERNS FOR DIALOGUES ABOUT TEXTS

Above, we have been trying to define and understand the benefits and problems that teachers, and their students, had when applying genre pedagogy in their classroom practices. Based on this analysis, below we will work with a conceptual design of VLEs and tools for VLEs. We wil use design to aim for a change of the situation, to use a designed digital learning environment in order to manifest good practices from the Results section above, and in line with the theoretical foundations of genre pedagogy. Our design process does not involve a specific VLE such as Moodle or Sakai; instead we aim for the development of design concepts useful for any VLE. We have chosen to describe the design concepts as patterns and their explicit connections to theory and classroom practices. For every pattern an example in form of a simple sketch has been chosen in order illustrate the use of the design concept. In the field of Technology-enhanced learning (TEL), the work of Winters & Mor (2009) and Goodyear & Retalis (2010) on design patterns are highly relevant for our work. They describe the problem for the TEL-community to share different innovations and technological solutions with each other. There is a lack of knowledge carriers for researchers and practitioners, and design patterns could be one solution to this problem.

Pattern: Building field using electronic brainstorming

The building field phase should not be excluded from the process. It is characterized by joint efforts, students and teacher taking an active part. One main purpose is to support the students' processes of going from everyday to specific knowledge domains.

In this stage, useful activities may be searching for information to find sources that are trustworthy, as well as social bookmarking (of multimodal learning materials). Other alternatives for the building field phase could be to put introduction videos and similar learning materials into the VLE.

The building field phase also includes identifying a group's pre-understanding (to build from), and our proposal is to connect the everyday domain with the new topic and genre using collaborative brainstorming tools in the VLE. The idea is to connect to the everyday domain by brainstorming about the students' current understanding of the topic, using students' own knowledge to increase motivation for learning how to write (Figure 2).

Pattern: Building field using electronic brainstorming

Problem: In current VLEs, the tools for brainstorming is limited (to our knowledge), both when it comes to brainstorming synchronously, and to the use of different modalities and use of representations.

Context: The current pattern is useful in the Building field stage of the genre teaching-cycle, and when some of the learning activities should take part in a virtual learning environment.

Solution: Develop electronic collaborative brainstorming tools in the VLE as one part of the building field phase. Involve the teacher if possible, the students can borrow the language of the teacher, and bring in at least

Figure 2. Pattern: Building field using electronic brainstorming

So-called electronic brainstorming (Figure 3) is an quite active research area (cf. Liikkanen, Kuikkaniemi, Lievonen & Ojala, 2011), indicating its usefulness.

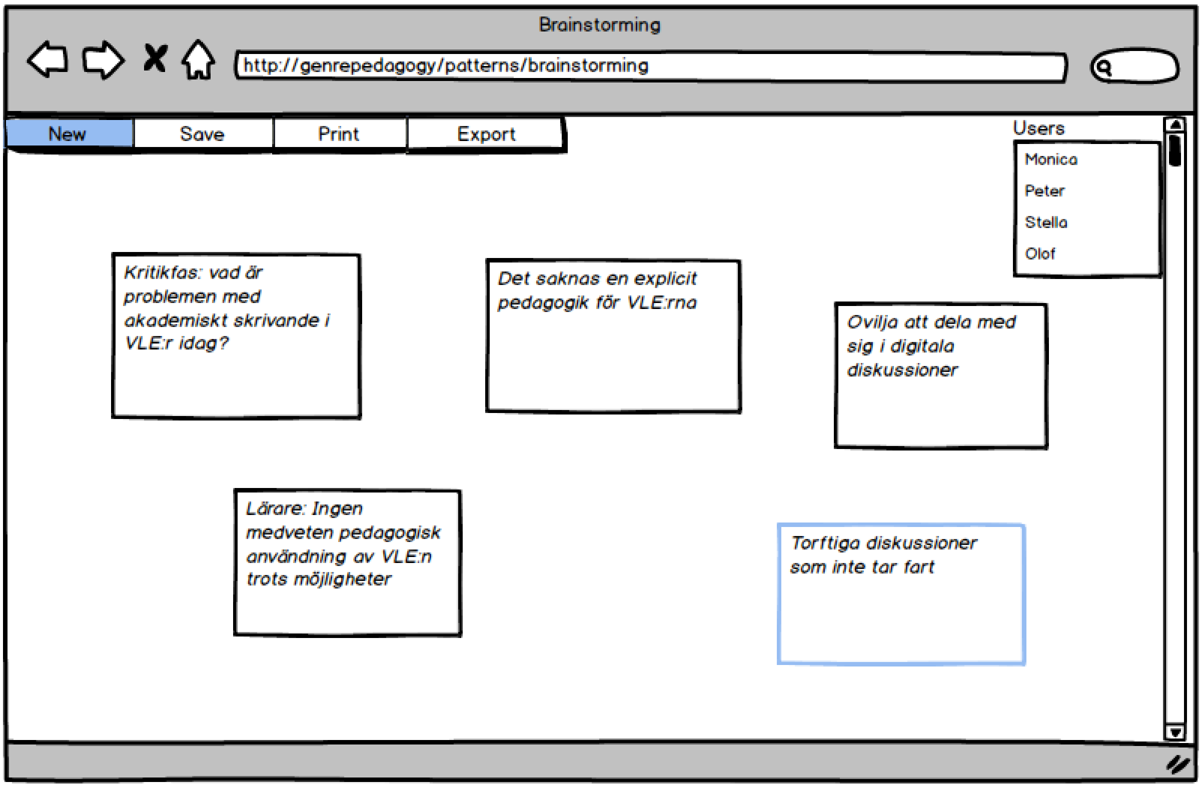

Figure 3. A sketch of a brainstorming tool.

Pattern: Deconstruction of text using description of micro genres in the VLE

According to genre pedagogy, a text contains several micro genres such as narrative, recount, description, statement and so forth. One design concept applicable for the deconstruction of texts is to use tools that support the analysis of micro genres with significant linguistic aspects according to SFL, relevant to use for both students and teacher (who may not be familiar with linguistic analysis at all).

A corpus of model texts could be designed as an open access repository. The model texts could be used as they are; a more ambitious approach would be model texts annotated with for instance causal connectors and different types of verbs. Interesting work in line with this is presented by Tribble & Wingate (2013). However, we will not develop this possible pattern further here, but we indicate its relevance when developing patterns for using the concept of micro genres. The descriptions of the micro genres need real textual evidence to be clear and meaningful, and the model texts need to be annotated with the micro genres in order to be useful for teachers and students.

Pattern: Deconstruction of text using description of micro genres in the VLE

Problem: According to genre pedagogy, a text contains several micro genres, and how they are structured is not easy to comprehend. In the process of identifying the micro genres of a more complex text, new texts could be deconstructed. From an interaction design perspective, it is a problem of having the right information at hand when carrying out a task in the learning environment.

Context: The stage of deconstruction of texts when students raise their metalinguistic awareness of how certain micro genres are structured.

Solution: Bring the information about the structure of different micro

Figure 4. Pattern: Deconstruction of text using description of micro genres in the VLE

The description of micro genre is here seen as a more traditional learning material as presented below (which is similar to a book page). The difference from a book is that the description of the micro genres (Figure 5) could easily be integrated where the actual writing takes place (the solution in Figure 4), when the student works with the writing assignment in the writing environment of the VLE.

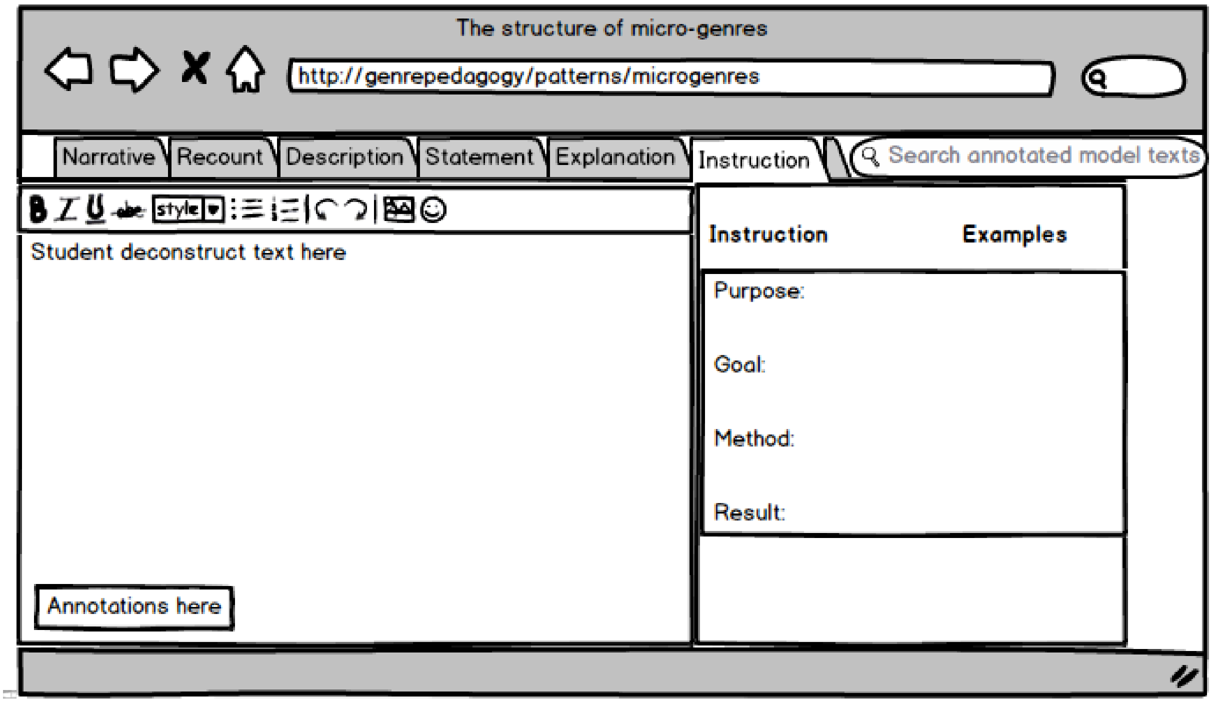

Figure 5. A sketch of a tool for working with the structures of different micro-genres. Inspired by Holmberg (2009), and Knapp & Watkins (2005).

Pattern: Joint construction of text using tools for synchronous collaborative writing

The VLE gives support to help with the logistics of co-constructing a text. Good examples of this are different wiki implementations and tools for collaborative writing such as Google Drive. Interactive boards and similar tools may also be involved here depending on how much the teaching is blended with classrooms sessions and collaborative work in the VLE. In those environments it is easy for teacher and students to jointly construct a text. Our main design proposal for co-construction of new texts is to use a wiki already in the VLE (Figure 6), such as the wiki in Moodle or Sakai.

Pattern: Joint construction of text using tools for synchronous collaborative writing

Problem: The problem is pedagogically about joint construction of new text using a collaborative writing environment, where small groups need to work synchronously and distributed on the construction of text and to use the micro genres and new concepts.

Context: In the teaching-learning cycle where the teacher want the students to jointy write a more complex text in a new knowledge domain.

Solution: Develop a virtual learning environment allowing for collaborative synchronous writing.

Figure 6. Pattern: Joint construction of text using tools for synchronous collaborative writing

Figure 7 exemplifies the pattern of an environment for co-construction of texts. However, it is important that the wiki allows synchronous writing for the process of co-constructing text.

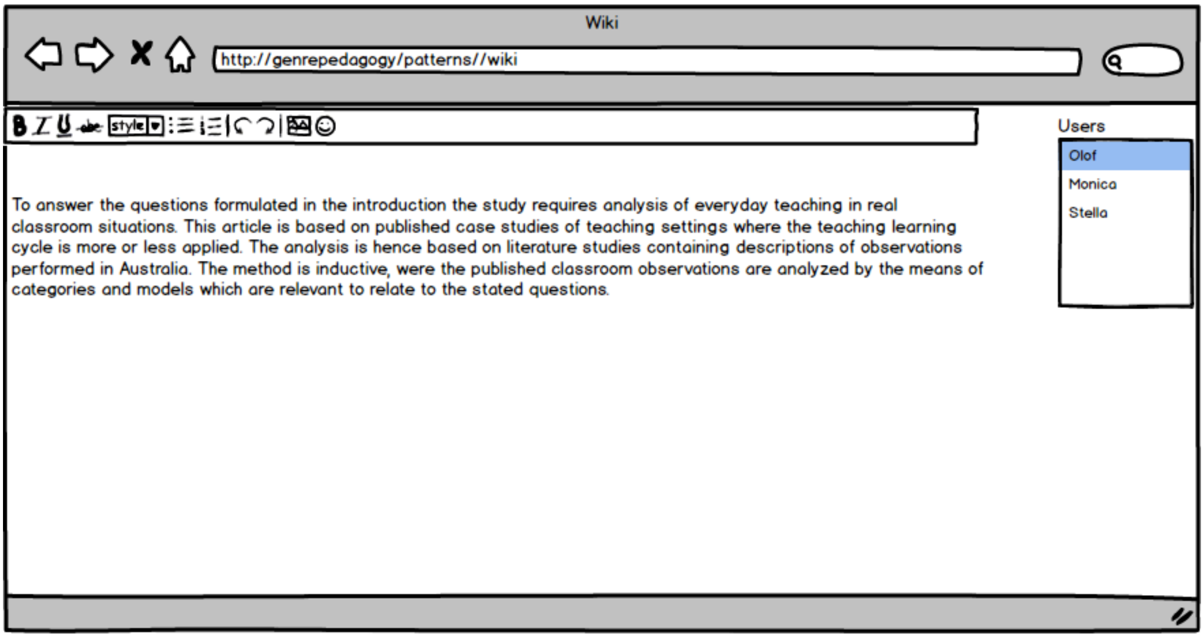

Figure 7. A sketch of a synchronous wiki for co-construction of texts.

Pattern: Automatic highlighting of linguistic features for independent construction of text

The individual construction of text is the most independent moment of the cycle. The design concept proposed here focuses on aids for the student when analysing the text she is writing (Figure 8). Good enough results using automatic word class analysers and some experiments using such technology in classroom settings have been carried out by Karlström & Lundin (2013). They developed tasks inspired by genre pedagogy in an academic writing course for students with Swedish as a second language.

Pattern: Automatic highlighting of linguistic features for independent construction of text

Problem: Independent writing, moving from the language of the everyday domain to the specialised domain, requires support.

Context: Independent writing is the fourth stage of the teaching-learning cycle of genre pedagogy. In this phase the students are supposed to use the newly learnt textual and linguistic features in a text of their own, with limited scaffolding from the teacher.

Solution: : Use tools highlighting linguistic aspects of a text in an environment in which students can both write and read text.

Figure 8. Pattern: Automatic highlighting of linguistic features for independent construction of text

Highlighting structure by the colouring of word classes in the Grim prototype (Knutsson, Pargman, Eklundh & Westlund, 2007) was an aid in the process of nominalisations, here exemplified by the sketch in Figure 9. Other solutions might focus for instance technical terms, modality markers, idiomatic expressions and abstract categories other than nominalisations.

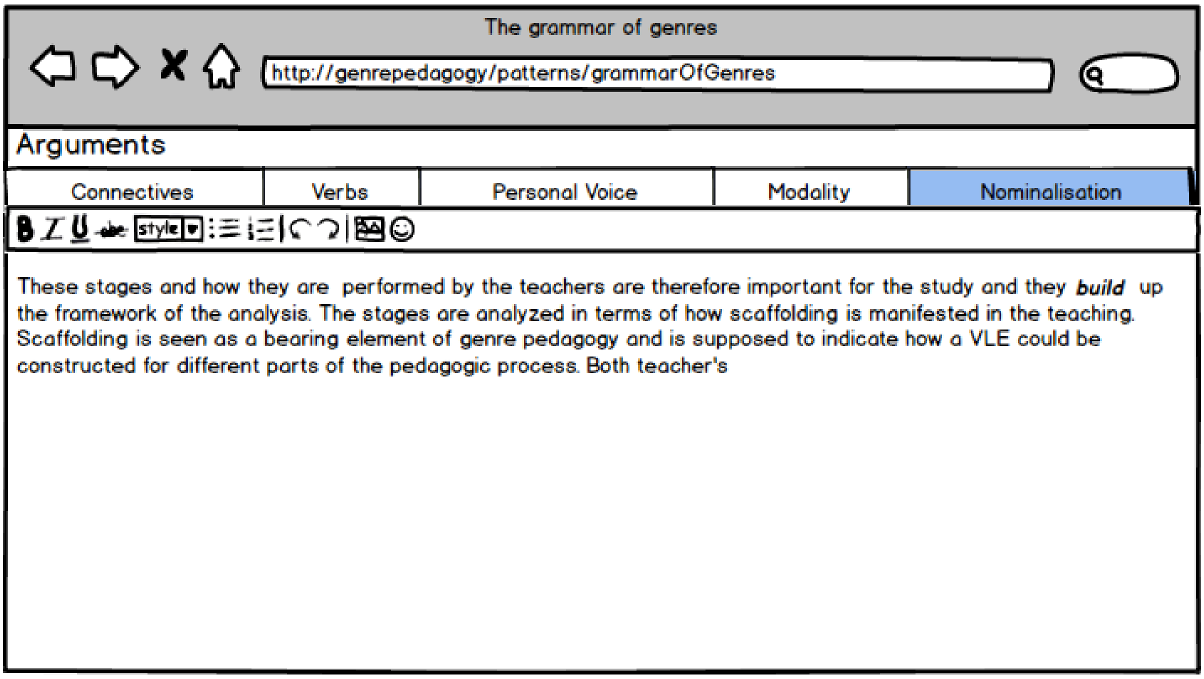

Figure 9. Active verbs are automatically highlighted in this "sketch" using a word class analyser. The example shows the word *build* highlighted. The main purpose of this is to work with grammatical metaphors, in this case nominalisations.

This pattern must be seen as the most mature of the four proposed patterns, in the sense that it has been empirically studied by Karlström & Lundin (2013), using the writing environment presented in Knutsson et al. (2007). However, all four patterns are based on existing software solutions, but not together in the same VLE, and without the framing of genre pedagogy.

DISCUSSION

In the analysed case studies, genre pedagogy has showed to be a method which does not necessarily follow a strict scheme or pattern. The different stages could be implemented at various times during the process. The connection to Vygotskian tradition is clear. The teacher's scaffolding is above all an important part of the initial stages. It is important to support the students to the more specialized and reflexive domains of knowledge. As the process progresses and when the students manage on their own, the teacher's support should diminish. Moreover, scaffolding is less manifest when teaching more experienced students.

During the building field stage, the teacher starts out with dialogue about student's everyday experience in relation to new knowledge. The everyday knowledge domain is the starting point, but during the process the teacher should increase the challenge for the students and promote movement to higher domains of knowledge. During the construction and joint construction stages, the teacher will expand the everyday language of students to a higher degree of abstraction. The teacher should use the students' suggestions for writing a text, but model and expand them when necessary.

Which are the main benefits to use design patterns when presenting our findings? Patterns make things concrete, as pointed out by Alexander et al. (1977), and that makes our design concepts possible to criticize. Our patterns do not contribute to the field of interaction design per se; instead the presented patterns are relevant for technology-enhanced learning. Without the pedagogical part of the patterns they more or less exist already, not only as patterns but also as software. Nor are the patterns to be considered purely as pedagogical patterns. The interaction design solution is a necessary part of the patterns, in order to be useful for designers and developers of virtual learning environments. The pedagogy has consequences when the designer choses between possible solutions of a “problem”.

We have shown that the implementation of genre pedagogy is dynamic. The four different stages could be used one at a time, without explicit connections, and follow-up lessons. This makes the design of VLEs easier, because a framework for steering the teaching learning cycle is not necessary promoting the usefulness of genre pedagogy. Existing VLEs and other tools could be applied to support the use of genre pedagogy, and its different stages. We have presented four design patterns in order to illustrate our view on how existing VLEs have to be integrated with other tools in order to support genre pedagogy, and we claim that this is a starting point for a pattern language for genre pedagogy and VLE design.

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What if Design Based Research does not design things, but Things?

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Abstract

The article is a contribution to the ongoing debate on fundamental aspects of DBR as a methodology, with regard to the question of what is being designed in DBR? It argues that Design-Based Research tends to reiterate a traditional division between theory and praxis. Praxis is seen as the execution of preconceived plans, designs or interventions. This division is based on a theoretical mindset where knowledge is perceived as a form of text in the scholarly mind. The origin of DBR in design thinking reinforces this division as the vocabulary in industrial design focuses on objects. The article provides an alternative analysis of the object of design - by way of the Aristotelian concepts of episteme, techne and phronesis - interpreted as an event taking place, in the sense of an assembly in the old nordic 'Thing'.

Keywords: DBR, Things, constraints, phronesis, praxis

Introduction

This article joins the ongoing debate within the DBR community on fundamental aspects of DBR as a methodology, particularly with regard to the question of *what* it is that is being designed in Design-Based Research (DBR)(Collins, 1992; Brown, 1992, Wang & Hannafin, 2005; Plomp, 2007; Anderson & Shattuck, 2012). The claim is that DBR tends to reiterate a traditional division between theory and praxis. I open the article with clarifying this claim. Secondly I examine different alternatives to the division. Thirdly I connect the discussion with the question of what it is that is being designed in DBR.

The question of 'what is being designed in DBR' is greatly influenced by what is meant by basing research on design. This is a much more encompassing question which I will not open, except to note the obvious; that design thinking draws upon a vocabulary developed in industrial design that focuses on the design of things or objects. It is fairly safe to say that what is being designed in DBR is not objects. As discussed elsewhere (Jorno & Gundersen, 2013) one of the things DBR proposes to design is 'interventions.' Anderson and Shattuck list "a learning activity, a type of assessment, the introduction of administrative activity or a technological intervention" as examples of interventions (2012, p. 16). The term 'intervention' suggests that we might be dealing with activities and it prompts the question 'how does one design a process or activity?' And furthermore 'are we designing a research activity or a praxis (the activities into which we intervene)?' Rather than answering these questions offhandedly I would like to shift your attention to the ease with which research activities are divided from praxis, although the divide may not be very clear cut. The reason for this shift is that I suspect that there is a false dichotomy at play in the question. This needs some clarification, to which I turn next.

The dichotomy between theory and praxis

In the article 'Why are class teachers reluctant to become researchers?' (Hancock, 2001) the author points to four 'areas of difficulty' or barriers for teachers to enter research. The first is the status of teachers. Hancock notes that "teachers' understanding of teaching and their insights into the way in which children learn has generally not been recognised as a valid form of professional knowledge which is worthy of much respect." (ibid., p. 121). According to Hancock this view has translated into public expectations to the teacher's role and function and presumably been internalized in the self conception of teachers. The second is the difficulty in finding the time and energy to enter into the 'separate activity' of doing research. There is an operational logic in both teaching and all other activities connected to being a professional that demands all the teachers resources. The third is teachers' confidence in having something worthwhile to say to an academic community. Hancock paints a picture of teaching professionals that are underappreciated and have come to believe their faultfinders. The fourth is the lack of an appropriate methodology for teachers to engage in. Hancock discusses Action Research (AR) and finds that it clashes with what teachers actually do in their everyday practice, making the use of AR extraneous to and possibly alienating from good professional practice. What I will direct your attention to is disconnected from a discussion of whether Hancock's compelling analysis is correct. The interesting thing is that all four barriers - status, working conditions, relevance, and methodology - rely implicitly on a certain conception of what theory and praxis are respectively. Relative to status Hancock writes that research means "to *write* about their professional practice." (ibid. p. 127, emphasis added). The working conditions speaks of a classroom teacher for whom "teaching is overwhelmingly a '*doing*' activity. It requires constant attention to the here and now of pupil life." (ibid., p. 122, emphasis added). As to the confidence and relevance of what teachers have to say it is noted that they do a lot of writing demanded of them, but not "writing of a spontaneous or creative kind - writing by one who wants to write because there is something burning to say." (ibid., p. 124). Finally, relative to a suitable methodology, it is said that "[t]he maintenance of a research identity necessarily results in a degree of detachment from the here and now being studied." (ibid., p. 127).

Such characterizations are commonplace. Theory is seen as intellectual labor, while praxis is the labor of executing what theory designates. However, the two terms in this well-known dichotomy are not intrinsically opposed to each other. The word 'theory' stems from greek, theoros, which means spectator or a witness to events (Nightingale, 2004). 'Praxis,' also from greek, on the other hand simply means 'to do' or 'to act.' Tim Ingold sheds light on how the dichotomy arises as part of a general tendency to "distinguish intellectual from manual labor, along the common axis of a more fundamental series of oppositions between mind and body, creativity and repetition, and freedom and determination" (2001, p. 18). This type of distinction is exemplified in the separation of technology and art, although the two terms hail from the same origin. Art, stems from the latin 'ars,' while technology was formed on greek 'tekhne,' but importantly both originally simply meant 'skill.' (ibid., p. 17) According to Ingold it is a modern distinction that splits art from technology; a way of differentiating the artist's creations in the fine arts from the base, mindless and mechanically copied technological work of a craftsman copying a pre-established template or design.

From Ingold's account we can surmise how theory, heavily associated with writing, and praxis, by its operational nature, divides along the same lines. Once opposed, the distinction perpetuates itself in common language use. This is evident in Hancock's article. Research is associated with writing and teaching is associated with 'doing.' And Hancock ponders the possibility that research may be fundamentally alien to teaching, as research requires distance (i.e. to become a spectator). Theoretical or academic pursuits are thus assigned a higher status than the practice of teaching. This distinction can be observed in action research, participatory action research, and design-based research in their specific attempts to overcome such a divide with their emphasis on collaboration (e.g. 'partnerships' in Anderson and Shattuck (2012)) and using terms such a 'co-designer' or 'co-researcher' (e.g. Dickens & Watkins, 1999). It is also evident in the term 'intervention' itself, where praxis is seen as a context into which the researchers intervene (Jorno & Gundersen, 2013; Dede, 2005). Praxis is often cast as the performance or execution of the intervention constructed by researchers. Teachers may be part of the planning of these preconceived plans, designs or interventions, but insofar as they are, their role differs from the one they have when they perform or execute once the intervention is set in motion. The division thus replicates the difference between art and technology, where the theoreticians are seen as free and the practitioners bound or mechanically executing instructions (even when the two are the same person).

Insofar as this distinction is at play in DBR, the above questions transform into the more pertinent: 'is design a research activity or a praxis?' But answering this question unreflected would commit the error of accepting the divide between theory and praxis as it stands. A more qualified approach would clarify in what sense we are asking the question? We have to also answer why we are designing at all? The object of DBR is by several writers stated as creating useful generalizable theories or design principles (e.g. Edelson, 2002; Collins et al, 2004; Dede, 2005). In more plain terms, the object is to create knowledge. This means that the question is what kind of knowledge are we striving to create?

What knowledge are we creating?

Fundamentally the above division is based on a theoretical mindset wherein (true) knowledge is considered a form of theoretical knowledge (text). There have been many attempts to mark up the value of practical knowledge, for example using Polanyi's famous tacit knowledge versus explicit knowledge (1966) or Ryle's distinction between 'knowing-that' and 'knowing-how' (2000). Unfortunately these concepts are in constant danger of deteriorating into mystical forms of quasi-knowledge. Davis Baird reminds us that "'Craft knowledge,' 'fingertip knowledge,' 'tacit knowledge,' and 'know-how' are useful concepts in that they remind us that there is more to knowing than saying. But they tend to render this kind of knowledge ineffable" (2004, p. 18). Furthermore an antithetical stance toward theoretical knowledge often works counterproductively because theoretical knowledge sets the standard for what knowledge is. Any attempt to support an *alternative* also works to confirm theoretical knowledge as the standard. Agre gives an example from engineers in the field of Arificial Intelligence, where "[e]ach discipline wears its defining activity as a badge of pride in a craftworker's embodied competence. It will be said, 'You can read books all your life, but you don't really know about it until you do it'" (Agre, 1997, p. 10). '*Real* knowledge is doing' seems to be the message. This type of condescension has an inverse form, where the practitioner will defer to academics in uncritical admiration and place them on a pedestal as naturally possessing a superior knowledge form. Both attitudes reveal an awareness of an asymmetrical power relation. This distinction is even reproduced internally among practitioners. Consider Schön's example in The Reflective Practitioner (1983) of the difference between those who deal with theory and those who 'do:'

"In the varied topography of professional practice, there is a high, hard ground where practitioners can make effective use of research-based theory and technique, and there is a swampy lowland where situations are confusing 'messes' incapable of technical solutions." (Ibid., p. 42)

Note that both lowlands and the high ground refer to technique of practice; and when it comes to theory the practitioner 'uses' it. She does not develop it. Even when the practitioner approaches the realm of creative writing, it is in a form bound by technical rigour. The practitioner becomes, "in effect, an operative, bound to the mechanical implementation of an objective system of productive forces" (Ingold, 2001, p. 18). The acting practitioner becomes a puppet, even when acting knowledgeable.

The main problem with the attempts at providing praxis with a different knowledge foundation is the idea that praxis is considered somehow inarticulable (i.e. a form of knowledge that is *not* writing). The point is well-taken that "even the simplest and most routine of everyday tasks are refractory to codification in propositional form...the skilled practitioner consults the world, rather than representation." (Ingold, 2000, p. 164) It is the attempt to create a different conception of knowledge that is *antithetical* to theoretical knowledge that errs.

Phronesis

Answering the question 'is design a research activity or a praxis?' by siding with either theoretical knowledge or with an antithetical form of practical knowledge simply reproduces this tension. It is equally a grave mistake to decide that design is something 'in between the two.' To argue this point, I turn to a line of research that has garnered increasing attention. It is the attempt to reinvigorate the aristotelian concept of *phronesis* (Flyvbjerg, 2001; Kinsella & Pitman, 2012). Phronesis is often distinguished from *episteme*, that is, "scientific, universal, invariable, context-independent knowledge" and *techne*, "context-dependent, pragmatic, variable, craft knowledge...oriented towards practical instrumental rationality governed by a conscious goal." (Kinesella & Pitman, 2012, p. 2). The two are here on outward appearance equivalent to theory and praxis respectively. The anthropologist Anthony Wallace (1978) provides a reason to think of episteme and techne differently. Not opposed - bound by a linguistic conception of what cognition and knowledge is perceived to be - but fundamentally different types of knowledge. Instead of paying tribute to a linguistic conception of knowledge he characterises the thinking involved in designing machines in a manner different from and not antithetical to theoretical knowledge:

"To the mechanical thinker, the grammar of the machine or mechanical system is the successive transformations of power - in quantity, kind and direction - as it is transmitted from the powersource (such as falling water or expanding steam), through the revolutions of the wheel, along shafts, through gears and belts, into the intricate little moving parts, the rollers and spindles and whirling threads of the machine itself." (p. 238)

The mechanical thinker does something *completely different* than the linguistic thinker. For him any description is auxiliary. What he does can - but not adequately - be captured in language, nor can his actions be conceptualized as rule following or executions of techniques (both linguistic projections). Working through this ‘moving image in 3D space’ is a form of thinking and knowing, which description neither adds to, nor detracts from. Wallace’s thought connects us with a different take on theory and praxis. They are different forms of knowing. One can be attempted translated into the other, but not without losing that which makes it knowledge. Ingold, for instance, provides the example of knot tying, where one can attempt to render the skill of tying knots in pictures, but seeing the pictures of knots can in no way impart the skill of tying them (2000). With this novel distinction of theory and praxis, we can turn toward phronesis, Aristotle’s third type of knowledge: a “practical wisdom or knowledge of the proper ends of life” (Kinsella & Pitman, 2012, p. 2). This has been interpreted in a decidedly ethical direction, which I will not discuss here. Instead, I would like to draw attention to a different aspect of ‘ethical’ or ‘the good’ in relation to phronesis. An epistemic approach may accurately describe a scene; a technical approach may specify the means to achieve goals, but neither of those are inherently preoccupied with ‘doing something well’ and by extension to ‘do good.’ Agre, for instance, speaks of a certain ‘work ethic’ among engineers and programmers:

“They often disagree about *how much* precision is required, and *what kind* of precision, but they require ideas that can be assimilated to computational demonstrations that actually get built. This is sometimes called the *work ethic*: it has to work.” (Agre, 1997, p. 13)

The quote can be read purely instrumentally (i.e. technically), however calling it a *work ethic*, makes it much more related to Schön’s ‘reflective conservation with the material’ (1983) and David Pye’s concepts involved in skilled action ‘care, judgment and dexterity’ (1964). It pertains to the “practitioner’s evolving sense of what can be built and what cannot.” (Agre, 1997, p. 11). It is grounded in the evolving horizon of whatever problem is at hand, but it is not identical with the problem. If we attempt to capture praxis descriptively, we may end up with indistinguishable descriptions for a job done carelessly, indiscriminately and clumsily as compared with one done with care, judgment and dexterity. The difference is the exercise of phronesis or what Kemmis calls a ‘negative space’ (2012, p. 157). It has no positive expression, but is found in discernments *in situ* that reveals whether an undertaking is done with care, discrimination (in its positive sense) and dexterity (not in its technical sense, but as in the heightened sensitivity of the more experienced practitioner). What is more - and this is probably the most significant departure from a theoretical type of knowledge - the situation is recognized as inherently uncertain by a phronetician. “Technical methods do not simply ‘work’ or ‘fail to work.’...Every method has its strengths and weaknesses, its elegance and its clumsiness, its subtle patterns of success and failure.” (Agre, 1997, p. 14)

The problemspace the practitioner is negotiating is one that shifts with many variables, such that a ‘final’ solution, technique or method is neither possible, nor desirable. This is an argument of adaptability. A praxis situation is not exhaustively assessable as a set of determinable conditions or processes, because praxis unfolds as a dynamic system which can be characterized as probabilistic, that is, outcomes fall into the regularity of patterns and can be affected by practitioners’ actions, but they are by no means ensured. A situation is dynamic in the sense of requiring different measures in different situations, and sometimes the same measures yield different results. The ‘better’ practitioner is the one able to adapt. Consider ‘mobility.’ A person able to run, crawl, climb, drive, jump, etc. is ‘more’ mobile (more adaptable), than the one insisting on only driving a car. Similarly the wise practitioner - the experienced practitioner - is flexible. She understands that the first impression of a situation may give way to different interpretations, that a technology may work well and in a particular way in one situation and not at all in another. She also realises that what has been done plays a role. Such flexibility involves an “*openness to experience* - a preparedness to see what the situation is, in what may be *new terms* or *new ways of understanding a situation*” (Kemmis, 2012, p. 155, emphasis in original) as well as a willingness to be formed by the experience. These are not simply attitudes. The different ‘ways of understanding’ a situation are always embodied and embedded in concrete, unfolding problems which are solved on the fly - the flow in the classroom, the particularities of a design problem, a sudden conflict, etc. The problem-space is therefore always ill-structured (Simon, 1973), but not considered as a messy swamp, but rather as a situation wherein the practitioner navigates a problemspace with shifting horizons, incomplete information and variable means. Learning this requires experience.

“Experience is not definitive knowledge. “The person who is ‘experienced’ learns a way to be open, sensitive, and responsive *in* and *to* new situations. The person who is ‘experienced’ does not always follow a rule or a principle, or interpret every situation as if it were the usual situation or the same as situations met in the past.” (Kemmis, 2012, p. 156, emphasis in original).

And this experience can, like the practical knowledge of tying knots ‘embodied in the hands’ of the knot tier, not be imparted by a description. The difference between a description of phronetic knowledge and having it, is like the difference between describing riding a bike and riding it. The minute sensorimotor adjustments required to bike form patterns as they are learned, but trying to solidify them would be equivalent to saying that one particular body pose or body movement is optimal or constitutes the ‘knowledge’ on the matter. Rather, the attempts at influencing the situation in a semi-predictable manner are continuously done with the understanding that the concrete decisions made in a situation at every turn affects the situation as an unfolding event, while they at the same time have no determining power over it. The crucial difference, which constitutes phronesis, is whether these choices are continuously made seeking to do *well*.

“[P]hronesis is no more than a commitment to do our best under uncertain and thus more or less unpredictable circumstances—to act for the best for all of those involved and affected. Phronesis cannot guarantee that the good will be done, for anyone, let alone for everyone.” (Kemmis, 2012, p. 153)

This is not self-evident. There are many ways of navigating a problemspace. One could seek to always optimize profit, conform as close to a ruleset as possible, act for personal gain, etc. The type of knowledge in question here should be understood along the lines of Wallace’s description of the mechanical thinker. Making it ‘work’ is primary. Describing it is secondary. A situation understood and navigated by an experienced maternity nurse turns out things about the development of the relationship between mother and child that an inexperienced never sees. Her choice of whether to influence the mother, the child, or 'let time tell' is based on a fluid reservoir of situations she associates. There is no causal mechanism at play in her actions and no guarantee of success. Only a qualified expectation or likelihood of affecting the situation in a new direction. Rather than falling under the mystical category of 'intuition' or a 'professional gaze,' the development of an understanding of phronetic knowledge or experience is one that takes its contingent formation into consideration in learning as well as designing. Not to map phronetic 'mechanisms' in a technical or methodological manner, but to open this path of inquiry.

This perspective, that Aristotle's forms of knowledge are interrelated and weave through each other, clears the path for a different take on 'what is being designed.' The DBR researcher engaging in a praxis field seeking knowledge (for instance in the form of principles) attempts to become knowledgeable on how to navigate a dynamic field (as in praxis) *and* on the difference between doing it well and not so well (phronesis). The *design* of this then is not one context (theory) intervening into another (praxis), but the gathering of resources, people, patterns of behavior, technologies, vocabularies, etc. that are drawn into the constitution of the dynamic field. The designer attempts to design a 'Thing,' as in the old nordic sense of Thing, an assembly in session (as in danish 'folketing') (Latour, 2003; Heidegger, 1971; Ingold, 2010), rather than things (objects). The entire design is seen as an event taking place. The thing is thus a problem space, but unlike the spaces designers normally traverse this problem space has multi-variable as explained above and - crucially - the actions of the designer affects the design.

Conclusion

This analysis ties into the discussion of 'what it is that is being designed in DBR' in two ways. First, it is relevant for what type of knowledge is at play in DBR. Secondly, it is relevant for what we believe ourselves able to design. From the analysis interventions can be clearly identified as the product of a theoretical mindset. Interventions are created by theorists that intervene into practical contexts. They articulate and reflect theoretical knowledge, while the actual intervention tests that knowledge, providing empirical evidence that affirms or disproves the hypothesis implicitly carried by the intervention. This is problematic in a perspective that sees the 'object' of design in DBR as a Thing. The type of knowledge that DBR researchers are trying to establish ties directly into the

Things they are able to 'design.' But here design should not be thought of as a noun but as a verb. A Thing is created *by design*. "The [T]hing...is a 'going on', or better, a place where several goings on become entwined" (Ingold, 2010, p. 4).

In the design of 'Things' text, concepts and ideas becomes auxiliary and praxis veers away from simple execution towards an expression of knowledge that is not adequately captured in words, but in no way inferior to theoretical thought, only an alternative. There is much to be learned by travelling this avenue, but what has been said here contradicts the idea that one can finalize the social skills involved in establishing a Thing. Describing particular techniques and expecting particular results from them would amount to a form of social technological determinism. The skill involved in establishing and maintaining Things can certainly be considered in a technical light, but what cannot be captured, as argued above, is the exercise of professional judgment (phronesis) combined with the skillful mastering of a subject (techne). There is a professional judgment involved in becoming enskilled that has to do with the uncertainty mentioned above. A large part of the uncertainty involved in professional judgment has to do with the choice of a course of action and the meta-judgment involved in choosing between different courses. It involves an understanding that different courses have different results; and it becomes more than technique with the realization that the problem may very well change depending on the course taken, making choices beyond a certain horizon incomparable. The question from this point is how does one take the open or unfinished nature of navigating a field into account when assembling a Thing?

What has been proposed here is that DBR designers do not design things, but Things. Because Things are constituted as open-ended dynamic fields with uncertain outcomes and only partially controllable means, we can say that what the wise (phronetic) and skilled (techne) designer *designs* are attempts of controlling as many constraints as possible and having as many arrangements in place as possible. But the DBR designer is continuously at the mercy of a Thing (an assembly) of like minded allies, which she has to convince to see the world in a particular way (theory), align, codify and discipline to do a certain way (praxis), but also has to coordinate into arrangements and agreements on what ends to pursue, how to resolve unforeseeable issues and, not least of all, why they should be done. The DBR designer designs (aims at) social technology, with the aim of becoming better at achieving goals together and simultaneously becoming better at *being together* in achieving them. The question of ‘what it is a DBR researcher designs’ should therefore be read differently. It is not with emphasis on ‘what’ is designed, but on what she ‘designs’ (aims at) and if she does so well?

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Supportive Elements for Learning at a Global IT Company

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ABSTRACT

This paper presents a completed research study that connects design, theory and practice. It explores learning in an online community of practice, which reflects upon experiences from facilitating learning situations in the context of work. The study's aim is to identify supportive elements for learning at a global IT company that is classified as 'big business' and supports hundreds of communities of practice. This study examines an online community with members from more than 30 countries in Europe, the Middle East and Africa. The members never meet, and yet develop new working practices by collaborating online. The study draws on Silvia Gherardi's (2015) work on working practices and Etienne Wenger's (1998) theory of communities of practice.

The research question is: 'How can the context support the development of new working practices in communities of practice, when the members only interact online?'

Keywords: big business, working practices, online community of practice, online collaboration

THEORETICAL FOUNDATION

This section presents the study's theoretical foundation, which is based on Gherardi's work (2015) on 'working practices,' 'the context' (Engeström, Rantavuori, & Kerosuo, 2013; Gherardi, Nicolini, & Odella, 1998; Wenger, 1998), and Wenger's (1998) work on 'community of practice.' The theoretical foundation is utilized for the description of the research setting, and it frames the analysis.

Working practice

According to Gherardi (2015), a working practice is developed by knowledgeable practitioners, who produce common ways of doing in order to know what to do. This 'production' is based on collective reflections on practice. The change in alignment between experience and competence can be characterized as learning (Wenger, 1998). Learning may be constructed in communities of practice when the members change working practices on the basis of collective reflections. However, working practices are not constant; on the contrary, they are disputed constantly and involve forms of dissent and conflict, as well as agreement and harmony. The sensory experience is supported by conversations that take place during the activity, and the emerging practices include knowing, working and organising. When new working practices are developed for collaborative online work settings, it is recommended that the practitioners condense the new practices from everyday use and experience with the technology involved by questioning their habitual way of acting (Gherardi, 2015).

Working practices are developed, diffused and maintained in certain contexts, which consist of relationships among people, material, artefacts and activities. The development of working practices affects the practitioners' ways of doing and the meaning of their work, and at the same time, new working practices affect the dynamics of work in the organisation (Gherardi, 2015). Thus, the development of working practices is affected by the context, and at the same time, the context is affected by the new working practices.

The Context

The context may be perceived as a resource in itself, and it may enable or obstruct the practitioners' accomplishment of their activities (Gherardi, 2015). Consequently, it is important to focus on the context to identify enablers and obstacles for learning in online communities of practice. The context may be defined by factors such as the physical surroundings, historical background and social aspects, which will be discussed shortly (Engeström et al., 2013; Gherardi et al., 1998; Wenger, 1998).

The physical surroundings include the geography, the building and the tools. This study focuses only on the tools, as they outline the possibilities of capturing and saving important parts of conversations (Engeström et al., 2013; Gherardi et al., 1998; Nonaka & Takeuchi, 1995; Wenger, 1998).

The historical background of the context is important for understanding the context itself, because context develops over time. The history provides insights about what has happened, which may lead to an understanding of the present situation. Thus, history can influence what and how to learn in the organisation (Engeström et al., 2013; Gherardi et al., 1998; Wenger, 1998).

The *social aspects* of the context include organisational structure, rules, channel of communication, time, and language for learning purposes (Engeström et al., 2013; Gherardi et al., 1998; Wenger, 1998).

Interaction and conversation are the foundations for developing working practices (Wenger, 1998). The interactions between the individuals in an organisation follow rules that may be implicit, such as habits and norms, or rules that may be explicit, such as local regulations and agreements. If top managers do not provide time for conversation or interaction, learning will slow down. Online conversation and interaction are supported and maintained by available tools. Conversations are based on a common language shared by the participants (Elkjær, 2003; Wenger, 1998). In global organisations, language will often be defined by the headquarters (Nonaka & Takeuchi, 1995), so the language of the headquarters is also the common language in the organisation. This means that some employees work in a language different from their mother tongue.

Communities of Practice

Wenger (1998) presents three dimensions of communities of practice (CoP). These dimensions are utilized for the description of the research setting, and they frame parts of the analysis.

Mutual engagement means that participants build relationships by socializing, so that they feel like a group. They are interested in others' points of view, conduct peer reviews, ask for second opinions on a regular basis, and accept disagreements (Wenger, 1998).

A *joint enterprise* encompasses a high degree of alignment. The parties involved build mutual accountability and define what they want to achieve, such as improved business results, improved processes and new inventions (Wenger, 1998). To create something new, they develop a common understanding by participating in conversations, sharing emotions and building social relations. They give form to their experience by producing abstractions, tools, symbols, stories, terms, and concepts (Wenger, 1998).

A *shared repertoire* refers to a shared language within the group, such as certain jargon and metaphors. The participants share 'good' and 'bad' stories as well as 'good' and 'bad' behaviours. They use the same artefacts, such as technology and working tools, and they are in alignment with the same concepts and traditions.

The members of a community of practice negotiate meaning through mutual engagement, a joint enterprise, and a shared repertoire. Negotiation of meaning implies engagement in conversation among participants, and leads to common understanding and increased trust in the group (Wenger, 1998).

METHODOLOGY

This study explores learning in an online community of practice that is dependent on the Internet for interaction and communication. It seems that a *netnographic* approach is suitable for this study.

Netnography

'Netnography is participant-observational research based on online field-work. It uses computer-mediated communications as a source of data to arrive at the ethnographic understanding and representation of a cultural or communal phenomenon.' (R. Kozinets, 2012, Vol. 3, p. 102).

Netnographic studies integrate 'thick' descriptions of a social world that is familiar to its participants but may be strange to outsiders. Downsides of netnographfic studies include the assumption that a 'real' reality does not exist, and therefore the readers of the study are dependent on the second-hand account of the 'netnographer' (Kozinets, 2012); and the difficulty in distinguishing between private and public online contributions, so that the researcher may be perceived as a 'lurker' (with regard to this, there are some serious ethical considerations). Furthermore, there is a lack of bodily cues, facial expressions or intonations, which makes it harder for the researcher to build relations and trust with the subjects under study. Moreover, there is always a risk of a breakdown in the technology, as a result of which data, analyses and findings may be lost.

The positive implications of netnography include accessibility to the subjects via the Internet, which broadens the subject types available for study, minimizes the resources needed for travel and accommodation, and makes the time for gathering data flexible. Netnography is mainly text based, as a result of which social cues such as gender, age, race, and ethnicity are reduced. The subjects under study may feel less uncertain, as they can participate from a place where they feel safe (McCoyd & Kerson, 2006).

THE RESEARCH SETTING

In this paper, learning is dealt with outside educational organisations. Instead, I looked into a global IT company classified as a 'big business,' as it appears on PwC's 'top 30' list of global companies (PricewaterhouseCoopers, 2013). This global IT company delivers hardware, middleware and software to market leaders in banking, transportation, healthcare, etc., which are business-to-business companies (Rao, 2003). Throughout Europe, the Middle East and Africa, this company has approximately 25,000 employees in more than 60 countries. The company supports hundreds of communities of practice, and recommends that all employees be a member of at least one community, for which the common language is English.

This study focused on a community of practice called the PR community, which had approximately 175 members from more than 30 countries, and a community leader who organised the activities in the community and led the facilitation program, the executive sponsor of which was a senior vice-president. This study follows the PR community over a period of five months in 2011. The objective of the facilitation program was to support learning from experience by facilitating a design for learning called Proactive Review, hence the name PR community. Members of this online community never met in person, but interacted by utilizing the following tools: a webpage with all facilitation materials and a calendar with online meetings, a discussion forum for connecting team members with those who required their services, a discussion forum for internal conversations, a blog presenting stories about facilitation, and ad hoc discussion forums for specific issues to be solved. The members belonged to the company's different divisions, so the PR community included various power levels from the company's hierarchical structure. Moreover, the interaction and communication within the PR community were independent of the organisational channels of communication.

The members had attended training as facilitators, and they facilitated, in addition to their everyday jobs, without any payment. The PR-community leader sent out invitations for online gatherings every third month, or more often if needed. The gathering could be a web conference or an online discussion forum. The leader used these gatherings to involve the community in the development of facilitation practices and the implementation of the facilitation program. The community members shared their latest experiences in facilitation, new requirements were discussed, and at least one member presented an issue he/she wanted to have discussed. In this way, they built mutual accountability and defined what they wanted to achieve.

DATA COLLECTION

This study follows an issue that emerged spontaneously in a PR-community web conference in March, 2011. It was addressed again in the following month, and by September of the same year, solutions were implemented. In an ordinary PR-community web conference in March, a community member claimed that it was hard for her to run facilitations and to participate in the facilitation program because these were ‘lacking interest from my manager,’ who hesitated to approve time for facilitation and participation in PR-community activities. It appeared that other PR-community members also had this problem, and the spontaneous conversation led to the following conclusion: there were general difficulties in finding the time to facilitate learning processes because managers did not recognize members’ skills or the facilitation program itself. Members of the PR community suggested that the community leader address this issue, which she was reluctant to do, because she wanted a sustainable solution owned by the members. Consequently, she convened an ad hoc PR-community web conference in April, 2011, in which 28 PR-community members participated.

This study followed the development of new working practices over several months. The objective of these new working practices was to solve the problem so that the facilitators could do the voluntary work, and by doing so support the facilitation program, which had the attention of the top management.

Number	Technology	Data	How the data are shown	These data illustrate
4	Web conferences	Slides from 2 web conf Chat from 1 web conf	In figure 1 and 2	Working practices Context CoP
1	Blog	2 Stories	Cited in the text	New working practices
1	Discussion forum	The reported results	Cited in the text	New working practices

Table 1. Data collection

As indicated in Table 1, the data consist of slide presentations from four PR-community web conferences, two blog stories, and a discussion forum for a small group of facilitation specialists. Figures 1 and 2 shows slides, including the chat from the ad hoc web conference in April, 2011. Brief citations from the blog stories and the discussion forum are presented later. The data illustrate the existing and suggested new working practices, the context of facilitation, and how the CoP moves within the three dimensions. A web conference did not include a web camera but consisted of the shared screen of the presenter, who might be the host or any participant, and a phone call where up to 100 participants could listen and talk all together or in break-out groups.

In April, 2011, the PR-community leader posed this question: 'What would be beneficial for you in the next 12 months?' in order to gather ideas for dealing with the issue of non-recognition of facilitation by managers, the participants were separated into four smaller groups, and the conclusions were written in a chat that was visible to all twenty-eight participants.

Figure 1. Slides from the ad hoc PR-community web conference in April, 2011

The first slide shows that the 28 names followed by two letters for their country in this case 24 different countries. The slide does not tell how many different divisions were present. The second slide shows how the members in the four break-out groups returned to the main conference. The third slide shows the results of the group discussions as they appeared in the chat, which is in English, consequently their common language is English.

The four groups came up with the following six suggestions:

1. Recognition for our facilitation work from top management and our manager – a thank you message;
2. Mention of the facilitation program on the main IT company web page;
3. Link to existing initiatives;
4. Inclusion of the title 'facilitator' on the e-card;
5. Inclusion of facilitation in the personal appraisal interview (PAI) and in the individual objectives for the fiscal year;
6. A facilitation award for outstanding facilitators.

The suggestion 'Recognition for our facilitation work from top management and our manager – a thank you message' needed more development. A small group of five facilitation experts set up a discussion forum in which they developed new working practices, which are showed on the slide below:

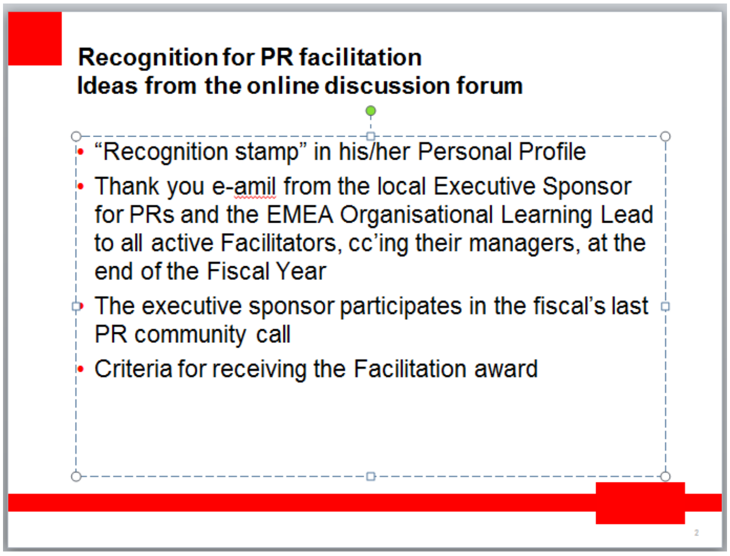

Figure 2. Ideas from the online discussion forum

A recognition stamp is a small picture that outstanding PR-facilitators can add to their personal profile at the intranet. The personal profile presents name, organisational affiliation, physical work address, phone numbers, email address, main responsibilities, skills and interests. The recognition stamp shows that this person has done something outstanding.
'*Following 11 Facilitators have facilitated more than three PRs in FY11 and updated them in the application; or they have facilitated more than one PR and contributed at least three times in this blog or in the "Facebook" group'* (Blog story, September, 2011).

By the end of the year, the executive sponsor for the facilitation program sent out a *thank you message* to the PR-community members who had facilitated during the fiscal year, and to their respective managers. Additionally, the executive sponsor attended the last web conference during the fiscal year to thank the community members for facilitating, as doing so was extra work that they delivered over their ordinary jobs. The criteria for receiving a *facilitation award* were developed, but not approved finally by the executive sponsor. The suggestion of mentioning the facilitation program *on the main company web page* was declined by the top management. The PR program was linked to *existing initiatives* by becoming an integrated part of the new overall strategy for the global IT company. An *e-card* (the description of the sender of an e-mail) was provided with a link to the facilitation webpage, which reminded the facilitator's manager of the extra obligations placed on the PR-community member. A facilitator specialist ensured the

Inclusion of facilitation in the personal appraisal interview (PAI) and in the individual objectives for the fiscal year by publishing a manual for updating the online PAI system with the facilitation competencies and estimated numbers of facilitation for the year to come.

'…*We would like to introduce a formal and visible recognition system for all PR Facilitators in EMEA through the yearly Appraisals. It is very easy to accomplish this – all you have to do is to click on "Add additional competency" and …*' (Blog story, June, 2011).

The data show that this online PR community of practice developed seven new working practices, but two new working practices were not approved by top management, namely, displaying the facilitation program on the main web page and giving out the facilitation award. Of the remaining five new working practices, the thank you message and 'being an integrated part of the strategy' involved colleagues or managers outside the online community.

ANALYSIS AND RESULTS

This section provides analyses based on the theories and data described above in order to identify supportive elements for learning at this global IT company.

Working practices

It seems that the lack of manager recognition was an unknown issue shared by all members until it was expressed at the web conference in March, 2011. Raising the issue at the web conference enabled the members of the PR community to define a common objective; namely, management recognition of the facilitation program (Gherardi, 2015). The collaboration in the web conference showed how the 28 members of the PR community built relationships across countries and organisational boarders, but we cannot know how strong or sustainable this relationship is. However, it led to the development of seven new working practices that were created by knowledgeable practitioners, who produced new ways of doing in order to know what to do. The 'production' of these new working practices was based on the facilitators' collective reflections on the existing practices (Gherardi, 2015).

The data do not show whether dissent/conflicts or agreement/harmony were involved, as the data only consist of written material that lacks facial expressions, gestures and intonation.

However, the data depict that a web conference with break-out groups supports conversations that may lead to inventions (Gherardi, 2015). One of those inventions was utilizing the existing online appraisal system for raising awareness about the facilitation competence and for setting objectives for facilitating in the fiscal planning. Here, the facilitators condensed a new practice from everyday use and experience with well-known technology. When the facilitators suggested placing the facilitation program on the main website, they involved their habitual way of acting (Gherardi, 2015). It appears that in-depth experience with the technology supported the learning in this online community of practice and enabled the members to suggest new working practices.

The members of the PR community originated from various divisions and countries. They were not in alignment with the communication channels that followed the organisational power structure, and they did not meet any obstacles for cross-divisional collaboration (Wenger, 1998). On the contrary, the IT company supported hundreds of communities with a strategy that emphasized the importance of collaboration and learning between peers in the absence of a manager. This norm enabled members of any community to note problems and create suggestions for solutions without interference from a manager, who on the other hand was expected to welcome these suggestions. It seems that the implicit habits and norms supported learning at the global IT company and enabled the PR community to invent new working practices.

Context: Tools and history

The context defines important elements in the learning environment, including ICT, which enabled participants from 24 countries and an unknown number of divisions to collaborate. The web conferences were the only opportunity for simultaneous oral communication, but this fact does not seem to be an obstacle for collaboration. On the contrary, the chat and the slides from the web conferences are examples of important parts of the conversations that were captured and saved, and led to further development of new working practices in a discussion forum. Here, these new working practices were developed; namely, the recognition stamp, the format of the 'thank you message,' and the facilitation award. It seems that *flexibility* in time and written communication supported learning in this online community of practice and enabled the PR community to invent new working practices.

The context also includes the history of the organisation, which provides insights into the past that may influence what and how to learn (Gherardi, 2015). The global IT company had had an internal webpage for more than ten years, so the idea of mention of the facilitation program being placed there may be seen as an extension of the existing way of doing. 'Infinite Red Potential' was a new strategy that was launched shortly before the PR-community web conference. Every employee was supposed to engage in the new strategy, so to link facilitation to this strategy may be seen as an extension of the existing way of doing. As all employees were obliged to add an e-card to their e-mails, the suggestion of including 'facilitator' to the e-card may also be seen as an extension of the existing way of doing. The personal appraisal interview (PAI) was mandatory once a year, and the conversation with the manager was based on the plan and the personal competencies described in the online PAI system. The suggestion of adding 'facilitation' to both the competencies and the plan may therefore be seen as an extension of the existing way of doing. A purpose of the online PAI system was recognition of good performance, and the global IT company awarded outstanding performance with celebrations and money. The idea of having a special award for facilitation could be seen as an extension of the existing way of doing, but the invention of the stamp was new and fitted well with the concept of celebrating outstanding performance. It seems that a shared history framed the idea generation and supported the learning environment.

Community of practice

The PR community showed *mutual engagement* (Wenger 1998), as they were willing to attend different online gatherings and assist or receive help from other members (for example, by co-facilitating). Moreover, they interacted and communicated as an integrated part of their work.

Even though a 'recognition stamp' was a new invention, the PR community instantly accepted this new word and the working practice it expressed. We may therefore say that the PR community shared a certain jargon. By sharing stories and concepts of facilitation, utilizing the same online tools, and aligning facilitation styles, the members of the PR community developed *a shared repertoire* (Wenger, 1998).

By participating in the conversations, the members shared emotions, social relations, stories and tools, which enabled them to produce symbols, terms and concepts. These interactions enabled the PR community to establish itself as a *joint enterprise* (Wenger, 1998).

It seems that being a community of practice supported the learning environment at the IT company and enabled the PR community to invent new working practices.

DISCUSSION AND CONCLUSIONS

In this section I will discuss the results presented above and methodological implications. Finally, answers to the research question will be presented.

It is interesting that a member of the PR community dared to question his/her manager's behaviour in an organisation with strong power structures, and it is interesting that fellow members shared this point of view. The members did put themselves at risk by doing so. So what made them take that risk? The PR community had been in existence for six years, with regular online gatherings that included the habit of raising a question or a concern. This habit may have been a source of encouragement for taking this risk. All members of the PR community had attended the same training, where confidentiality was an important subject, so maybe confidentiality was a norm at this company. This may have motivated the members further to raise this issue.

Inviting problems and issues from the PR-community members seems to have led to common understanding and increased trust, both of which supported learning in this online community of practice and enabled the PR community to invent new working practices.

Methodological Considerations

This study used a netnographic approach, so all data stem from online media. I had access to these data in my role as a PR-community leader. This position raises the following ethical considerations: My role may have made me biased, and I may be perceived as a lurker.

In my position, I could accept or decline the issue of 'getting time for facilitation.' I accepted the issue, as it is important for the survival of the facilitation program. Moreover, I withdrew myself from the development of solutions, because it was important for the program that the proposals were aligned with the everyday working practices in the different divisions, and that the solutions were owned by influential employees who were members of the PR community. My former position as leader of the facilitation program made me biased, but on the other hand, it gave me access to all of the data. I left the global IT company in 2012, so the results presented here neither influence my role nor influence the facilitation program at the global IT company.

I would probably not be perceived as a lurker, as it was a part of my role to enable learning in the community and to communicate throughout the organisation. I facilitated the web conferences and the discussion forum without contributing to the content, and I asked for consent when I posted the blog stories.

The readers of the study are dependent on the second-hand account of the 'netnographer.' I have added a few slides from one of the web conferences and a discussion forum, as well as citations from two blog stories, in order to provide 'real' experience of the online PR community and give the readers a brief 'first hand' account.

Conclusion

This section suggests some answers to the research question 'How can the context support the development of new working practices in communities of practice, when the members only interact online?'

The company supported the development of new working practices by creating and maintaining *communities of practice*, in which employees from various hierarchical levels and divisions contributed. Another supportive element is a *strategy*, which emphasizes the importance of collaboration and learning between peers.

The physical surroundings in this study consist of the tools and language available for the collaboration. At the global IT company, *the shared language* was defined by the headquarters to be English. However, most of the members of the online community of practice spoke a native language different from their working language. A supportive element in the development of new working practices was fluency in a foreign language.

The tools consisted of a web conference, which included a chat function, a discussion forum and a blog. These tools included written utterances that were captured and saved as important parts of the conversations. Furthermore, the web conference provided the option of dividing the group of participants into smaller groups, and the discussion forum provided flexibility in time and space for collaborative reflections. It appears that *flexibility in time and written*

communication and *in-depth experience with the technology* are supportive elements in the development of new working practices.
The members of the PR community were familiar with existing working practices, which inspired them to develop new working practices, and most of these were accepted and implemented in the organisation. An *in-depth understanding of existing working practices* seems to be a supportive element in the development of new working practices.

In this study, the interactions between the individuals in the organisation were heavily supported by *habits and norms*. The habit of inviting members of the PR community to *present problems or issues* led to common understanding and seemed to increase trust in the group, which turned out to be a supportive element in the development of new working practices. The norms allowed them to discuss important issues without the presence of a direct manager. A supportive element in the development of new working practices is *the managers' willingness* to stay away from the development of new working practices, and welcome initiatives and suggestions from employees at hierarchical levels below their own. The development of new working practices was possible due to *the employees' willingness* to contribute to the online PR community on a voluntary basis, without any sort of payment, in addition to their everyday jobs.

The habit of *celebrating outstanding performance* enabled the PR community to invent a new working practice that was in alignment with existing working practices at the global IT company.

The members of the PR community took the risk of sharing concerns regarding lack of management support. By doing so, they made themselves vulnerable, or in other words, they trusted their fellow community members. A supportive element in the development of new learning practices may be the *openness* in the community.

Supportive elements for learning in this global IT company include communities of practice based on voluntary membership, tools that allow collaborative reflections independent of time and space, fluency in a shared language, and familiarity with existing working practices; as well as norms and habits, such as openness to discussion of problems, willingness to engage in problem solving and willingness to welcome suggestions from others.

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Future Workshop as a Pedagogical Framework for Problem-Based Learning:

An Exemplary Learning Design for a Six-Week, Intermediate-Scale, On-Campus University Course

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Abstract

As the guiding learning principles in higher education, problem based learning (PBL) is challenged in different ways. The challenges are linked to the large intake of students, the a routinisation of PBL and a relapse into a lecture-based dissemination strategy. This paper addresses how to design for PBL so that the practice is not diluted and so the students and professors become participants in a shared learning process when scaling up the number of students. The research takes its point of departure in a single case study, using Future Workshop (FW) as a pedagogical framework. Design based research principles guide the research. Observations during the process, evaluation surveys and exam results are used as the basis to discuss pitfalls and future redesign. The research reveals that a renewed awareness of the fundamental principles of PBL is needed. FW provides a new dynamic for the overall design of the semester, a systematic method to work on problem formulation and a way to overcome the routinisation of the students' expectations about how a semester is organised and of the students' participation in coursework and projects.

Keywords: PBL, routinisation, Future Workshop, scaffolding

Introduction

Both nationally and internationally, networking, team working and problem solving are emphasised as 21st-century competencies that a future workforce must possess (Kolmos, Fink, & Krogh, 2004). Since the beginning of the 1970s, our case-study university has developed principles and models for problem-based learning (PBL), and graduates from the university are trained to solve problems, engage in collaborative and cooperative relations and to communicate with various actors in a globalised labour market (Kolmos et al., 2004). Although PBL is considered a hallmark of the university, PBL principles have been challenged in different ways in recent years. The challenges are, among other things, linked to an increasing intake of students, the layout of the physical learning environment and national regulation and standardisation based on curriculum thinking and formed by the Bologna Declaration of 1999 (Hüttel & Gnaur, in press)

According to Moust, Berkel, and Schmidt (2005), Maastricht University has also experienced a watering-down process in the PBL curricula. Alterations that have occurred, either by coincidence, error or decisions made by faculty staff, have resulted in decreased self-study time, minimal preparation in study-groups, minimal time spent on literature searches, the dropping of the brainstorming and elaboration phase, the use of lectures to convey information and inadequate student–staff ratios.

Although a numerus clausus has been introduced into our case-study programme to meet the challenges, PBL is still under pressure. We are concerned that the tendency to return to auditorium lecturing will make the students passive and cause alienation in the relationships between students and between students and teachers. In an attempt to revitalise PBL as a pedagogical strategy in Communication and Digital Media (CDM), we conducted a course in the autumn of 2015 with a focus on the core PBL principles: problem orientation, exemplarity, group work, peer engagement, teachers as supervisors and students' shared responsibility. During the course, we, as teachers and researchers, reflected and discussed this question: How can we revitalise the principles of PBL so that its practice is not diluted and in such a way that the students and professors become participants in a shared and unpredictable learning process even when scaling up the number of students? This paper describes our course, the original framework and the changes we recommend for any future redesign. The course has to be seen as the first design cycle for the revitalisation of PBL.

Method

The research approach to the present study has been inspired by the principles of Design Based Research (DBR), as defined by Wang and Hannafin (2005): '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' (2005 pp. 6–7). According to Bell, Hoadley, and Linn (2004) DBR is a methodology originating in the pragmatic paradigm, inspired by Dewey's research model that employed the 'systematic study of teaching and learning associated with the enactment of complex educational interventions' (Bell m.fl., 2004, s. 74)

DBR draws from 'pragmatic lines of inquiry where theories are judged not by their claims to truth, but by their ability to do work in the world' (Barab & Squire, 2004, p. 6). In this methodology, researchers collaborate with participants to achieve theoretical and pragmatic goals that change and improve educational practices. Hence, one of the tenets of DBR is that theory informs practice and practice informs theory.

In applying DBR methodology, we have simultaneously acted as pedagogical designers, teachers and researchers. One advantage of this has been the ability to reflect/research in action and to renew and adjust along the way. A disadvantage may be the lack of distance from the design and the practice. However, this has been compensated for in several ways. The research is based on data collected through multiple channels independent of the researchers; in addition, the collaborative process within the research group and with teaching peers affords a process of mutual and data-driven reflections. The course we conducted is a first iteration of the design, and the research will be used to inform a second iteration design, which will take place next autumn.

The Case Study

The case study comprises a fifth-semester course in the CDM study programme in the Faculty of Humanities. The course is prescribed as a six-week period of study, rated at 10 ECTS, meaning 270 working hours for the students. The overall course theme is 'Designing Communication: Learning, Network and Organisation'

The semester's roll has just under 180 students. The year-group of students has been organised into two groups working with two different case. We are following Group 1, containing 73 students. The course content deals with a project concerning a specific PBL course for the first semester in CDM, in which the first-year students will acquire IT skills to engage in PBL. As a part of the project, Group 1 was given the task of planning, designing and carrying out a course for the first semester in CDM. The course's objective was for first-semester students to develop an understanding of the necessary tools, techniques and skills required to complete training in CDM, based on PBL, with a particular focus on collaboration and learning. The students are expected to work collaboratively to organise several workshops for the first semester. The first-semester course is part of a compulsory course on PBL principles (5 ECTS in all). The first semester's roll comprises approximately 90 students. Group 1 has been divided into 16 project groups. Three faculty staff (380 working hours in total) are responsible for organising and running the course and projects.

The idea behind the course is supported by 20 years of practice. Over the years, some of the strong learning theory ideas behind the course have been phased out. With the support of the study board, the teachers wanted to revitalise the course by basing it strongly in learning- and didactic theory,[1] as well as principles relevant for PBL. The overall collaboration and coordination work has taken place through milestone meetings, which have been compulsory for all students. In addition, the groups have been asked to develop a learning contract between themselves. All the learning activities and resources have been orchestrated through Moodle, an open-source learning management system (LMS).

Theoretical Inspirations from a PBL Perspective

PBL and its pedagogical ideas are rooted in constructivist and social learning theories drawing on a number of theorists, such as Andersen and Kjeldsen (2015), Dewey (1916), and Dirckinck-Holmfeld (2002), Kolmos, Fink, and Krogh, (2004), Lave and Wenger (1991), Negt (1977), Piaget (2013) and Vygotsky (1978). Despite their somewhat different understandings of learning, the theories all agree that learning is a student-centred and learner- active process that takes place through social interactions and peer-to-peer learning, and with a point of departure in real-world issues.

The educational researcher Knud Illeris has been discussing and developing pedagogical principles for the last 40 years. Motivated by his experience of PBL pedagogy, he wrote a proposal

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[1] We use the concepts 'didactics' and 'didactic' in line with the German use of the term *Didaktik*, which refers to a critical/humanistic understanding of teaching as the teacher's practice.

for an alternative didactics in 1974, where he identifies the following stages of a problem-oriented project:

1. Introduction and definition of the framework for the project work,
2. Introduction of methods and the general subject area,
3. Social introduction and group formation,
4. Choice of topic and problem to be worked on,
5. Formulation of the project idea,
6. Writing, evaluation and corrections of the project.

(Andersen & Kjeldsen, 2015, s. 8)

Researchers and teachers have since reflected on the characteristics of PBL and the principles have been renewed and redeveloped. Krogh (2002) has been working with three characteristics of PBL – problem orientation, interdisciplinarity and participatory management – understood both as philosophy and pragmatics ,and Kolmos (2002) argues that the theoretical basis for PBL is central, since PBL cannot be reduced to a pragmatic approach to training. Illeris's core principles for the project and problem orientation are still the basic approach to teaching, supervision and project work at the case university. At Aalborg University the current model is translated into the following principles:

1. Project organisation creates the framework of PBL
2. The project is supported by courses
3. Cooperation/collaboration is the driving force in the project work
4. The PBL project work of the groups must be exemplary
5. The students are responsible for their own learning achievements

(Askehave, Prehn, Pedersen, & Pedersen, 2015, p. 4–5)

Although these principles are common to the overall educational approach at the case-study university, the unfolding of the principles varies among teachers and supervisors. Some teachers and supervisors grew up with AAU PBL, while others have experience with more classical forms of education, including lectures and curricula.

Furthermore, central to a PBL strategy is the use of group work and collaboration for the majority of the learning processes, with the students self-directed and organising the project works. The teacher's role is as supervisor, guiding the project. The core types of enquiry are problem identification, problem formulation, theoretical and methodological inquiry, data collection, analysis and discussion (Holgaard, Ryberg, Stegeager, Stentoft, & Thomassen, 2014; Illeris, 1974; Kolmos, Fink, & Krogh, 2004). Another central principle is the concept of exemplarity (Illeris, 1974). The concept draws on Oscar Negt's work on 'Sociology, imagination and exemplary learning' and serves to establish a coherent scientific output based on a single case or single instance (Negt, 1977). This requires that students can transfer and generalise from what is learned to new areas. According to Illeris (1974), PBL's pedagogical principles serve the educational goal of producing the skills demanded by society and the labour market, including such qualities as independence, interpersonal skills and critical thinking.

In our role as teachers, we are inspired by the concept of scaffolding, as introduced by Wood, Bruner, and Ross (1976) in a paper on tutoring on problem solving, where they use the concept as a metaphor for a supervisor's necessary, but temporary, support in problem-solving situations. The role of the supervisor or teacher is to support the student as much as needed and to let the student take responsibility for the learning process in steps, according to the student's ability (Wood, Bruner, & Ross, 1976). The teacher is a competent, professional person who can undertake guidance from several different approaches and theoretical perspectives (Kolmos, Du, Holgaard, & Jensen, 2008).

It is important to point out that our understanding of the German term Didaktik refers to the critical/humanistic view that considers teaching and learning to involve a process of personal formation, which emphasises meaning, relevance and coherence between theory and practice. Didaktik refers to the teacher's practice, which takes as its starting point an understanding of learning, student knowledge, subjects and framework conditions (Westbury, 1998) In a PBL context, it is relevant to distinguish between curriculum and Didaktik, as Westbury does:

> Didaktik seeks to assist teachers in the complex deliberation by offering frameworks and models to crystallise 'appropriate' patterns of thinking. Whereas the core task of curriculum centers on thinking about building and managing a controlling institutional (curricular) delivery system, Didaktik seeks to explicate,

> and then turn into a usable framework, deliberation about the educational (in the largest sense) problems which teacher reflection must and might engage.
>
> (Westbury, 1998, s. 65)

In the following, it will be described how, inspired by theoretical and didactical perspectives and recommendations, the course was conducted within the framework of the FW; followed by an analysis of the problems and recommendations for the second iteration.

Future Workshop as a Didactical Framework and Its Different Activities

The Future Workshop methodology (Jungk & Müllert, 1989) has provided the guiding principles for the overall course design. In a Future Workshop, participants with common interests and concerns meet and exchange experiences and discuss visions. One or two moderators chair the workshop to ensure that the participants do not raise objections to each other's statements and that the thematic and prioritising statements are implemented. A FW can realise common dreams and seek common denominators in place of contradictions; and is based on the participants' own visions. It can be applied to groups of up to 30 people (Jungk & Müllert, 1989). The workshop consists of the following phases:

Preparation. The moderators communicate information about the ideas behind the project, its aim and the set-up for the Future Workshop.

Critique phase. The participants formulate all the critical statements they can think of in relation to the present project. The statements are listed on posters. It is not permissible to comment on or ask questions of the statements, except comprehension questions. The purpose of the criticism phase is for participants to remove any negative emotions. The critical statements are thematised and prioritised.

Fantasy phase. In this phase, criticism from the first phase is transformed into utopian proposals and the explication of a number of visions and ideas. The rule is not to worry about laws, logic, economics, space, 'necessities', power constellations, etc. There must be room for all utopias, visions and dreams, even if some seem impossible or 'mad'. Utopias can be expressed in other ways than with words, such as through drawings or drama. Again, no objections are allowed, only clarifying questions. Proposals are thematised and prioritised again.

Realisation. In this phase, the priority themes from the fantasy phase are discussed in order to translate them into reality and identify how the realisation will take place (who, what, when). Finally, the tasks are realised are prioritised. Statements, responsibilities, follow-ups, timeframe and so forth are noted.

Permanent workshop. This phase may extend dynamically over several weeks or months. Concrete realisation and contact with any expertise or collaborative partners take place.

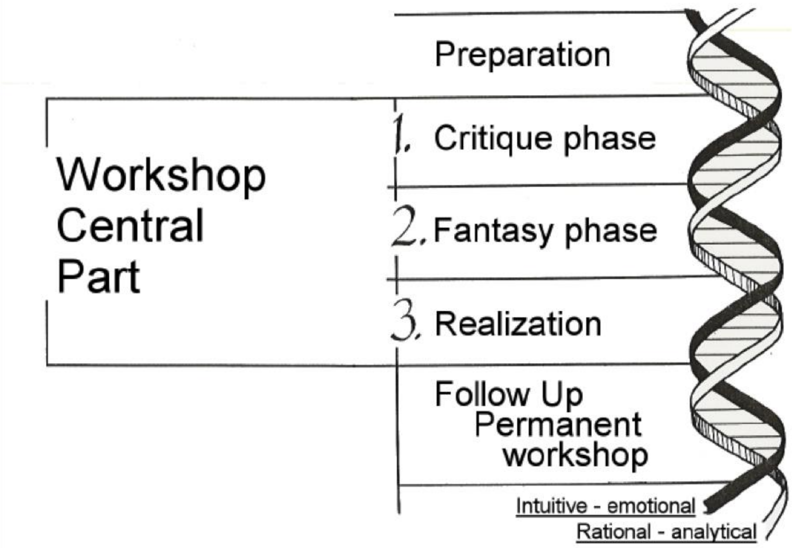

Figure 1 Future Workshop phases (Jungk & Müllert, 1984)

Figure 2. Future Workshop phases (Jungk & Müllert, 1984).

In the present project, phases 0–3 served as a springboard for the course and took place as a seminar over two days. In an attempt to follow the recommendations of Jungk and Müllert (1984), Group 1 was divided into two groups, each with one teacher and two student helpers to conduct the workshop, one of them being primarily responsible for data collection. The teachers were in charge as moderators and for communicating the information and ideas behind the Future Workshop. The overall objective was to give the students an experience with Future Workshop as a method and a framework for the course. With regard to the theme of the course and its project, the objectives were to explore problems, barriers, visions and fantasies in order to enable the students to plan and design the course for the first semester. By establishing a mutual understanding between the students, they should be prepared to work collaboratively in planning educational design and teaching.

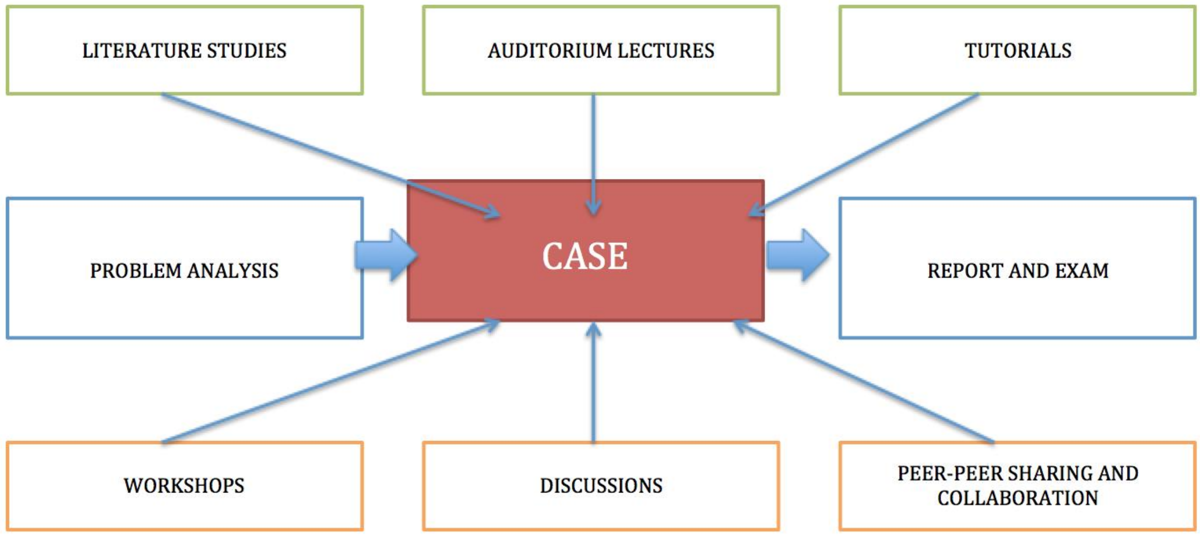

Figure 3 A Model for the PBL activities

With regard to preparation, the teachers generated a plan for the six weeks, with activities (case, lectures, workshops, milestones and exams) and provided information about the Future Workshop. The most important information was available on Moodle before the beginning of the course. To make the structure and principles visible to the students, an illustration inspired by Kjærsdam and Enemark is used (Kolmos et al., 2004, p. 13) (see Figure 2). It was important to make clear that the project was the focal point, preceded by problem analysis and finishing with a joint report and exam. The purpose of the other activities served to help students to learn about the project and to be able to produce a proposed solution. The students were asked to read about the Future Workshop as an idea and to consider specific issues related to the present issues and acquaint themselves with the project.

During the critique phase of FW, some recurring issues quickly appeared. Since the project concerned a situation that the students had experienced a few years earlier, it was easy to relate to the situation and brainstorm problem areas. It appeared to be more difficult for them to produce utopian proposals for their problems. Very quickly, they let themselves be limited by logistics and rules. However, good suggestions and metaphors surfaced, on which they continued to work in the realisation phase. Asking them to draw their ideas as metaphors proved later to be constructive in generating ideas for their chosen teaching approach.

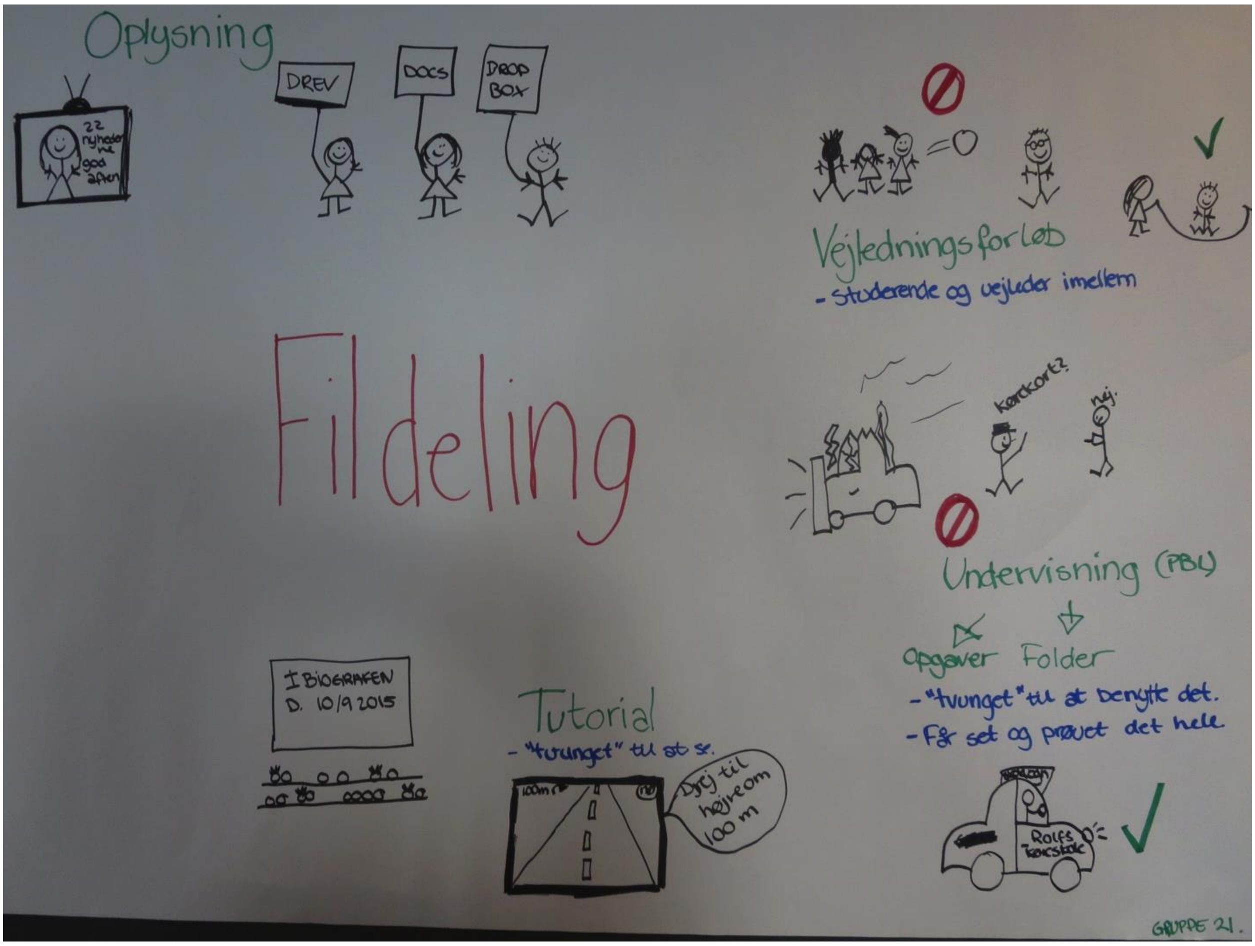

Figure 4 Drawings and notes from the Future Workshop

After the realisation phase, the group was asked to write down a draft for the problem area, explaining why the problem was considered a problem. In this way, the two-day springboard seminar, orchestrated as the first phases of a Future Workshop, gave the groups some ideas about their problem area and a first draft of the report. In addition, they had some ideas about how their teaching should be approached.

Beyond the lectures, the follow-up phase of the Future Workshop, the permanent workshop, was extended and supplemented by so-called breakout sessions, consisting of short technical and academic inspirations. Ten break-outs were offered during the course. The groups were asked to send at least two representatives to each breakout so that not all students had to participate in all activities but the group as a whole would have the necessary knowledge and inspiration.

Developing a common teaching program with 73 people requires joint decisions, strong coordination and strong management. One way to achieve these goals is to divide the process into milestones. A milestone can be considered as a sub-goal, a stopping point in a phase of the project in which the development group shares and presents its work thus far and decides on solutions in order to be able to advance the next milestone. The groups had four milestones during the course. Two days before each milestone, we communicated in detail what the students were expected to present and asked them to share a reflection paper in Moodle the day before the milestone. At the milestones, the students were asked to take responsibility for conducting the session by taking the roles of moderators, presenters and opponents.

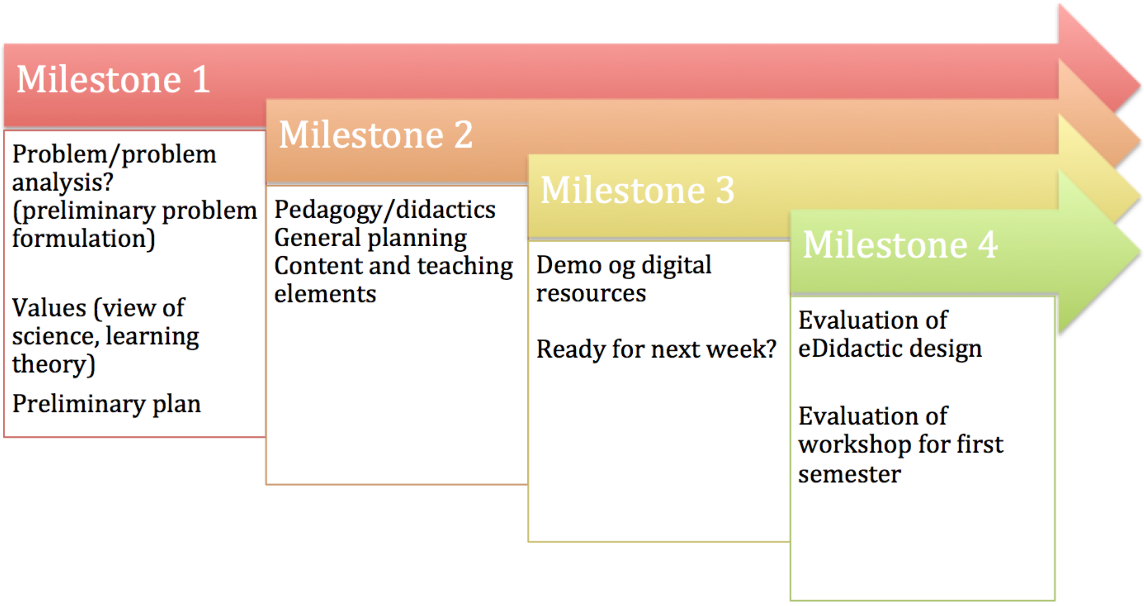

Figure 5 The course´s four milestones with themes to be presented and discussed

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In the fifth week of the six-week course, the students conducted their planned courses for first semester. These were planned as thematised workshops over two days. On the basis of their teaching experiences and their theoretical knowledge, the last step was to refine their learning design, finish their report and get ready for their exam. In the exam, we emphasised that all the students' sketches made along the way were to be included so that it not only was the project that counted, but also the process.

Data Collection

The teachers' observations during the course, the process data from the FW, the documents in Moodle and the formal evaluation, together with data from the examinations, provided the basis for the analysis.

Figure 6 Notes from the Future Workshop

Analysis

In relation to PBL principles, the Future Workshop embraces the core principles. During the initial springboard seminar, the project was clarified, causes for concern and problem areas were discussed and re-formulated, and by using their prior knowledge, the students brainstormed proposals and utopian and realistic solutions. During the permanent workshop, they elaborated on the proposed issues. They acquired theoretical knowledge through lectures and literature and practiced ICT skills through workshops and breakout sessions with support from the teachers and the ICT team and MediaLab at the university. They constructed and learned new theories that might explain the phenomena described in the problem through self-directed group work, and they evaluated the work. As teachers, we took the role of scaffolding supervisors. The Future Workshop helped to construct a framework with activities and a pedagogical approach reflecting PBL principles.

There was activity and engagement among the students during the course. Though frustrated that they had too many tasks and that there was much theory, especially new learning theory, to relate to, they worked hard and in good spirits. The students described several 'Aha' experiences, when they suddenly realised that theory and practice are linked. They stated that the fact that the problem was based on real-world problems close to themselves was motivating. They often referred to their own experiences, asserting their certainty that they could plan a better course on digital resources than they had experienced themselves.

With regard to exemplarity, the students agreed that the project work and their own experiences of teaching had given them a deeper and more general understanding of different learning theories and didactic approaches. In the formal evaluation, a majority of the students emphasised their own teaching experiences as a turning point; as one student formulated it: 'It has been great to try out something in practice and great that the course has been so creative and practical. It gives a much better perspective on the theories and how they relate to real life.' Another student was excited by the fact that, in the experience of teaching himself about learning theories, he realised that the theory explained the practice in which he was engaged. At the workshop for the first semester, he exclaimed excitedly, 'The theory I have read fit well to reality'.

The groups were random and defined in advance by the teachers. For most groups, this worked well. However, there were a few remarks in the formal evaluation that some students felt they had done the hard work in the group. In particular, significant differences in writing skills were noted, a problem that we as teachers also had noticed.

PBL emphasises self-directed learning, collaboration and group work, placing demands on the space available that is not fully supported at present. The entire CDM student cohort (approximately 450 students) has only a few group rooms available. The students have to share nine group rooms that can only be booked for half a day and the students have to take this into account in their everyday planning. To avoid too much chaos, available group rooms for the fifth semester were reserved as a special arrangement in the course period. The lack of working spaces could result in students spending time being 'nomads', as described by Ryberg, Davidsen and Hodgson (2016), using a lot of time and energy to find a place to work and ending up either in the canteen or at home. The students enjoyed the ‘ownership’ over the space and practically moved in during the course period. Beyond serving as a workspace, it also facilitated collaboration across groups. However, we could not provide a private workspace for each group, so all groups received a private whiteboard on wheels, which they could use and bring with them. The students used the whiteboards as a handy location for their Future Workshop posters and their notes about the direction of their project work, their shared planner, notes, etc. The groups also brought their whiteboards to the exams to share the study process.

Hence, in the informal and self-directed learning situations, we observed activity, collaboration and responsibility. However, in the formal learning situations as milestones, we experienced a lack of mutual engagement in peer projects. It was difficult for the students to take responsibility for the presentations in the auditorium. To some students, it was too transgressive to speak in front of the rest of the group. Because of the large size of the year-group and the predominance of auditorium lectures, they were not used to speaking to a large audience. With regard to the learning outcome of the milestones, some students addressed the psychological issues more than the learning outcome of the content:

In spite of the above reflections, however, we have experienced an exciting course, which besides having contributed to knowledge about learning design and teaching, has moved our personal limits. We refer in particular to the milestone meetings, in which all groups had to present their work so far in the auditorium, and each was given the role as moderator during the meetings. We hope that this experience has given us an incentive for a higher degree of activity during our own lectures.

Another student:

> The milestones were well set up, in the sense that each of us had different roles and we were all forced to speak in the microphone and present in front of our students, something most of us have tried to avoid in the previous semesters.

Other students argued that it was a waste of time listening to each other and that they were interested only in the subjects clearly relevant to their own project. Some students said the milestones were good and educative but that they were time consuming. A few students asked for clearer goals for the milestones and no milestone at the end of the course.

On the whole, there was good feedback on the teachers' role as supervisors. The students felt that they had a good dialogue with the supervisors, that the supervisors were attentive, engaged in the project and gave constructive feedback. They liked the possibility of emailing questions between meetings with the supervisor and the fact that the supervisors recommended literature.

The examination went very well. As shown in the figure below, the students made good presentations and a majority of the students achieved marks of *excellent* or *a very good performance*. The lowest mark was a *fair performance* and a small group received the grade of *good performance*.

Danish Grading Mark	Equivalent ECTS mark	Students grades in the present case
12 For an excellent performance	A	22
10 For a very good performance	B	37
7 For a good performance	C	10
4 For a fair performance	D	5
02 For an adequate performance	E	None
00 For an inadequate performance	Fx	None
-3 For an unacceptable performance	F	None

Figure 7 The students' final marks at the exam

All in all, the course was educative but a lot of hard work for the students and supervisors.

Discussion

Framing the course as a Future Workshop facilitates some of the core PBL principles. Because a critical and familiar project was made the focus in the first phases of a Future Workshop as early as the springboard seminar, all the participants became acquainted with the project problem area, and were placed in a situation in which to reflect and specify the core issues. By explicating and discussing different perspectives and issues, some students started to identify their own concerns in relation to the problem area. Other students, found it more difficult to connect the Future Workshop to the course as a whole, however. Information in Moodle about the course and the texts to read about the Future Workshop framework was insufficient. In a Future Workshop, the participants are supposed to have time to reflect and to get to know each other. Somehow, some students could not exploit the time meant for group discussion and felt they were wasting their time when the tasks given were not specific.

We recognise that the design of the course – framing it as a Future Workshop, with multipart goals and assignments (learning about learning and teaching theory; organising, conducting and evaluating a course; and writing about the whole process) – was challenging and an entirely new way to study. One answer to this may be to view the module's design as a systemic contrast to the way the students had studied up to this point, with the final evaluation of the students taking place through traditional project and group exams. What is the purpose of engaging with the work of other students when it is the marks of group and the individual that count?

The students highlight teaching themselves as the part of the course where they learned the most. The teachers also mention this feature as a turning point, in which the students actually understood the different learning theories and their consequences in practice. Apparently small issues, such as the way tables and chairs were placed in the room, the way questions were asked, etc., have an impact on learning and the quality of the dialogues. This confirms that the revitalisation of PBL is necessary and, in particular, that linking theory and practice is educative. When asked directly, at the beginning of the course, several of the students were unable to identify when and how their studying approach built on PBL principles.

The tangible mobile board can be considered as a boundary object (Wenger, 1999) for the group members and the supervisor. Following the learning process by keeping notes, posters and metaphors on the tangible mobile board allowed it to serve as an anchor during study, supporting meaning making over time, a common understanding and collaboration across groups.

Results

Designing a course with a PBL pedagogical approach as a Future Workshop has been successful. The structure, the rules and the activities, so to speak, lead to a PBL mindset. The three phases – critique, fantasy and realisation – and the real-world project facilitate a springboard from which the students can advance. The permanent workshop makes it possible to analyse, theorise in depth, discuss and report on the problem. However, on the basis of the present case and the evaluation, a redesign will be useful. This will focus on getting the students to understand better how the Future Workshop can kickstart their project work, and on reducing the number of activities so that students get more time to focus on their project without losing sight of the shared activities and responsibilities as a large group. By putting a video/slidecast in Moodle beforehand with information, examples of other Future Workshops and an assignment to reflect on the FW´s critique phase, some of the activities at the very beginning of the course will be flipped. A clear timeline of all activities and their goals, including which are compulsory and which are not, will provide a better overview. Clarifying the purpose of the milestones and refining the methods, as well as addressing the psychological issues concerning speaking to a large audience, are expected to meet the critique of the milestones sessions.

Conclusion

One way to remedy the problems that PBL faces in higher education today is to use Future Workshop as an overall framework and place a renewed focus on the core principles of PBL pedagogy. We divided a large year-group into smaller groups and adopted a student-centred and student-directed approach, using different teaching methods and encouraging the students to be more active and to speak before and converse in larger groups. The overall framework was a Future Workshop with a specific project and its problem as its focus. Literature studies and lectures have been tools to generate knowledge about the project. However, a renewed awareness of the fundamental PBL principles is needed. This first iteration has shown some focal points to be redesigned for the second iteration, which will be the course taking place in the autumn of 2016. It should be clarified for the students that this course design differs radically from that of the courses in which they have participated thus far. As a didactical framework for teaching, Future Workshop will put PBL on the agenda and will show that the facilities and teaching resources can continue to support this pedagogy.

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MultiMAP: Exploring *MultiM*odal *A*rtefacts *P*edagogy in digital Higher Education

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In spite of an established and growing body of literature in the field of "multimodality", there are scarce examples of studies that acknowledge and explore this approach to communication in HE pedagogy (teaching-learning). This paper reports preliminary findings of a study on multimodal artefacts pedagogy in a postgraduate online course in Education. The focus reported here is on how students perceive the pedagogical value of creating multimodal artefacts that consist of a digital pictorial image and an accompanying narrative. The results point at three pedagogical experiences: the tension within a "monomodal assessment – multimodal activity" orientation, the "outsider" status of an image-based activity in a PG Education course, and the "liminal" experience that the activity triggered as a route to a transformative learning experience. Some implications for HE pedagogical designs are briefly noted.

Keywords: Higher Education, multimodal artefacts, images, students, learning

INTRODUCTION: MULTIMODAL ARTEFACTS IN HIGHER EDUCATION

The rise of multimodality approaches (Kress & van Leeuwen, 2001; Kress, 2009), accelerated by the advent of web 2.0 and digital education have been reshaping long-held views on what constitutes knowledge, literacy and learning. Such approaches argue that knowledge and learning need to be seen as mediated by more than just one socially constructed communication mode, for example "language", but as involving other forms such as images, sound, design, gesturing and so on. However, exploring the application, relevance and impact of those approaches within Higher Education teaching-learning is still at an early stage so that this is an under-researched area.

An argument for students' deeper engagement and explorations of multimodality in HE teaching-learning is presented by Barton and Ryan (2013) in relation to reflective thinking. This argument is related to three illustrative cases on student reflection triggered by multiple modes, situated within the disciplines of Dance, Fashion and Music. Although the examples are from particular disciplines, the authors state that HE disciplines in general develop via three distinct areas that together constitute disciplinary knowledge: disciplinarity (concepts operating in a discipline), reflection, and modality (varied communicative forms of expression). The value of multimodal triggers in students' reflection is emphasized by the authors (Barton & Ryan, 2013, 422):

"Attending to all levels of reflection in teaching and learning, using multimodal triggers to enable depth of understanding, and allowing students to participate positively in the discourse of the discipline are highly valued and impact greatly on reflective practice."

In particular, Higher Education institutions might be failing to acknowledge the potential of *images* as legitimate modes of "higher" learning, alongside other modes. As Jewitt (2008,15) points out: "where image is acknowledged in educational settings, it is often celebrated for its potential to interest and motivate learners and the link between visual forms of knowledge and learning is seldom made."

There are few empirical studies that report on image-based communication in Higher Education teaching-learning. For example, Archer (2006; 2010) focuses on multimodality as a form of academic "literacies" presenting examples of multimodal texts, mainly image-language ensembles in few disciplines, such as Engineering and Architecture. The author (Archer, 2010) argues in favour of pedagogical shift in Higher Education to acknowledge and adopt multimodal forms of expression as well as relevant metalangue to "talk" about multimodal forms, most notably the relationship and connections between image and language.

A fairly recent PhD study by Lackovic (2010; 2014) was conducted in the spirit of students' reflective explorations and creation of multimodal artefacts, focusing on pictorial images. The study explores a longitudinal application of a multimodal pedagogical framework – Image-Based-Concept-Inquiry (IBCI) – that encourages students to explore disciplinary concepts via selecting images and reflecting on them individually and in groups. It shows that image-language multimodal ensembles created by students are useful and unique expressive modes and triggers for the reflection on concepts in Educational Psychology. It points at both learning benefits and challenges involving a cyclical pedagogic design that focuses on reflective inquiry with pictorial digital images. One of a few benefits is a pictorial potential of such images to evoke personal life experience and tap into the ways of how concepts may exist in real life that language solely may not evoke, in terms of linking abstract concepts to depicted entities or situations via the medium of pictorial image. Another benefit lies in spontaneous uncovering of held views/ lay beliefs that surface during the interpretation of images. In particular, there occurs a sudden awareness of how strongly stereotypical images are infiltrated in our mind and quickly evoked, hence students become more aware of the existence of and personal repertoire of dominant socio-cultural representations.

The above mentioned studies and reflections make a case for developing and applying multimodal pedagogy in Higher Education, but research explorations of that pedagogy outside the field of so called “creative” subjects such as arts and media, are rare. It is important to stress though that there exists a solid body of literature rooted in Psychology in the field of multimedia learning and learning concerning multiple representations (e.g. a series of images or an illustration shown together with a video to explain a concept) situated in HE and exploring learning that involves more modes of communication. However, those studies have mainly concentrated on the resources *given* to students rather than *created or found* by them. Such traditional “multimedia research” is not what is at stake in this article, since much of that research strives towards exploring and confirming individualistic cognitive theories, instruction and designs, with control and experimental groups (for instance, see Mayer and Estrella (2014)). On the other hand, research that focuses on creative media production, outside the “arts and media” fields and related to learning, is mostly conducted at school level, with isolated pockets of examples in HE.

There are also differences in terms of how “learning” is identified across studies that involve pictorial images and multimodality. The pedagogy in question here adopts the view that “learning” is a multifaceted conceptual development (Blunden, 2012) via shared, critical and pluralist forms of *multimodal creation and expression* (Sousanis, 2015) towards a “knowledge building” community (Scardamalia & Bereiter, 2003).

With regard to where learning resources are presented and managed, they have gravitated towards the screen, if we consider university VLEs where the activity of this study is situated. Referring to VLEs and its "visual" side, Bayne (2008, 395) rightly states that

"(a)s certain areas of practice in higher education shift online, the work of learners and teachers increasingly takes place within the domain of the image (…) Visuality gains a new urgency as we move further into the digital age."

This should encourage potent research opportunities around the affordances of the digital format and tools in HE. In particular, there has been a proliferation of digital image friendly technologies that students can use to express themselves and reflect on in HE context. However, there is a scarce understanding of how students view an image-based activity/pedagogy in HE, when it is applied in any discipline or interdisciplinary. In spite of widely spread digital provisions in HEIs (e.g. online courses), the contribution of various (creative) digital tools and designs to HE pedagogy is still an underdeveloped area (Selwyn, 2014).

The present paper contributes to the stated research gaps by exploring the opinions of postgraduate online students in Education on the pedagogy that required them to create image-based multimodal artefacts as a way of reflecting on a specific learning resource (an academic article). In the following section, the paper proceeds to explain the study context, aim and research question. It must be noted that the results reported here are preliminary.

STUDY CONTEXT AND METHOD

The preliminary findings reported here stem from an ongoing research study in relation to a particular activity designed within an online learning module at Lancaster University (UK). The module is a part-time module for postgraduate students tackling the issues of learning, teaching and assessment in Higher Education. To fit the common programme standard, the students are required to read selected academic articles, engage in Moodle (the university's VLE) activities and write a final assignment in the form of a publishable academic article. The module activity reported on here was designed to support analysis, critique and multiple perspective approach to various issues pertinent to the module content. It builds on the method designed by the applicant termed "inquiry graphics" (Lackovic, 2014) which is a methodological orientation that encourages students to "depict and explore" a curricular concept aspect (either tutor-assigned or identified by the students) by selecting or creating a multimodal artefact: a pictorial digital image and an explanatory narrative. For the purpose to engage in "inquiry graphics" on this module, the students were asked to select a particular issue or concept from the assigned academic readings (articles), choose a digital image that relates to that concept in some way, write a reflective narrative about the link between the image, concept and their own experience/interest, upload it in a reflective image activity forum. They were also encouraged to engage in commenting on peer's contributions and tutor feedback. The aim of the project is to explore learners' reported experience and reflections on the personal pedagogical value of such a multimodal activity.

A specific **research question** relevant to this paper is:
How do students perceive the pedagogy of a multimodal, image-based activity in an online postgraduate module in Education?
(The pedagogy is here explored with regard to: module requirements, their previous experience of HE pedagogy and the perceived learning value of such an activity).

A permission to do the study was first obtained by the author's university's ethics committee, followed by students' informed consent to participate. To avoid the possible conflict of interest and bias in students' reflection, the interviews were held after the students received their final assignment marks. There were altogether 13 students taking the module and seven students agreed to be interviewed via Skype. Interviews took between 45 minutes to 1hour 20 minutes; they were recorded by an audio recording device and transcribed verbatim. The interview style was akin to a photo-elicitation interview that uses photographs or other images to elicit interviewees' responses. The similarity lies in the fact that the students were asked to look at the module's Moodle pages and reflective image activity forum while answering the questions.

Some of the questions asked were:

Can you talk me through your experience of this module and related teaching-learning activities?

What was your experience of the image reflective activity in this module?

Can you talk me through the processes you engaged with during the creation of the artefact?

How do you view the activity in relation to your learning?

The interviews were analysed adopting a theme analysis (Braun, Clarke and Terry, 2014) in order to answer the research questions, identifying dominant thematic clusters and conceptualisation in phases. The next section is the summary of selected preliminary findings.

FINDINGS

There are three prominent themes in relation to the value students attached to the multimodal activity: 1) the tensions with regard the multimodal activity's nature as conflicting with "mono-modal" assignment nature, 2) the activity was seen as uncommon (outsider) within postgraduate Education pedagogy, and 3) the struggle triggered by the activity was seen as a positive and transformative learning experience in the end, but quite challenging in the beginning. Further developments in relation to the findings are expected in the future. The following two sections provide a brief overview of the first two themes followed by a more detailed section on the "liminal" pedagogy with multimodal artefacts that has a potential for a transformative learning experience, hence characterised as "virtuous liminality".

"MULTIMODAL ACTIVITY-MONOMODAL ASSESSMENT" TENSION

One thing that was troubling the students was how the activity they were asked to do related to their final assignment task. There is only one final assignment graded in this module: the final article which is judged on its "publishable quality". This created a tension between 1) the assessment mode/format, an outcome oriented attitude, an ambition to meet the assignment requirements and get a good grade and 2) doing creative, image-based, "out of the box" kind of reflective activity. What students were voicing can be defined as the issue of "constructive alignment" (Biggs, 1996). This concept is mostly used in relation to "outcomes-based education" that calls for an alignment of assessment forms and criteria from one side and teaching-learning practice from the other. This is of course desirable. However, the trouble occurs when the standardised assignment form is in one dominant mode, the one of language. This orientation privileges one mode of communication. Therefore, although images and other forms of expression and communication are salient in human every day's life and relevant for understanding the world and how it operates, the "constructive alignment" in many HE disciplines requires an alignment with the chosen dominant mode (language) as the normative expression mode in students' assessment. This can be called a "mono-modal" HE assessment orientation, that is, the orientation that privileges language as the norm in many disciplines, notably the field of Education and Education studies. The word mono-modal is used with caution to signal a *dominant orientation* rather than the mono-modal quality. It can be said that there is possibly no such a thing as purely mono-modal teaching-learning act or resource, since there will be more modes "in operation", for example, with regard to tactile aspects of resources, gesturing, chunking of language text into paragraphs (a "visual" side of language exposition), etc.

"IMAGE-LANGUAGE" (MULTIMODAL) ACTIVITY AS PEDAGOGICAL OUTSIDER

It was apparent from students' reflections that the image activity was seen as an alien activity, an unexpected form of pedagogy within a postgraduate course that tackles Education. It must be noted that the status of being a pedagogical outsider is made with reference to postgraduate courses in Education and with special reference to the programme with a clear part time and research orientation. The findings may be different for other tertiary levels of programmes in Education. According to the students, the activity was absolutely outside of their expectations and what they could imagine as a possible activity on the module that explored learning, teaching and assessment in HE. It can be concluded that such a "surprise" effect signals that postgraduate students may have the "language dominance" *expectations* when it comes to what constitutes pedagogical routes to their learning in a postgraduate Education course.

IMAGE ACTIVITY LIMINALITY AS PEDAGOGICAL VIRTUE

Contrary to the views that may be widely held on pictorial (/depictive) images as prominent in pre-school and school pedagogy to "serve" illustrative, "fun and light" engagement purposes (Stanczak, 2004; Cyphert, 2004), the mature postgraduate students on the module soon realised that the activity was not "naïve and childish" at all. Quite the opposite, they identified it as a unique place of struggle. This struggle was manifested as the effort and time needed to complete the activity, in particular the act of "finding" an image that would satisfy students' representational intentions and expectations as well as develop a narrative that bridges an academic article and an image. The time it took students to complete the activity resulted both in the frustration with it and the realisation of the learning value it bore, in comparison to a purely verbal forum contribution.

Almost all students (six out of seven) voiced their discomfort with the activity, an experience akin to entering a destabilising and "out-of-the-comfort-zone" territory. Such a state has been conceptualised as the state of "liminality" (Land, Rattray and Vivien, 2014; Land, Cousin, Meyer, J. & Davies, 2005) when it comes to learning experiences, related to the approach of "threshold concepts", that is, when students enter a disorienting, in-between state before they develop a key concept understanding. The liminality in question here is of a strong pedagogical and not only conceptual nature, hence uniquely bridging the practical and conceptual side of teaching-learning in HE. This means that the perceived difficulty is both in relation to the activity approach applied here (with images) and the personal learning challenge to identify a prominent thread of article content to reflect on via a pictorial image. As it was concluded in the previous section, the activity was unexpected, but yet intriguing enough for students to "give it a go" as they explained which led them to a discovery of its transformational possibilities. It is indeed this moving outside the comfort zone in learning that creates the space of liminality and often leads to transformational learning experiences.

The following excerpts from interviews illustrate the struggle that the students encountered that led them to realise the pedagogical virtue of the image activity liminality, of being taken outside the comfort zone via the image activity. This struggle is expressed mostly in terms of either suspicion about the activity's value in the beginning and/or feeling disconcerted and challenged with regard to what was demanded, due to the image involvement. The pedagogical virtue was framed as personal pedagogical value (as a new learning method experienced and understood, allowing the student to use it personally in the future), learning value (as a personal learning experience) and/or research value (doing research with an awareness of the "visual" methodology and the role of images).

Bryan: "I did not think there would be much value to it, I thought it was childish a bit ,I thought it would be fine, something you would do in pre-school, I was suspicious in the start, why would we find an image, rather than just say something. But then I found myself as I read papers thinking also about images I would connect to them, rather than just reading through papers, now I was trying to identify a common ribbon, it helped me to learn and keep that learning and I remember the stuff and my thought processes at the time, yes."

Susan: "Looking back upon it now I remember the experience fondly where it was not the way I would describe it at that time, you took me out of my comfort zone and then moving forward with this format I would be more confident in doing it now myself (with my students). It made me think differently about the readings and how it could be linked in a different way, it made me think about things possibly more deeply than otherwise. It is easy to just think about the paper and you are meeting the task. Whereas this one took a bit more time and it took some time to find the image and narrate it."

Catherine:" I have never thought about the visual representation…From a very skeptical beginning, I think it is important to say that I did not think: "Amazing, I am going to do the picture", but "Why am I doing this?" But hey this is actually really fun and I am doing learning and I did not think I would do that and that the purpose would be learning…There is now even in my academic practices a certain freedom of using a visual image I would not have used in the past. "

Matthew: "Ooh, I thought: this is a bit shocking and new, I am not sure I am going to cope with this well like the other ones. I had to take rather tangential approach which was fine, this is all about *meanings and artefacts coming together (…) It has given me an extra dimension in thinking and the interview protocol set up…to make sure you walk around the place with a camera, video camera and at least note down images that you see that may influence people and their thinking*."

More explorations could be done within this and similar studies, such as looking at the role of students creating multimodal artefacts for reflection as a method to elaborate information, in relation to strengthening student understanding and memorization. As Bryan's and Susan's excerpts above suggest, linking two different modes of communication to think about one concept is such an example of "multimodal information elaboration" that points at the value of multimodal pedagogy in Higher Education. Furthermore, image content and related narratives could be analysed. Moreover, communication between students (and teacher/tutor) in the image activity fora is also a potential unit of analysis. For instance, an analysis could focus on what kind of initiatives/responses are being made, what these are about and how these are followed up on, or not in the interactions, thus tapping into reflections that are made and "possible" reflections that are not made. This is something to consider for future studies and analyses. However, the scope of this paper focuses on student-perceived pedagogical value of the multimodal activity.

Going back to the points made about the experienced difficulty with the activity, the path to transformation is indeed the willingness to enter the destabilising territory, to take risks, to create and engage (Lupton, 2013). The image-based activity proved to be an appreciated liminal state, the process that can be termed "virtuous liminality" of thinking with pictorial images in HE, towards students' professional and learning development.

CONCLUSION AND IMPLICATIONS FOR PEDAGOGICAL DESIGNS

The preliminary findings of the study reported here show that students' *first impression* about the use of pictorial images in their learning positioned those images as not "high" and "logical" enough resources and modes of communication to lead to any deeper learning engagement. This may be for a variety of reasons such as students' prior experience, disciplinary background, adopted views on HE pedagogy, and the courses' standardised assessment formats. However, in hindsight, they all saw a strong learning value of the multimodal activity with digital images described here. They realised through their activity and module engagement that thinking with images required a considerable effort and that doing research in Education needed an “image” side to it. The value and appreciation of this struggle suggest that learning may often involve disconcerting feelings, a situation of entering an unsettling bubble of “liminality”, a transitional learning state of struggling with a concept or activity that leads to a transformative learning experience. Therefore, this study challenges any view that positions a pictorial image as a superficial, illustrative and light side of learning. It points at the learning value of an initially “troublesome” experience with such a pedagogical activity, hence named “virtuous liminality”.

Although we live in an ever expanding world of image rich technology and digital multimodal formats, this neither means that the “old” pedagogies have caught up with those new technologies (Selwyn, 2014; Noss & Pachler, 1999) nor that the new digital environments (VLEs) operate within some new value system or ontology, but reproduce traditional HE values and assessment formats (Bayne, 2008). Moodle represents here such new technology that may still operate within particular hierarchies and the “not-that-image-approving” pedagogies in Education courses and possibly more disciplines.

One design implication stemming from these preliminary results is the need to re-think modality of expression and communication in HE pedagogy and assessment to allow learning designs that are multimodal, both in online and face-to-face contexts. This is envisaged to happen at a systemic, rather than fragmented departmental and individual level. To support such re-thinking at both macro and micro level, an educationalist or a specifically dedicated team may be assigned (via any (cross)institutional or research investment) to work and preferably develop and conduct relevant studies around multimodal pedagogy with representative academics from each department at an HEI and subsequently across HEIs, nationally and internationally. Such a person/research group could aim to present managerial and academic staff and students with a synthesized collection of studies on how images and related multimodal artefacts and activities “work” in HE pedagogy, both in digital and face-to-face learning environments, and what they bring in terms of critical reflection and (inter)disciplinary learning in each department/school. That action may affect VLE and course designs to become more flexible and adaptable in relation to modality.

It is acknowledged that there is no intention to dispute the importance of language in learning and no claim that it is easy to change assessment and pedagogical formats without much effort, evidence and perseverance. Some academics may have difficulties in seeing how images (and other modes) may fit within their particular disciplines or programmes. However, it is worth continually aiming to raise awareness among university professionals on the value of student and tutor created multimodal artefacts in pedagogical design via practical and research examples. This awareness may grow and accumulate towards greater systemic acknowledgment and application of various (hybrid) modes of expressions (notably containing pictorial images) as *equal, challenging and legitimate* within the technology-mediated pedagogy in Education courses in particular, and all disciplines in general.

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Video Podcasts: Learning by Listening?

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ABSTRACT

This project's aim was to support and facilitate master's students' preparation and collaboration by making video podcasts of short lectures available on YouTube prior to students' first face-to-face seminar. The empirical material stems from group interviews, from statistical data created through YouTube analytics and from surveys answered by students after the seminar. The project sought to explore how video podcasts support learning and reflection online and how students use and reflect on the integration of online activities in the videos. Findings showed that students engaged actively in podcasts that included designed activities, and moreover – although to a lesser degree – that students engaged actively in podcasts that did not include additional activities, suggesting that learning via podcast does not always mean learning by passive listening.

Keywords: video podcasts, blended learning, collaboration, designs for learning

INTRODUCTION

Video podcasts can be defined as video files that are distributed or shared on the Internet to be downloaded or streamed to computers and/or mobile devices (McGarr, 2009). Several advantages to this technology are often highlighted. Students generally find podcasts rewarding in relation to learning (Dupagne, Millette, & Grinfeder, 2009; Green et al., 2003; Vajoczki, Watt, Marquis, & Holshausen, 2010) and appreciate the easy digital access to lectures they might have missed or wish to watch again (Traphagan, Kucsera, & Kishi, 2010; Zhang, Zhou, Briggs, &

Nunamaker, 2006). Podcasts can be a useful resource for students' revision (Hill & Nelson, 2011; Kay, 2012) as they adapt to students' learning patterns (De Boer, Kommers, & De Brock, 2011). The format provides access to lectures without demanding students' physical presence on campus (Traphagan et al., 2010). Video podcasts can be used to supplement or support face-to-face teaching on campus, and the format allows for segmentation of lectures (Zhang et al., 2006), giving students the independence to choose which parts they wish to watch (Heilesen, 2010; Hill & Nelson, 2011; Jarvis & Dickie, 2009).

However, students' learning activities related to video podcasts have been found to consist mainly of passive watching and listening (Giannakos, Chorianopoulos, & Chrisochoides, 2015; Kay, 2012), and such passivity does not necessarily improve learning outcomes (Pegrum, Bartle, & Longnecker, 2015).

In this project, we wanted to create video podcasts that integrated active participation from the students, and at the face-to-face seminar, we encouraged students to collaborate and reflect on the basis of the podcasts' content. We also wanted to see if any patterns emerged when we analysed 24 master's students' ways of engaging with two different kinds of video podcasts: one that required online activities active participation and one that did not. Thus, the research project sought to discover the benefits of coupling passive listening to video podcasts with activities requiring collaboration and reflection. The project further sought to understand the ways the master's students used the podcasts in their own learning. The project took place within the Master i IKT og Læring (Master Programme in ICT and Learning), a blended learning program with face-to-face seminars and online courses. The master's degree class consisted of 24 students who had access to the videos and the survey questions; 23 of them participated in the face-to-face seminar.

RESEARCH DESIGN

The overall goal of the project's intervention in the master's degree class was to strengthen the students' collaboration, active learning and reflection on line before the first seminar and after, when we met for the first time. To reach that goal, four video podcasts were produced, with the content focussed on the course objectives. The videos were between 6 and 19 minutes long. These podcasts were shared with the students before we met for the first time. This paper will present and discuss findings relating to two of the podcasts, video A and video B. Video A presented the field of learning resources and ICT, and video B presented the field of ICT and learning design in the form of a recorded lecture structured by PowerPoint slides;. Like video B, video A was structured by PowerPoint slides, but it was supplemented by quizzes and questions for reflection and collaboration. At two points in video A, students were encouraged to pause the podcast, leave YouTube and go to another online platform to answer related questions. The quiz was scored immediately to give them feedback, and the questions that demanded reflection more than factual knowledge were discussed later, at the face-to-face seminar.

Both videos were recorded and edited in Camtasia. With this software's picture-in-picture feature, the face of the teacher and the PowerPoint slides appeared on the video simultaneously. Video A (about learning resources) also linked to quizzes and open questions on Socrative.com and encouraged the students to bring further questions to the face-to-face seminar. Video B (about learning design) followed the same principles but did not integrate or link to activities outside the video.

A mixed methods design was employed (Denzin, 2012; Tashakkori & Teddlie, 2010) in order to "[…] add rigor, breadth, complexity, richness, and depth to [the] inquiry" (Denzin, 2012, p. 82), and the data was created and analysed with inspiration from a grounded theory approach (Bryant & Charmaz, 2013; Glaser & Strauss, 1967; Lempert, 2013): On the basis of categories that emerged from the semi-structured group interviews and from the data retrieved from YouTube analytics, a questionnaire was developed in order to saturate the emerging categories.

ANALYSIS AND FINDINGS

The students were expected to watch the videos and answer the quizzes and questions in video A. Activities and discussions relating to video B would not take place until the face-to-face seminar. Because no activities or discussions were integrated into video B, the expectation was that students would watch video B more passively.

In the group interview, students declared that they found the video podcasts a good way to meet the teachers, be introduced to the course and start collaborating and discussing the questions prior to the seminar in their previous study groups. The quizzes also raised new questions to be answered at the seminar and thus created a link between the activities online and face-to-face.

Study of the viewing patterns that emerge as students watch educational videos is a growing field in educational research (Kay, 2012). Although e-learning tools support the creation of educational videos, only a few of these tools afford tools for analysis of the viewing patterns related to the videos. However, through the use of the YouTube analytics metrics “absolute and relative audience retention”, we were able to track the times that students viewed specific points in the videos (Alexandros, Alexandros, & Georgios, 2013), when they rewound, paused, fast-forwarded or stopped the video. This was of interest because we wanted to see whether the students actually paused video A to go to Socrative.com to answer the questions and whether they came back and continued watching, as our design had intended.

The viewing pattern for video A thus emerged as seen in Figure 1:

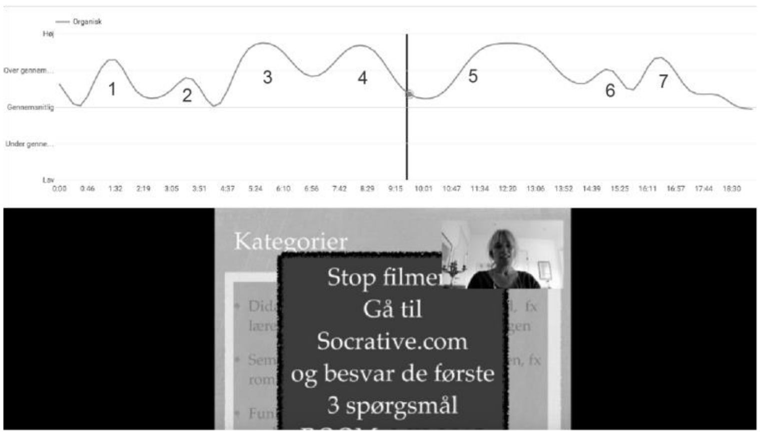

Figure 1: Video A

The local maxima of the curves show where several students watched without pausing, fast-forwarding, or taking other action, and the local minima show where they paused to go to Socrative.com and answer the questions (seen, for instance, in the curve decreasing to minimum 4). However, the curves also indicate that the students paused (possibly to take notes) when the teacher in the podcast writes an e-mail (the decrease to minimum 1), when complicated and condensed content is presented (the decrease to minimum 3), when students are encouraged to pause a second time (minimum 4) and when students are directed to reflect and write answers down (decrease to minimum 7). Smaller drops in the curve are found where some of the students might have lost interest (decrease to minimum 2: long passage on old quote; and minimum 6: definition of learning resources that is already known). The maxima are seen where introductions and new content are introduced (increase to maximum 1, 2 and 3) and when students are encouraged to continue on after pausing (maximum 5 and 6) or when they choose to do so on their own initiative (increase to maximum 4 and 7).

These patterns were not unexpected, given that we had designed for the pauses and that the master's students were very motivated to take the course. However, when we looked into the students' viewing patterns for video B (the video without integrated activities), an almost similar curve was found. As with video A, the students paused, rewound and fast forwarded the video, and a majority followed the same viewing pattern:

Figure 2: Video B

This indicated that this video was actively paused, fast forwarded, repeated, etc. by the students and when analysed a pattern similar to video A emerged: Local maxima and increases were found when introductions and new (interesting/relevant) content were presented (increase to maximum 1, 2, 3, 4 and 5 in Figure 2), whereas minima and decreases (i.e., pauses, stops, fast forwarding) were found when the lecturer presented already known content (decrease to minimum 2 and 3) or when content was presented that was not directly relevant to the students' course projects (decrease to minimum 1 and 4).

In order to have the patterns elaborated in relation to the students' experience and retention of the content, an anonymous online survey was conducted. The questionnaire was offered to 24 students approximately one month after they viewed the videos; 16 completed the questionnaire. One of the survey questions asked which of the videos or related discussions/activities students remembered the best. We were surprised to learn that students did not remember the actual activities very well, and that they remembered the content of the video A much better than video B.

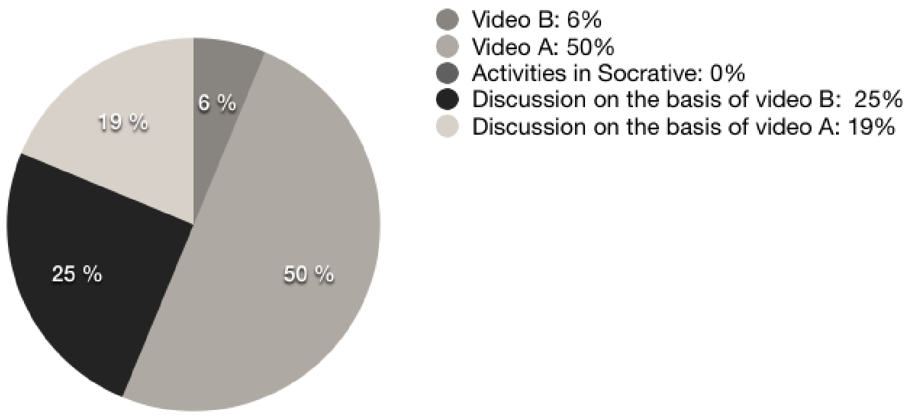

Figure 3: What I remember best right now is related to...

However, as students could choose only one of the 5 categories, it was also surprising that 25% of the students remembered the discussions based on video B better than those based on video A.

The survey also showed that even though no activities or encouragement for discussion were integrated into video B, 50% of the students did discuss its content with each other on their own initiative:

I discussed video A with others	Yes:	62%
	No:	19%
	Do not remember:	19%
I discussed video B with others	Yes:	50%
	No:	38%
	Do not remember:	12%

More than a third of the students answered that they did not discuss video B with others, but when we looked deeper into the answers and compared the individual answer patterns, we saw that twothirds of the students giving this response had engaged actively with the video and had watched video B or both videos more than once.

Based on the viewing patterns that emerged from the YouTube analytics, the students were also asked whether they chose to watch the videos, or parts of them, more than once, and whether they paused and/or fast-forwarded the videos. With these questions, we hoped to get a picture of the students' level of interest and/or difficulty in understanding the content. We also hoped the last question would give us an idea of whether the students found some or all of the content too easy, whether they already knew what was being taught or whether they were perhaps simply bored.

I watched the videos, or parts of them, more than once:	Video A	6%
	Video B	12%
	Both	44%
	No, only once	38%

I paused and fast forwarded	In video A	25%
	In video B	0%
	In both of them	50%
	In none of them	25%

All the students watched the videos at least once (c.f. Giannakos et al., 2015; Harley et al., 2003).

Finally, the students were asked whether they learn best by watching and listening to the video without interruptions (as with video B) and whether they learn best when there are activities integrated in the video (as with video A).

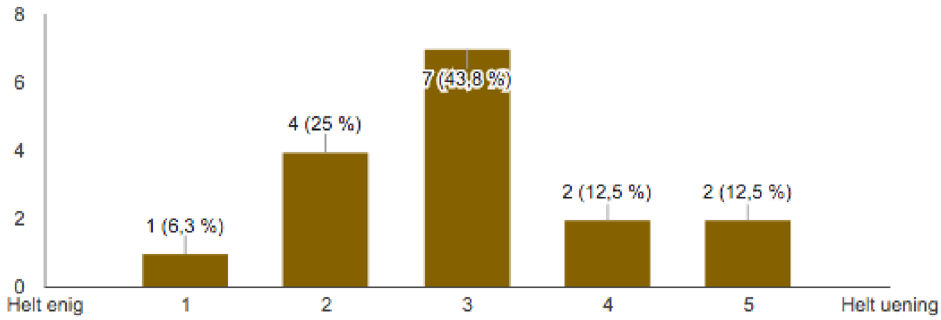

Figure 4. Student responses to the statement, “Normally, I learn best by listening uninterrupted” (video B). From totally agree (1) to totally disagree (5).

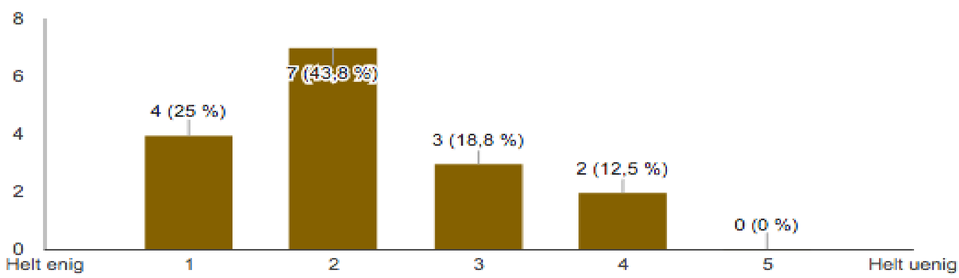

Figure 5. Student responses to the statement, “Normally, I learn best when activities are integrated” (video A). From totally agree (1) to totally disagree (5).

As the figures show, students reported that they learn better when there are activities integrated in the video(s). From a learning perspective, it appears that it is best to design videos that integrate activities that set the stage for reflection and dialogue.

In general, the students expressed satisfaction about the opportunity to watch the videos prior to face-to-face teaching and appreciated being introduced to the academic of the module and to the teaching staff.

"It's good to be taught in advance so that we can start to negotiate and discuss," was a statement from one of the students. The responses of the students (as shown in Figure 3 and expressed in additional comments in the questionnaire) show that the students used the videos for discussions in their study groups. The teachers had not specifically arranged for discussion in groups, as the study groups for the module had not yet been established; students were intended to answer questions related to video A individually. But the students were accustomed to working in groups and thus chose, on their own initiative, to discuss the videos in groups, using their study groups from the previous module. This calls attention to the importance of considering the podcasts in the context they are part of, which not only includes the module, but it must be seen in relation to the whole Master in ICT and learning concept and the teaching and learning culture that is based on this concept.

DISCUSSION AND CONCLUSION

In the Master in ICT and Learning Programme, collaborative work and project work is encouraged; inherent in the concept is that students work independently and plan their own learning processes. There is a strong emphasis on the development of dialogical forms and reflections. In the master's modules, both teachers and students act as learning designers (Sørensen & Levinsen, 2014a, 2014b; Levinsen & Sørensen, 2015). The teachers design for teaching and learning, and the students design for learning. Thus, the teachers design a learning framework as a field of possibilities with goal, objectives, activities, organization and evaluation, and this framework encourages agency and self-direction; the teachers' approaches are facilitative, incorporating supervision and short lectures. In relation to the teachers' framework, students perform and reason their choices regarding objectives, content, organization of work processes and technology. The students design their own learning trajectories. They share knowledge and act independently. In their groups, they decide which activities to choose to facilitate their reflection-in-action and reflection-on-action (Schön, 1983) for a deeper learning experience.

The students use a variety of learning resources in their design for learning. The students choose learning resources for their own trajectory that best suit their learning approaches. In the supplementary notes in the questionnaire, students suggested activities that could be incorporated into the videos. Suggestions included having students prepare written summaries and questions for group discussions and incorporating relevant texts from the podcasts to provide an overview. Students also proposed technological improvements to make the videos more interactive.

This project examined how video podcasts could be integrated into a learning design to link online and face-to-face activities and support students' reflection, collaboration and learning. However, several findings emerged. First, by linking between digital spaces like YouTube and Socrative, we saw that the students were encouraged to watch and listen to the video podcasts' content but also to reflect and collaborate with their fellow students on the basis of that content. In the seminar, we discussed the answers from the online activities on Socrative in order to create a link between the spaces of preparation for the seminar, the students' individual studies and the group-based activities after the seminar, and the discussions taking place on campus with the teacher present. The answers and the online survey results showed that students accentuated this as a support for their recall of the podcast content. By the same token, our analysis of the YouTube analytics showed that the students travelled as expected through the digital spaces and back to the podcast, just as we had designed for in video A.

Our second finding had to do with active versus passive learning. Our hypothesis was that video podcasts create passive students who watch a video without interrupting it, then move on and never watch it again. In contradiction to this hypothesis, we found that not only was video A (with activities) watched actively (students paused, rewound and watched the video several times), the students' pattern for watching and interacting with video B resembled the pattern for video A, although to a lesser degree.

A relevant critique of podcasts noted that academic staff often find that video podcasting leads to passive learning (Elliot, King, & Scutter, 2012; Palmer & Devitt, 2007), and metaphors relating to podcast lectures often centre around learning as acquisition and knowledge as something that can be passively transferred from teacher to student (Sfard, 1998). If, however, the perspective on podcasts is broadened to consider the technology not only as a learning resource in itself but also as part of a learning design or environment, it is interesting to see that even if we did not design for activities in the video B, the students reacted (Wenger, 1998) to the design actively. Thus, we see that although the podcast with activities integrated best supported student collaboration and content recall, a majority of the students also responded actively to the passive podcasts: they reflected on their own understanding of the content by interacting with the technology (re-watching, fast-forwarding, rewinding) and by discussing the content with others.

Based on these findings, we conclude that it is inaccurate to define certain technologies or modes of presentation as leading to passivity. Student reaction to the learning design itself must always be considered, and these reactions are not necessarily as passive or active as expected when the design was made.

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DESIGNING INNOVATIVE EDUCATION FORMATS AND HOW TO FAIL WELL WHEN DOING SO

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Keywords: Design-based research, Methodology, MOOCs, Teacher Education, Organisational Innovation

Abstract

In this article we explore the challenges of designing new, radical education formats from a design-based research perspective. The article opens with a discussion of central challenges in organisational innovation with particular emphasis on innovation in educational institutions prompted by new education reforms. The different roles and functions assumed by the design researcher are also discussed, and it is argued that the role of the project manager should be reconsidered as exceedingly crucial in successful implementation of reform-driven educational innovation. The findings discussed in the article indicate that radical education innovations may be adversely challenged by 1) dilution of the core design idea as it travels through departments and 2) a tendency to prioritise efficiency-related payoffs rather than payoffs focused on positive learning experiences. As a measure to eliminate these challenges, the article finally presents the concept of the cross-functional design team and the notion of learning experience as a central value proposition of radical innovations in education.

INTRODUCTION

“All designs for devices are in some degree failures, either because they flout one or another of the requirements or because they compromise, and compromise implies a degree of failure”
(Pye 1978, p. 70)

In the past, many organisations have been able to survive and thrive without putting much effort into innovation, since providing quality products or services and updating them to a level that maintains their competitiveness in the market was sufficient. However, recent changes such as globalisation, rising customer expectations and a rapidly changing technological landscape now require organisations to become increasingly innovative and, consequently, to learn the art of managing successful innovation processes.

Jon Campbell (2015) has compared traditional innovation processes in organisations to the child's game Chinese whispers, in which one person whispers a message to another, which is passed through a line of people until the last player announces the message to the entire group. Alterations tend to accumulate in the retellings, and the final statement will inevitably differ markedly from the original message, hence the amusement of the game.

What happens in Chinese whispers is referred to as cumulative error, and organisations may well fall victim to the same phenomenon in innovation, when the original core idea is inadvertently manipulated by different stakeholders as it passes from department to department and from person to person in a process that much resembles the child's game described above. While this kind of linear and inflexible passing-on approach may be effective when (re)implementing known products or services in a simple environment, it fails when large organisations are dealing with new, radical innovations in a complex environment. To stay within the metaphor, innovation processes that rely primarily on collaboration between the immediate partners in the Chinese whispers line, rather than between the whole lot of stakeholders, are likely to result in a distorted outcome that lacks the original intent of the core idea or central features thereof.

In an educational context, the need for innovation is often caused by new demands from the surrounding world, which places educational innovation in a complex environment where collaboration between different stakeholders, such as educational institutions, municipalities and public as well as private companies, is a prerequisite. In addition to this, innovation is often impelled by large-scale education reforms, which involve different political agendas and a vast number of stakeholders with diverse, and sometimes even opposing, interests. As is often the case for such reforms, consequences tend to be far-reaching, the problems to be addressed may be ill-defined and the effectiveness of the suggested interventions is hard to predict and depends on successful implementation in a variety of different contexts. One way of dealing with radical innovations in an educational setting is through design-based research (DBR), which we would like to explore in this article as an experiential and iterative approach to studying reform-driven innovation in online education.

THE ROLES OF THE DESIGN-BASED RESARCHER

Design-based research is often used to explore practical problems and to generate and/or inform existing theory within the field of online education, including the concept of MOOCs (Gasevic et al. 2014). However, case studies substantiating how to implement design activities in DBR projects remain scarce (Wyche & Grinter 2012). When engaged in design-based research a well-known and well-described challenge is how to engineer particular forms of learning while at the same time systematically studying those forms. A potent risk when designing educational innovations is to focus too strongly on delivering a product and thereby neglecting the potential of gaining theoretical insights. On the other hand, one may also run a risk of narrowly pursuing new knowledge, which may adversely affect the quality of the final product. The different foci are neatly visualised in the model below.

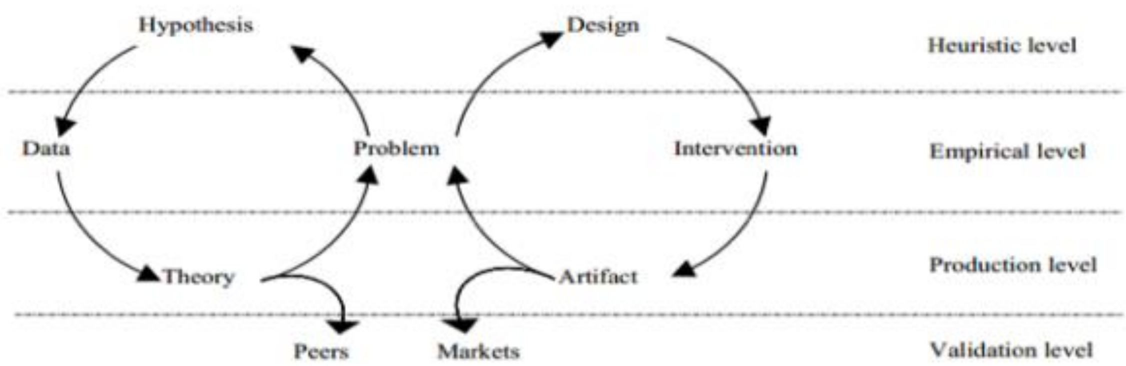

Figure 1. From Ejersbo, L., Engelhardt, R., Frølunde, L., Hanghøj, T., Magnussen, R., & Misfeldt, M. (2008).

The left circle mimics the traditional way of conducting educational research, where theoretical insights on the basis of hypotheses compared with collected data, are shared with academic peers. The right circle mimics a regular production cycle, but with a much stronger focus on user feedback. Here the end product is an artifact to be sold and evaluated by customers. Ideally, a DBR project moves in synchronous, circular movements, but this synchronicity rarely takes place in practice.

While in the beginning, DBR focused on small-scale learning designs to be tested and refined in real-life settings such as classrooms (Brown 1992; Collins 1992), there has recently been a growing interest in organisational innovation within the field of DBR (Collins, Joseph & Bielaczyc 2004; Penuel, Fishman, Cheng & Sabelli 2011). The expanded research scope of DBR calls for new methodological reflections on the roles and functions of the design researchers.

The specific movement from design to intervention imply infinite loops of redesign towards the final refinement of a given artifact (Ejersbo et al. 2008), but there are no specific guidelines as to how this can be done in practice apart from it being an iterative process. The additional activities we suggest in the design phase align with Edelson (2002) and include differentiation between design frameworks and design methodologies, where the former provides guidelines for the product (the design) and the latter provides prescriptive guidelines for the process (of designing) for a particular design (Edelson 2002). From a design theoretical perspective Buxton (2007) has in fact suggested that the design phase includes the design of the engineering as well as the refinement of the overall business model. According to him it is just as crucial to invest in the design of the design process, as in the design of the product itself.

Such additional designer activities are especially important when engaging in design-based research focusing on large-scale organisational innovation. Planning and managing a design processes with the many people involved from different departments can help ensure that the initial research hypothesis and the core design ideas are not distorted when travelling through the hands (or ears) of different stakeholders.

In the following, we will look into key concepts from the field of design theory, such as value proposition, payoffs and forgivable attributes, which are useful in discussing the challenges that design-based researchers face when trying to gain new knowledge, design useful artifacts and manage the design process at the same time.

THEORETICAL FRAMEWORK

Handling the interest of various stakeholders is by no means a new phenomenon. Consider this paragraph written by architect, industrial designer and wood craftsman David Pye almost forty years ago:

"For the purpose of a ship is any purpose imputed to it by any man. To the owner the purpose of the ship may be to make money. To the captain it may be to ply the seas. To the designer it may be to carry four thousand tons of cargo at ten knots. To the enemy it may be to compass his defeat. The purposes of things are the purposes of men and change according to who entertains them. They change, moreover, when a man's mind changes." (Pye, 1978, p. 12)

This serves to show that the purpose of a design is not inherent within the design itself, but rather assigned to it by the people using it. For this reason, Pye argues that devices of any kind should be classified not by their purpose, but by their results. It is true that whenever something is designed, it is done with a purpose in mind, but it is also clear that from any designed object, we get unwanted results as well. No designer ever wanted people to die from car crashes or less seriously to be caught for hours in a traffic jam. When it comes to design, we will never reach a completely satisfactory result. In addition to this, many things have no specific function but can lead to numerous results; for instance, a straight cylindrical bar of steel a quarter inch in diameter on cross section and four inches long can have multiple purposes, but on the other hand, it is very difficult to point out a purpose for which it is more suited than anything else. When looking at designed products and services, we might instead map out a whole range of different purposes depending on who interacts with it.

With regards to evaluating MOOCs, Downes (2013) similarly points to the fact that we need to distinguish between the intended and the actual outcome. When we assess a tool we look to the design specifications or the intended outcome, whereas when we evaluate the use of a tool we evaluate against the actual outcome. Measuring drop-out rates, counting test scores and adding up student satisfaction scores will therefore only tell us whether a particular application of a MOOC was successful in a particular instance. In determining the quality of a MOOC we therefore need to consider both the facet of design and delivery (Conole 2013).

Technological products and services are usually designed with a value proposition in mind, that is, a promise that the design in question can be used to solve a specific problem and in this way

allows users to attain a specific goal (Kolko 2014). The successful outcome of that promise can be referred to as the payoff. Simply put we could say similarly to design ideas and delivery there is from a user perspective a value proposition.
Following this line of thinking, the success of a technological solution does not depend on its ability to match any conceivable purpose, but on its ability to deliver the promised value proposition. In fact, users tend to be exceptionally forgiving of imperfect products and services as long as the promised value proposition is obtained. Just think of the limited space in vehicles, the security control in airports or the inconveniently small buttons on mobile devices, which users accept because the payoffs of instantly delivering messages to friends and family and being able to travel great distances in short time are delivered. Interestingly, users are even more likely to forgive suboptimal solutions when entering new territory, which the early stages of text messaging serve to show as mobile users were sometimes required to hit the same button four times to enter a single letter. Such design attributes, which are clearly less than optimal but yet acceptable, are called forgivable attributes (ibid).

In an educational context, various payoffs have been promised with each new wave of technological advancement. In the case of MOOCs, for instance, we have been promised payoffs in terms of affordability and scale, which would enable teachers to educate a huge number of students across the globe. Likewise, distance learning promised a payoff of convenience by rendering it possible for students in remote areas or students with non-academic obligations (e.g. families) to study at home. MOOC students and distance learning students have in many cases accepted the downsides that have followed in the wake of these technological advancements, such as a lack of teacher presence and teacher feedback, increased feelings of social isolation and online platforms that fail in creating collaborative, engaging and creative learning experiences.

To sum up, there are many difficulties involved in designing new educational formats. Firstly, the design ideas may become diluted due to by the vast number of stakeholders involved. Secondly, new education formats are often prompted by large-scale education reforms, which tend to cause complex environments for innovation. Thirdly, when it comes to technological advancements in education, there is a tendency to focus one-sidedly on efficiency-related payoffs at the expense of the user's learning experience.

There is challenge for designers in preventing the value proposition from the vision of the design ideas to gradually erode through the course of the design process leaving users unsatisfied with the actual outcome of the delivered design.

EMPIRICAL FINDINGS

The empirical data which we will discuss in the following stem from a MOOC designed to meet the challenges of an extensive education reform requiring that all primary and lower-secondary school teachers in Denmark have obtained formal qualifications within the subjects they teach by 2020. This means that more than 10,000 teachers, who have for many years taught a course without formal qualifications, need professional development, and Danish municipalities have asked for new training concepts that are scalable, flexible as to the teachers' work situations, take into account that the teachers already possess certain professional skills, and at the same time are resource-efficient compared to the expenses and the time teachers must spend to be formally qualified.

To meet this challenge, University College Zealand (UCZ) has designed and produced a MOOC (Massive Open Online Course) which is offered to a number of municipalities to solve the training task described above. MOOCs are a relatively new educational format introduced in 2008 by George Siemens and Stephen Downes at the University of Manitoba through a course on connectivism (Nkuyubwatsi 2013). In their MOOC a regular course was opened up for participants outside the university with no fee or any prerequisites required. As a result of this, the course grew from 25 students to 2200 students. The massiveness of the course should not, however, be understood solely in terms of the amount of students enrolled, but in the sense that the MOOC can continue to scale without losing its essential shape (Downes 2014). MOOCs have since been adopted and adapted by numerous other universities and to lower levels of education too. Some MOOCs are less open, but the design principle described above of scalability or courses being massive by design (Downes 2014), is still a defining characteristic of MOOCs.

The promise of providing resource-efficient courses for a scalable amount of teachers with no formal qualifications is what prompted UCZ to choose MOOCs as the most suitable design solution. In addition to this, a team of researchers at UCZ have closely followed the development and implementation of the MOOC. In the following, a number of significant findings are discussed to gain insight into the challenges that may arise when designing reform-driven educational formats.

EROSION OF THE DESIGN IDEAS

In the first period of the design process, design ideas were sketched and discussed with the customer (i.e. the municipalities) resulting in a three step study model.

Before accessing the MOOC, the student was to complete a digital self-assessment resulting in two learner profiles, one of knowledge and one of skills. This idea corresponds with the requirement of acknowledging the prior experience of the teachers.

On the basis of the profiles, the student was directed at those specific areas within the subject in the MOOC that specifically addressed the learning outcomes which had a low score in student's the learner profile, thus creating a personalised curriculum for each student. Not only would this serve as way of reducing the student's study time and thereby the cost, but also serve as a means of ensuring a higher degree of relevance for the student.

Lastly, at the end of the course the student was to take a formal exam at the university college to earn a nationally accepted diploma.

As the project progressed additional departments at UCZ as well as external partners were involved in the process; lecturers from the teacher training faculty at UCZ were recruited to produce the content of the subjects in the MOOC, the IT department developed a prototype for the self-assessment tool, and the marketing department started showing an interest in selling the concept to other municipalities. Finally, users from schools in the region were selected to test a prototype of the MOOC.

As illustrated in the Chinese whispers metaphor, the design ideas of the adaptive MOOC weakened when travelling through the hands of lecturers, technicians and marketing people. The format sold turned into a blended format due to the demands of the clients, the content produced did not always match the degree of adaptability present in the initial design as a result of the lecturers not being accustomed to teaching through an adaptive MOOC and the platform could not deliver in terms of interchangeability between self-assessment tools and personalised curriculum for the course participant. Internally in the organisation of UCZ there was a gradual erosion of the design.

A key element in the overall distortion of the design was the repeatable non-negotiable demand from the municipalities of the MOOC being supported by some degree of face to face teaching. Rather than asking for a high level of learning support within the adaptive MOOC design, the clients would not solely depend on an exclusively online format for the teacher training course. Subsequently, the content produced by the lecturers was to a lesser degree seen as independent teaching elements of high quality with no need for further teacher scaffolding. This decrease in ambition became clear when the first user survey emerged.

PERCEIVED REDUCED LEARNING EXPERIENCE

Six months after the official launch of the MOOC, a satisfaction survey in the form of a self-completion questionnaire with close to one hundred participants was conducted. The questions were primarily focused on the students' perceived achievement of their learning outcomes, amount of time required for studying, usefulness of the self-assessment tool and the learning potential of the resources available on the platform. Students were asked to anonymously rank their responses to a number of questions on a ranking scale from 1 to 10 with the option of commenting further on their responses. We would like to discuss three significant findings from the survey, which all relate to the students perceived learning experience. It is important to note that the findings do not cover the actual learning efficiency as no test results have yet been deduced from the course to compare with the perceived learning experience. Also, bearing the distinction of the intended design and the actual delivery in mind what is being assessed here is a particular delivery of the design ideas.

Firstly, a significant number of students ask for more traditional face to face lessons because, as expressed by one student, they would like to interact on a more regular basis with a teacher 'who can advise and guide you'. Secondly, many students express frustration that the MOOC encourages peer to peer feedback rather than teacher feedback, which is rarely given, as pointed out by one student who would like her 'teachers to give feedback on the papers I hand in. As students we are not qualified to do this'. Along the same lines another student argues that 'it simply doesn't work if you don't know whether what you do is correct or incorrect'. Thirdly, a significant number of students find it difficult to navigate in the MOOC due to the massive amount of resources available on the platform, which implies that the intended personalised learning path may not be as personalised and simple as expected. Finally, it should be mentioned that the average satisfaction level with the achieved learning outcome for the respondents as a whole reaches 4.3 on a ranking scale from 1 to 10, and that the learning activity which is rated most successful by the respondents is face to face teaching conducted by a lecturer followed by activities which involve group work with peers.

As the questionnaire only represents a preliminary assessment and is solely based on the participants own experiences, conclusions regarding the actual learning efficiency would prove to be premature. It seems, however, fair to conclude that students enrolled in the MOOC express a reduced learning experience and, consequently, ask for a better learning experience in which teachers and students interact and collaborate.

DESIGN METHODOLOGICAL RECOMMENDATIONS

As a measure to eliminate the challenges described above, we will in the following present the concept of the cross-functional design team and the notion of learning experience as a central value proposition of radical innovations in education. The last recommendation deals with figuring out what to produce, whereas the first relates to the processes of actually producing it. However, it should be noted that the processes of setting and solving design challenges will always be intertwined.

THE CROSS-FUNCTIONAL DESIGN TEAM

In order to meet the challenge of keeping the core ideas intact from the initial sketching of ideas to the end product we saw from the project that having the same design team was not sufficient to keep the design ideas from eroding. Not having the technical, PR-related and academically relevant competencies present in the core design group itself can still lead to fundamental distortions as the process progress. Campbell presents the ideal solution as a cross-functional implementation team consisting of 5-9 people tightly knit together in a co-located setting enabling real-time collaboration and quick decision making (Campbell 2015). In Sweden successful examples of implementing radical new formats of distance learning in municipalities in the outskirts supports this solution (Hattinger, Hellsten & Snis 2007; Roos & Grepperud 2007). The people designing and engineering the educational innovation are characterised by having multiple functions that help mediate processes between organisations, departments and users. This type of double function positions would be of great benefit in maintaining core ideas throughout a design process. A team member working part time in the technical department and at the teacher training faculty or a split position between the R&D unit and the marketing units would be examples of this.

LEARNING EXPERIENCE AS VALUE PROPOSITION

If we look into the promised payoffs of the teacher training MOOC, we find that they all relate to the notion of efficiency, which is usually considered the most important payoff of technology-driven change in education. In the case of the MOOC, the value propositions thus include affordability (the payoff being courses that minimise training expenses because the curriculum is personalised and takes into account the teachers' prior knowledge and skills), scalability (the payoff being an open access course with unlimited participation) and certification (the payoff being the fact that graduates receive a nationally accepted certificate).

However, the findings presented above clearly indicate that what the students ask for, is a payoff in terms of a positive learning experience. In fact, it seems that we have traded the qualities of a good learning experience for efficiency-related benefits like access, scalability, convenience and affordability. The argument that we would like to put forward here is that a poor learning experience is a non-forgivable attribute, that is, the value proposition of technology-driven change in education should not be reduced to efficiency and economy, but must always include the promised value proposition of a better learning experience and the payoff should be a positive learning experience. If we miss this, we have missed the whole point of education.

CONCLUSION

The challenges of maintaining the core design idea and a positive learning experience as the main value proposition when designing large-scale educational innovations is both a complex and challenging task.

The findings presented in this article support the theory that core design ideas can easily erode as they travel from one department to the next. Furthermore, the empirical findings clearly indicate that prioritising efficiency-related payoffs rather than payoffs focused on positive learning experiences, results in an unsatisfactory learning experience for the students. Benefits such as the affordability and scalability of MOOCs are attractive value propositions, but if design-based research does not prioritise focusing on creating better learning experiences in new education formats such as MOOCs, we might as well not design education at all.

In order to ensure high quality solutions when entering new grounds within the field of online education, it is just as crucial to invest in the design of the design process as in the design of the product or service itself, and we believe that further research within this area would prove beneficial to the design-based research community as a whole.

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Quantitative Literacy Practices in Civil Engineering Study: Designs for Teaching and Learning

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Higher education needs to produce increasing numbers of good quality graduates. Included herein is the need for graduates that can engage in high level quantitative literacy practices, which requires designs for learning that understand how texts are constructed through language, images and mathematical notation, which together form the meaning-making repertoire of quantitative literacy. This paper applies a framework for quantitative literacy events in the analysis of a particular graphical procedure used during undergraduate civil engineering courses throughout South Africa. The framework draws on the New Literacies Studies' view of literacy as social practice and examines the specific practices that students need to engage with during individual quantitative literacy events. Application of the framework demonstrates that such graphical procedures constitute quantitative literacy events in which students engage in various quantitative practices, the implications of which inform designs for learning in civil engineering in several key respects.

Keywords: quantitative literacy; higher education studies; multimodal social semiotics; new literacy studies; engineering education

INTRODUCTION: QUANTITATIVE LITERACY AND HIGHER EDUCATION IN SOUTH AFRICA

Higher education needs to produce increasing numbers of good quality graduates, but South African higher education's graduate output rate is low and the drop-out rate is high (Council on Higher Education 2013: 15). The South African school system is characterized by significant inequalities and does not adequately prepare many students for higher education. It has been pointed out that "the educational factor to which poor performance is perhaps most commonly ascribed across the higher education sector is student underpreparedness for standard undergraduate programmes" (Scott, Yeld & Hendry, 2007: 42). This underpreparedness arises not only from content knowledge in the various school subjects that may not have been adequately taught and learned, but even more crucially from difficulties in the area of academic literacies. McKenna (2009: 8) argues that the real key to whether students will succeed is related to the literacy practices they bring with them to the University from the school and home environments, and the extent to which these are related to the literacy practices of the chosen discipline.

Quantitative literacy is an aspect of academic literacies in which students experience particular difficulties. This can be seen in results from the South African National Benchmark Tests (NBTs) Project. For example, in 2014, 76 693 candidates wrote the NBT quantitative literacy test as prospective applicants to higher education in 2015. In this case only 11% of the candidates were classified as 'Proficient' in quantitative literacy and the remaining 89% of candidates were expected to experience academic challenges due to their low levels of proficiency (Centre for Educational Testing for Access and Placement, 2015: 26). The notion of 'underpreparedness' often implies deficiency in the students only and does not recognise that higher education institutions themselves are underprepared to meet the needs of the students that they admit (Boughey, 2009: 4). However, university teaching and learning needs to take into account the strengths and weaknesses of the students and make changes to the curriculum to address the "articulation gap" (Scott, Yeld & Hendry, 2007: 42) between the demands of curricula and the level of many students' quantitative (and other) literacies. Furthermore, Selander (2008) argues that formal learning sites have generally struggled to get to grips with the possibilities and challenges of the new information structure that has resulted from the rise of digital communication and information technologies. In order to design a more responsive curriculum, lecturers and curriculum developers in higher education need information about the capabilities of students.

In this paper, we apply a quantitative literacy framework initially developed as part of the NBT project (Frith & Prince, 2006: 28), but later adapted for more general application (Frith & Prince, 2009: 89). The framework is used to explicate the quantitative literacy practices associated with a quantitative literacy event in civil engineering. The importance of quantitative literacy for higher education in general and engineering in particular is widely recognised (see, for example, Steen, 2004), and there is also an increasing awareness that many academic disciplines make complex quantitative demands that are often very different from those that are the focus of traditional mathematics courses.

THEORY: A FRAMEWORK FOR UNDERSTANDING QUANTITATIVE LITERACY

The nature and definition of quantitative literacy are actively debated, particularly in Australia and England (where it is often called 'numeracy') and in the United States (where it is most often called 'quantitative literacy'). This debate concerns itself not only with the definition of the concept, but also with its relationship to mathematics itself. Hughes-Hallet (2001: 94) expresses the distinction between quantitative literacy and mathematics as follows: “Mathematics focuses on climbing the ladder of abstraction while quantitative literacy clings to context... Mathematics is about general principles that can be applied in a range of contexts; quantitative literacy is about seeing every context through a quantitative lens”.

In this paper, we adopt a designs for learning approach that ties the social semiotic concern with sign-making practice to the institutional framing for learning activities (Selander, 2008). We identify quantitative literacy as a social practice in which people engage in formal and informal learning activities so as to identify some kind of problem and arrive at some kind of solution by using and transforming, in this case, quantitative information (Selander, 2008). Street and Baker have written a number of articles (Street, 2005; Street & Baker, 2006) in which they develop the idea of quantitative literacy as social practice. Johnston (2007) and Yasukawa (2007) also conceptualise quantitative literacy as social practice, and focus on an individual’s critical awareness. Within such a view, quantitative literacy is ‘a critical awareness that builds bridges between mathematics and the real world’ (Johnston, 2007: 54). This definition arises from work in basic adult education as well as with students in higher education. It is desirable for students to develop the ability to ask critical questions about the use of data and mathematics, questions pertaining to the appropriateness and limits of the mathematical models applied to real situations and questions that ask in whose interest these mathematical models work (Johnston, 2007: 53).

The framework deployed in this paper is presented in Table 1. As can be seen, it divides quantitative literacy into six broad competences. The definition of quantitative literacy that underpins this framework is as follows:

> Quantitative literacy is the ability to manage situations or solve problems in practice, and involves responding to quantitative (mathematical and statistical) information that may be presented verbally, graphically, in tabular or symbolic form; it requires the activation of a range of enabling knowledge, behaviours and processes and it can be observed when it is expressed in the form of a communication, in written, oral or visual mode.
>
> (Frith & Prince, 2006: 30)

Table 1: Framework for analysing the quantitative literacy demands of higher education (Frith & Prince, 2009: 89)

Competence	
1 Knowing the conventions	1.1 Understanding verbal representations of quantitative concepts
	1.2 Understanding symbolic representations of quantitative concepts
	1.3 Understanding visual representations of quantitative concepts
2 Identifying and distinguishing	2.1 Identifying connections and distinctions between different representations of quantitative concepts
	2.2 Identifying the mathematics to be done and strategies to do it
	2.3 Identifying relevant and irrelevant information in representations
3 Deriving meaning	3.1 Making meaning from representations
4 Doing mathematics	4.1 Using mathematical methods.
5 Higher order thinking	5.1 Synthesising
	5.2 Logical Reasoning
	5.3 Conjecturing
	5.4 Interpreting and reflecting or evaluating
6 Expressing quantitative concepts	6.1 Representing quantitative information using appropriate representational conventions
	6.2 Describing quantitative ideas and relationships using appropriate language

In higher education, there are different quantitative literacy practices associated with different academic disciplines. These practices are often tacit (Collins, 2001) and are embedded within curricula that often remain implicit, regardless of which students in those disciplines need to become competent practitioners. Yet, these practices involve the transformation of signs and the formation of new signs and, in so doing, act as traces of learning and support the development of new capabilities (Selander, 2008). In Prince and Archer (2014), the notion of academic voice is used to facilitate the awareness and analysis of multimodal texts in order to "enable student access to the invisible norms and conventions of quantitative disciplines." The quantitative literacy framework presented in Table 1 is designed to work across all higher education disciplines and contexts and aims to make visible the implicit quantitative demands of higher education.

A QUANTITATIVE LITERACY EVENT IN UNDERGRADUATE CIVIL ENGINEERING STUDY

The work of the civil engineer can be conceived of as a series of meaningful re-presentations. This series begins with a systematized representation of a real world phenomenon, object or process, which usually entails a process of data gathering. Thereafter, the gathered data is manipulated often through further representations or through manipulation of the initial representation, which culminates in a plan for a re-designed phenomenon, object or process. The manipulation of the gathered data and its attendant representations occurs through any number, possibly hundreds, of interim representations and draws on multiple sets of data. In combination, these interim representations constitute what can be termed engineering design work. The final step is construction, where the designed plan is put into effect back in the real world context. Learning to become a civil engineer is thus a process "of interpretation and identity construction [in which learning is] an activity where signs in different media (information) are elaborated, and where the forming of new signs in new media (re-configuration and re-contextualisation) takes place" (Selander, 2008: 12). This re-configuration and re-contextualisation of meaning occurs in numerous forms which have in common two important aspects. First, each re-presentation takes place through the deployment of meaning-making practices. Because of the nature of engineering, these practices often involve quantitative literacy. Second, the deployment of these meaning-making practices is interest-laden. That is to say, each re-presentation is partial in the sense that it foregrounds aspects of the real world that are of particular interest to the civil engineering practitioner, and backgrounds aspects of secondary or limited significance.

In this paper, we examine one such civil engineering practice, and locate it within the transformation of meanings described above. The aim of this analysis is to apply the quantitative literacy framework described to a specific engineering practice so as to explicate the quantitative literacy demands involved in the teaching and learning thereof. In so doing, we deploy a case study approach so as to illustrate the kinds of quantitative literacy demands associated with such practices. The purpose of such a case study approach is to illustrate the application of the framework while acknowledging, of course, that the manifestation of this application will differ from one case to the next (Stake, 2005). In this particular case, civil engineering students use a graphical procedure to depict information and then transform this information so as to construct new knowledge about the physical environment. The graphical depiction is underpinned by a calculation mechanism, that is, it deploys the spatial resources of graphics in service of undertaking and completing calculation tasks.

In this civil engineering practice, the strength parameters of a soil are determined by applying Mohr's circle to the results of a triaxial test undertaken on a sample of that soil. The triaxial test is used to determine the mechanical properties of a soil. The results of the test can be interpreted through the graphical procedure developed by Christian Mohr in the late 19th century, Mohr's circle, which relates the geometric properties of a circle to the shear strength of soils. The procedure and calculations involved in conducting a triaxial test are beyond the scope of this paper, but it suffices to say that the outcome of these procedures and calculations is the major and minor principal stresses at which each of three samples of a soil fail (dependent on different loading conditions). The test is thus an exercise in data gathering, the results of which are represented by being plotted to scale on an axis. The difference between the two stresses are taken to represent the diameter of a circle. Once the three circles are drawn, a tangent to all three circles is found, and the geometric properties of this line (its intercept with the y-axis and its gradient) are determined. These properties are, respectively, the cohesion and angle of resistance of the soil which, in turn, are the two parameters required to calculate a soil's shear strength. An instance of this practice, as produced by a civil engineering diploma student, can be found as Figure 1.

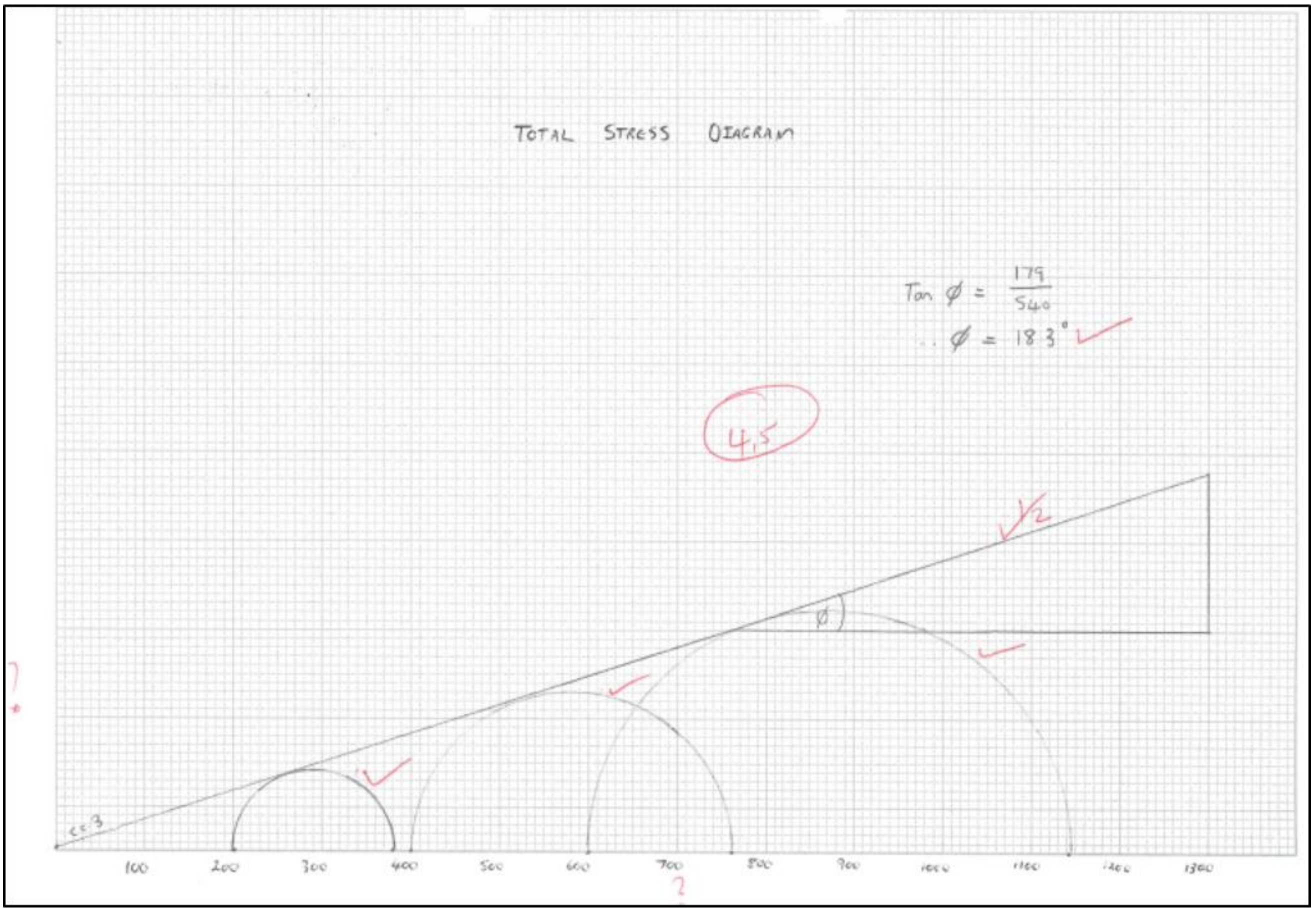

Figure 1: Student’s determination of stress parameters of a soil based on triaxial test results

QUANTITATIVE LITERACY DEMAND IN CIVIL ENGINEERING PRACTICES

The first competence included in the quantitative literacy framework involves knowing the conventions for the visual and verbal representation of quantitative concepts. Successful undertaking of the Mohr circle analysis is heavily reliant on such competence. It requires, for example, that students understand the conventions for symbolizing unknown angles (the Greek letter, ϕ). It also depends on knowledge of the conventions of the Cartesian plane, where two axes are used to represent the relations between two variables: in the case of Mohr’s circle, the x-axis represents the principal stresses and the y-axis the cohesion of the soil, both of which are stresses and both are measured in kPa (kiloPascals), though the student does not indicate this in the Figure.

The competence of identifying and distinguishing is also evident in this civil engineering practice. In particular, included in this quantitative competence is the need to be able to identify the mathematics to be done and strategies for doing it. In this regard, the practice represented in Figure 1 requires students to calculate a scale that is appropriate to the dimensions of that which is being represented, taking into account the need for accuracy and the limitation of the size of the paper available. The mathematical problem at stake is, put simply, akin to: given I have a paper sized at X centimetres and given I need to represent an object which has a largest dimension of Y kiloPascals, what scale should I use to represent this object? In the example of Mohr's circle, it is the results of the triaxial test that need to be represented to scale. Here, students' knowledge of ratio and proportion is indirectly tested. Students are also expected to identify that the use of the trigonometric function TAN can be used to calculate the unknown angle, ϕ. The student must identify that an equation involving TAN ϕ must be formulated, using the dimensions of any right-angled triangle including angle ϕ. Of course, the unknown angle can be measured using a protractor, but the decision to use the trigonometric function is informed by the need for a greater degree of specificity and exactness that is not afforded by the use of a protractor.

A third quantitative competence comprises deriving meaning from representations. Figure 1 illustrates this competence well in that it requires the students to use their own visual judgment to construct a line that is tangential to the three Mohr's circles, to use the axes to determine the lengths of the lines of the right-angled triangle that are adjacent and opposite to the unknown angle ϕ so that these values can be placed into the TAN ϕ equation, and to determine the value of C, using the y-axis. Indeed, this competence is of utmost importance, given that the goal of this representation is not to simply represent pre-existent data, but to use graphical procedures to derive new knowledge about the physical world, that is, to determine the strength of a particular soil so as to ascertain its suitability for a particular construction application.

The fourth quantitative competence included in the quantitative literacy framework involves doing mathematics. This has already largely been addressed. In the example, students must use trigonometric relations to model the situation algebraically in the form of the TAN ϕ equation so as to solve for ϕ. There are also instances where students must undertake basic operations such as subtraction. It is thus evident that this practice involves using the required mathematical methods to undertake meaning-making work.

The penultimate quantitative competence demanded of students in higher education is higher-order thinking, which comprises synthesis, reasoning, conjecture, and interpretation, reflection and evaluation. This is a crucial component of the meaning-making process, but largely takes place outside of the graphical procedure described in this paper. In the case of Mohr's circle, students demonstrate these higher-order thinking skills when they synthesis the results of the procedure with other data and reason out the overall viability of the use of the soil for a particular construction application. This higher order thinking is hinted at in the context of the graphical procedures, but does not take place therein. For example, the fact that the student whose work is given in Figure 1 does not include axis labels indicates that this student may be too focused on determining values for C and ϕ, without due consideration to both the pedagogical context for the event, but also the real-word context, which relates these circles and lines to the kilopascals of stress that soils can bear (which the axis label would indicate). Higher order thinking is the means by which the meaning-making transformations of civil engineering activity, described above, move forward. As students move from one interim representation to another, they exercise reasoning, evaluation and synthesis in determining how to move forward and which representations to deploy so as to ultimately arrive at a workable design for a civil engineering service or structure.

A final quantitative literacy demand is expressing quantitative concepts. This has largely been addressed already. It requires that students use the verbal, symbolic, graphic and diagrammatic meaning-making repertoire so as to make meaning for others. This ranges from tasks as simple as using a curved line and greek symbol to indicate an unknown angle (see Figure 1), to providing axis labels that assist viewers in understanding the context for a graphical representation (not done in Figure 1), to having the mathematical, statistical and quantitative vocabulary with which to discuss diameters, line segments, samples and so on, and to being able to use representations in subsequent texts (spoken, written or visual) to explain the reasoning that has informed one's own design and analysis work.

DISCUSSION AND CONCLUSIONS: QUANTITATIVE LITERACY AND DESIGN FOR LEARNING

Using the six key competencies in the quantitative literacy framework to do an analysis of the quantitative literacy demands of, in this case, civil engineering practices allows for an understanding of points of disconnection or confusion in the texts that students produce which, in turn, can inform the design of pedagogy that seeks to minimize these points of disconnection. This is evident in the data reported upon here in four key respects, each of which is discussed below.

First, quantitative literacy events such as that described here often serve to mathematize space, that is, they use the spatial resources of graphics to undertake calculative tasks. This is particularly common within civil engineering practices. The mathematisation of spatial resources introduces a level of semiotic complexity that has not yet been well understood in the literature, or in pedagogical practice. The potential confusions that it may introduce are evident in Figure 1 where the student fails to label the axes of the graphical construction because of a focus on the QL event as an attempt to calculate the stress parameters of the soil and not as an attempt to produce a Cartesian graphic. In so doing, the student does not recognize the 'semiotic economy' of the graphic, that is, the social norms for organizing information in routine and recognizable ways (Selander, 2008). The fact that the assessor notes the absence of axis labels, through the use of question marks, and awards marks (or not, as is the case here) for these axis labels, indicates that, from the perspective of the assessor, the exercise is as important as a graphical representation as it is as a calculative task. That is to say, the representation of the procedure in accordance with the conventions of such graphical procedures, the form, is as important as the content of the answer. It is evident that further research needs to be undertaken into the mathematisation of space in graphical procedures such as these.

Second, the data reported upon here problematizes notions of context and abstraction. Hughes-Hallet (2001: 94) argues that "mathematics focuses on climbing the ladder of abstraction while quantitative literacy clings to context... Mathematics is about general principles that can be applied in a range of contexts; quantitative literacy is about seeing every context through a quantitative lens". The absence of axis labels is relevant again here. Axis labels provide a semiotic bridge between the abstracted nature of the Cartesian plane, and the real world context of the variables it represents. When these are not provided, they remove one of the key contextual indicators within such texts, making it difficult to tie the meanings generated to specific real life contexts. In this context, the axis labels are a generic convention associated with the use of the Cartesian plane. Their non-use violates a social agreement aimed at lessening meaning-making effort for both the reader and author (Selander, 2008).

Third, the example provided here also demonstrates the extent to which it is possible that the use of tools and technologies, however mundane, impacts upon text-making. Whether texts are produced using computer software applications, pens, pencils or, as the case may be in this example, compass, protractor and ruler, their production relies upon knowledge of these tools, and how to use them to achieve the representational requirements of the event. In these events, students do not express their understanding of quantitative concepts using language: they do so using the tools present in their stationery sets. These tools and technologies coordinate the ways in which individuals (can) construct knowledge (O'Halloran, 2007): as Gee (2000: 192) argues, "you can't just do anything you want with a hammer... and the hammer has certain affordances that make it easier to use in some ways than others". In our particular example, it can be seen that the student obtains c = 3 (in small print in the bottom left of the Figure; c represents the cohesion of the soil). However, the correct answer which was supposed to be obtained is c = 0. When one examines the student's answer to the question, it is evident that the participant understands the procedure involved in using the Mohr Circle to interpret triaxial test results and determine the total stress parameters of the soil. However, the student nonetheless obtains an incorrect answer due to the inaccuracies introduced through inexperienced use of the procedure and of the tools involved in its undertaking. The evidence of this is subtle: the line, which is meant to be a tangent to all three circles, does not actually touch the middle circle and acts almost as an arc to the largest circle, for example.

Tool usage, and quantitative literacy demand, are also built into the decision to use graph paper, as opposed to plain paper. Graph paper is a tool that is utilized in order to assist with accurate scaling in the production and/or reading/viewing of scaled diagrams. But, this is not self-evident: in fact, anecdotal evidence suggests that many students have no experience using graph paper and do not understand how it works. The use of graph paper is intricately tied to the QL competence of identifying the mathematics required and identifying strategies for doing it. As discussed above, choosing an appropriate scale for the graphic is one of the tasks facing the student. In this respect, strategic use of the graph paper can assist in the mathematics involved herein, and poor use can complicate the mathematics involved. This is because the nature of graph paper is such that it makes sense to work in a scale that is easily divisible by 2, 5 and 10, as the paper is made up of 2mmx2mm blocks grouped into squares of size 2cmx2cm (or 10 blocks x 10 blocks). In Figure 2, the student has strategically opted to use a scale where 2cm represents 100 KPa (Kilopascals, a unit for pressure). This significantly lessens the mathematical effort required in using trigonometric identities to calculate ϕ, as compared to a scale where 2cm represents 80 or 90 KPa, where each 2mm block would then represent 8 or 9 KPa and each mm represents 4 or 4.5 KPa. Although not evident in this example, such uninformed use of graph paper is common amongst students. It is thus evident that use of tools and technologies is perhaps a competence that is lacking from the QL framework used here and consideration could be given to adding this dimension. The deployment of tools and technologies in service of representing quantitative information is crucial to the meaning-making success of students in civil engineering, specifically, and higher education more generally, and curricula may do well to take greater cognizance of the fact the tools associated with mathematics, science and engineering have allowed their users to understand, control and manipulate the physical landscape (O'Halloran, 2009).

Finally, discussion of how graphical procedures such as this work, not only draws greater attention to the QL demands embedded therein, but also facilitates enhanced critical questioning on the part of students. As Johnston (2007: 54) argues, such critical questioning establishes a bridge between the mathematisation undertaken within the event, and the real world context for which it has implications. Students need to not only understand how such graphical procedures work, but also how they arise, and how they serve the particular interests of the civil engineering community. In so doing, their learning becomes "a complex process of transformations of signs, by way of modes and media in different institutional settings" (Selander, 2008: 10). For example, the use of three samples in the triaxial test serves the interest of the discipline of civil engineering in that it provides for accuracy and reduces the chance of error. This can feed back into a deeper understanding of the procedure itself. A discipline can only progress if its practitioners routinely question the appropriateness and possible improvement of the mathematical models and quantitative techniques it uses to achieve its aims. Indeed, as Selander (2008) argues, the ability to search, select, critically evaluate and present information are crucial incidents in the design of learning. In civil engineering, where the quantitative literacy practices are often both implicit and disciplinary experts are unaware of the demands made on novices, it is of fundamental importance to explicate these practices to both the expert and novice and to design safe learning spaces where the imparting and acquisition of quantitative literacy practices can be facilitated.

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IS THERE ANYBODY IN HERE?

– Present-Absence, positions and relations in MOOCs

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Abstract

This paper discusses MOOCs as a special format for distance teaching and learning. A grounded theory study of teachers and students in a Teacher Training Programme MOOC and their experiences with teaching and learning in MOOCs is presented. We argue for a special focus on roles and relations, which in the MOOC format is challenged in new ways since the presence of the teacher – when the teacher has left the platform – is a certain kind of presence. Our findings show that the teacher still plays a major role in a MOOC, and the relationship between student and teacher is important. Our work also shows a need for students to be part of a learning environment, and their needs for proper response and correction are articulated as highly important. The concept of Present-Absence which derives from the empirical study is proposed to gain further understanding of teachers' representation in MOOCs.

Keywords: *MOOCs, teacher-student relations, teacher education, online education, presence, telepresence.*

INTRODUCTION

This paper deals with the challenges teachers and students face when designing for and teaching and learning in MOOCs. At the beginning of this paper, we present a short introduction to the field of MOOCs. Next we present a study based on the principles of grounded theory in which we have interviewed teachers and students in MOOCs. This leads us to a presentation of four important empirical findings derived from the study of positions and relations for teachers and students in MOOCs. Our studies reveal that certain specific circumstances are of great importance: *the teacher still plays a pivotal role in the MOOC; the relationship between teacher and student is seen* *as very important; the sense of being part of a learning environment is substantial but also one of the greatest challenges in MOOC-teaching; and the professional response and correction from teachers is seen as significant.* From our empirical analysis, we then propose a concept of *Present-Absence*, which can bring into focus the ways a teacher can be represented in MOOCs and also shines a spotlight on the teacher being present even if she has "left the platform", as one of our respondents pointed out. Finally, we end the paper highlighting our perspective on further research needed regarding relations and positions between teachers and students in MOOCs.

THE FIELD OF MOOCS – A CONCISE OVERVIEW

MOOCs are a relatively new phenomenon in the history of distance learning and teaching. In 2013, *The Horizon Report* identified the MOOCs development as "the most important trend in education" (Horizon Shortlist Report 2013). According to Wikipedia, a MOOC is simply an "online course aimed at unlimited participation and open access via the web" (article on Massive Open Online Courses). MOOCs are new forms of distance learning, and there is ongoing discussion of whether they are "expanded forms of online higher education", as proposed by Evans & Myrick (2015), or the newest fad in online distance learning and soon to be written off in favour of the next educational quick fix. We will argue that they are more than just that.

Adding up experiences and research in a coherent form was already possible more than 25 years ago (Moore 1989). Distance learning is in no way new, and it contains many challenges as well as opportunities. Some of these are general for a variety of concepts, and some of them are more specific. As the theoretical discussions in this paper emerged from research in MOOCs, we have decided to focus on this concrete concept of distance learning.

Today, distance learning has grown into a wide area of concepts – MOOCs being just one of them. The MOOC concept originated in 2008 when the first MOOC was introduced, and in the seven years since then, various MOOC-designs have, generally speaking, evolved from two fundamentally different views on MOOCs: the so-called cMOOC, and the xMOOC. The latter was influenced by more traditional e-learning courses in distance learning while the first was born from the theory of Connectivism (Siemens 2005) and emphasizes collaboration and the production of text, video or artefacts in addition to bringing learners together.

George Siemens was one of the people behind one of the first 2008 MOOCs – a cMOOC held at the University of Athabasca titled *Connectivism and Connective Knowledge*. During a presentation at the *MOOCs in Scandinavia* conference in Stockholm, Sweden in June 2015, he stated the difference between cMOOCs and xMOOCs as follows: “In an xMOOC you watch a video – in a cMOOC you make one”. In 2012, Siemens formulated the difference between x and c more thoroughly: “A cMOOC model emphasises creation, creativity, autonomy and social networking learning” in addition to “focus on knowledge creation and generation” whereas the xMOOC model emphasises “a more traditional learning approach through video presentations and short quizzes and testing and focus on knowledge duplication” (Siemens 2012).

In the last five years, however, MOOC-designs have drawn inspiration from both of these basic approaches, and more “blended” formats have appeared combining elements from both camps: “What we are starting to see now is a move away from the cMOOC/xMOOC binary toward recognition of the multiplicity of MOOC designs, purposes, topics and teaching styles” (Bayne & Ross 2013: 22). The MOOC milieu from which our empirical study derives is such a MOOC, drawing on both principles from the x and c as well as adding other dimensions.

Already in listing up these differences, using the broader concept of MOOC becomes unqualified, and it highlights the need for a more precise use of the concept and an understanding of how the MOOC design builders subscribe to various ideas of learning, teaching, participation, content production and collaboration. Furthermore, it becomes clear that the concept of MOOCs cannot be described as merely the newest form of distance learning – there are several weighty arguments against writing off MOOCs as the “newest fad”.

What binds the xMOOC and cMOOC camps together is the notion that both formats have the ability to become a factor in the field of lifelong learning. They have the ability to break the boundaries of more traditional distance learning, which is often closely linked to institutional membership of some sort.

Both types of MOOCs as concepts share the idea of free access and scalability, but when it comes to concepts of learning and teaching and the role of pedagogy in the design of the MOOCs, research has shown vast differences (Rodrigues 2013).

The idea of openness in MOOCs are inspired by thoughts of democracy for all, accessibility and trying to reduce the distance between those who have and those who don't – access to education and formal studies. Also, at least to some degree, both camps can cash in on the idea of open learning resources (OLRs) for all.

That being said, MOOCs, since they are generally influenced by x or c, are not the answer to all questions regarding the problems that distance learning has faced in the last decades. MOOCs offer some answers, but they simultaneously give rise to other problems. Of these problems, we will be addressing the following: How are teachers and students produced in a MOOC? How do they appear for each other, and what can be seen and what cannot? And what can be said of the production of teacher positions and teacher-student relations in MOOCs?

There are good reasons for focusing on teachers in MOOCs: "The role of the teacher in the MOOC has so far been under-examined" (Bayne & Ross 2013: 23). Until recently, most MOOC research has been occupied with the learner perspective (Liyanagunawardena et al. 2013) and to a much lesser degree with institutional threats and opportunities. Bayne & Ross concludes that: "To date, the complexities of teaching on MOOCs have been largely absent from debate, which typically describe only three forms of teacher – the distant 'rock star' or 'academic celebrity' lecturer, the co-participant or facilitator within a network, and the automated processes which serve as proxy tutor and assessor" (Bayne & Ross 2013: 23).

This is of importance since most MOOCs have no access to rock stars or academic celebrities. The likes of George Siemens and David Cormier cannot provide content (and occasionally be present) in all MOOCs all over the world. There is – in light of the work by Bayne & Ross – an urge to discuss what happens when teachers who may have a lot of experience in face-to-face teaching and even some experience with e-learning is asked – or forced – to teach in MOOCs. There is need for research and the development of a language that can encompass what is at stake when teachers move from a platform that has been refined for decades, even centuries, to a new platform where new roles and positions emerge, where new ways of learning, teaching and making feedback become immediate challenges for teachers and students in MOOCs.

In this paper, we propose the use of the concept of *Present-Absence* as a means for understanding some of the challenges regarding teacher-student relations that teachers and students face in MOOCs.

GROUNDED PRINCIPLES – RESEARCH METHODOLOGY

The empirical data informing this article are mainly collected in and about MOOCs produced and offered by University College Zealand running from 2014 until today. This great MOOC investment is based on a societal concern: By 2020, all primary school teachers in Denmark must have certifications in all subjects they teach, meaning that more than 10,000 primary school teachers need to receive additional formal education. MOOCs are seen as a way to meet this demand, and the study presented in this paper draws on the MOOC participant's experiences – teachers as well as students – in these teacher education MOOCs.

At the time of writing this, only a very few students from a pilot project have finished their education and the empirical data therefore primarily include perspectives from 'before/starting' and 'during' MOOC teaching.

The empirical data have been gathered by analysing the following recorded and transcribed sources:

- Observations of workshops with 17 MOOC teachers' collaboration and negotiations on how to design their subject in the MOOC, before the students had access.
- Observations of eight introductory student screening conversations between MOOC teacher and students individually.
- Observations of introductory meetings between MOOC students and MOOC teachers in two different subjects.
- Interviews with groups of students. In all, 11 MOOC students were interviewed.

- Interviews with six MOOC teachers.
- Survey among MOOC students regarding their experiences in the MOOC.

We have not followed students and teachers at the point of engaging in MOOC work or teaching; we have not seen them *in* action. We have, however, gained access to their thoughts on positions, relations, teaching and learning through interviews set up by us and through our participating observations in workshops, meetings and conversations. This has brought to light MOOC students' and teachers' reflections on working in MOOCs, their experiences, feelings and thoughts, which have been of great value to us, allowing us to respond to the research questions presented below while bringing forth some principles concerning importance in MOOC teaching and learning. These are presented as our empirical findings in a later paragraph, but in addition to this, it also enabled the construction of the concept of Presence-Absence.

We collected a data set consisting of articulations and considerations concerning the students' choices and ways of dealing with and in the MOOC, but unfortunately, we did not track their clicks and movements in the MOOC, which might have enabled us to discuss conceivable correlations between e.g. students' concrete actions in the MOOC and their articulated experiences on presence and learning environment. Consequently, we focus on the teachers' and students' experiences and reflections and not on how, say, hours spent in the MOOC increases or weakens the sense of presence.

Analysis from the data has resulted in numerous empirical categories of which the concept of Present-Absence presented and unfolded in this paper is one of several.

The study is carried out using the principles proposed in grounded theory (Charmaz 2006, Glaser 1998) combined with relevant literature on MOOCs and teacher roles. Grounded theory is a systematic way of collecting and analysing data in the aim of constructing theories derived or "grounded" in the empirical data. In other words, for a theory to be grounded means that it has to have its origin in data. Furthermore, provided that data is collected and treated in a proper way (using the guidelines provided by grounded theory), it is possible to say something about a particular part of everyday reality or a specific domain. The things being said are believed to have a certain sustainability and durability. This work, however, is ongoing and never ends: "Theory building … is an ever-developing entity, not a perfected product" (Glaser & Strauss 1967/2008: 32). Working with data in a grounded way, trying to create theories or concepts, means that categories emerge from the material (Glaser 1994). This is a way of organizing the data. The term Present-Absence has not been uttered by any of the participants in the study but is a label coined by us to create a frame around the many statements being made by the MOOC teachers and students about their feelings about teaching and studying within a MOOC, as will be unfolded in the next paragraph.

Being faithful to grounded theory, we started the study with two open research questions: What is important in teaching and learning in MOOCs from students' and teachers' perspectives; and what is gained and lost in MOOC education?

These questions build on literature concerning online distance learning as online distance learning in educational research often is understood as the state of being "absent from the institutional space" (Raddon, 2006:161). However, we find this understanding problematic, because it draws attention away from what is, toward what is not (Ross et. al., 2013). In the physical classroom, the identity and visual appearance of the teacher plays a crucial role in the interactions between the participants (Kannen, 2012), but although the human body in a MOOC is not always as visible, the identity and the role of the teacher is as multifaceted and – maybe even more – complex compared to in the physical classroom (Ross et al., 2014).

A challenge in all distance learning is, then, how one can appear present when absent or create the sense of a Present-Absence as we call it.

THE TEACHER IS (STILL) OF GREAT IMPORTANCE – PRELIMINARY EMPIRICAL FINDINGS

As outlined earlier, this paper builds on a research study in progress. In other words, we are still following teachers as well as students in the MOOCs from UCSJ. Thus, the empirical findings presented here can also be said to be preliminary, even though we see some very legible traces and statements concerning positions, relations and roles of the teacher as well as the students in the MOOCs.

The findings can be summarized into these articulated main points:

The teacher still plays an important role in the MOOC. The students in our MOOCs are very concerned about finding out *who* their teacher is. “What is the teacher’s take on the subject, what is important to him/her?” The MOOC students try to figure out who is behind the screen, and they ask themselves, “what does this person [the teacher] want from me; how can I study in the correct way?” The visibility of the teacher in the MOOC is, then, very important to the students in these MOOCs, and many of the students are in this case satisfied with the videos: “There has obviously been spent a lot of time on making the videos in the MOOC, and the teachers do a great job transmitting the subject”. This, even though they still miss the ‘sense of a traditional teacher’: “I want to have the ’real’ teacher instead of having to use videos and YouTube as a teacher or explanation.”

In addition, the teachers are concerned about their appearance and presence as professional and capable lecturers in the MOOC, and some are concerned about the acknowledgement and evaluation of other professional teachers: “It’s … the subject matter that I’m nervous about: all my colleagues can see ... a mistake can be replayed over and over again”.

Here we have found one of the greatest challenges in MOOC education: The teacher – both from the perspective of the teachers themselves and the students – is not recognisable as a teacher in a traditional sense.

Some teachers mention that they think a lot about what clothes to wear in the recording studio, and so relate to not only being in front of a screen but also to appearing on a screen: “When you don’t have the face-to-face interaction, you are unable to get a feel for the reactions from the students and adjust to their needs at that specific moment.”

This is supported by other teachers: “You have to be so precise in the lectures and videos – in the conventional classroom, you are much more likely to react to response etc.”

The traditional understanding of teacher and student positions and roles are challenged when the teacher does not participate in the MOOC, and the students are considered having a much more independent role.

This leads us to another central finding: **The relationship between teacher and student is seen as very important**. When a certain level of teacher-student relationship is felt so is the sense of a present teacher in the MOOC. This relationship with the students is also very important for the teachers as they focus on how to establish engagement and interaction in the MOOC. They also find it important to ‘know their students’ so that they can find ways to support them in the best way possible, just like they are used to from conventional classroom teaching. Teachers find it difficult to adjust their lectures to accommodate the students’ reactions and understandings in MOOC teaching. One teacher explains her biggest concern: “The thing is that you just don’t know each other.”

The relationship is not only on the mind of the MOOC teachers but also appears as a concern for the MOOC students as an unfulfilled need: “I often miss a teacher that I can ask questions and who can explain central topics like in an ordinary classroom.”

The focus on establishing and being part of a community leads to a third finding: **The sense of being part of a learning environment is important, and that is also one of the greatest challenges in MOOC-teaching**. More teachers are concerned with their ongoing professional modification, differentiation and the discussions known from conventional teaching. They find it difficult to establish the same atmosphere and environment in the MOOC where central and general discussions about, for example, relevance, policy etc. within a given subject can take place. One teacher expressed her feeling that in a traditional classroom, she sense all the students and their interests, motivation and professional skills and adjust the room to all this and thereby develop the learning environment. She felt, however, that this competence was lost in the MOOC environment.

The presence of the other students is also seen as crucial to the students: ”to use each other to sort of dig into the stuff in the MOOC – to be united in the learning process.”

Or as one teacher puts it: “It is very difficult to get the engagement and dynamics from the classroom to show in my recordings or on screen.”

The last finding we’ve chosen to bring up here is that not only is the teacher’s visibility as a person important but also **the professional response and correction from teachers is seen as significant**. As touched upon earlier, the students are very focused on how to meet the expectations of the teacher and the institution as they want correction and they find right-false adjustment central to their learning processes. They have a feeling that the teacher’s response matters the most, and they don’t feel that the same correctness can be achieved by response from the other MOOC students: “It’s not that I don’t think the other students have a lot of competences – it’s just very comforting to get feedback from someone who knows the theoretical parts of the subject as well as the teacher alone does.”

The teachers, too, find this part important, because they consider that in the MOOC it is difficult to know when a student gets something right or when a student continuously gets something wrong and isn’t corrected.

In search for the conventional teacher and teaching in the MOOC

With teachers as well as students, we encounter a consistent conventional understanding of teaching where the teacher is understood as the one knowing and the student as the one who must learn from the more knowledgeable person. One student emphasises this point combined with the importance of a visible and present teacher by saying it is much easier to learn when ”a real human being instructs you”. Another student states: “I find it problematic that I don’t get to ’get taught’ by the teacher in an ordinary way – it is a real challenge for me to not have the option to discuss and learn in a setting with a qualified teacher.”

The students distinguish between teaching as a face to face meeting, for example in a classroom at a campus and studying online. In our study presented here, some of the MOOCs are organised with elements of blended learning, meaning that the teacher and the students meet face to face from time to time.

Students in the MOOCs generally experience the blended parts of the MOOC as very motivational: “I’m very satisfied with the blended process – I personally do not like online teaching standing alone.” In this way some of the students – and teachers – actually overrule the MOOC concept when they find the face to face meeting crucial for commitment and participation. This point is supported by Vignare (2007, p. 38): ”Blended courses integrate online with face-to-face instruction in a planned, pedagogically valuable manner, and do not just combine but trade-off face-to-face time with online activity, or vice versa.”

The teachers will, of course, always base their MOOC teaching on what they do best already, but it is significant that the traditional face-to-face teaching cannot be transferred to a MOOC – the subject must undergo a pedagogical (re)design so that the teaching is suitable and useful in a MOOC. Our empirical data indicate that there’s a need for an ongoing attention to and dialogue about these pedagogical design processes – a finding supported by Milligan & Ringtved (2015) stating that the learning effects are not increased by using blended learning in addition to MOOCs if it is used as a compromise to fix a poor online environment.

Hereby a view into our preliminary findings – primarily with a focus on teacher and student positions and relations. Of course, we have stumbled upon a lot of other challenges according to technique as well as platform and understanding of subject and so on. Several other findings point out challenges within design and subject: How to construct MOOCs with teachers having influence as constructors of learning environments as in a MOOC? How can a certain curriculum be re-designed as a MOOC without the specificities and the tradition of the subject being damaged? That, also, is a crucial design challenge when curriculum is simulated, re-mediated or transformed from ordinary teaching programs to MOOCs.

Not all findings are challenges, however. The students regard the teachers as being committed and qualified, and they also find great use in online learning resources because they can be replayed and accessed at all times. Positive perspectives on MOOC also unfolded through the teacher's work: The freedom one has as a MOOC participant can be beneficial when it comes to choosing certain content in the learning process: "A variety of resources is found in MOOCs, and they have to give the participants the possibility of having the content explained to them in various forms."

With regard to one of our main research questions about what is gained and lost in MOOC education, it is still a bit too early to make actual conclusions since only four students have completed their MOOC education at this time. A comparison with other Teacher Education formats like e-learning and conventional face-to-face education can therefore not yet be made.

A NEW CONCEPT EMERGES: PRESENT-ABSENCE

Coding and analysing the interviews has brought forth a collection of data which we have collected and labelled under the name or concept of Present-Absence. The concept is influenced by the theories of tele-presence that were first proposed by Marvin Minsky in 1980. For Minsky, tele-presence was a question of making an illusion of "being there", using this illusion as a co-operation between technology and human senses. Other researchers have stated that "tele-presence is about projecting human cognition (i.e. intelligence, relevant human senses, responsiveness, dexterity) to a remote operations site without physical human presence." (Thronson, et al., 2012). When talking about education and learning, the concept of presence has always been essential. Students can be said to be "not present in mind but only in body" in the classroom and the actual, physical presence of the teacher in the classroom (at least in primary school) is crucial to the students' learning outcome (Taiwo 2009). From Minsky to Thronson, the view of presence has gone from a mechanical view to a view of experience: How does a person experience a situation as more or less real? This is essential to understanding what is going on in MOOCs, when "the teacher is not here... he has left" as one of the teachers puts it in an interview.

The International Society for Presence Research (which more or less equals tele-presence and presence) have for the last 15 years been occupied with the study of the concept of (tele)presence. On their website, they define presence as "The psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience" (ISPR website). Presence is a state of being, a state of viewing and experiencing the context that the individual engages in. Presence here also pertains to the absence of technology, which is in danger of ruining the experience – as can be seen in video conference teaching, that can be very much alive for the students being physically in the classroom, but the feeling of watching a movie without the possibility to interact is present in the students being online in the session. "It's like watching telly of people being taught something" (Christiansen & Gynther 2013).

For MOOCs, this discussion is essential. The MOOC teacher was in, and has left again. But where are her foot prints? How is she "preserved" in the MOOC when students enter the MOOC wanting to learning something – and when they want to meet a person who is not there at the moment? How is she present when she is absent? In our study, we can see that both students and teachers are occupied with the question of the role of the teacher in MOOCs.

Drawing inspiration from ISPR, the concept of Present-Absence in teacher-student relations in MOOCs, where a teacher has developed a MOOC and students attend this MOOC with a specific learning goal, could be defined as follows: "*The psychological state or subjective perception in which a part of or all of a student's perception fails to acknowledge the role of technology in his or her current experience of a learning situation involving a teacher represented digitally in such a way that he or she is recognised and acknowledged as a teacher".*

Research on these matters in MOOCs are very limited (Ross et al. 2013, Ross et al. 2014), and we have been very much on our own in constructing the concept of Present-Absence. For a while we even considered the concept of Absent-Presence, but – and this is also significant and clear in the definition above – the presence *is not* absent. There *is* a presence going on –

however, the question is rather what kind of presence it is, and how it is possible to optimise this feeling of presence.

It is a pedagogical challenge for MOOC teachers to gain experience with principles and methods on how to raise students' experience of teachers' Presents-Absence in MOOCs: It is important to gain knowledge of how MOOC teachers can represent and produce themselves and their positions as teachers in a MOOC in ways that support students' experiences of presence.

WHAT NEXT? FURTHER POINTS OF INTEREST AND RESEARCH

Along with the discussion in this paper and following the line of our findings, several aspects of further research can be pointed out – besides, of course, a further effort into answering the question of what is gained and lost in MOOC education. Teaching in MOOCs calls for further research on how to understand and develop relations and positions in MOOC education. We have located a student need to be part of a learning environment, but this has its difficulties within the MOOC environment, and it leads us to propose that further work is needed on how to set up, maintain and develop such a learning environment within a MOOC. Our empirical material presented here derives from before-MOOC and during-MOOC activities, and it would also be fruitful to look at an after-MOOC perspective on roles and relations in addition to examining more closely the results as well as the experiences for the students who complete the MOOC.

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Recognition of learning: a social semiotic exploration of signs of learning communicated by jewellery design students

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Broadly speaking, this research explores the recognition of signs of learning within practice-based pedagogies. The context of this research sees students submit signs of learning communicated through three-dimensional artefacts, their process of production, and social interaction. This an overview of the findings from my PhD research with the presented data being one example of many possibilities where signs of learning are recognised. The research offers a developed understanding of practice-based assessment practices by critically reflecting on what are recognised as signs of learning.

The implications of this research are relevant not only to jewellery design contexts, but other contexts where students produce artefacts for assessment, presented in person. In recognition-based assessment, texts may be digital, materialised or embodied as the process of assessment recognises signs of learning in any form.

Keywords: Recognition, signs of learning, assessment, conceptual process of development

CONTEXTUALISING THE RESEARCH

The recognition of signs of learning are defined within a social semiotic approach where learning is understood as the communication of ‘change’ through artefacts produced as a result of pedagogical engagement. What is recognised as learning is fundamental within assessment. The notion of recognition is based on perception, in that we can only recognise what we perceive. Therefore, in order to recognise signs of learning, the way in which they are communicated must be understood.

Submissions are analysed for signs of learning within both the three-dimensional end-product and the process of production. The process of production communicates the most change as the artefact is developed over time. The analytical framework includes exploration into the way in which the artefact is used to communicate meaning, the substance which the artefact is produced from and how this influences meaning making, and tools used for the production of the artefact. Signs of learning communicated within the process of production are recognised within the refinement of these three areas of analysis.

The framework also takes into account signs of learning recognised within social interaction instigated by assessment practices. Students present their materialised submissions verbally within a context where social exchange is encouraged. Engagement is recognised as students interact within a particular context which results in a change of their understanding of the content being presented. Signs of learning are recognised within social exchange, embodied interaction and formative feedback.

Signs of learning are explored within the context of a single assessment practice, the group critique, used within jewellery pedagogy. The data is used to explore the communication of signs of learning within the ‘things’ which students produce and submit for assessment purposes. A framework has been designed for the analysis of data which recognises signs of learning in the practice-based discipline of Jewellery Design. Students submit three-dimensional artefacts which include jewellery, prototypes, posters, drawings and the props used for the site of display. Artefacts are recognised as having the potential to communicate meaning and are explored for signs of learning.

A SOCIAL SEMIOTIC APPROACH TO COMMUNICATION

In a social semiotic approach towards communication, meaning is made and communicated within a social context. Meaning is made, it is not arbitrary and insignificant, but rather directed by the choices of the maker based on their interest in the world (Kress 2010:64). Communication is understood from a broad perspective which includes, but is not limited to, sound, image, gesture, writing, two- and three-dimensional forms. Each form of communication has defining features. In order to understand the making of meaning regarding three-dimensional artefacts and social interaction, keys terms must be defined. These include semiotic resources and materiality.

Semiotic resources

All communication makes use of a multiple of semiotic resources to communicate meaning. Materials or actions used for making meaning are ‘always at the same time material, social, and cultural resources’ and referred to as semiotic resources (van Leeuwen 2004:285). Therefore, whether signs of learning are communicated through visual, audible, embodied or tactile means, all signs are made up of semiotic resources. The research focuses on a combination of visual, audible, embodied and tactile semiotic resources. Visual and tactile semiotic resources make up the artifact, which are explored for signs of learning while the audible and embodied semiotic resources are used by students who verbally and physically submit their artefacts for assessment purposes.

Semiotic resources used in three-dimensional artefacts include, but are not limited to, shape, form, colour, texture, mass, light and movement. The semiotic development of artefacts and the choices made regarding semiotic resources are recognised as indicators of signs of learning. The meaning maker changes or develops semiotic resources as a consequence of them having learnt something new (Selander 2008a). The same principle is relevant for audible and embodied semiotic resources.

Each semiotic resource is used based on the maker of meaning and their communication of interest in the world. Semiotic resources are socially, culturally and historically influenced as the maker of meaning chooses based on what they know and who they are. Assessment practices which recognise signs of learning communicated through semiotic resources explore change within the choices made by students. Students are assessed based on their communication of interest and how this develops over time.

Materiality

All forms of communication have a materiality in that they relate to the senses visually, audibly or tactilely (Björkvall 2012:58). A social semiotic approach recognises the shaping of materiality through social action by changes made to semiotic resources. An example of this is seen in the use of sounds which are socially shaped into music.

Materiality has three aspects that influence meaning making namely surface, substance and tools of production (Kress and van Leeuwen 2006:216). The surface of production refers to the ‘surface’ as a platform for communication and how this is used to distribute meaning. Three-dimensional artefacts have a materiality which is physically shaped and formed and, therefore, have a surface which communicates meaning.

The substance of production refers to the materialisation of semiotic resources used in making meaning. Any single or combination of semiotic choices regarding the substance of production affects meaning making. An example of this is considered in the main material that the artefact is produced from, as this affects the options regarding colour, texture, mass, shape and form.

All materiality is developed using the tools of production, even if the tools are ones hands. The tools used for material production are afforded options based on the choice of substance from which the artefact is made (Risatti 2007:15). The relationship between substance and tools of production is interconnected with the producer needing to understand both aspects in order to develop an artefact. An affordance of materiality with regards to three-dimensional artefacts is experienced in the tactile interaction made possible as the body has the potential to interact with the materialised form.

A social semiotic approach focuses on the making of meaning as part of social practice with context forming the basis for the development of different signs. Students produce artefacts to be submitted within assessment practices which are intended to be recognised as signs of learning (Bezemer et al 2012). The pedagogical context directs the communication of signs of learning in that students produce and present artefacts directed by the curriculum.

Recognition of meaning-making: signs of learning, transformative engagement and interest

The concept of ‘recognition’ is understood as making explicit the way in which semiotic resources are understood and used in meaning making. Meaning is made in multiple ways with the process of production and the final product being recognised as communicating signs of learning. Artefacts and social interaction are recognised as communicating student transformative engagement and interest, with these used as indicators of change in meaning-making and, therefore, signs of learning.

Engagement is a key concept in the production and development of artefacts where students transform through active learning scenarios. Submissions reflect semiotic development and change which occurs as a consequence of transformative engagement. All submissions are produced prior to the assessment practice with signs of learning communicating the transformative engagement which students underwent during the process of production.

Signs of learning are recognised within the communication of interest as semiotic choices which are determined by an individual’s view of the world (Selander 2008a:274). The shaping of meaning through material and conceptual choices is directed by the communication of interest as the maker of meaning chooses what meaning to make and how to make it. The curriculum is designed to develop the individual so that they can be the best communicator of their interest. This approach makes assessment less about the lecturer and their subjective choices, and more about the student developing into a designer who understands their surface, substance and tools of communication.

Students choose semiotic resources based, not only on their understanding of the world, but also their perception of what is privileged by the assessment practice. When the curriculum is directed towards privileging the development of communication through the social, cultural, historic and economic contexts of the maker of meaning, then the signs of learning are recognised as being fair and valid.

A FRAMEWORK FOR THE RECOGNITION OF SIGNS OF LEARNING

Data has been captured over a period of a year with it forming part of third year jewellery students' main assessment practices. This research presents data from group critique 2. A description of this type of assessment practice will be given when the data is presented.

A single framework has been developed for the recognition of signs of learning in practice-based pedagogies where three-dimensional artefacts and the process of production are recognised as communicating signs of learning. Data is analysed by questioning how signs of learning are recognised within artefacts, created by students and used for their own communicative purposes. The framework offers detailed definitions with regards to the communicative functions which make up the signs of learning. Each aspect of communication defined within the framework accounts for a possible area where signs of learning may be recognised. Aspects differ for artefacts, the process of production, and social interaction as the materiality and mediums vary. Furthermore, individual aspects are understood as being part of the whole, by collectively making up the artefact.

Aspect of assessment	**Metafunction**	**Realisation of metafunction**	**'Transformative engagement' as sign of learning**	**'Interest' as sign of learning**
Three-dimensional artefacts	Representational metafunction	Purpose	Refinement of artefact to coincide with desired purpose	Directed by prompt, interpreted by the student
		Symbolic signifier	Refinement of design to communicate symbolic signifier	Choice of topic and visual representation
	Interactive metafunction	Value	Aesthetic refined to align with value	Purpose affected by interpretation of value
		Style	Refinement of visual signature	Choice communicated as visual signature
		Site of display	Refinement of presentation and representation	Choice related to contextualisation of artefact
	Textual metafunction	-Cohesion -Spatial arrangement -Shape / Form -Surface texture -Colour -Light -Movement -Mass	**Refinement of:** -Cohesion of textual elements -Spatial arrangement in a single artefact or a collection of artefacts -Shape / form -Surface texture -Colour choices -Effect of light on artefact -Movement within artefact or in site of display -Mass relative to meaning-making	**Choice of:** Textual elements relative to design based on interest
Process of production	Representational metafunction	Conceptual development	Development of concept communicated through material and verbal means	Choice of topic and the interpretation communicated in three-dimensional artefact
	Interactive metafunction	Social exchange	Change in understanding of materiality through peers' submissions	Social interaction based on interest in peers' process of production
		Embodied interaction	Change in understanding through physical interaction with artefacts	Physical interaction with artefact based on interest
		Formative feedback	Change in submission as a result of social interaction	Choice regarding which formative feedback to accept and reject
	Textual metafunction	Surface of production	**Refinement of materiality through:** Surface of production Substance of production Tools of production	**Choice of:** Textual elements relative to production of artefact based on interest

Table 1. Framework for the recognition of signs of learning.

The framework for the recognition of signs of learning makes use of Halliday's metafunctions by applying them to three-dimensional artefacts separately to the process of production, as signs of learning are recognised differently within each aspect. Within each metafunction are detailed functions which relate specifically to the meaning potential of three-dimensional artefacts as product and process. An artefact may be analysed using all three metafunctions or a combination of these, and in a combination of process and product as there are no clear-cut aspects where learning is recognised.

The analytical framework is designed to support the semiotic enquiry into artefacts produced by students for the purpose of assessment. In other words, the framework is not a set of rules but rather a platform which offers a full range of semiotic options relating to the artefact/s being assessed.

The process of production is analysed by exploring the materiality of the artefact based on the surface, substance and tools of production. Signs of learning are recognised within the choices and transformative engagement which students demonstrate within the three aspects of materiality. Change, or a lack of change is analysed for signs of learning with these being recognised through the individuals communication of choice and the refinement of the communication of interest.

Signs of learning are explored within social interaction which occurs within assessment practices which foreground the process of production. Signs of learning are recognised within social exchange, embodied interaction and formative feedback. Each aspect refers to a specific interactive engagement which results in student learning. Signs of learning are communicated through transformative engagement and interest with these being recognised within the ways in which students interact either socially or within the development of materiality.

RECOGNISING SIGNS OF LEARNING IN A JEWELLERY ASSESSMENT PRACTICE

Alternative assessment practices are understood in this paper as innovative methods of getting to know students and recognising learning which occurs within a specific educational context. This is achieved by making use of student interaction and co-participation in an endeavour to create a dialogical interaction between the assessor and students, which results in the development and communication of learning. This research explores one particular use of the group critique as an assessment practice, while acknowledging that valid variations exist. The two assessment practices researched in my PhD, are used widely within applied design pedagogies with variations dependant on the discipline and reason for using the type of assessment (Soep, 2006).

A single submission of a student during a group critique session is analysed to explore signs of learning presented by a student within a socially driven assessment context. The group critique is used within this analysis of the process of production as the assessment practice foregrounds process and formative feedback. The student, Lynda, whose presentation and artefacts are analysed is presenting her concept for her collection of work. The presentation includes visual, material and verbal explanations which are used to explain the notion of 'site of display' which she is working with. The refinement of meaning-making is recognised as signs of learning in the way in which materiality is semiotically developed.

Students are encouraged to present the strongest aspects of their current process for all the group critique sessions. For some, this is concept, whereas for other students, process and potential production is what they present within a group critique. In order to present 'concept', a student would generally use conceptual drawings or photographs of other artefacts which inspire them, in conjunction with a verbal explanation of the concept. To present 'potential' is to showcase prototypes and artefacts which are processed far enough to offer an idea of what they might be like when finished.

Figure 2 demonstrates how students place their artefacts on the table for discussion within this group critique. In the foreground are brass masks; to the left, wooden blocks with jewellery on them, and, to the right, fabric with displayed objects. Each student comes to the group critique prepared with their presentation as the students understand the requirements of the assessment practice. As the year progresses, so does the students social interaction with each other's work. The students' discussions generally focus on materiality and the surface, substance and tools of production.

Both assessment practices used within the jewellery programme utilise a social element to develop learning from feedback. Social interaction is understood as verbal and embodied interaction within a group environment which foregrounds learning from feedback. Each assessment practice has different prompts which define them, and varied participants making the interaction differ depending on the assessment practice and when in the year it occurs.

Figure 8. Lynda's presentation within the group critique.

Lynda, 2013. Poster presentation. Group critique 3.

In Figure 2, Lynda is holding up a double-sided poster which she has made. She also passed around an A4 piece of paper with images on it for each student to examine. The moment being presented as data where signs of learning are explored comes from the third group critique session. Typically, the sessions have students submit artefacts in any form, with the focus being on the process of development regarding the collection of jewellery which each student submitted at the end on the year. The group critique is designed to allow students to present their work in person, which means that they take ownership of what is submitted. Furthermore, students learn from each other as questions are asked regarding the artefacts as they are passed around the room.

Lynda focuses on challenging the concept of what is jewellery and whether the site of display assists in defining the artefact as jewellery. Lynda's exploration is orientated towards the representational metafunction where the refinement of concept is her starting point in the development of a collection of artefacts. Her research explores the boundaries of jewellery where she questions the point at which something is outside of the definition and could no longer be defined as jewellery. Lynda explored this concept by using the site of display as an area of focus. Her research into the topic led her to other jewellers who have also challenged the realm of jewellery through their use of the site of display. Lynda began the session by offering her definition of ‘jewellery’ and the ‘site of display’, where she explained that jewellery is understood only through its relationship with the body. She went on to question whether jewellery was still ‘jewellery’ if it had no relationship with the body.

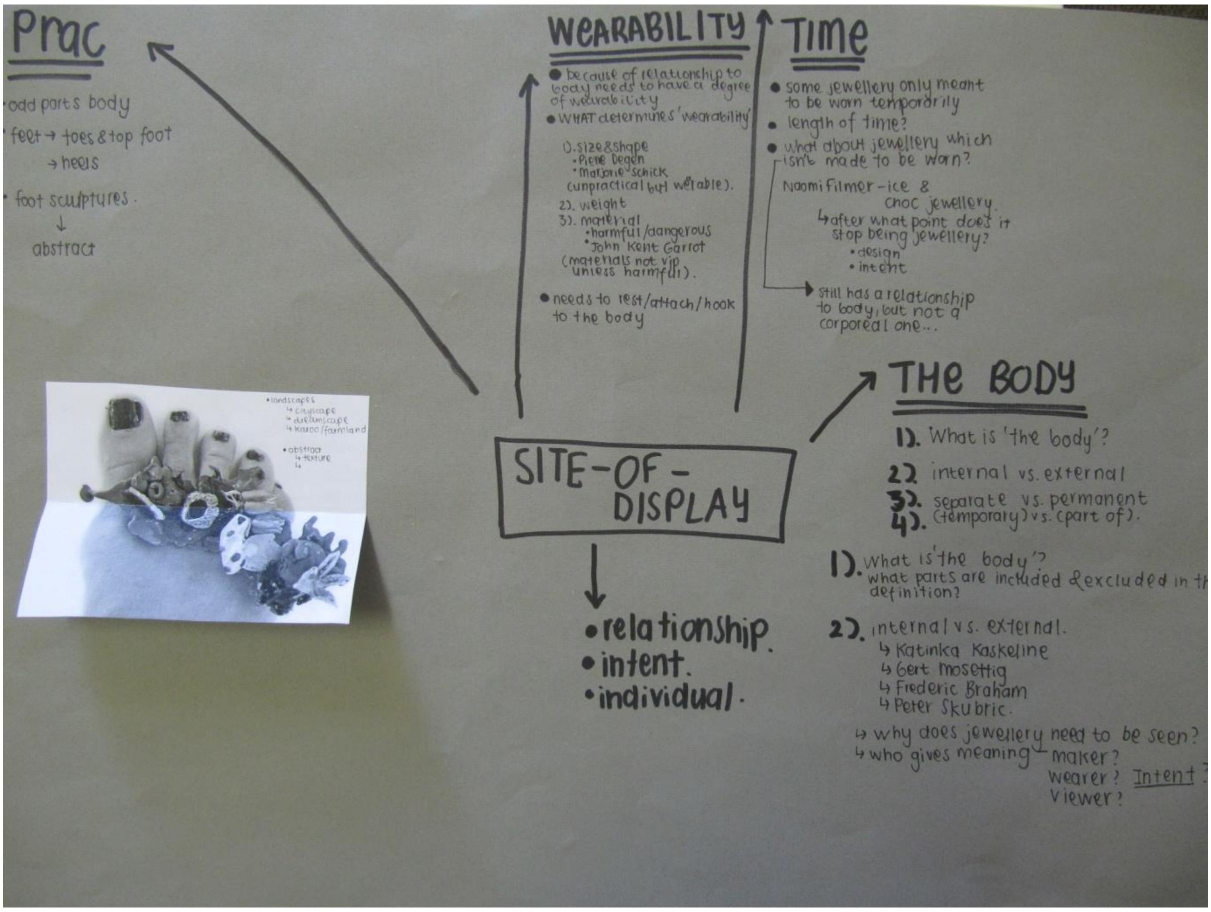

Figure 9. Lynda's mind map.

Lynda, 2013. Poster presenting the concept of ‘site of display’. Group critique 3

The poster as artefact is materialised as a double-sided medium, which Lynda was able to hide behind as she presented her research. Being shy, Lynda literally put the poster between herself and the group. The technique allowed her to present her concept in a social environment with as much confidence as she was able to muster up. The poster as a medium affords the use of writing (Figure 3) which, in this instance, was presented in point form, allowing Lynda to ‘talk’ to the information by using hand gestures to indicate what part of her information she was explaining. The reverse side of the poster has photographs which Lynda used in a similar way by pointing towards information presented within them. She used the poster as a prompt for her to present a cohesive collection of information and visual research.

Both writing and photographs are used to support Lynda's verbal explanation of her work. In Figure 3, writing is presented as a 'mind map' which is understood as a diagram which represents the key aspects that will be used to construct and define the concept. This genre of representing information is used extensively within the applied arts as it is a visual way of communicating condensed ideas. On the reverse side of the poster, minimal writing is used to indicate the theme of groups of photographs used to explain her understanding and research regarding the site of display. Lynda constantly turned the poster around for the viewer to see either side of it, depending on what she was speaking about. The poster assisted her in explaining each aspect relating to the concept.

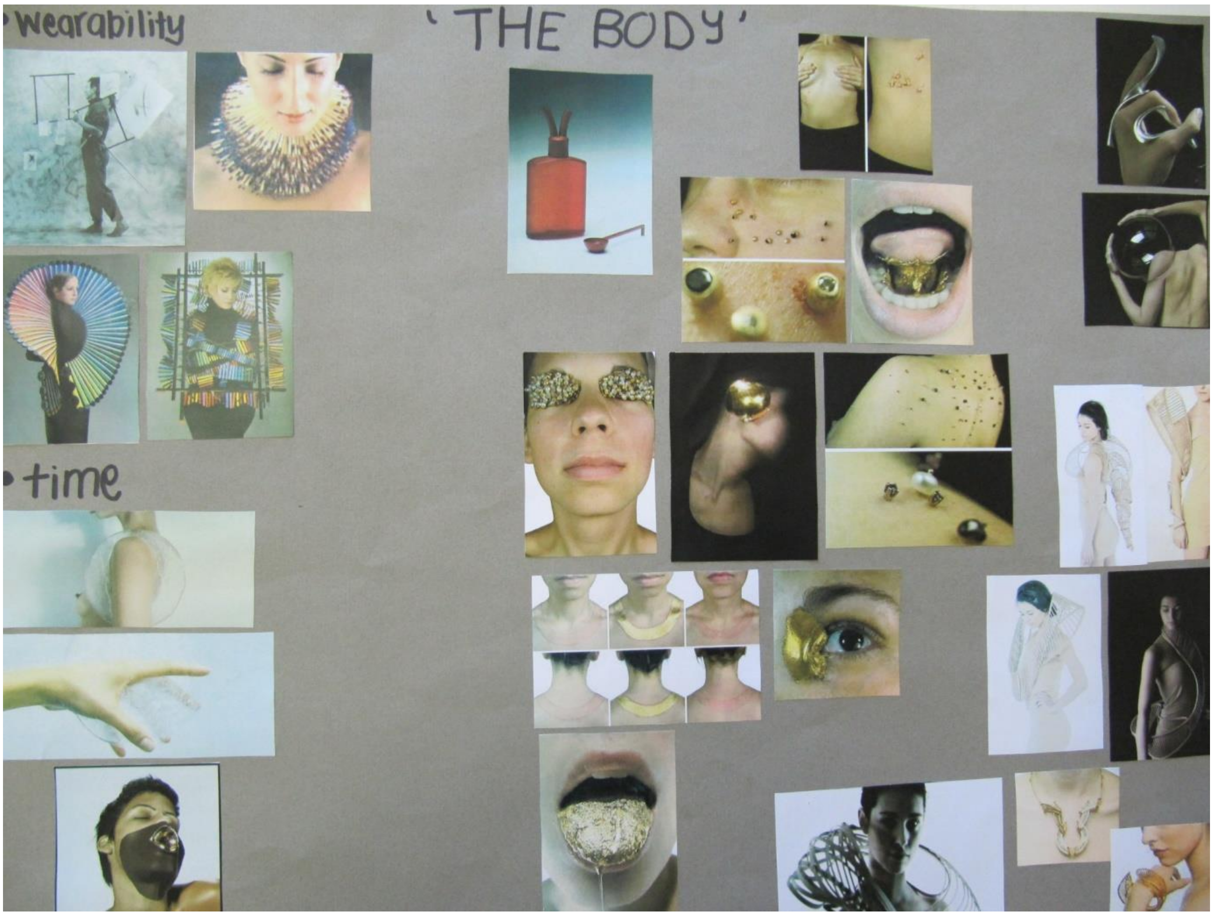

Figure 10. The reverse side of Lynda's poster.

Lynda, 2013. Poster displaying images of jewellery in various sites of display. Group critique 3.

Lynda presented various aspects which related to her concept such as 'wearability'. She explained that the concept made use of various aspects such as mass, size and material usage. The top four images presented on the poster in Figure 4, communicate about wearability. Lynda spoke about the mass of an artefact and the boundary of wearability, and questioned whether an artefact that is too large or too heavy to wear, or produced from un-wearable materials would still be considered 'jewellery'. In her presentation, Lynda went on to discuss her understanding of other aspects such as 'time' and 'the body' which she saw as factors that affect jewellery being jewellery. In the poster, shown in Figure 4, Lynda made use of a combination of photographs and writing to communicate how international jewellers have explored the concept of the 'site of display'. Lynda did not use photographs of her own jewellery to communicate the concept which she was researching as her proposal was to first understand the concept and then produce 'jewellery' which challenged the constraints of what is defined as a legitimate 'site of display' in jewellery.

Each photograph was placed on the poster without writing reference to the jeweller whose work it was. Lynda spoke about each photograph and mentioned the concept behind the jewellery, what the artefact was made from and who produced it. The photographs are visually descriptive as the materials and placement of the site of display is clear. What is not indicated in the image is the conceptual understanding that the artist wanted to communicate through the use of the jewellery. The placement of the artefact within the site of display may conjure up thoughts but each explanation offered by Lynda, clarified and defined what the jeweller's intentions were.

Signs of learning are recognised within the artefacts produced by Lynda, through exploring her use of semiotic resources which included visual, aural and embodied means of communication. Lynda used an extensive collection of photographs to communicate her concept. The photographs included jewellers' work from both Europe and America and showcased various ways in which jewellers have challenged the notion of the site of display. The variety presented within Lynda's poster is recognised as a sign of learning as she has had to research in order to find the information. Lynda furthered her indication of signs of learning through her verbal explanations of the poster, which demonstrated how much she knew and understood about each jeweller and what they had produced.

Within this session, Lynda presented her research and the development of her understanding of the concept. Lynda later developed her collection of jewellery on the strength of the concept.

Signs of learning recognised in social interaction within the group critique

Lynda's 25-minute presentation of her concept to the group was communicated using verbal explanations supported by photographs which she spoke directly to, using her hands as indicators of where the audience should look. When referring to a specific concept such as the placement of jewellery on 'the body', Lynda pointed towards the poster and the images which had 'jewellery' placed on or in the body. According to her, each image reflected how other jewellers have explored this concept. The diverse collection of jewellers and jewellery indicates that Lynda has done extensive research in this area, which is recognised as a sign of learning. Her verbal discussion also illustrated her new understanding that she was not the only jeweller who explored the site of display of jewellery connected to the body.

The presentation sparked dialogue regarding the group's definition of what defines jewellery and therefore the 'site of display', especially when Lynda spoke about the body and what defines a site of display relative to the body. Lynda suggested that jewellery is defined by its relationship to the body. One of her conceptual challenges is regarding the notion of 'body' in relation to jewellery and where this begins and ends. Lynda's research discovered many jewellers who had produced 'jewellery' which specifically resides inside the body. Her two examples included pearls placed under the skin and gemstone dust which was to be ingested. Lynda related to the group that the definition she presented was broader and inclusive of an artistic means of expression, which the group had not previously considered. Another student, Claire, nodded many times in the conversation, indicating that she was in agreement with Lynda regarding the challenge of deciding how the definition of jewellery may change relative to the site of display.

Figure 11. Social interaction between Lynda and the group.

The group, 2013. Group critique 3. Screen shot

A caption of the dialogue between the group is seen in Figure 5. Lynda has the attention of the group as they all face her. At this stage of the social interaction, she has put her poster down and is in discussion with the group. The group presentation encourages the presenter to hear other opinions and to recognise that her notion was not widely accepted. Yasser was the most challenged with the broadness of Lynda's definition and eventually pushed the discussion into conceding that the presentation was Lynda's opinion rather than a universal truth. The lecturer did point out the vast research that Lynda had presented, which showed that her concept of challenging the site of display was reflected in the work of others.

This dialogue is an example of how students learn within the group critique through social interaction. Those students who include themselves in the discussion add to the interaction, with the transformative engagement being as a result of new learning.

Transformative engagement and the communication of interest are evident within the submission as the topic is one which Lynda is drawn towards. In her communication of the concept, she indicated how much she had learnt from researching. These signs of learning are evident in the way in which she referred to various jewellers, what they had done to challenge the concept and the action of pointing to an image which was 'proof' of her research. Transformative engagement took place as Lynda researched and learnt new scenarios regarding jewellers who challenged the concept of jewellery.

IN CONCLUSION

This paper is an aspect of my PhD which explores assessment practices by making explicit the potential of what may be recognised as signs of learning. The conclusion I would like to leave is that signs of learning in practice-based assessment practices do not fall into the confines of 'right and wrong'. The view taken is rather one of how can we offer formative feedback in order for students to better their future submissions. Students who communicate based on their interest in the world are more likely to engage with the process of learning. In order to produce signs of learning, students must engage with the process of production and understand the potential that materiality brings to the ensemble of possible ways of communicating. Lynda has chosen to communicate her conceptual develop through a mind-map and visual research which suits her chosen ways of communicating what she knows and how she perceives the world.

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Learning Design Patterns for Hybrid Synchronous Video-Mediated Learning Environments

By CHARLOTTE LÆRKE WEITZE, PhD fellow, Aalborg University, Copenhagen Campus, Case: VUC Storstrøm, Global Classroom Project, Contact: cw@learning.aau.dk.

This article describes an innovative learning environment where remote and face-to-face full-time general upper secondary adult students jointly participate in the same live classes at VUC Storstrøm, an adult learning centre in Denmark. The teachers developed new learning designs as a part of their daily practices and also participated in a design-based research project exploring new learning designs for this environment (Weitze, 2015). The teachers' traditional learning designs were challenged, and this led to altered pedagogical approaches with less group-work and an extensive use of monologue-based teaching. The findings were, however, that the teachers, through pedagogically innovative strategies, developed knowledge about how their pedagogical patterns in this hybrid synchronous learning situation could be supported by an array of additional educational technologies and strategies to create activating and equal learning designs for the students. This article is written on the basis of a chapter in the PhD–thesis by the author.

Keywords: Hybrid synchronous video-mediated learning, learning designs for hybrid synchronous teaching, pedagogical innovation, pedagogical-technological patterns.

THE GLOBAL CLASSROOM

VUC Storstrøm, an adult educational institution in southern Denmark, has implemented the Global Classroom concept, a hybrid synchronous video-mediated learning environment, as a full-time educational option for adult general upper secondary students. The Global Classroom allows for synchronous lessons for students who are present in the classroom with a teacher and students who participate from home via their own PCs. It is a parallel-teaching method in which all participants can communicate, see each other and see and write on an interactive white board. The use of the hybrid synchronous video-mediated teaching environment is particularly relevant to

VUC because the flexible programme makes it possible for adult students to combine their education with their family and working patterns by studying from home. This is in line with findings about how hybrid or blended synchronous video-mediated learning designs are becoming part of a new, flexible way to offer education for students who live far from educational institutions or are challenged by family or job obligations (Ørngreen, Levinsen, Jelsbak, Møller & Bendsen, 2015).

The video-mediated teaching and learning environment

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 1 & 2a&b). 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 2a). The teacher is able to see the at-home students on flat-panel screen 2 (Figure 2b) when looking towards the classroom students.

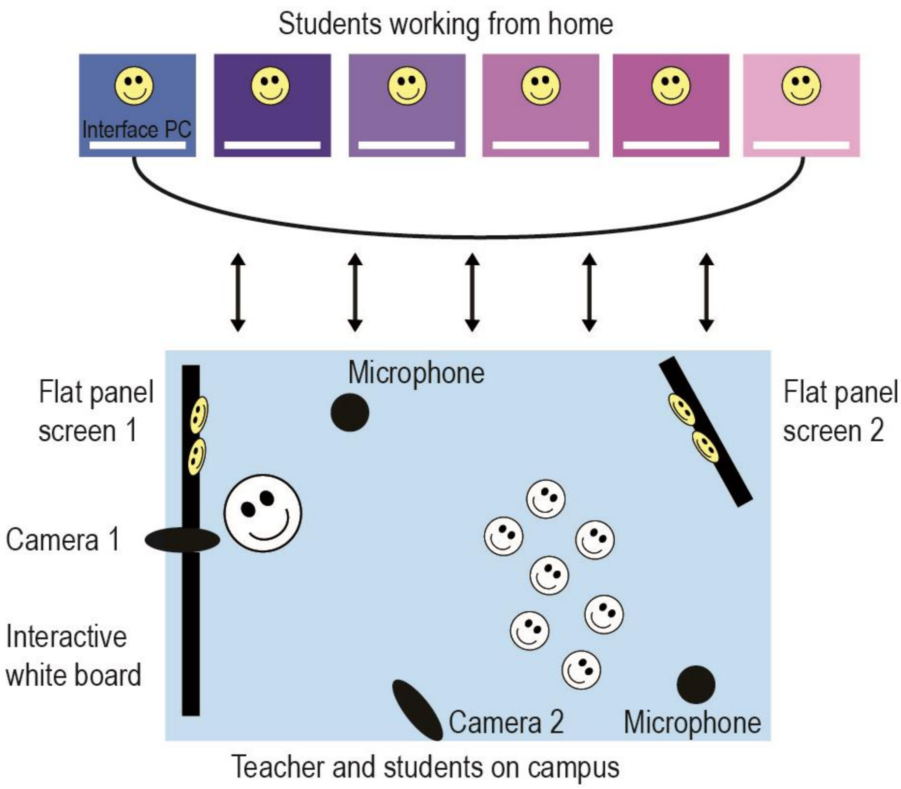


Figure 1: The Global Classroom - A hybrid synchronous video-mediated learning environment.

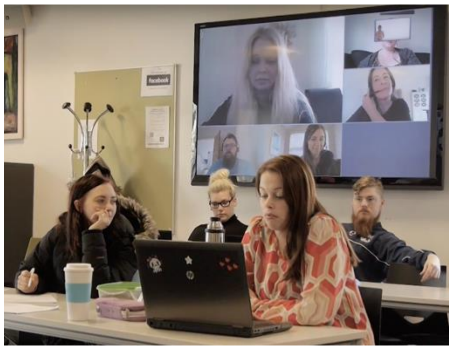


Figure 2a (left): Global Classroom teacher from the perspective of an in-class student.

Figure 12b (right): Students in class and at home (on the flat-panel screen in the background) from the teacher's perspective.

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.

TEACHING AND LEARNING IN THE HYBRID SYNCHRONOUS LEARNING ENVIRONMENT

When teaching adult students in traditional brick-and-mortar classes, the teachers generally designed the learning as a combination of teacher-controlled and student-controlled learning designs. The pedagogical approaches were variations of individual/acquisition learning processes and social/participation learning processes, and in many cases the teachers also had clear aims to create motivating learning situations for the students (Illeris, 2007). In the Global Classroom, however, the narrative or monologue form of teaching became a large part of several teachers' learning designs (Laurillard, 2012). This created a dilemma for many of the teachers, as their pedagogical aims were to make the students participate actively in learning activities. As in findings by Bower and colleagues (2015), the teachers reported that teamwork often was difficult and time-consuming to establish between cross-over groups of at-home and in-class students in the learning environment because of technological problems and classroom noise. The teachers therefore used less teamwork in their learning designs than they traditionally would. Teachers found in particular that they assigned fewer short-term group projects that would have required students to meet together during class time.

Many of the teachers in the Global Classroom had motivating learning strategies for their adult general upper secondary students in the traditional bricks-and-mortar classes. The purpose was to activate the students, involve them in the learning processes and to vary the teaching approaches and thereby achieve the students' attention in order for them to focus and learn. Such strategies were hindered in this new hybrid synchronous classroom because most of these designs demanded the presence of all students within a physical classroom, where they could move and interact together, or at a physical location outside the classroom. The teachers lacked learning designs that could create shifts, vary the teaching and engage and activate the students in the Global Classroom.

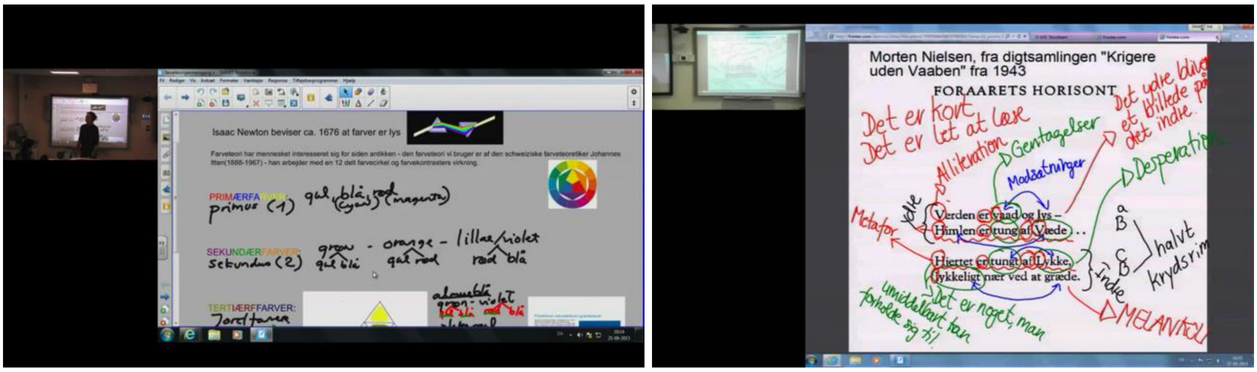


Figure 3: PC interfaces as viewed by two students attending class remotely.

The students participating from home experienced the classroom on their computers' interfaces (Figure 3). But for many students participating from home, it quickly became "boring" to watch the lessons over videoconference; as they sat in private, familiar surroundings with other spheres of interest that could distract them, their attention dropped more quickly than when participating in class. The students at home indicated that they felt somewhat left out; they felt as if they were spectators rather than participants. Most home-students did not participate in the same active way as students in the class, and, according to both students and teachers, home-students learned less than the students in class. Participating in the video-mediated lessons required more concentration and initiative than participating in the classroom.

This called for learning designs that would involve at-home students more actively in the learning situation, designed to include more frequent variations to help students participate in a more active way. One purpose of researching within this area is therefore to create new knowledge about how to design engaging video-mediated collaborative online learning experiences that involve the use of additional educational technology and enable remote students to participate in face-to-face classes on equal terms (Szeto, & Cheng, 2014; Roseth, Akcaoglu & Zellner, 2013). There is a need to learn more about how to design technological setups combining hardware and software so they support educational designs and to investigate how the involved teachers and students qualify these technological setups through motivating learning designs (Bell, Sawaya & Cain, 2014). To make these new learning designs work, it is important to develop knowledge about key learning designs, frameworks and pedagogical patterns that may contribute to the best possible learning experiences for the students as well as for the teachers (Bower, Dalgarno, Kennedy, Lee & Kenney, 2014).

METHODS AND RESEARCH DESIGN

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 with the teachers. Some of 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 (Schön, 1983). Other learning designs were developed through common ideation and creation in teacher teams that were part of the design-based research experiment (Weitze, 2015). 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 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 aim of the following empirical analysis is to give an overview and characteristics of the potentials and barriers for re-designing learning experiences in the Global Classroom. The research question for this part of the design-based research project was: How can teachers create activating and equal learning designs in hybrid synchronous video-mediated contexts?

THEORETICAL AND EMPIRICAL ANALYSIS

The following sections describe 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, this article describes alternative learning designs involving educational technologies additional to the mediating videoconference system. As the teachers used several pedagogical approaches in each lesson the following learning designs represent a mix of cognitive, collaborative and motivating learning designs. The aim for these learning designs was to create equal and activating learning conditions for the students sitting in class and at home.

NEW LEARNING DESIGNS FOR THE HYBRID SYNCHRONOUS VIDEO-MEDIATED CLASSROOM

Learning Design #1: Collaborative Writing Processes and Formative Evaluation

Many teachers 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 4).

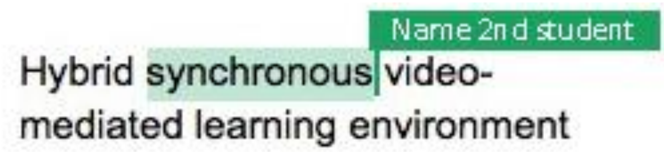


Figure 4: Group members' names are shown live as they write in Google Docs.

If these writing processes are combined with video-mediated cross-over groups (Figure 5), 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 cross-over groups wore headsets and worked at a non-disturbing distance from other in-class students. (In Figure 5, the students are in a room by themselves and therefore do not need headsets.)

Figure 5: Students collaborating in a cross-over group between home and school in the Global Classroom.

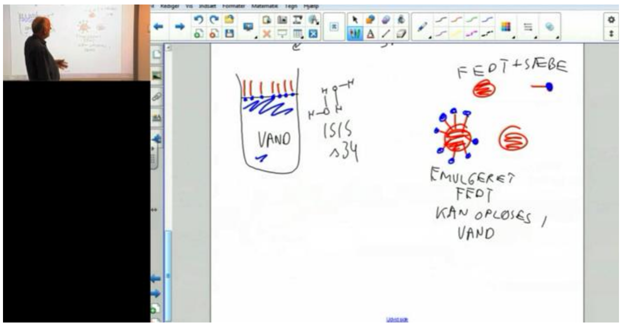
Individual formative evaluation: “It is very difficult to keep track of the students at home, and therefore one cannot differentiate teaching when you cannot sense what they have learned” (Teacher in Global Classroom). This was a recurring problem that several of the teachers experienced. The reasons 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 cross-over 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 6). 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) 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 6: Learning design in which students brainstorm on subject areas for group assignments in an English as Second Language lesson.

Learning Design #2: 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 7 & 8). The two chemistry teachers used three different approaches for making learning designs for the chemistry lab experiments:



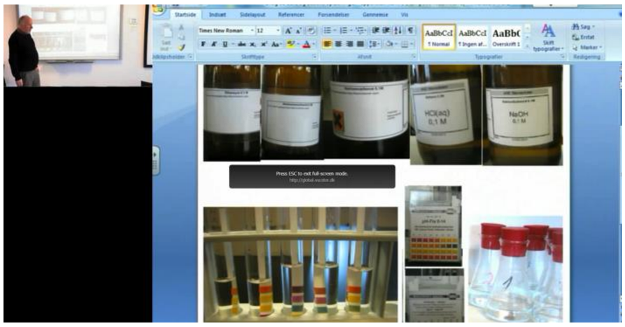


Figure 7 (left): Writing chemistry formulas on the interactive whiteboard.

Figure 8 (right): Pictures of chemistry experiments on the interactive whiteboard.

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 8). 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.

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 9 and 10).

Figure 9 (left): The teacher talks to the camera and the students "on the wall," as seen from the class.

Figure 10 (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.” 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 (and perhaps by adding a document camera), 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.

Learning Design #3: 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 (Weitze, 2015). In a teacher workshop 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.

Learning Design #4: Students Producing Films

One of the new initiatives among many initiated by teachers 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. Several of the teachers reported that this learning design with video had been fully integrated into their teaching practice in class. 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 difficult to work together in this tool in virtual groups, as the software worked on each person's individual computer. These hurdles were examples of how crossover-group collaboration can become difficult because of the (missing) affordances of a digital 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 cross-over groups ended up working cooperatively (Dillenbourg, 1999); 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.

DISCUSSION

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) **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). 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 #1 and #3 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 (Orlikowski, 2010). These tools enabled students in class and at home to interact on equal conditions.

2) **“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, hear or smell. 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.

3) **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 (Dillenbourg, 1999). 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). 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 because they could not make their current learning design work when participating remotely.

4) **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 “without their body in the class” participation was difficult. The teachers began to develop hybrid synchronous mobile learning designs so all students could participate in learning designs outside the classroom.

CONCLUSION

The new learning designs aimed to create equal, activating and motivating learning experiences for in-class and at-home students and followed one or more of these four patterns: 1) Some designs relied on web-based collaborative construction software, equally accessible for in-class and at-home students to work in. 2) “Unequal” learning designs for experiments with shared activities involving artefacts in the classroom were experienced to be the best possible motivating learning design solutions for both involved student groups. 3) Other designs allowed for collaborative workarounds, where in-class and at-home students distributed tasks between group members and combined their individual results later, and technological bricolage, where students constructed collaboration practices with the tools at hand by combining various technologies. 4) The hybrid synchronous mobile learning designs allowed all students to participate in learning designs outside the classroom as well as within.

This study contributed new, relevant knowledge to the newly developing research field of learning designs for hybrid synchronous video-mediated learning environments. This involved developing 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. In future studies, it would be valuable to deliberately implement these four learning design patterns as overall learning design strategies in order to investigate their effects upon teaching and learning in a hybrid synchronous video-mediated learning environment.

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DIDACTICAL DESIGNS IN USE – EXPLORING TECHNOLOGICAL, PEDAGOGICAL AND CONTENT KNOWLEDGE

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Abstract: In this article we operationalize the Technological Pedagogical And Content Knowledge (TPACK) model as an analytic lens to trace progression in teaching practice. We explore teacher development by studying didactical designs. Didactical design refers to the design of teaching sequences within a particular subject, and includes a pre-planned sequence of lessons, with a detailed teaching plan of how to implement the task in the classrooms. We report from a three-year school development project which involved 48 teachers and over 1000 students in elementary school. An in-depth analysis of 14 didactical designs in the subject of mathematics respectively 13 didactical designs in mother tongue was conducted. The analysis was based on classroom observations, video recordings, chat logs, online forums, interviews and participation in teachers' daily work. Our position is that our approach can serve as an effective way to categorize, analyze and evaluate didactical designs.

Keywords: TPACK, Progression, Collaboration, School Development, Didactical Design.

INTRODUCTION

Given the societal development and the influence of digital technology in the 21st century workplace, researchers stress the importance to include technological knowledge as part of teachers' competencies (e.g. Angeli & Valanides, 2005; Mishra & Koehler, 2006). The TPACK model, denoting Technological Pedagogical And Content Knowledge, has emerged as a framework for competences required for teaching in the digital era, where the reciprocal relationship between the components technology, pedagogy and content knowledge is emphasized (Mishra & Koehler 2006). Initially the model was developed to guide students in pre-service education, and the model was used to discuss how the students could be prepared for technology use in their future profession, in a meritorious way. The model has, however, received far more impact and spread within the school context as well as in research (e.g. Tallvid 2015; Hofer, Bell, & Bull, 2015; Graham, Tripp, & Wentworth, 2009; Guzey & Roehrig, 2009; Chai, Koh, & Tsai, 2010). The framework has attracted much attention, as evidenced by over 600 journal articles using the TPACK model (Koehler, Mishra, Kereluik, Shin & Graham 2014) to evaluate and assess pre- and in-service teachers understanding and use of TPACK (e.g. Ozgun-Koca 2009; So & Kim 2009; Schmidt et al, 2009; Harris, Grandgenett & Hofer, 2010; Suharwoto, 2006).

However, the TPACK model has also received criticism, concerning not being practically applicable. The model has been criticized with respect to its definitions of the knowledge domains being inaccurate and inadequate (Graham 2011; Cox & Graham 2009) and it is questioned whether these knowledge domains can be distinguished in practice (Archambaud & Barnett 2010). Furthermore, the model has been criticized for being two-dimensional and only describing the three knowledge domains and their mutual relationships, but is lacking a deeper analysis of the principles underlying those practices. Thus, the model needs further development in order to become an explanatory theoretical framework (Howard & Maton, 2011).

Since the model was introduced, several researchers have attempted to improve the model (e.g., Hong & Stonier 2015; Hammond & Manfra 2009; Archambault & Crippen 2009). Still, in a recent review article of TPACK-related studies (Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013), the authors observed that only a few studies have addressed using TPACK for specific subject domains, and likewise, only a few studies focused on in-service practitioners.

In this article we present an operationalization of the TPACK model which address in-service teaching and subject-related issues over time, in the two subjects' mathematics and mother tongue. We report from a three-year school development project where *in-service* teachers collaborated across schools to develop innovative *subject-specific* models for teaching supported by digital technology. This article builds upon previous work from the same project were the TPACK model was used as an analytical lens to detect progression in teaching practice in mathematics (Willermark & Pareto 2015). Here, we conduct the same analysis in a different subject domain (mother tongue) and compare the two analysis to each other in order to explore subject-related issues. The aim is to validate our operationalization of the TPACK model and to explore teachers' progression in conducting TPACK-competent teaching, within different subject domains. We address the following research question: *How can we understand teachers' progression with respect to technological- pedagogical and content knowledge as revealed in their subject-specific teaching practices in their respective classrooms?*

MATHEMATICS, MOTHER TONGUE & TECHNOLOGY

A school subject is not static; it is constantly changing, evolving and defined based on the dimensions of time and context (Bergöö 2005). Which competences that are considered necessary to be knowledgeable in a subject is negotiated and renegotiated as a result of societal development.

The extent as well as the ways technology is used in different subjects seem to vary. While in language classes along with social studies current uses of technology is most frequent in Sweden, in mathematics technology is used least (Skolverket 2013). This may be a result of subject cultures and what is considered as valuable and legitimate subject content and teaching practice (Erixon, 2010). Due to the above-mentioned subject-specific issues, it is of interest to explore and compare the *degree* of technology usage as well as *the way* technology is implemented in these two subjects, respectively, in order to investigate similarities and differences related to subjects.

TPACK-MODEL

The TPACK-model constitutes a development of Shulmans (1986) Pedagogical Content Knowledge model (PCK). In the original model Shulman stresses the importance of integrating teachers' content knowledge with the pedagogical knowledge. Shulman was critical to the separation of knowledge fields and emphasized the importance of combining these. Thus he defined PCK as going beyond content or subject matter knowledge to include knowledge about how to teach particular content.

In Mishra & Koehlers (2006) development of the model the aspect of technological knowledge has been added, which refers to knowledge of how to work with, and apply technological recourses. The TPACK- model does not only emphasize the components independently of each other, but stresses the complex interplay of content, pedagogy and technology knowledge, within certain contexts. The components can be combined in numerous ways. The model suggests that apart from considering these components in isolation, we need to explore them in pairs as: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and lastly, all three taken together, as technological pedagogical content knowledge (TPACK). Their interrelationships are illustrated in the figure below.

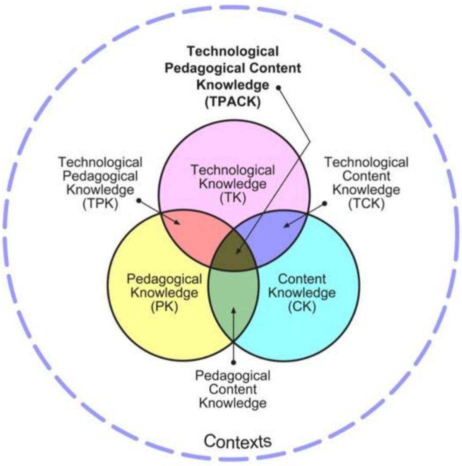

Figure 13. The TPACK model (Mishra & Koehler, 2006).

Evaluation & Development

The TPACK model is often used as a conceptual framework to understand how teachers explicate their understanding of how knowledge of technology, pedagogy and content interact (e.g. Doering, Veletsianos, Scharber, & Miller, 2009; Graham, 2011). Numerous studies have been carried out in order to evaluate and measure pre- and in-service teachers' TPACK, comprising different approaches. One approach is self-evaluation methods such as interviews and self-reports. *Interview studies* have been conducted. For example, Ozgun-Koca (2009) interviewed pre- and in-service teachers and asked questions about the advantages respective disadvantages of technology usage and the effects on the teaching and learning process and on the environment. Also, *Self-Report Measures* have been developed and applied (e.g. Koh et al. 2014; Archambault

2011; Chai et al. 2011). Often, participants numerically rate statements concerning teaching and technology. For example, Schmidt et al (2009) conducted a survey instrument to assess pre-service teachers TPACK. In their study the participants were asked to rank statements on a Likert scale, reflecting different TPACK components. For example, “I keep up with important new technologies” constitutes a statement about their technological knowledge (TK) and “I have sufficient knowledge about mathematics,” reflects content knowledge (CK). Additionally, *Open-Ended Questionnaires* can also be used as an instrument to measure TPACK. For example, So and Kim (2009) asked in-service teachers a series of statements in order to examine perceived difficulties related to applying knowledge on technology, pedagogy and content to design a technology integrated lesson. These approaches are all indirect self-assessment methods, examining the teachers own perceived use and competence ratings.

There are few studies that have used direct, activity-based approaches as ours. These have either examined and measured TPACK through observation (Suharwoto’s 2006); or based the evaluation on demonstrated performance on tasks representing authentic teaching situations (Harris, Grandgenett & Hofer, 2010; Kereluik, Casperson & Akcaoglu, 2010); or evaluated responses to a teaching scenario (Curaoglu, Bu, Dickey, Kim & Cakir, 2010; Graham, Borup & Smith, 2012). However, these studies address pre-service teachers in educational settings, not in-service teachers and real classroom practices.

We have found two articles also studying in-service teachers and didactical designs. Koh, et al (2014) examined teachers’ planning of ICT lessons in order to understand how contextual dimensions (Physical/technological, Cultural/institutional, Intrapersonal and Interpersonal) influence their TPACK development of lessons design. They examined teachers’ conversations during group-based lesson-planning sessions by categorizing comments as either content, technology or pedagogical comments. The study showed for example that higher proportion of talk focusing on Cultural/Institutional factors, resulted in lower proportion of TPACK talk. Here, the unit of analysis was “design-talk”, and teachers’ TPACK were understood through the teachers’ discussions while planning, not through actual implementation in classroom setting. Similarly, Boschman, McKenney & Voogt (2015) conducted a study where they explored teachers’ conversations as they collaboratively designed technology-rich early literacy activities in relation to

TPACK. The analysis focused on *what* topics that were discussed and *how* these topics were discussed, i.e., they studied design-talk as well and did not focus on the teaching being carried out. In our previous study, Willermark & Pareto (2015), the TPACK model was used as an analytical lens to examine progression in mathematic teachers' actual teaching practice in the classroom. Our unit of analysis is the didactical design as a *design product*; i.e., its description, its intentions and its implementation. We studied how in-service teachers planned, argued for and implemented their didactical designs in the classroom. The teacher teams' different didactical designs were studied during three years, in order to examine potential progression with respect to TPACK. Thus we consider TPACK-model as an instrument for analyzing didactical designs. In this study, the same approach was used with didactical designs from the subject, mother tongue in order to combine and compare the two data sets.

EMPIRICAL SETTING, DATA PRODUCTION & ANALYSIS

In this article we report data from a three-year Nordic school development project. The aim of the project was to use digital technology to develop and support cross-border models for innovative teaching and collaboration between Danish, Norwegian and Swedish schools. Thus, technology served as a facilitator to conduct teaching in a cross-national context and constituted a necessity in order to handle the geographical distance. In the project teachers worked in cross-national teaching teams, composed of representatives from all three or only two of the countries. The constellation of a teacher team and their respective students, were referred to as class-match groups and in these constellations, joint teaching between the Nordic classes were planned, conducted and reflected upon. A total of 48 teachers (22 in mathematics, and 26 in mother tongue) and more than 1000 students from 14 middle and upper elementary schools participated in this study.

Since our aim was to explore teachers' progression in conducting TPACK-competent teaching, our focus of the analysis has been on the activity of teaching and how it was manifested in the classroom. In order to study the teaching activity, the process was organized around manageable units, which still involved all main aspects of teaching. These units were referred to as *didactical designs*. Didactical design shall be understood as the design of teaching sequences based on the specific topic within a particular subject area (cf. Ruthven, Laborde, Leach, & Tiberghien 2009; Hudson, 2008). In our case, a didactical design specification consisted of a pre-planned sequence of lessons with specified learning objectives based on a subject curriculum and a detailed teaching plan of how to implement the task in the classrooms.

The teacher teams conducted a total of 27 didactical designs (14 in mathematics, and 13 in mother tongue) within the project. In general, the teams invented one didactical design per semester and most teacher teams participated the entire project duration, and contributed with several designs each. Hence we could study changes over time. These designs were planned, implemented and evaluated in several iterations during the three years.

The, the didactical designs are the unit of analysis and constitute a way to organize on-going processes into chunks of teaching-in-action. The studied didactical designs were invented, planned, implemented in classrooms, and reflected upon during the three years by teachers and researchers. Additionally, the, didactical designs were analyzed by researchers' in order to detect whether the teaching practice changed and developed over time. The analyses were based on a rich set of data such as; documentation by means of teachers' common description format, along with documentation such as sound and video recordings from planning session and classroom observations, teachers' planning documents and communications logs as well as teacher and student interviews. Such rich, contextual data is motivated due to the complexity of understanding a practice carried out in action. The primary focus was on teachers' actions in their teaching practice, not on the students or student learning.

The TPACK model was operationalized by categorizing the knowledge dimensions into 5-10 categories as follows: a) the *content dimension was categorized according to* which subject specific competencies the students practiced in the design b) the *pedagogy dimension* in terms of the intended pedagogical values due to the collaborative setup and c) the *technology dimension* according to which technologies that were used in order to carry out the didactical designs. Using this operationalization, each didactical design was analyzed by identifying which of the content categories, which of the didactical values and which of the technologies that were part of the designs. The analysis is based on the *idea of complexity of a didactical design* as the degree of design difficulty, in accordance with the notion of problem complexity as defined in Kotovsky, Hays & Simon (1985). The idea is that *the difficulty to design* increases by addressing more competencies, by aiming for more didactical values, and by integrating more types of technologies in the didactical design. Since all three components are part of the same didactical design they are inter-dependent, and combining many things into a meaningful whole is more complex than combining a few. Hence, the operationalization constitutes an approach to explore the teacher teams' abilities to design learning tasks that are rich in content, offer much pedagogical values and apply a variety of technologies, i.e. represent complex didactical designs. However, it should be highlighted that the complexity measure refers to *how complex the task is to design*, not to how difficult the task is to perform or solve. For example, a teacher can select difficult math problems from a website as exercise for the students; this is a task that is easy to "design" for the teacher using the website, since most didactical design work was already conducted by the producers of the site. The complexity measure is used to denote teams' collected ability to apply their technological, pedagogical, and content knowledge in a practical classroom situation, and is used as an indicator of TPACK in-situ demonstration and progression over time. (Note, we are not claiming that complexity is good per se, merely that it demonstrates an ability.) A didactical design that includes all components (technology, pedagogy and content) is considered a balanced didactical design. However, if any of the components is excluded it is considered as unbalanced, for example if the didactical design includes several different technologies and enables students to practice content specific competencies, yet, neglecting the pedagogical dimension.

In this paper, we extended the previous analysis by also exploring the technology usage in more detail. In addition to determine the number of competencies, pedagogical values and technologies that were used in the designs, we also explored *in what way the technologies were used*. We recognized different behaviors among the teams where some teams repeatedly conducted more or less the same type of design, whereas other teams explored many different designs and technologies over time. Since the overall aim was to measure teacher teams' TPACK ability to plan good designs, we wanted to capture these phenomena as well. Therefore, we distinguished between repeated use of technology and new types of usage.

RESULTS

The four teacher teams in mathematics conducted a total of 14 didactical designs. Table 1 (left) shows these four teams A-D, and one didactical design per row where the addressed categories are marked with a cross and coloured background. Team D only conducted one design since the team entered the project in its final phase. The four teacher teams in Mother tongue (Table 2, right) conducted 13 didactical designs. Also in this case, Team D only performed one didactic design;

Table 2 Categorization of didactical designs based on content, pedagogy and technology use.

Subject: Mathematics

teacher teams	year	didactical design	class level	Content: math thinking	problem solving	modelling competence	reasoning competence	representation	symbol- & formalism	communication	tool usage competence	Pedagogy: curiosity & motivation	explain to each other	need of math language	see differences, variation	compare national data	reflect on subject	Technology: synchronous audio+video	synchronous text (chat)	shared documents	asynch. communication	asynchronous text	image/video production	image/video distribution	spread sheet	math specific
Team A	1	Enumerate 1-20	6,7									X						X			X		X			
	1,5	School statistics	6,7			X				X	X					X					X				X	
	2	Fraction problems	6,7		X			X		X		X			X		X			X						X
	2,5	Packaging factory	6,7		X	X	X		X		X		X		X					X						
	3	Pizza feast	7		X		X						X		X					X					X	
Team B	1	Enumerate 1-30	8,9									X						X								
	2	Explain fractions	8,9	X	X		X			X			X		X		X						X	X		
	2,5	Statistics survey	7,9	X		X		X		X	X	X			X	X		X							X	
Team C	1	Brain teasers	5,6		X			X		X		X					X	X								
	2	Math dictionary	5,6	X					X	X	X		X	X	X					X		X				
	2	Price comparison	5,6		X				X		X	X			X	X				X					X	
	2,5	Product containers	5	X	X		X	X		X		X	X			X		X	X						X	
	3	Base-10 system	4,5	X				X	X	X		X	X		X		X	X	X	X		X	X	X		
Team D	3	Educational game	6,7	X	X		X	X	X	X	X	X	X	X				X	X							X

Subject: Mother tongue

teacher teams	year	didactical design	class level	Content: written and oral	adopt to audience	multimodality	understand prose	information literacy	Pedagogy: curiosity & motivation	authentic speech	cultural identity	technology-mediated	virtual communication	collaboration	Technology: synchronous audio+video	synchronous written	shared document	asynch. communication	asynchronous text	image/video production	image/video distribution	sound productio	mother tongue specific	public distribution
Team A	1	Presenting the School	7	X	X				X	X					X		X			X				
	1,5	Newspaper articles	7	X	X		X			X	X							X	X					X
	2	Youth writers	8	X			X	X		X	X	X			X		X							
	2,5	Poems	8	X	X		X			X	X	X			X		X							
	3	Tell through a movie	9	X	X	X	X			X	X	X			X					X				
Team B	1	Everyday life in	5	X	X				X	X							X	X		X				
	1,5	Comics	5-6		X	X	X		X	X		X		X	X		X						X	
	2	Poems	5	X	X		X			X	X				X		X		X			X		
	2,5	Setting sketches	5	X	X	X			X	X	X	X		X	X		X		X			X	X	
	3	Language differences	5-6	X	X				X	X	X	X		X	X	X		X						
Team C	2,5	know your neigbour	7	X				X		X	X								X	X	X			
	3	Character sketches	7	X		X	X			X									X	X	X			
Team D	1,5	Short story relay	7	X			X		X	X				X	X		X	X	X					

but in this case it was a consequence of teachers dropping out of the project.

In order to visualize the change in complexity during the project period, we summarized the number of categories identified for each component. For example, the first didactical design from team A in mathematics resulted in 0 content, 1 pedagogy, and 3 technology categories marked, which adds up to the "complexity degree" 4, as shown in the leftmost bar in Figure 2. The dark pink bars denote new technology usage, the light pink repeated usage. Since we want to explore patterns of progression, we have studied each team separately.

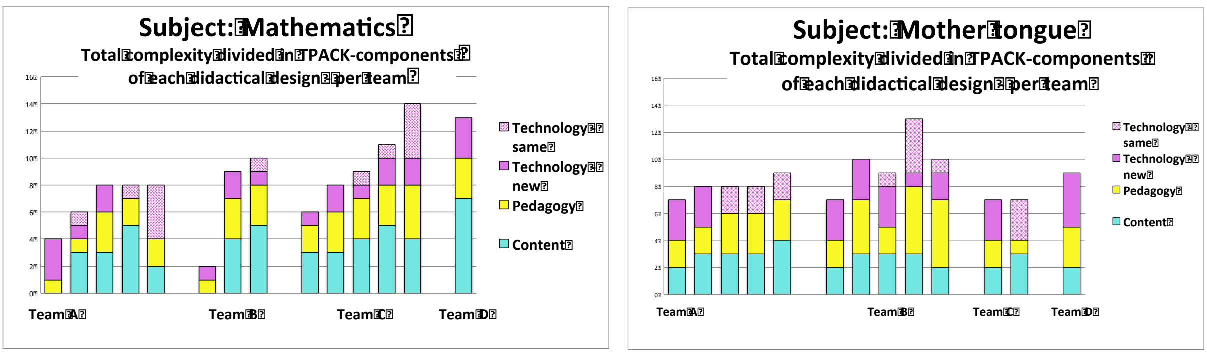

Figure 14. Complexity bars divided in TPACK components ordered by teams. Mathematics to the left and Mother tongue to the right.

As the bars indicate, there was a general trend towards more complex didactic designs at the end of the project. The trend appears clearer in mathematics, where teams generally start at a lower level but also achieve the most complex didactic designs during the project. Thus, the diagrams illustrate the teams' demonstrated ability to create good TPACK-designs, which we interpret as TPACK progression. Through our results, we could identify progression patterns, which refers to the development of of teacher team's sequence of didactical designs.

Progression in Mathematics

In mathematics, we see a clear progression towards more complex and also more balanced didactical designs during the project period: addressing all TPACK components (see Figure 14, left).

Team A and B demonstrates similar progression patterns. The initial didactical designs are low in complexity, even lacking the component of content completely. Initially the teachers focused on *how* to manage cross-country collaboration and *what* technology to use, and hence the content component was overlooked. Nevertheless, in due time the designs evolved to demonstrate rather high complexity levels, where content was given primary focus and technology and collaboration was used to support the didactical designs.

Team C and D started at a higher degree of complexity involving all components of TPACK and where technology was used as a pedagogical strategy to develop students' knowledge of a particular topic. **Team C** used a greater variety of technology in comparison to the other teams; the teachers were experimenting with new ways to implement technology in the teaching.

Progression in Mother Tongue

The four teacher teams' didactical designs in mother tongue (see Figure 14, right) were balanced. They comprise all three components throughout the project. The didactical designs became gradually more complex towards the end of the project as well, but the progression is less clear than in mathematics.

Team A shows an evolutionary development with rather stable complexity using the same technology with varied subject content. Early in the project the team found a teaching model, which they kept and gradually refined with various content during the project. This is shown in the figure by five similar bars and light pink components illustrating repeated use of technology.

Team B shows a more irregular complexity development in relation to TPACK, nevertheless they demonstrate more advanced didactical designs towards the end of the project. The team's work is characterized by exploration of content, pedagogy and technology resulting in innovative designs. They experimented with different technologies and a variety of applications throughout the project combining already tested and new ways of using technology.

Team C only conducted two didactical designs, which are both quite similar in complexity. Technology is applied in a repetitive way, i.e., they reuse the same technology.

Team D conducts one didactical design, which is quite complex from the start primarily due to the technology component.

DISCUSSION

We stress that it requires a fine-grained analysis at a detailed level to spot teaching progression in relation to the complex notion of TPACK, where the components are entangled and interdependent. In this study, we repeat our approach to use the TPACK-model as an analytical lens to trace progression in teachers' didactical designs in mathematic, also within the subject of mother tongue. Our ambition was to validate our approach to identify teachers' progression in relation to TPACK. In all essential we repeat our previous analysis, however with minor subject-related adjustments. For example, the categorization of *content* was disparate, since the subjects differ in nature. Moreover, *pedagogy* involved overlaps, e.g. "curiosity and motivation" recurred within the different subjects, while other such as "provide authentic language experiences" were specific for mother tongue. Lastly, *technology* were almost identical: independently of subjects, however comprises subject-specific software, which were categorized as "math specific" (geogebra http://www.geogebra.org) respectively "mother tongue specific" (pixton https://www.pixton.com). Thus, with subject-related modifications, the analysis could be applied in the different subject domains.

Through our analysis, we have explored and compared progression patterns within teams (within one subject) and between teams (either within subjects or between subjects). We could identify progression within the teams, independent of *subject.* However, as we compared the progression patterns *between* subjects, we could generally see a clearer and more apparent progression in mathematics. As been stated, mathematics is characterized by more traditional forms of teaching. The lowest as well as the highest complexity levels were found in the subject mathematics, hence a more substantial development and progression took place there compared to mother tongue. This can be explained by mathematics teachers experienced (but overcome) greater challenges and obstacle during the project, which in turn enabled a greater learning effect (Willermark 2015). After the initial didactical designs, teachers questioned the usefulness of the collaborative, technology-mediated teaching which forced them to find new innovative approaches to teach mathematics. In mother tongue, on the other hand, it was more straightforward to find strategies for teaching. Thus technology could both be considered as a *means* to create interesting didactic designs, but also as an *objective,* as it becomes an opportunity to learn how to master multimodal texts (Sofkova Hashemi, 2014). This is consistent with previous research showing how mother tongue in a greater extent integrates technology relative other subjects (Erixon, 2010). The project in general was not quite as challenging for these teachers and consequently, their learning trajectory was somewhat smaller.

We also spotted similarities among the teaching teams between the two subject groups. We found similar examples of development and progression patterns: An evolutionary development was found in teacher teams across the subject groups (Team A in mathematic and Team A in mother tongue). Here teachers deployed a pedagogical approach and a technology usage that were gradually refined. In contrast, we spotted examples of more exploratory approaches involving more of risk-taking. The groups elaborated with different ways to carry out the didactical designs: using a variety of technology and recurrently combining established uses with new uses. This is either mirrored by a great progression (Team C mathematics) or by moving slightly up and down resulting in an alternating progression (Team B mother tongue). The greater progression in Team C may be explained by the teachers' prior proficiency in technology usage. Hence, they did not have to focus on learning the technology, neither focusing on figure out possibilities and limitations related to technology usage in the teaching.

CONCLUSION

In this article we have successfully repeated our approach, to use the TPACK-model as an analytical lens to track progression in teachers' didactical designs. Our position is that this approach can serve as an effective way to categorize, analyze and evaluate didactical designs. Thus the systematic fine-grained analysis of the designs enabled an opportunity to identify progression patterns over time. The complexity analysis showed that the teams learned and developed more complex designs towards the end of the project, even though the general level of TPACK complexity varied among the teams. The progression could to some extent be traced to subjects (mathematics showed a clearer progression than mother tongue). However, also explanatory factors that were subject independent was contained, demonstrating different approaches were some successively refined their didactic designs, while others had a more exploratory and experimenting approach to design.

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Participatory Design with Teachers: Designing the Workshops

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Participatory methods are becoming more and more commonly used in social research. These methods are used in a variety of research fields, such as; Human Computer Interaction, Education, Public Health, Civic Engagement, and so on. Participatory methods are valuable because they utilize the knowledge and experience of all the collaborators. The paper focuses on the participatory design process performed with a group of junior high school teachers and the conditions for the development of a pedagogical practice. The process, which aimed for supporting increased pupil participation, was fuelled by the development of a pedagogical model at four workshops during 2015 (April to September). Main findings from the analysis of these workshops propose that participatory design as an action research method support the appropriation of new pedagogical approaches in general, and the understanding of the possibilities of supporting pupil participation in formal education in particular.

Keywords: Pupil Participation, Participatory Design, Action Research, Participatory Methods

INTRODUCTION

Children's participation is enshrined in our governments' legal documents in our society, with each country having their own variations. Furthermore, one of the cornerstones in the United Nations Convention on the Rights of the Child (UNCRC (Unicef, 1989), is to allow children to have opinions about matters that concern them. Two of the articles, no 12 and 13, states that a child has "the right to express its views freely in all matters affecting the child" (p. 5) and that "the child shall have the right to freedom of expression" (p. 5). In the Swedish national curriculum (LGR 11) (Skolverket, 2011) it is written that every pupil should be able to participate in democratic processes and be able to utilize critical thinking in their everyday life. These are a few of the reasons why participatory research is continuing to be implemented.

The importance of pupil participation has inspired a whole new research field, Pupil Voice Research. The focus for this field is the pupils and their perception of what is happening during their time at school. Just as it is important for the pupils' voices to be heard it is equally important for the adults to listen to them. As Fielding & Rudduck (2002, p. 12) tells us:

"Thus, to judge the potential of student voice for change we need to know who is talking and who is listening and whether such attentiveness is customary or spasmodic, an entitlement or a dispensation. We also need to know whether the listening is authentic."

It is not sufficient to only listen to the pupils; the persons doing the listening should also be the ones that are able to take action. Without authentic listening no change will occur. One solution to this issue will be discussed in this paper, where a group of teachers develops a new working method.

Another issue with pupil participation is the act of disengagement, where the pupils themselves are causing distractions for the class by talking, playing, wandering around, and disrupting fellow pupils (Ravet, 2007). A large part of this research is taking place in the UK, with the government funding several projects. One of these projects is called "Building Schools for the Future" where pupils were invited to participate in the design process of the schools and classrooms. Woodcock and Newman (2010) studied the results from different schools in various stages of this project and they observed several benefits of the pupils' participation. Some of the effects that they documented were; a reduced level of vandalism, an increase in learners' self-esteem, new opportunities for learning and teaching, etcetera.

The benefits of increased participation at school are many, e.g. according to a report by Lyle, Hendley, & Newcomb (2010, p.1):

"Involving learners as active partners in shaping their learning experiences and environment reaps benefits in terms of learner engagement, self-esteem, confidence and skills."

But it is also true that active participation is better promoted through group work and projects where the teacher takes a more supporting role (Said, Sahimi, & Rahman, 2015). This means that one should not only include the pupils in the design process but also design the process with pupil participation in mind. It is equally important to remember to also design the teacher's role for the learning process.

Research shows that the engagement and role of the teacher can make a big difference for pupil participation and engagement. E.g. Flutter & Rudduck (2004) writes about a British school (Exmouth Community College) where the head of the science department asked a group of pupils to fill out a questionnaire on what they thought of the science subject. A new approach to the science lessons was investigated based on the answers. The pupils were going to conduct topic-based projects on issues chosen by themselves, including finding all relevant information and deciding on which material to use. The project was a big success with the pupils feeling proud and confident about their work. Another factor that can be changed is how the teacher is giving feedback, by putting the pupil's process and curiosity at the centre the results can be improved (Björklund Boistrup, 2010).

The purpose of our project was to use the process of developing a pedagogical model together with a group of teachers (educators) to facilitate discussions focusing on pupil participation. The teachers all belong to an elementary school in the larger Stockholm area, a school that has previously participated in a project with our department. The purpose of the project was to build upon the lessons learned during the previous project where pupils were co-researchers ("The Research Party", see the section The Design Process) and utilize them while developing something practical together with the teachers. The research question for the researchers during the project was: How can participatory design and the Action Research method support a group of teachers increased knowledge of pupil participation?

METHODS

Two main methods have been used in a specific setting during this project. By combining participatory design with action research during workshop sessions the participating teachers are feeling that they own the end product, the model.

Participatory Design

The concept of participatory design was started in Scandinavia in the 1970's by the Norwegian Iron and Metal Workers Union (NJMF) (Nygaard & Bergo, 1973). The Norwegian project inspired several more Scandinavian projects e.g. the DEMOS project in Sweden (Ehn, 1988), the DUE project in Denmark (Ehn & Kyng, 1987), and the UTOPIA project (Bødker et al, 1987).

Even community planning activities have taken a step towards using the public as co-designers instead of just consulting them, or even not listening to them. This kind of community planning is especially widespread in Melbourne Australia where they have an entire website dedicated to this purpose (“Participate Melbourne”, 2015).

Participatory design means, as the name implies, that two or more persons or groups are collaborating in the design process. The product that is designed can be virtually anything, from a graphical user interface to a pedagogical teaching process (as was the case in this project).

Action Research

The term Action Research was first used in the 1940’s by an MIT professor named Kurt Lewin. He describes it as (Lewin, 1946, p. 2):

“It is a type of action-research, a comparative research on the conditions and effects of various forms of social action, and research leading to social action.”

The action research method has been divided into two main groups, each with several sub-groups. One group believes that action research means that a researcher is studying a group of practitioners in order to report what they are doing. This form of action research is sometimes called Interpretative Action Research. The other group means that the researcher has to be a part of the group of practitioners that are under study. This form of action research can be called: self-study action research, first-person action research, living theory action research, or plain action research (McNiff & Whitehead, 2011).

Action research has the same goal as all research, to generate new knowledge. Action research generates a form of practical knowledge, as it is the one conducting the research that is using the new knowledge. For example a nurse may perform action research on how to improve his/her practice and a teacher may do it in order to improve on his/her teaching methods. Action research is often meant to be used to improve someone’s social or personal situation, i.e. the person in focus is the one performing the study. Action research is useful for a number of situations, e.g. you want to improve on your methods for handling certain situations or you want to help yourself or your colleagues to be more time efficient. But it is important to remember that action research may not be the proper research method for other situations, such as: studies that involves observing the situation and calculating statistics or studies that consist of comparing different data sets from e.g. interviews or surveys. This is because action research should put the researcher in focus and how he/she can improve him/herself. An action research question should take the form of “How can I ..?”, or “How do I ..?” and not “Why do they ..?” and “What are they ..?” etcetera.

In this study we were inspired by the Interpretative Action Research (IAR) method since we collaborated with a group of teachers in developing a pedagogical model. The IAR method is appropriate since we are not a part of the group that is doing the actual method development but we are observing and guiding them. The Action Research method was chosen because we wanted to improve the teachers’ teaching methods as well as to put pupil participation in focus.

Workshops

Workshops offer a forum for open discussions between the participants as well as a way for the researchers to guide and inform the participants of the current tasks.

Before starting the workshops it is important to plan them, Steinert (1992) gives us 12 tips on how to successfully plan and conduct our workshops. Especially her ninth tip was considered, “Remember principles of adult learning”, where she writes that adult learning is important to teach differently from how young people are taught. Moreover she tells us that for adults it’s more of a process of re-learning than learning something new and that the group’s previous experience and knowledge needs to be respected. The adult learners’ motivation comes from within and they need to overcome their potential resistance to change in order to absorb this new knowledge and become co-learners.

By using workshop the participants are able to learn more than just what’s on the agenda. The atmosphere and smaller groups helps the participants to also acquire skills such as: collaboration techniques, verbal communication skills, and how several people often can come up with a better solution than a single person.

THE DESIGN PROCESS

Before the commencing of this project a study plan was written (by the researchers), detailing the goals and purposes for each group of collaborators.

The purposes of the project were:

- Together enhance the understanding for the qualities of the method (pupils as co-researchers)
- Together develop a, for the practical pedagogy, working pedagogical model.
- The goals formulated for the teachers were:
- Through dialogue with researchers develop one's own teaching, with focus on pupils learning.
- Through dialogue within the work team reflect around the current and possible alternative forms of teaching.
- The researchers had slightly different goals with the project:
- Enhance the understanding of how pedagogues (teachers) develop and shape pedagogical models.
- Enhance the understanding for how pedagogues (teachers) shape a common vocabulary around complex teaching processes (to be reported in a separate paper).

This project built on the success of a former project called The Research Party (Öberg, in review). The school was the same for both projects and more teachers were asked to join this new project. The detailed plan for each workshop and its purpose is described below.

The Research Party was a project focusing on facilitating pupil participating. The project took place during one semester (fall 2014) where fifteen pupils conducted research on a question of their own choosing. The research question was connected to the topic democracy. The research data was collected using interviews, surveys and observation of the nearby community in order to investigate the question: "What meaning does democracy have for people in their everyday life?"

The participating researchers supported the pupils with their analysis and educated them in various research methods. The pupils, the co-researchers, reported their findings during several presentations and as a written report. In addition to being invited to the co-researchers presentation, the school's teachers also got information about the project by the researchers at a teacher conference, along with an invitation to continue collaboration on pupil participation.

Overall Design

Before the workshop sessions started the teachers that had agreed to participate all received information about the goal of the project and what ours and theirs purpose was. Throughout the collaboration with the teachers they were informed that it was completely voluntary and that they could withdraw if they wanted to. They also did not have to be in the movies (that were used for documentation) if they didn't want to.

At the start of each workshop the present teachers were informed of what had taken place during the previous session. Moreover, the previous experiences helped the researchers to plan for the workshops efficiently and manage the unexpected issues in the workshop process.

There were six teachers involved in this project, with three females and three males. Their teaching experience varied from newly examined (less than 5 years) to experienced (more than 20 years). The subjects they were teaching were everything from art and language to social science, natural sciences and math.

Workshop 1

Purpose: Acquire a common platform for continued cooperation and method development as well as discussing four different concepts (Pupils as co-researchers, the pupils' interest in focus, Pupil democracy, and Pupil governed).

The setup was to first discuss the four different concepts in two groups and then present their thoughts for the whole group. A time limit of five minutes for each concept was decided in order to give the teachers a small time pressure. The discussed concepts were some of the ones that had come up during the interviews with the pupils from the Research Party project. During the common discussion about the concepts each group was able to present their thoughts as well as reflect over the thoughts of the other group. Similarities and dissimilarities of the thoughts and ideas between the groups were discussed. The teachers were encouraged to take photographs of the common material for their own reference together with their own notes. The teachers were informed that the next workshop was to be about evaluation.

Workshop 2

Purpose: Create a pedagogical model that promotes pupil participation as well as pupil evaluation by the teacher. The model is to be used as a tool to help design new subject areas for the teachers and it needs to be viable for all subjects.

Material: The group notes and personal notes from Workshop 1 (WS1), LGR 11 chapter 1 (the school's basic values and tasks) and chapter 2 (the school's overall goals and guidelines) together with an extract about pupil influence. Chapter 3 from LGR 11 was not to be used since it is too detailed; it contains the specific course plans for each subject. The teachers were also supposed to remind themselves about the concepts that were discussed during WS1.

The teachers were given time to sit in the same groups as last time discussing and developing a pedagogical model. The model should promote pupil participation and their work should be able to be evaluated. The tentative model can be seen in figure 1. After 30 minutes, a short pause was taken after which both groups were able to express their thoughts and ideas so far. Both groups were able to comment on each other's work, both positive and negative comments were encouraged. After the reconciliation both groups were given another 10 mins to rework their model based on the received comments. Lastly both groups presented their model and answered questions at the white board. These two models were after the workshop amalgamated, by the researchers, into one common model to be presented during Workshop 3 (WS3).

Workshop 3

Purpose: To present the model to the teachers and give them a first chance for reflection. The focus of the workshop was how the pupils' learning would benefit from the model.

The teachers were to sit in pairs and study the model that the researchers had presented and discuss three different questions.

Question 1: What do you (the teacher) want to get out of this model?

Question 2: What would be different with using this model instead of your previous approach?

Question 3: How can you see signs of this difference?

The questions were discussed in pairs for 10 minutes and afterwards in the whole group. After the group discussion the teacher pairs were given another 10 minutes to further discuss the model. Then the whole group evaluated the model together based on these three questions. The workshop ended with a short examination question that was answered independently. The question to be answered was: What will the pupils learn by using this new pedagogical model?

Workshop 4

Purpose: To give the teachers the time needed to go through the model one more time in a more practical way. To make the teachers feel that they own the model and are able to use it in practice.

The time for this workshop was extended to three hours including coffee and a tour of the University premises, the earlier workshops had taken place at the teachers' own school. The first task was performed in three groups; the teachers were sitting in pairs with someone they didn't usually work with. The teachers were using the model as a base and were discussing how it could be used in practice. After 45 minutes the discussions were stopped and a short coffee break was taken. After the break the three groups were to present their findings to the others and if they found something missing from the model that needed to be added. 45 minutes later another short coffee break was taken together with a short tour of the University students facilities. The last task for the day was for the teachers to write down, in one group, a common plan on how they could work practically with this model. This common plan was to be supported by considering the discussion they've just had and their own experiences as teachers. Lastly a short recap was held where the teachers were asked to express their thoughts about the project.

DISCUSSION

The workshops with the teachers were grounded in a mutual understanding of the previous project "The Research Party" (as described in the previous section) as successful and important. The teachers participating in the workshops have all followed the process of supporting pupil participation up close, in the preceding project.

The main strive for these workshops were to design a pedagogical model to support work on pupil participation, and also to visualize some of the core benefits of such work.

The model above was presented as an interpretation of the sketches made at workshop 2, and used at workshop 3 and 4 to further the discussion on possibilities for pupil participation. As an Interpretative Action Research project, we as researchers were active in the process, setting up goals and planning the workshops. Still, we do study the creative process of the workshop participants. Our aim is, in that respect, something else than the goals of the participating teachers. Their ambition was to find new ways of conducting their profession, with an increased emphasis on pupil participation in general and pupil responsibility of their own learning process in particular.

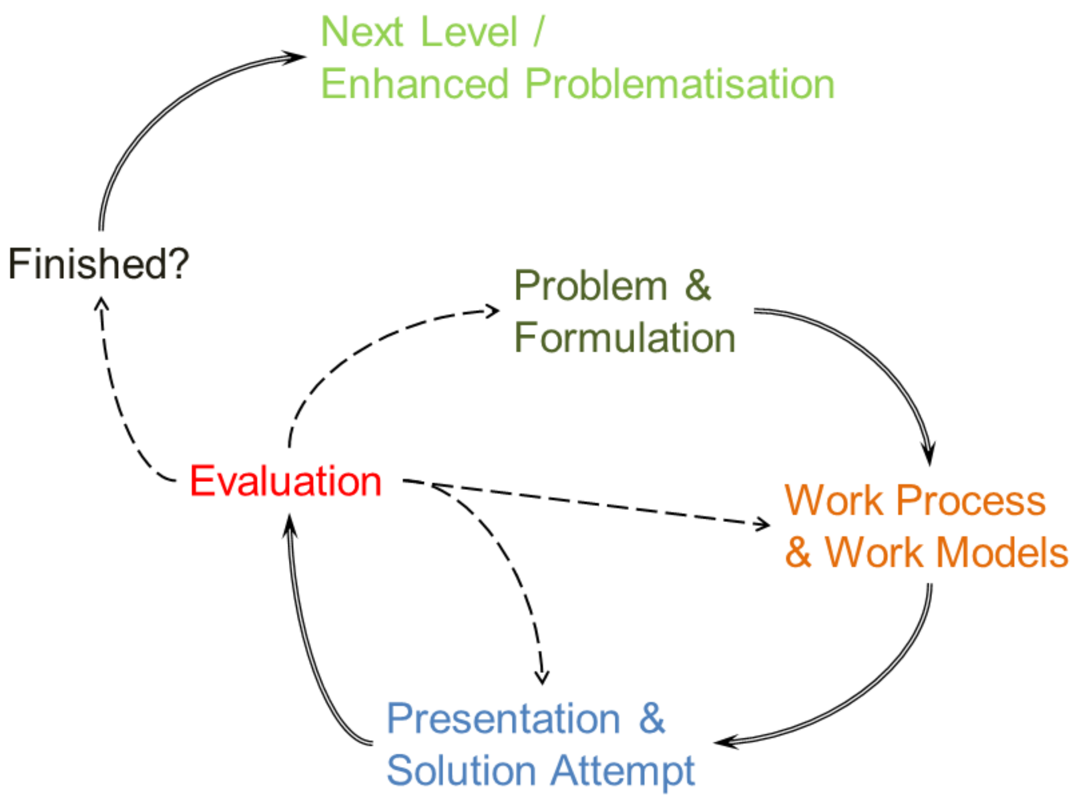

Figure 1: Tentative model produced and used in discussions on how to facilitate pupil participation.

The model itself can be used both for the teacher's process as well as that of the pupils. The model starts with a formulation of the problem area at hand, where the teacher describes the problem area and the pupil a specific problem within the area. Then a work process is formulated, where the suitable methods are presented and chosen (groups or individuals, lab work, interviews, surveys etcetera). The next step is deciding how the solution is to be presented; oral, written, dramatization, etcetera. As well as presenting a solution attempt, after which all the steps are evaluated. If something is found to not be satisfactory that step is re-taken. If everything is found to be ok one can proceed to the next level or delve deeper into the problematisation. This process has several similarities to the example at Exmouth Community College presented by Flutter & Rudduck (2004).

The value of the participatory method thus differs for the subjects and the researchers. For us as researchers, we have been given the opportunity to follow a process of practice development as conceptualized by a group of junior high school teachers. In our preliminary analysis of that process, what stands out is the participants' eagerness in both the discussion as well as in the appropriation of the new methods and concepts. At several occasions the participants commented on the value of having time to discuss and to be creative. They also put much emphasis on the need of collegial support in focusing on the goals and guidelines of the national curriculum (LGR 11), and thus move beyond the syllabuses in that curriculum.

A more concrete result of the project is that (at least) two of the teachers immediately started involving the pupils in the planning of their learning processes, inspired by the workshops and the model.

Study Limits

Even if findings developed out a study like this may not be generalizable due to the low number of participators we believe that participatory methods can increase understanding on how co-designing in particular can support development of the pedagogical models, and participatory methods in general can further the mutual benefits of the meeting of researchers and practitioners.

The quality of the actual model is hard to evaluate, as it first need to be tested in pupil participation projects in the school. This process is now being followed.

Future Work

A basic idea for these workshops was to support pupil involvement in school activities, by increasing the teachers understanding of the possibilities for such pupil participation. Thus, it will be interesting to follow the teachers in the implementation process of the developed pedagogical model and which adjustments are needed to adapt it to the classroom situation. Does it increase the pupil participation – and if so, in what respect? How do the teachers conceptualize pupil participation?

CONCLUSIONS

It was inspiring to witness the enthusiasm of some of the participating teachers' will to implement and test the new developed pedagogical model in their classrooms. The enthusiasm of three of them (half of them) were shown even during the process and from the very beginning, when some of them showed the interest to discuss further after the workshops were ended. Voices were also heard in the beginning about the researchers not having the same level of expertise in the curriculum as the teachers.

Three out of the four workshops were held in classrooms at the school. The main argument for this was to be more time efficient as the workshops were held directly after their ordinary workday as teachers. Still, being at their workplace did cause some distractions for the teachers (pupils and colleagues asking questions, etc.). However, the last workshop was held at university campus (app. 500 meters from the school). The balancing of convenience (being at the home ground, be more time efficient) and of inconvenience (less time efficient, other distractions) is probably a balancing of being in familiar and safe environment and of finding new inspiration. Regardless, the place chosen, and how that place (room) is set need serious considerations as it will influence the process and eventually the results – regardless if these being findings in terms of research of usefulness or in terms of inspiration for the pedagogical practice.

The model uses the pupils' own interests as support for increasing their engagement and participation. This is done by letting them choose their specific task within the subject area, which data gathering method and which presentation method they want to use.

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Mobile probes: A scaffold for local learning with online resources?

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A project investigating the effectiveness of a collection of online resources for teachers' professional development used mobile probes as a data collection method. Teachers received questions and tasks on their mobile in a dialogic manner while in their everyday context as opposed to in an interview. This method provided valuable insight into the contextual use, i.e. how did the online resource transfer to the work practice. However, the research team also found that mobile probes may provide the scaffolding necessary for individual and peer learning at a very local (intra-school) community level. This paper is an initial investigation of how the mobile probes process proved to engage teachers in their efforts to improve teaching. It also highlights some of the barriers emerging when applying mobile probes as a scaffold for learning.

Keywords: mobile probes, learning scaffold, online open learning, distributed learning environments, professional development

INTRODUCTION

This paper reports on the mobile probes phase of a large empirical project with science teachers in Danish elementary schools. This project designs and implements a collection of online multimedia materials that teachers can work with and apply to their teaching. In this paper, this collection of multimedia materials is referred to as the Online Resource (OR). The research is a design-based research (DBR) project (Amiel & Reeves, 2008) which commenced in 2013. DBR is an intervention research approach, characterised by iterative cycles of testing and refinement of solutions in practice and in collaboration with practitioners. DBR tries to simultaneously understand and contribute to the improvement of a specific educational practice (Amiel & Reeves, 2008). This paper presents findings from a phase which took place approximately two years into the larger project. The researchers discovered that a digital mobile data collection method, *mobile probes*, provided an opportunity for scaffolding learning-in-practice process at the individual and peer level.

The area of open online learning has grown in recent years in higher education and continuous learning. *Massive open online courses (MOOC)* are a rapidly growing trend in eLearning. There are two most commonly known types: xMOOC often have standardised structure (video tutorials, readings and often computer graded assignments), where the instructor is viewed as the expert and the learner as a knowledge consumer. cMOOCs have an open structure and see knowledge as a networked state, where learners' participate in the collaborative process of sharing knowledge that others can connect to and with (Siemens 2013).

Few professional development activities for teachers are defined as MOOCs and further research on their effectiveness is needed (Jobe et al. 2014). The OR can best be described in terms of the quasi-MOOC format which does not provide the social interaction of cMOOCs or the automated grading and tutorial-driven format of xMOOCs. Quasi-MOOCs are loosely linked asynchronous learning resources that are not packaged as a course (Siemens, 2013). This OR likewise does not provide ready-made teaching plans and other activities to use as is. Rather, the focus is on the pedagogical and process level of inquiry-based teaching. On the other hand, it is also not an open space for sharing, as the OR in itself is not a Web 2.0 resource.

When dealing with large-scale professional development in geographically distributed environments, changes to professional practices often require the learners to partake in activities isolated from their workplaces. Referring to renowned teacher professional development researchers such as Borko, Elmore and Little, Schlager and Fusco discuss the argument: 'that teacher professional development is more than a series of training workshops, institutes, meetings, and in-service days. It is a process of learning how to put knowledge into practice through engagement in practice within a community of practitioners' (Schlager & Fusco, 2003, p. 205). They illustrate how a large body of studies on technology-driven learning relies on the notion that online learning can provide such a community of practice. However, they draw attention to the fact that many of the implemented online communities are isolated from the existing local communities of practice at the workplace, and further argue that there is great potential if the Internet is used to support these local communities (Schlager & Fusco, 2003).

The research scope and questions for this paper were not formulated prior to the commencement of the research project, but instead emerged during the research process as follows:

- What can be learned from mobile probes studies in the context of eLearning and professional development?
- How do the participants experience and change due to the mobile probes process?
- What signs are there that the mobile probes scaffold learning?

MOBILE PROBES

The term 'mobile probes' refers to mobile approaches used to collect digital data in various situations from and/or with participants, e.g. when investigating traffic situations or for gaining information from potential customers. In human–computer interaction (HCI), probes are often inspired by the cultural probe method, which is a very explorative and user-participative approach (e.g. Gaver & Penningtong, 2004). The cultural probes method involves activities where the researcher hands out or mails packages containing, for example, postcards or disposable cameras to the participants. The packages include largely open-ended questions and tasks for the participant to answer and return. Hence, the cultural probe method provides user-generated data, and the content of this data cannot be predicted beforehand. The data collecting process is seen as preceding the design phase and contributes to the qualitative knowledge base about users (as, e.g. presented in Gaver & Penningtong, 2004).

Rikke Ørngreen developed in 2013 a type of mobile probes approach, which was inspired by the cultural probes method, and by qualitative interviews. It was developed as the means to obtain insights about work situations and discover new (not yet identified) contextual factors when designing for online learning and knowledge sharing. This approach uses SMS/text messages with questions or tasks in a dialogical manner (Duvaa et al., 2013).This approach proved valuable in obtaining knowledge about users and their work with tasks, particularly when these users are geographically distributed and work asynchronous.

Duvaa et al. (2013) argue that though semi-structured interviews (as in Kvale, 1997) can aid in generating rich descriptions of the context, they only address issues that the researcher is able to address. Cultural probes add an element of uncertainty (Gaver & Penningtong, 2004), which provides an opportunity to uncover issues that were unknown to the researcher, but which could be important for the design. Similarly, the mobile probes method makes it possible for the researcher to ask questions by SMS about the user's daily tasks and reflections on these tasks while they are still in the context of their daily work life. These unknown issues may not surface in an interview, as the users may not even be aware of their importance. By using the mobile probes, the researcher is able to ask about here-and-now issues (e.g. what are you doing/seeing/discussing right now?), and the user may also receive a task to perform in practice. These questions and tasks then unfold in a dialog with the user. Inspired by Darsø and Polainy, this is called 'uncovering non-knowledge': 'Non-knowledge is the knowledge that depends on context, social relations and artifacts in order to become understood or recognized as significant and to be codified' (Duvaa et al., 2013, p. 163).

The mobile probes developed by Duvaa et al. (2013) have a longer timespan than cultural probes or semi-structured interviews. The participant would typically receive three messages with questions or small tasks a day for one week / five work days. The authors found the method successful in that it generated new insights, also there was a very high response rate to the questions. The interpretation by the researchers in the study was that the dialogical nature of this type of mobile probes (unlike cultural probes) would support the 'unravelling' of complex relations and identify key issues for the design process. However, even though the dialogical approach seemed to work, the researchers in the study concluded that it was difficult to engage users to give in-depth explanations, which seem easier in synchronous dialogs (whether online or face-to-face) (see Duvaa et al., 2013). In a similar study, an SMS probe was used, and the study also highlights the 'on-the-spot' answers of the method: 'The context you're in when you get the question will influence what you answer or how you do your assignment' (Jönsson et al., 2002, p. 19).

THE PROJECT FRAME

The OR is targeted at science teachers (primarily K1–6) and was developed by the Kata Foundation. The foundation partners with various stakeholders and research allies, including Aalborg University in this case. Figure 1 and 2 show screenshots from the OR, which gives an impression of the kind of interface the teachers are navigating in.

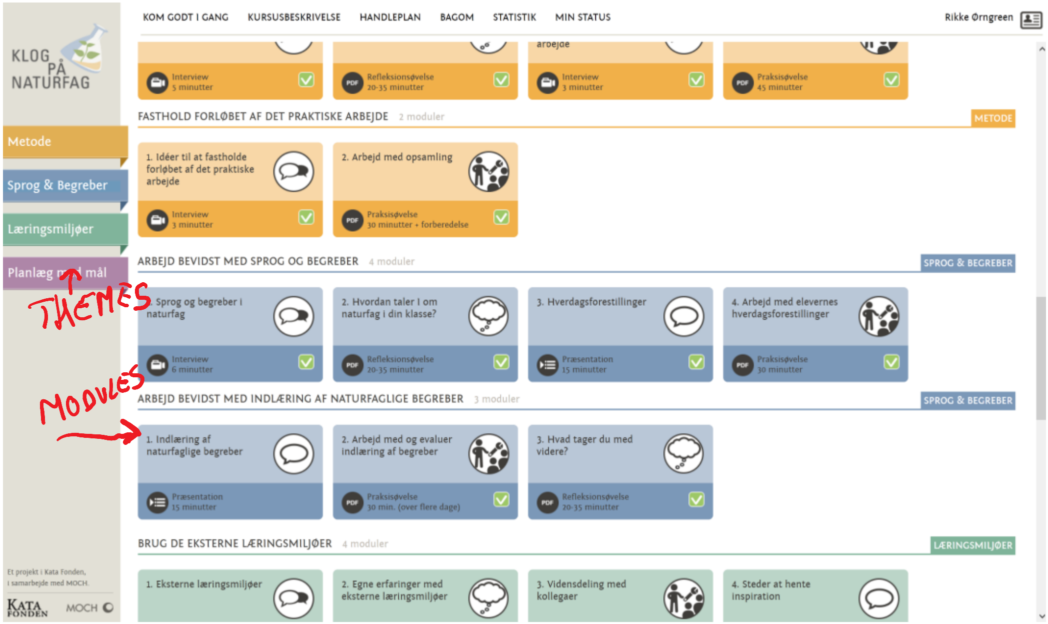

Figure 1.;A screenshot of the front page of the OR

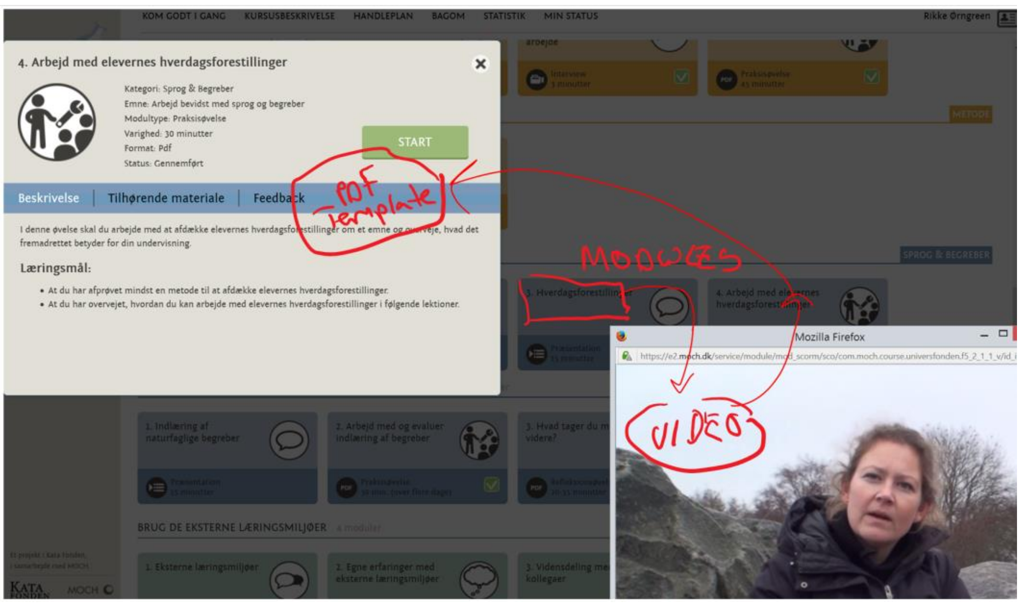

Figure 2.; A screenshot from the content pages of a module

Figure 3 depicts a possible pathway of how users are intended to work with the solution: The learning material is structured into modules that can be completed in any sequence, though a specific sequence is suggested for each module.

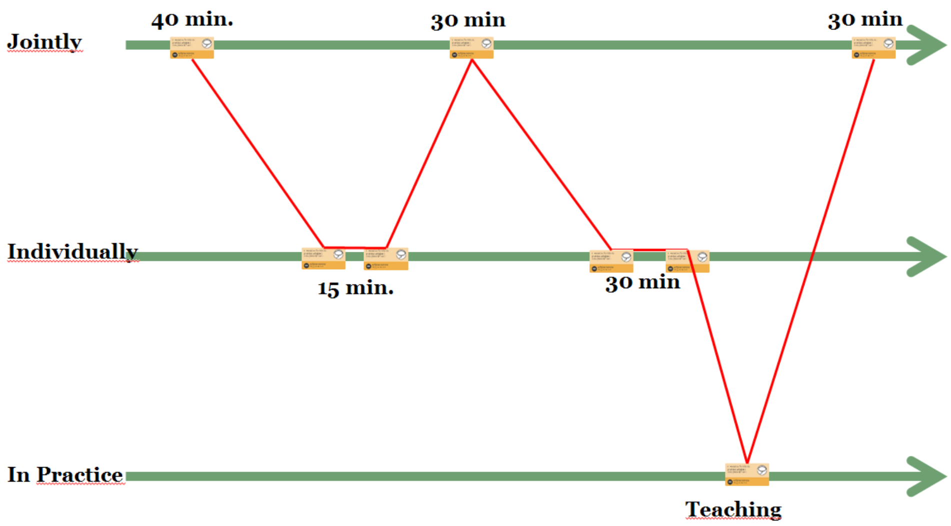

Figure 3: Suggested sequence from the module: ‘work practically with students’ (by project manager Jesper Ingerslev).

A timewise linear view of the DBR-based iterative process is depicted in figure 4. The development of the first version of the online resource (OR1) took place during the first year of the project in 2013. Simultaneously, the researchers established knowledge about science teachers’ current practices through explorative field studies at two schools (RS1, as reported in Noesgaard, 2014). Once the first version was ready to test (OR1), a number of qualitative empirical studies were carried out during 2014 involving seven teachers at three Danish elementary schools (RS2, as reported in Noesgaard & Ørngreen, 2015).

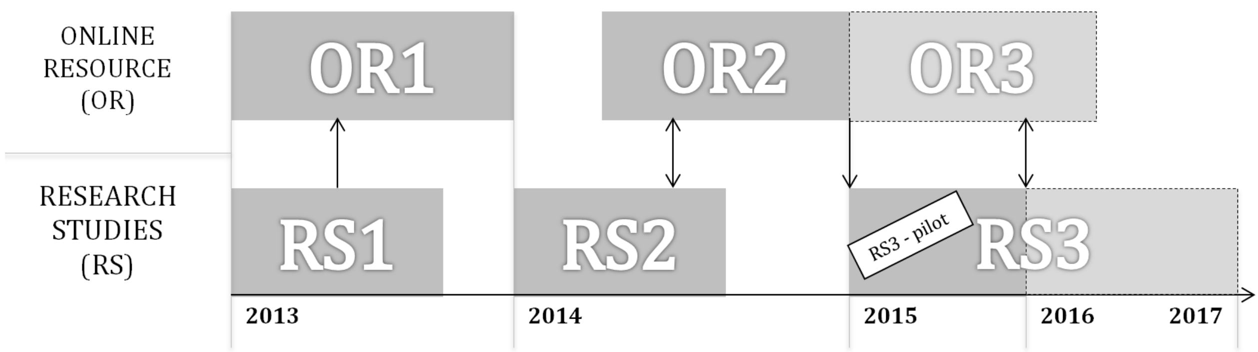

Figure 4: An overview of the interplay between research and design

Though the OR suggests that the teachers complete the modules in a sequential order, the 2014 RS2 indicated that teachers could not always be expected to work through the material as suggested. Even when the researchers were present, some teachers would skip through parts of the material and did not explicitly talk to each other about their current practices as requested in the exercises. However, three of the teachers noticeably changed their teaching in the process; nevertheless, most teachers used strategies to show that applying the material in their teaching was not necessary (Noesgaard & Ørngreen, 2015). In 2014, more modules were developed (OR2), and in the late spring/summer of 2015, the OR was made available for all K1–12 teachers in Denmark via an online login system governed by the state called uni-login. At the same time, preparations for a large-scale longitudinal empirical data collection process began (RS3).

For the research studies in 2015–2016 (RS3), a series of digital and remotely qualitative and quantitative research activities are planned. For example, a back-end statistical module provides information about which modules a certain uni-login has used. Similarly, a pre- and post-survey has been developed. The RS3 pilot took place in June 2015. The mobile probes were conducted at one school with two teachers. The pre- and post-surveys were given to two schools, with a total of five teachers completing the survey. Focus group interviews were held after both surveys and after the mobile probes process with all five teachers. Despite a small cohort, it was possible to detect the relevance of the mobile probes as a scaffold because this relatively new mobile probes approach had already been used in three other projects as an empirical data collection method. The case of mobile probes as a learning scaffold can be viewed as an exemplary single case, which can inform science (Flyvbjerg, 2006) and indicate areas of further research. While stating that scaffolding and facilitating a learning process is vital to online distributed education may seem obvious and perhaps even naïve, the elements in this mobile probes approach were different from other facilitating processes that the researchers had previously seen in eLearning approaches.

MOBILE PROBES IN PILOT RS3

The RS1 investigated the current practices of science teachers and found that when designing for learning transfer, extra attention to the learners' work environment (context) is necessary (Noesgaard, 2014). Mobile probes were thus chosen because they provide an opportunity to follow people, who work at multiple locations and at different hours of the day. In addition, there are situations that are perhaps best 'seen' when the researcher is not present due to the private nature of a classroom setting. Of course, this is also a cost-effective approach compared to being physically present, which requires more man-hours and travel funds. Furthermore, it is an explicit choice to focus on the teachers' change process and inner thoughts (motivation, frustration etc.).

The RS2, where participants used the OR1, found that the teachers are able to self-report on learning effectiveness that involves parameters of satisfaction and transfer to practice - a finding which was in alignment with other studies in the literature (see Noesgaard & Ørngreen, 2015). The mobile probes could thus act as a self-reporting process.

As it emerged, the process showed that the mobile probes may not only act as self-reporting, but also as an act of scaffolding. Scaffolding can be defined as a process where the learner receives just-in-time support to solve problems or achieve learning goals, which this person without support had not been able to solve / reach (Belland 2014, Holton & Clarke, 2006). In education, scaffolding is usually used to refer to how teachers support their students. Holton and Clarke (2006) noted that not everything a teacher does can be viewed as scaffolding and that the following two components need to be present in order to count as scaffolding: to support the immediate construction of knowledge and to support the basis for independent learning in the future. Self-scaffolding and metacognition is considered an important component of problem solving and learning processes. Metacognition can be defined as 'the awareness that individuals have of their own thinking; their evaluation of that thinking; and their regulation of that thinking' (Holton & Clarke, 2006, p. 133, with reference to Wilson and Clarke).

The pilot began with (texting) a series of practical questions concerning which days the teacher teaches science topics, with which classes and if and how much they had already looked into the material online. This provided a framework for which new questions to text and when to text them (during the 2-week period). Prior to the commencement of the process, an array of themes (questions and tasks) had been identified as possible starting points for the dialogs. The intention with the pilot was to see if the themes and the process were meaningful to work with. The process included the perspective that the following question would depend on the answers received (as in a semi-structured interview, Kvale, 1997). This means that the researchers interpret the material when it is received and act upon it immediately. As such, analysis and interpretation of data was an ongoing process - in accordance with the DBR-thinking of the project.

The example in Figure 5 shows the teacher's reflections prior to her teaching. The correspondence shows that she does not normally micro plan a session in this way, and that she is considering if she will be more or less confined in her actions. While it is not possible to conclude that she would not have the same reflections without the probe, the question makes this issue explicit at this point.

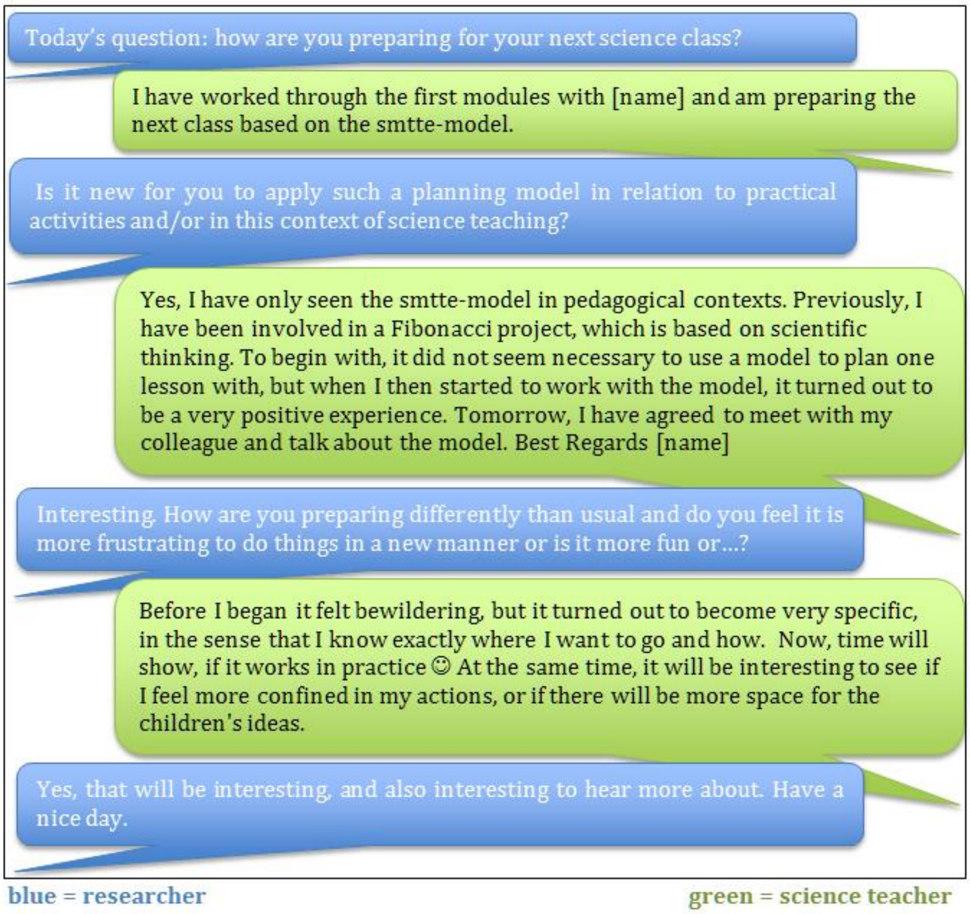

Figure 5: Participant on choice of module and micro planning (translated from Danish)

The length of the received messages ranges from a few words up to 200 words. An example of a lengthier answer is shown below in Figure 6, where the same teacher reflects in her preparation after the teaching. Two interesting matters should be noted from this example. First, by means of a relatively simple text message, the teachers reflect on and relate to how the material connects to their own practice, which in turn gives the research team meaningful knowledge about the context. When comparing the answers from before the teaching (Figure 5) with after the teaching (Figure 6), this teacher evaluates her steps and changes her mind regarding whether the model was useful as a planning tool for a single lesson. Second, this is an example of what was seen in both the mobile probes as well as the focus group interviews in the pilot: The teachers tend to over-plan, which leads to frustration. Many of the teachers plan with too much content and others plan with too many activities that they are not able to fit in the sessions.

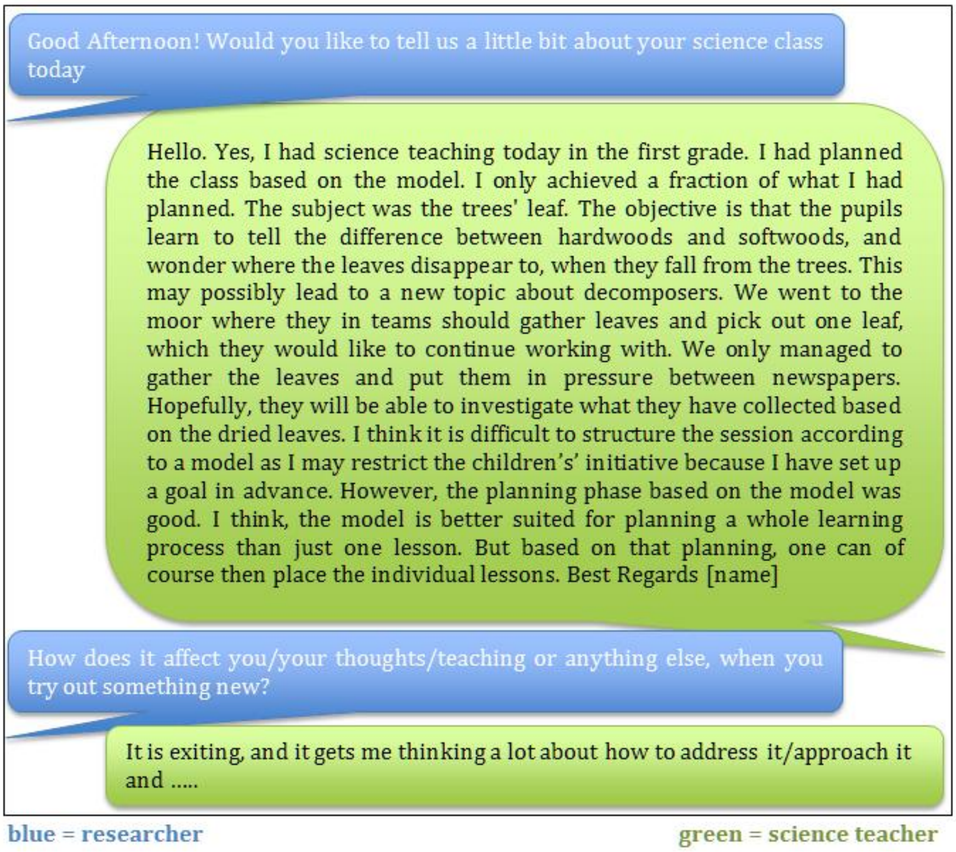

Figure 6: Participant on how the chosen module then worked in class (translated from Danish)

Figure 7 provides an example of the richness of the material received from the participants. In this particular situation, the 'wise word wall' [DK: Klog Ord Væg] situation from the dialog above. These pictures aid in understanding the context and the situation that took place. However, the act of taking the pictures and describing what they represent also requires an evaluative and reflective stance from the teachers, forcing them to see their own decisions from an 'outside' position.

Figure 7. Contextual material returned by a participant (faces and names scratched out by researchers)

Though this is not a quantitative analysis, an overview of the number of messages to/from the two teachers in the pilot RS3 is seen as meaningful, as it shows that this method seems to motivate to a dialog. 58 text messages, 32 questions, and 3 bigger tasks were sent from the researchers to the participants, and 40 text messages, 29 directly answered questions and 1 big task were returned from the participants - app.150 SMS in total. The response rate for the questions was 91%.

DISCUSSION

As professional development often occurs in real-world settings that are complex and include many intervening variables, causal interference is not possible. Furthermore, many schools are involved in several reform programs at the same time, which means that, 'isolating the effects of a single program or activity under such conditions is usually impossible' (Guskey, 2002, p. 50). Nevertheless, Guskey often stresses that professional development initiatives should seek to focus on the relationship between professional development activities and the signs of improved learning among the students. This project focuses on signs of transfer of the OR to practice through teachers' self-evaluation. However, it has thus far proven to be difficult to get teachers to carry out tasks that are directed at getting more knowledge from their students. For example, a teacher was asked to interview her pupils about their experiences during the break immediately after the lesson. She was then supposed to record herself as she reflects aloud afterwards and send this recording to the research team. She misunderstood this task a little and instead recorded the short interview with her pupils. From the video it is clear that she did not manage to get the children to evaluate or to give their opinions; rather, they gave a summary of activities in the lesson. Though not the exact task that was asked for, this dialog provided her with feedback regarding whether the children understood the lesson. The recording also shows that the children were very engaged, which is a sign of motivation. It cannot be concluded that the teacher learned from this and thought about what to change/keep, as she did not offer any specific reflection in this regard. However, it can be argued that the mobile probes questions and tasks provide a space for doing so.

The professional development initiative with the OR3 is voluntary and thus the time and energy invested by the teachers is their own choice. Teachers in Denmark have a culture of working relatively autonomously with a lot of pedagogical freedom. Participants in this pilot are clearly collaborating (they refer to each other and to meetings in the mobile probes and post-interview).

This is also seen in some of the newer mobile probes, which were initiated in January 2016 (RS3). However, since participation is voluntary, the research team now finds that getting teachers to begin the mobile process is quite difficult. Many teachers sign up, but fewer actually begin answering the first questions. This is the same dilemma that many MOOC providers face (Siemens, 2013).

These issues may be reinforced when it comes to quasi-MOOC solutions that rely on collaborative learning at local levels. In a report on open educational resources, a chapter on teachers' professional development concludes that there is a need to change the community culture around sharing: 'This is because teachers and instructors often show a reluctance to share or collaborate in open networks.' (OECD 2015, p. 48).

From the pre- and post-surveys in this project [RS3], it is evident that very few teachers collaborate with other teachers on planning, conducting and evaluating specific teaching. The discussions with teachers revealed that when they collaborate it is on a more practical daily administrative level and then primarily across subject/curricular boundaries, because teacher teams are formed around a grade-year or in subject matter teams which discuss themes of interest not a specific session. This reinforces that initiatives that ensure a sharing culture may need to be scaffolded from outside in order to change the practices and current work culture in small steps.

Follow-up activities are important to support sustainable large-scale change, e.g. an analysis of approximately 1300 studies confirmed the vital importance of follow-up (Guskey & Yoon, 2009). As previously mentioned, the intention of this project became to create an environment that supports and strengthens existing local communities, rather than just creating online communities (similar to the arguments of Schlager & Fusco, 2003). The mobile probes approach can provide such a space for local facilitation at the individual and peer level by providing just-in-time support to solve problems or ask direct questions that prompt evaluation and reflection.

In this light, mobile probes may be viewed as a heuristic scaffolding (Holton & Clarke, 2006), which encompasses open and generic questions (e.g. What are you doing? Why are you doing it? How does it help you?) that prompt metacognitive thinking, and as opposed to a conceptual scaffold, which is related to domain knowledge. The researchers' (in the analysis of the empirical material) and the participants' (in their verbal reflection on the process in the focus group interview) experience that the mobile probes pilot had a positive influence on self-awareness and requires self-assessment (self-evaluation); however, signs of sustainable self-regulation have not yet been documented.

Teachers in general, as in many other professions, are reflective about their own everyday practice. The experience in this project, however, is that there is a difference between the reflections that involve thinking by oneself and those that are explicitly recorded (written or spoken) with an audience in mind. There is also a difference in reflecting on everyday descriptions or on a specific incident that is experienced as critical/profound. One of the participants compared the approach to ‘having a weight watcher in your pocket’ (from the post focus group). When one signs up for the Weight Watchers program, even though it is voluntary, one needs a gentle push once in a while to eat a carrot rather than the chocolate bar. Similarly, the mobile probes, though voluntary, can serve a disciplinary function.

Although too much frustration is not constructive for learning, reflective learning processes often have an element of productive frustration (Illeris, 2006). The teachers in the pilot showed signs of productive frustration. However, in the future use of mobile probes in this project (RS3), it is suggested that further investigations are conducted to examine what factors result in excessive frustration, at what moment do teachers ‘give up’ and whether there are circumstances where over-frustration can be turned into productive frustration.

For many years, the relationship between attitude and behaviour has been discussed, and there is evidence that changes in behaviour are not always linked to changed attitudes and beliefs (Ajzen & Fishbein, 1977). The mobile probes participants showed signs of transfer from the OR to practice and also provided productive insight into the difficulties they experienced. However, the data lacks sufficient depth and was not derived from a long-enough period of time to determine if this is a sign of sustainable change in attitude/beliefs. Also, the study is not a controlled experiment that can point to the correlating factors between attitude/belief and behaviour. Nonetheless, it is an example of people volunteering to being probed to act and then actually doing so, which means they start experimenting, without necessarily changing their whole setup and their entire mind-set. This may allow them to stay at a minimum frustration level, where the changes are incremental and manageable. These factors need more investigation.

Limitations and suggestions for future research

Changes take time, and the researchers in this study found that there is a need to utilise mobile probes of a longer duration than those used until now; furthermore, perhaps a still voluntary but more collegial disciplinary sign-up at the workshop is necessary.

In some of the new rounds of mobile probes (RS3 from January 2016), it was found that it can be difficult for some participants to go beyond the descriptive level. Just as in face-to-face scaffolding, these participants require more time to reach the kind of reflectivity which is sensitive to the specific and/or extraordinary. Though a test to stretch the timeline was conducted, it seems that one of the limitations of mobile probes for some people is that it is easier to stop participating. Many issues could be at stake, including time-related priorities, lack of back-up from the organisation or simply the distance and digital nature of mobile probes, which can make it less natural and thus more difficult for some people to make a commitment. Research is therefore needed regarding why people refrain from starting and also the reasons why they drop out.

The current exemplary case, i.e. the RS3-pilot, resulted in the investigation of the 'good' case of mobile probes as a scaffolding activity in the time- and place-distributed environments of school teachers. The next sampling in this DBR project could be to investigate a 'not-so-good' situation that may shed some light regarding why early drop-out (deliberately and involuntarily) happens.

CONCLUSION

At the start of the paper, three research questions were formulated and are included here again to sum up what is now known.

What can be learned from mobile probes studies in the context of eLearning and professional development? Mobile probes are seen as useful for environments where the professional development activity is about content that teachers see, adapt and transfer to own work practice and where the tasks are carried out in different geographical areas and time intervals. The approach provides insights into the contextual situation via open and here-and-now questions, which enabled participants to evaluate what happened today rather than how things went one or two months ago, which is often the situation in courses, workshops etc. This pilot had very engaged teachers, but in the newer RS3 studies it proved to be difficult to get the participants started and sometimes to even engage in and complete the process.

How do the participants experience and change due to the mobile probes process? If commitment and motivation are present, the mobile probes process can support the teachers to change their practice and begin further collaboration in local settings. The mobile probes process and the OR try to address change and transfer to practice in small incremental steps. The participants were very open regarding their activities and when reporting on their students' activities and own evaluation hereof. It can be difficult to move beyond the more descriptive level or to provide nuanced/full answers to mobile text questions. Also, the participants showed signs of productive frustration, but in the newest rounds there have also been signs of over-frustration.

What signs are there that the mobile probes scaffold learning? The open questions that served to uncover non-knowledge of the original mobile probes method as an empirical data gathering method, served in-line with a heuristic scaffold. The mobile probes enable participants to do a just-in-time reflection, and can support supported participants in the externalisation of metacognitive processes by prompting them to explicate and evaluate their own thinking and doing; however, the mobile probes process cannot document the sustainability of these self-regulations. As a professional development activity, the mobile probes focus on the teachers and their ability to self-report and to support self-scaffolding through an external heuristic scaffold. The approach has an explicit focus on signs of transfer, where the signs are seen in the teacher's answers.

The conclusion is that the mobile probes can function as a scaffold for learning at the individual and peer level. The probes can create a space for teachers to explicitly reflect on their own teaching processes and try out small things. In the future of this project, reasons for opting out and dropping out of this volunteer teacher professional development activities will be investigated. This can create knowledge both for research and future design in general, and in the project this will be related to both an individual, peer and organisational level.

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