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Published in:
Proceedings of the 7th International Conference on Networked Learning

Publication date:
2010

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

A Theoretical Design for Learning Model addressing the Networked Society

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Abstract

The transition from the industrial to the networked society produces contradictions that challenges the educational system and force it to adapt to new conditions. In a Danish virtual Master in Information and Communication Technologies and Learning (MIL) these contradictions appear as a field of tension between time resources and the demand for educational quality. The size of curriculum is growing while the time available for learning is continuously decreasing. We teach for deep learning but are confronted by students' cost-benefit strategies when they navigate through the study programme under time pressure. To meet these challenges a Design for Learning Model has been developed. The aim is to provide a scaffold that ensures students´ acquisition of the subject matter within a time limit and at a learning quality that support their deep learning process during a subsequent period of on-line study work. In the process of moving from theory to application our model passes through three stages: 1) Conceptual modeling; 2) Orchestration, and 3) Operationalization that direct the students' performance in practice when the design model is applied. Moving from conceptual modelling and orchestration to operationalization is a move from the generic theoretical modelling into a specific description of an application of the model in a specific context. We discuss our theoretical Design for Learning Model arguing that the model gives birth to scaffolding which enables students to maintain progression in the learning process and develop Networked Society competencies.

Keywords

E-learning, theory, scaffolding, deep learning, complementarity principle, meta-reflections

Understanding education in the Networked Society

Castells (2000) points to central characteristics, which have already emerged from the transition from industrial to networked society, and describes the new societal structure through three dimensions. *1) Informational:* The capacity to generate knowledge and process information determines productivity and competitiveness. *2) Global:* Development of a worldwide it-infrastructure provides strategic activities with the capacity to work as a unit on a planetary scale. *3) Networked:* The connectivity of the global economy generates a new form of organization, the *network enterprise* made from either firms or segments of firms where the production unit is the business project. Flexibility and mobility characterizes the new Economy and people who work in this system are divided in two categories: 1) self-programmable labour equipped with future competencies for lifelong learning. This means autonomous ability to retrain/adapt to new conditions and challenges through experiential approaches; abduction, knowledge sharing and negotiation of meaning; and 2) generic labour which is exchangeable and disposable.

All aspects of society including the educational systems and learning are challenged by forces that draw in contradicting directions and leave education and learning open for interpretation within at least three meta-discourses; The first is the current *political-ethical discourse* which is focused on the development of a new paradigm inspired by social constructivist and constructivist theory and the general consensus, that *future competencies need time to mature.* The second is the current *economic-pragmatic discourse* which demands fast, *efficient, predictable and controllable productivity* from the educational institutions (Dyson, 1999). Because they are based on entirely different grounds and objectives, the meta-discourses becomes mutually incompatible and generate a paradox that appears as *tension between the quality of educational outcome and quantitative measures of productivity*. This also shows itself in the third paradigm, the *educational discourse*, which is caught between the learning paradigm of the knowledge society and the learning paradigm of the industrial society (Sørensen, Danielsen and Nielsen 2007).

ISBN 978-1-86220-225-2

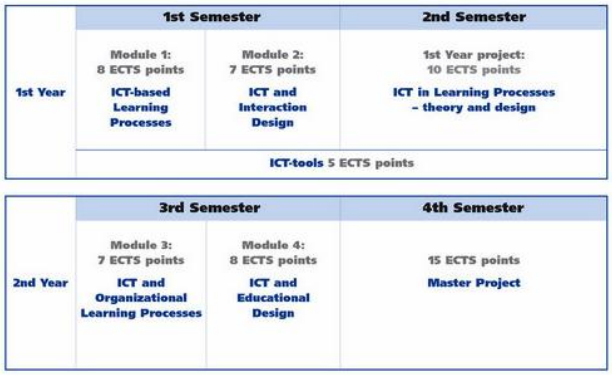
In our teaching we encounter the paradox at first hand. Our approach is based on constructivist and social constructivist traditions but we are required to measure students according to a list of learning goals. The size of curriculum is growing while the time available for learning is continuously decreasing. We teach for deep learning but are confronted by students' cost-benefit strategies when they navigate through the study programme under time pressure (Biggs 2003, Lawless & Allen 2004). Students expect teachers to deliver digested lectures on the subject matter, in order to *fill* in their knowledge gab through transmission of knowledge. However, our task must be to maintain and develop educational quality and support students in becoming self-programming participants in the networked society. The students themselves must *bridge* the knowledge gab through their own transfer and construction of knowledge.

In *section one,* we introduce the case: MIL (Master in Information and Communication technologies and Learning). In *section two,* we show the paradox of time/learning quality in MIL. The paradox cannot be removed, so we suggest that the challenge is to exploit the paradox (Hastrup 1999; Yuthas, Dillard & Rogers 2004). In *section three,* we develop our Design for Learning Model. In the process from theory to practical application our model passes through three stages of construction; 1) *Conceptual modeling;* 2) *Orchestration* and 3) *Operationalization.* The move from conceptual modeling and orchestration to operationalization is also a move from the generic theoretical modeling into a specific description of one way to apply the generic model to a concrete context. In *the final section* we discuss scaffolding enabling students to maintain progression in the ongoing learning process.

MIL – the case

MIL is an established blended mode part-time study programme of two years duration. MIL aims at HR developers, e-learning designers, software developers, education planners, and teachers. The average number of students in a class is 30. MIL´s overall objectives are that the students acquire academic as well as practice related design competencies in relation to ICT and learning. The competencies will allow them to develop, implement and evaluate ICT-supported learning processes in various contexts. Admission to MIL requires a relevant bachelor degree within the humanities, social sciences, engineering, education, design or art combined with minimum 2 years of relevant working experience upon completing the qualifying exam. In general students are full time employed, they have family obligations and they have left the educational system 5 to 10 years before starting on a master degree in MIL (Levinsen 2006).

Figure 1: MILs study program



The actual implementation of MIL's design for learning mixes online periods with face-to-face seminars, but the main collaborative student work and interaction with teachers take place in the on-line periods. Figure 1 above shows the overall structure of the study programme. MIL's pedagogical foundation is based on the Scandinavian tradition of Problem Oriented Project Pedagogy (POPP) (Illeris 2006). The most important principles of POPP are problem formulation and enquiry of exemplary problems. At MIL, POPP is adapted into ComputerSupported Collaborative Learning (CSCL) as MIL's overall model of design for learning (Dirckinck-Holmfeld, 2002). However, also problem-based learning (PBL) and Case Based Learning (CBL) are used. The fundamental difference between the approaches is the outset. In POPP the students define their area of interest and choose the problem, whereas in PBL and CBL the teacher defines the problem of interest.

Design for learning in a Networked Society

ISBN 978-1-86220-225-2

The conceptual model

MIL´s *design for learning* is based on group work and projects. As a frame for developing our conceptual model for learning we use Darsø's theory of group dynamics and project management (2001). Especially her concept *preject* with its relation to time embraces and supports the development and consolidation of the Network Society competencies of Castells' self-programming individual: Experiential approach; abduction; knowledge sharing and negotiation of meaning. All preject participants, also MIL students, bring whatever resources they posses into the preject. Therefore prejects draw on divergent knowledge in terms of tacit knowledge, conscious everyday- and qualified knowledge, but also on ignorance and the emerging relations among the participants.

Darsø defines two dimensions of major importance when knowledge constructing group dynamics are to succeed. On the *relational* axis the group dynamic must be pushed into a state where it becomes 'essential for the group to share'. On the *complexity* axis the groups must be challenged by genuine problems with 'ambiguous and uncertain solutions'. According to Darsø the group dynamics then transforms to the state named *the area at the Edge of Chaos.* This is where the participants are challenged to negotiate meaning, explore and construct (to them) new knowledge on the basis of their everyday- and qualified knowledge, tacit knowledge and ignorance.

Design for learning

In the following we focus on the preject and MIL´s seminar activities together with the competencies of the self-programmable individual. Instead of working from zero and as teachers fill in the knowledge gab through digested transmission of knowledge, the students themselves must bridge the knowledge gab through their own transfer and construction of knowledge. They must bring their everyday arena into the specialized arena of the subject matter. Therefore, our design aims to actualize the students' informal resources in terms of everyday- and qualified knowledge through carefully designed activities that pushes the students towards the Edge of Chaos. When everyday resources are externalized through practice, they may constitute a basis for constructing common grounds and clarify concepts. Everyday resources may work as a vehicle for reflection and knowledge construction, as the teachers can direct awareness to their alignment with the theory of the subject matter. E.g. the everyday activity of deciding what is practical to do when we want to know about something aligns with the specialized activity of methodological data-collection design; the everyday realization of ignorance aligns with the specialized activity of formulating research questions.

The conceptual model of our design aims to push the educational activities into the *Area at the Edge of Chaos*:

> *Relational axis;* A *role-play scenario* frames the group work, confronts negotiation of a common ground and push the activity into a state where it is essential for the group to share.
>
> *Complexity axis;* The *role-play problem* confronts genuine dilemmas and problems that push the need for
> experiential approaches, abduction, knowledge sharing and negotiation of meaning.
>
> *The area at the edge of Chaos;* The roles assigned to the participants direct their actions towards the theory.

The design aims to actualize the qualified and everyday knowledge, tacit knowledge and ignorance in a way that may generate new knowledge – where everyday knowledge that can be aligned with the theory. However, the participants practice has to be facilitated, as it is important that students become aware of both the use of communication and the progress in order to maintain the preject stage and not progress into the pre-project phase. The students must maintain an abductive approach and avoid attempts of persuasion or jumping to conclusions. Knowledge construction and progress are related to genuine problems. That is, situations of productive frustration where the participants are forced to negotiate choices.
The preject's time trajectory is a path of bifurcation points, which Darsø describes as *"rather like 'forks in the road' leading to different futures*" (Ibid: 326). Learning is linked to the participants' conscious awareness of the bifurcation points, their related choices, de-selections and the negotiated decision making of how to proceed. To facilitate the process, our Design for Learning faces the challenge of how to balance between the opposites: Static deadlock and destructive chaos. Therefore the last claim to our conceptual model is that it aims at obtaining that balance. The abductive approach is maintained by defining the groups task as open-ended and explorative. The awareness of bifurcation points and choices is sharpened through the demand to

ISBN 978-1-86220-225-2

document, and through the actual focus on what to document: Choices, de-selections, decisions and arguments. Finally the ongoing negotiation and structuring of the collaboration is maintained through the script for the groups' task.

So far, Darsø's model has served as a vehicle to develop a general conceptual model of our design for learning.
The next steps are to orchestrate and then operationalize the conceptual model onto a specific case.

Orchestration of the conceptual model
Orchestration can be understood in terms of a score for a music composition or the script for a play. Here orchestration means to transform the conceptual model into a script for a concrete practice. A main challenge for
our design for learning model is the general inherent contradiction in educations between a curriculum's complexity and extent as content and the time pressure on the students. As it is defined now the conceptual model cannot deal with this challenge. This is where Bohr's Complementarity Principle becomes relevant (Bohr
1957; Levinsen 2005).

Bohr's Complementarity Principle relates to quantum physics but Bohr also saw its relevance in relation to the humanities and as a contribution to epistemology. According to Bohr, reality exists independent of our consciousness but we are excluded from direct access. We can only experience phenomena – never objects or
events. Every observation is tied to the observer as agency, the position and the conditions. Consequently phenomena are situated and relative to the observer while objects and events are not. Within Bohr's principle, it
is accepted that some objects and events cannot even be experienced as phenomena but only indirectly as index
signs – they evade observation and they evade language. The classic example is the object *light*. From one position light appears and behaves as waves and from another position as particles. Bohr argued that in order to
express the complex and inexpressible object light we have to accept that light – which we do not know what *is* -, is simultaneous both and yet cannot simultaneously be experienced as both. This is a paradox that cannot be
solved. According to Bohr it is possible to know something about objects we can never experience. Bohr argues
that metaphors or complementary images allow us to communicate about, and explore the inexpressible objects and events, because we as humans share a frame of reference through our bodies being in the world. This shared
frame of reference is our everyday experience and language, which allows us to communicate, listen, wonder, ask questions, negotiate meaning and produce knowledge.

A fundamental epistemological consequence of the complementary principle is that, in contrast to other approaches, e.g. epistemic science or holistic approaches, the different pieces of a complementary image cannot
be expected to fit as a puzzle (Lemke 2000). There will always be blank areas in the image where some of these gabs may be filled through new knowledge while others can only be filled through abductive construction. Thus, the complementary image or metaphor becomes a constructed, interacting and dynamic new object in the world.

In the Humanities, dynamic objects and events as life, learning, thoughts, practice, competencies, media and ICT possess similar qualities, they are constantly negotiated and therefore continuously floating. Still we can know something about them and negotiate their meaning. In the case of MIL. instead of trying to expose all students to the entire curriculum, the idea of orchestration (and operationalization) is to force distribution and sharing of knowledge by exposing the students to different essential parts of the content at the edge of chaos, thus facilitating the construction of a complementary image of the content. This is the essence of our orchestration.

ISBN 978-1-86220-225-2

Facilitating learning in the Networked Society through operationalization

So far, we have described the Conceptual model and the Orchestration. The last step is *Operationalization*; the
directions the conductor follows during a concert performance in practice. The tools for operationalizing are: Role-play, Jigsaw method and Knowledge sharing. The model is applied on the specific course 3 of Module 2.

Module 2; Learning, ICT and Interaction Design

The module is on the study of human-computer interaction, focusing on interface design and design of (virtual) learning spaces. The learning objectives are; the ability to participate in experimental user oriented development, the ability to analyze, test, evaluate and critically access the implications of ICT learning systems. The module runs for 5 weeks, starting with a f-t-f seminar followed by an on-line period. It is divided into three courses; 1) introduction to a theoretical psychological frame with focus on sense making; 2) design of visual communication and visual interaction as the basis for human-computer interaction; 3) HCI methods and techniques in design, test and evaluation of learning systems. Scientific theoretical papers and a textbook on interaction design make up the basic. An 8 page case assignment requiring study groups to write a paper on the design and user-test of an e-learning application interface ends the module.

The time constraints are severe during the f-to-f seminar with only four hours allotted to Module 2. It is impossible for the students and teachers to touch upon the entire content and its implications, and we know the students come unprepared. To scaffold this broad and complex content according to our design for learning model, we focus on the design lifecycle model. The lifecycle model represents a dynamic, progressive and iterative process running from the start of an interaction design project to the deliverance of a final product. Additionally, the model combines the progression over time in terms of design process phases with the returning activities of the iterations within the phases. It consists of four primary activities: Identification and specification of needs; Idea generation and design; Build/rebuild physical design; and Test and evaluation. The primary activities are not to be understood as sequential phases. There is no linear determinant sequence between the activities. However, there are certain milestones, which define when, and how an iteration cycle progress from one phase to the next in the overall design lifecycle. One of the big challenges for the students is to grasp the relations and the distinctions between Primary Activities and phases.

Facilitating Performance

At the seminar the students start with a crash course where Power Point presentation of the core issues of interaction design to establish a shared frame of reference. The collaborative work at the seminar is framed by the lifecycle model and strives to fulfil the conditions to reach *the Edge of Chaos*. The *complementary principle* is used to support distribution and sharing of knowledge. To further enhance the process the students are divided into design teams of 5-6 participants (Not their project groups). Each collaborative team has to work iteratively with the Primary Activity; test and evaluation, but is assigned to different phases of the full lifecycle and given a specific task and a specific HCI technique. For the teams covering the phases before production, the evaluation and test is explorative and abductive. In the remaining teams evaluation/test are hypothesis driven. In this way our design for learning and the activities cover the subject matter as an exemplary, but complex and complementary system.

Documentation and knowledge sharing are essential in the learning model. All teams are therefore requested to document their work (written notes, video), to document bifurcation points and the arguments for their decisions. Finally, all teams are requested to present their learning during a video documented plenary session – and all must be shared online afterwards. The teams share the same case narrative that stages the role-play, which is orchestrated as a 4-Hour Script that leans on classic role-play theory (Johansen & Swiatek 1991). The role-play script is a fiction with realistic activities that scopes specific challenges while limiting the participants within certain constrains. The script builds on a formula that aims to force the teams' task into the *Edge of Chaos*. Accordingly, the script is designed to drive the role-play through four steps that force the participants to invent relevant activities through exploring, meaning negotiating and decision-making. The role-plays progress through the following steps; 1) You design the specific use of the given method; 2) You perform the method (evaluation) on real users while collecting data as notes and video; 3) You analyze the data, the quality of your design and your data collection and evaluate the use of the methods and 4) For the plenary session you prepare a presentation of what you have done and learned. The 4-hour face-to-face seminar session is followed by an
5 week on-line period where the students are back in their semester groups. During this period the students

ISBN 978-1-86220-225-2

work on the final 8 page case assignment.

The reader may recall that we understand learning as linked to the participants´ conscious awareness of the bifurcations points, the negotiated decision making of how to proceed and the related choices and de-selections.
Therefore we required the students to document their choices, de-selections, decisions and arguments at the seminar. Concurrently, we required students to reflect on their documentation in order to force awareness, and open for reflections and meta-reflections on their learning and what is learned. It is the same which is required of students' case work during the on-line period where ideally the scaffolding constructed during the 4-hour script work will enhance the learning process.

Discussion; learning in the Networked Society

The 4-hour setup confronts the students with the fact that they come to the team activity from different positions, with different preconceptions and understandings. The orchestration forces the students to externalize their different positions and to meta-reflect on the differences, e.g. which strategies for negotiation and decision-making were chosen? How was this complexity dealt with in practice? In this way the students may take on both the participant inside-out position and the contemplative outside-in position and in turn these bifurcation points may open for further perception and externalizations of emerging problems.

Our data collection was motivated by our experimental and iterative work where we needed to be able to follow the learning process, and to reflect upon the Design for Learning Model. The data was not collected to test the model. However, an initial analysis of; a) data from the 4-hour face-to-face seminar; b)analysis of the final 8 page case assignment students handed in; c) assignments handed in from two earlier master modules give some directions for researching our model. The initial analysis show that the students´ main themes for meta-reflections were; 1) Pilot studies prior to actual tests; 2) Role of test leader; 3) Need for specifications of users tasks in test design; 4) Relationship between test leader and user; 5) The applied HCI technique and the test purpose. There are indications in the final 8 page case assignment that the intended scaffolding was indeed constructed during the 4-hour teamwork and was transferred to the on-line work. In the case reports from the on-line period - and here it must be remembered that the students had returned to their original semester groups carrying back with them new knowledge and competences - *students reflected upon the same issues as in the f-2-f seminar*. However, the *students also unfolded new themes*, e.g. how to manage unforeseen events during a test such as technological breakdown, users who are not interested in the test-task or contradicting interpretations of core concepts. E.g. in one project group members recalled their reflections on the test leaders role during the face-to-face seminar. With the new understanding developed during the work with the 8 page case a dialogue unfolded where they reflected critically upon their prior contemplations -*meta reflections* -and with this followed a re-cognition and an explicit decision; a test leader must be able to change roles.

Before we introduced the Design for Learning Model and the 4-hour script, our experiences as supervisors for the semester group assignments were that it was difficult for students to reflect critically on theories and methodologies. At best they would re-tell the theory – or at worst apply theory as if it could be used off the shelf, directly and mechanically. In the new design for learning course we found that students reflected critically upon the theoretical frame and concepts in the project reports on the case assignment. E.g. one group carried out a theoretical analysis of an existing e-learning website. First step was based in guidelines for design of digital interfaces, enabling them to identify and show inconsistent use of graphics, layout, navigation, and lack of aesthetics. Their second analytical step was a clarification of the interactive functions and the identification of the underlying grid structure of the website. They then qualified their theoretical conceptual analysis by introducing two new concepts: immersion and agency, and *developed a new theoretical model*. In a final step they uncovered the social constructivist learning perspective - the original basis for the website - and showed how the visual design and the navigation did not support this.

We suggest that unfolding of new themes and the meta-reflections that embed complementary perspectives are
indications that scaffolding has been constructed, is transferable and does support students in their on-line project work. The scaffolding makes it possible for the students to maintain progression of the learning process

ISBN 978-1-86220-225-2

also in the online period. A final reflection diverts us to the international organizations such as the G8 and OECD. In their understanding the future world depends critically upon a population's competencies in knowledge construction, skills, adaptability and ability to enter into lifelong learning (2009). Globalization and the technology driven development offer opportunities, but at the same time challenge Educations; anybody can participate in any education irrespective of geographical locations. This, in turn, poses radical challenges to existing educational systems, because the change is initiated bottom up; the learning unit will no longer be the educational institution. It is the specific educational program that picks up the challenge – not the bureaucratic system and it is, as Castells (2000) argue in his theory on the networked society and his notion of the self-programmable labour the ability of the human being to retrain itself and adapt to new conditions and challenges which is the drive. If we accept this claim the educational system and learning need to be innovated.

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