

# DIGITAL DIDACTICAL DESIGNS: RE-IMAGINING DESIGNS FOR TEACHING AND LEARNING USING MEDIA TABLETS

Isa Jahnke<sup>1</sup>, Andreas Olsson<sup>2</sup>, Anders Norberg<sup>3</sup>, Lars Norqvist<sup>4</sup>

<sup>1</sup> Umeå University, Dep. of Applied Educational Sciences, IML, Sweden, isa.jahnke@umu.se

<sup>2</sup> Umeå University, Dep. of Applied Educational Sciences, IML, Sweden, andreas.olsson@umu.se

<sup>3</sup> Umeå University, Dep. of Applied Educational Sciences, IML; Sweden, anders.norberg@skelleftea.se

<sup>4</sup> Umeå University, Dep. of Applied Educational Sciences, IML; Sweden, lars.norqvist@umu.se

## Keywords

Design, Media Tablets, Teaching, Learning, Educational Institutions, Empirical Study

## 1. Summary

The approach of Digital Didactical Designs offers a new thinking for planning, doing and reflecting on teaching and learning. It uses the European tradition of *Didaktik* and scrutinizes teaching and learning as socially constructed forms of social practices. Results from our empirical research in Denmark and Sweden (higher education) point to teaching practices that attempts to change from traditional course-based learning into learning expeditions where the implementation of educational technology, in particular media tablets, is the lowest common denominator but still not the main focus for re-imagining old and new designs for teaching and learning.

## 2. INTRODUCTION

In the era of Social Media, we have all information always with us in our pockets and handbags. Policies tend to say we have open learning cultures. But it is a myth that learning is open or becomes easier. Access to content does not necessarily mean that a person learns. There is no learning progress without reflections. Secondly, educational institutions often rely on the model of textbook readings in which students learn to reproduce the knowledge of the textbook and the teaching aim is closely associated with the textbook. It supports surface learning levels like remembering and repetition but neglect to support deeper learning approaches like intellectual development and “conceptual change” (Kember, 1997).

In our data we see that educational technology is sometimes used as digital textbook reproducing the traditional textbook-based learning model. However, in the age of mobile devices, Web 2.0 and social media, a constant omnipresent online presence is available. It provides a ubiquitous access to information. It means that it is normal for the Homo Interneticus to look up for facts and to search for problem-solving solutions. Informal learning, learning outside of formal educational institutions, comes closer to the learning within formal education.

To make a difference, let's change the perspective. Instead of focusing on traditional course-based learning or the technology, the pedagogical practice and the designs of those practices need our attention. In the Internet-driven networked world, the re-invention of already existing, traditional learning models is out of time, we need designs for teaching and designs for learning opportunities to enable and foster a *learning walkthrough* (Pleul et al., 2011; Norberg & Jahnke, 2014; Jahnke, 2011). In particular, we need designs for student learning that enables students to change their roles from a consumer to a prosumer role (producer and consumer) and to become learnerpreneurs to help them to grow in their learning progress during their learning processes.

In our research projects, we follow the innovative teachers and study their designs for teaching when they use media tablets. In detail we study sociotechnical-pedagogical processes in teaching practices to identify *digital didactical designs* for quality learning.

### 3. THEORETICAL APPROACH

Innovation and implementation of new technologies like mobile technology leads to a new situation in higher educational institutions on different levels. The use of media tablets affect many layers of education, stretching from how humans act in the classroom, teachers and students, the content, the activities and agendas which taking place outside of the classroom, and decision making, both locally and national. The new situation affects different levels of didactics (European *Didaktik*) such as,

A) the relation between teacher, students and content, what we call the didactical interaction model (teacher-content-student) adopted from Klafki (1963),

B) the didactical design (teaching aims, learning activities and assessment) as well as

C) the didactical conditions including curriculum development (curriculum-driven learning including style of examinations), institutional development and academic staff development (e.g., teachers, instructors).

The three different layers affect the development of each other, see figure 1.

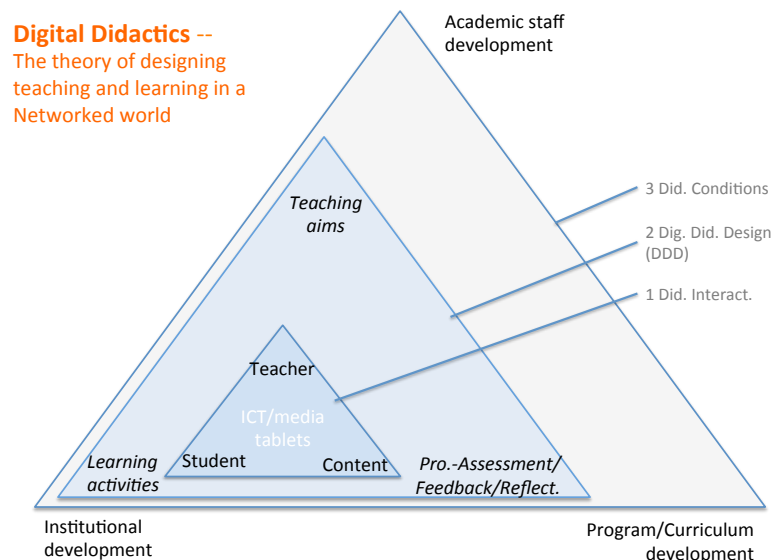


Figure 1: Digital Didactics - three layers

We use the word “digital” because we want to stress that in our Internet-driven networked world, teaching practices are always technology-based from low extent to high extent supporting different forms of learning where the quantity and the quality of mobile technology-integration vary. For example, the sharing of document via the university Intranet is a form of low technology-integration. In our studies, we focus on media tablets and don’t use the expression tabletPC since the latter also represents a laptop where the screen is used as tablet, whereas a media tablet is a rather a small flexible lightweight device with easy Internet access via WiFi and 3G/4G. Examples are Apple I pads, Google Tablets and Windows Surface 2.

The *enablement of learning* is the central concept. Teachers can restrict or enable learning by applying different designs helping to increase the likelihood that learning takes place (Wildt 2007). Following the concept of “informed choices” (Olofsson & Lindberg, 2012), the approach of Digital Didactical Design is an attempt to make the relation between design, education and technology integration visible (“de-construction”, Jacques Derrida, in Caputo, 1997).

## Digital Didactical Designs

The approach of “Digital Didactical Designs” (Jahnke, Norqvist, & Olsson 2013; Norberg & Jahnke, 2013) sounds promising to study teaching practices since it supports a changing perspective. The term Didaktik (Didactics) is adopted from the Scandinavian and German concept of Didaktik, which focuses on the *design for social relationships*, for instance student-student-interaction and teacher-student-interaction, and stress the differences of teaching activities and learning activities (Lund & Hauge, 2011). The European Didaktik does not only include methods, ‘how’ to teach, but also embraces the question of ‘what’ to learn (curriculum and content), ‘why’, and ‘when/where’ (in what kinds of situations, spaces) and how it can be reached (resources, organizational and academic development).

We define teaching practices as the creation and doing of sociotechnical-pedagogical processes that aim to supports students’ learning. More specifically, teaching practices can be analyzed from a digital didactical design perspective. In an ideal world, a teacher does design following elements in a “constructive alignment” (Biggs & Tang, 2007):

- teaching aims (intended outcomes defined by the teachers)
- student learning activities (surface and deeper learning concepts),
- process-based assessment to help the students to become better during their learning processes (guided reflections, networked scaffolding; Bergström, 2012),
- social relations and roles (Jahnke et al., 2005)
- interactive media and ICT (e.g., the integration of media tablets)

Figure 2 shows the five elements and the relations.

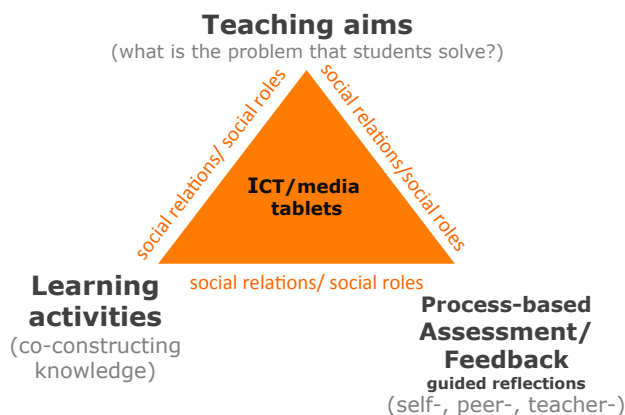


Figure 2. Model of the Digital Didactical Design and the relations of the five elements

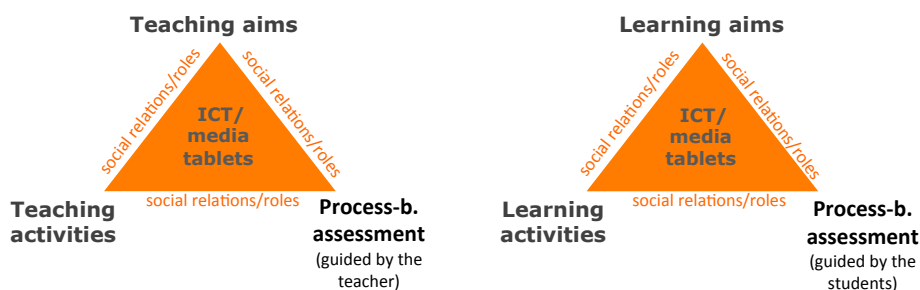


Figure 3. Teacher and student views

Figure 3 stress that the digital didactical design model (fig. 2) is compounded of two different designs; design for teaching and design for learning. The design for teaching embraces teaching aims, teaching activities and process-based assessment, which the teacher defines. The learning design views learning from the student perspective. The both design may overlap to each other in an ideal, dream world but in practice the expectations from teachers and students may differ.

When all these five elements (fig. 2) are constructively aligned, then the likelihood is higher that learning takes places and students are able to learn. In a dream world, the constructive alignment of the five elements is like a house built on building blocks or pieces of a bigger puzzle where the pieces complement each other. However, the dream world differs from the practice. There is a gap between theories and practices of teaching.

The concept of design is a mean to make specific actions and parts of activities of teaching practices visible; it focuses on certain elements but does not take the whole reality into consideration. A design shapes a focus and key points and gives a form (Gestalt). A design has both a planned component and an operative doing; it is process and product at once.

This view on Didaktik and design puts studies on tablet-enhanced teaching and learning into a new light. Learning is not only a cognitive effort and teaching is not only a tool to reach the cognitive dimension. Instead, teaching is rather an activity-driven design, and learning is an on-going activity of knowledge production and creation instead of consumption. An elaborated example of “activity designs for learning” is published in Hauge & Dolonen (2012), which shows that designing teaching and learning needs a “multimodal perspective” (Selander & Kress, 2010).

The integration of technologies in didactical designs and vice versa is more complex for teachers as it seems. Studies (Koehler et al., 2007; Mårell-Olsson & Hudson, 2008) show how complex the integration of content, technical and pedagogical knowledge is (TPCK). In addition, Loveless (2007) illustrates at the example of schools how the co-evolutionary development of subject knowledge and didactics needs the support of “improvisation”, and shows the complexity of ICT use in education. A framework on “learning how to use ICT” and “learning via ICT” is given in Kirschner & Davis (2003). Their study reveals rubrics of how ICT is used in education and how it should be used in training programs for teachers. The benchmarks include a) the didactical use of ICT, b) ICT as a tool for teaching and c) social aspects of ICT use in education.

### From surface to deeper, from individual to group learning

Following a constructivism approach, learning is knowledge co-construction defined as co-creation of new knowledge that is “an active process of constructing rather than acquiring knowledge” (Duffy & Cunningham, 1996, p. 171). Active learning is related to the role of the learners, where they are not only consumers of information but also active agents, creators and producers in the co-construction of new knowledge (pro-sumers).

Teaching contributes to surface learning in forms of remembering what is in the textbook and contributes to deeper learning in forms of critical-constructive, creative activities. Teaching that supports both surface and deeper learning helps the learners expand their thinking beyond consumptive behavior and beyond traditional reproduction of existing knowledge (“conceptual change”, Kember (1997).

Table 1. Matrix for Designing the Quality of Learning

|                             | Individual learning (I)  | Learning in groups (G)  |
|-----------------------------|--|---|
| Complex deeper learning (D) | <i>Examples (DI)</i><br>Critical thinking,<br>Creating something                             | <i>Examples (DG)</i><br>Peer-reflective learning<br>(learners are pro-sumers) |
| Easy surface learning (S)   | <i>Examples (SI)</i><br>Text-book readings,<br>Curriculum-driven<br>(Learners are consumers) | <i>Examples (SG)</i><br>Group learning: students split the tasks              |

Following Kember’s empirical study, there are five quality levels of teaching: from *surface levels* a) information delivery, presentation of information, b) providing structured knowledge via c) student-

teacher interaction to *deep levels* d) facilitating development and understanding and e) student conceptual change (intellectual development). Surface learning can be described as remembering facts (Anderson & Krathwohl, 2001), whereas a deep learning approach also focuses on skills like evaluating, creating, being critical, self-reflections, new ideas, collaborative reflections and multi-perspectives (Jahnke et al., 2012; Jahnke, 2012; Jahnke, 2010). To contribute to a matrix of different quality learning levels, a differentiation between individual and group learning is useful, too. The different *designs-in-practice* by teachers reach from surface, individual to a deep, collaborative learning (table 1).

Based on Kember’s study, teaching has been seen for many years as *delivery activity* as if one could deliver learning where textbook readings are in the center of learning. Reading was the main activity, illustrated as SI (surface, individual) in table 1. His empirical results also made clear that teachers think that deep learning takes place as “conceptual change”, the intelligent development of a person. But his work does not show how to support such learning and does not give hints how to move from SI to DG (illustrated by the arrow). Peer-reflective learning and learning expeditions in groups could be some options, as illustrated in table 1 “DG”, deep learning in groups. In an ideal world, have we left the SI activity completely and moved on to DG or is the ideal scenario that both are covered in a learning situation?

Our study aims to explore sociotechnical-pedagogical processes in tablet-mediated learning to identify designs of teaching practices with regard to the quality of learning. The main research question is: To what extent and how do the teachers apply what kind of digital didactical designs in their media tablet classrooms to support what kind of learning quality? (RQ).

#### 4. RESEARCH METHODS

In the study programme of preschool teacher education at Umeå University in Sweden, two student cohorts, ca. 130 students got iPads launched in 2012. In addition, in a Danish community, around 200 teachers and 2,000 students in K-9 schools got iPads. In both settings, we studied the teaching designs using mixed methods (Cohen et al., 2011), especially classroom observations, interviews with teachers and students, workshops and online surveys (Jahnke, Norqvist, Olsson, 2013).

#### 5. FINDINGS

Based on the approach of digital didactical designs, we derived a sheet for analyzing the different forms of teaching practices illustrated in table 2. The main analysis has been focused of two issues, first how many elements are aligned, and secondly, what is the quality of the aligned elements and the design in total. A detailed description is published in Jahnke & Kumar (2014).

Table 2. Scheme for data analysis (per course/classroom)

|  | Description - data based | Element aligned? Y/N                  | <b>Details: elements aligned?</b><br>5=strong alignment; 4=aligned; 3=in between; 2=weak aligned; 1= no alignment at all |
|--|--------------------------|---------------------------------------|--|
| <b>Teaching aims</b> are visible/ clear? Are expected learning outcomes visible/clear?                             |                          |                                       |  |
| <b>Learning activities</b> are clear/appropriate, correspond to teaching aims?                                     |                          |                                       |  |
| <b>Feedback:</b> assessment is process-based or summative or both?   |                          |                                       |  |
| <b>Social relations:</b> forms of teacher-student interaction, student-student-interaction, forms of communication |                          |                                       |  |
| <b>How media tablet is integrated</b> into the whole learning scenario   |                          |                                       |  |
| <b>Overall analysis per classroom/course</b>   | Brief summary            | How many addressed elements in total? | -Summary<br>-Extent of tablet integration as high (3) medium (2) low (1)   |

Analyzing our 24 tablet-learning cases in detail, five themes have been explored:

*Theme of media tablet didactics (MD).* 11 of 24 classrooms show an innovative use of media tablets for teaching and learning. In these cases, all of the five didactical elements including technology are aligned to each other with a high extent of tablet-use. The result of the aligned elements together with extent of tablet use is 7 or 8. These cases illustrate a specific Media-tablet-Didactics and show the full potential of a digital didactical design where the elements are aligned to increase the possibilities for learning through the added value of the media tablet integration. The five elements of a DDD are aligned in such a combination that they foster the expected learning outcomes and increase the likelihood to enable learning towards the teaching objectives.

*Theme of digital didactics (DD).* There are 5 classes that have applied aligned digital didactics. The aligned elements include a high to medium extent of the tablet-use, which have the result of 5 or 6. The difference to theme MD is, that the teachers didn't use the unique potential of a media tablet as multi-modal device (like in theme MD). These five classes used the media tablets as laptop substitute to reach the intended learning outcomes. The cases show that the tablet is also useful when not using its full potential of a multimodal device but more as a laptop function. The teachers said, however, when using the tablet like a laptop for writing assignments, there are some obstacles, for example, there is no keyboard for writing and that makes a tablet slower than a laptop (or an external keyboard for the tablet is required).

*Theme of weak alignment but benefit of tablet-integration (BT).* The case No 3 is an interesting case. The elements of a digital didactical design are not aligned but through the use of media tablets the learning process has been enabled stronger than without the media tablets; it is a high extent of tablet-use (1 case). Although there is a weak alignment, there is a benefit of the tablet-integration: The aligned elements are only 4 (from 8) in total but with a high extent of tablet use. The class started as a traditional class where process-based feedback and the design of social relations were not aligned. The digital didactical design elements were in a constructive alignment to foster traditional teaching (Instruction-Response-Feedback, IRE; Mehan 1979) and less collaboration. The observers reported that the whole classroom was in a rather bad quality and the weakness of not creating a supporting learning culture was obvious during the observation. But the media tablet-integration made then the difference. The students got the task to create a movie or a book (students' choice) about the historical person called Kristian IV in order to show the teacher what they have learnt. The collaborative production of a movie by using the iMovie app was an added value to foster learning by producing. Through the phase of producing the students also reflected on what they created and discussed changes.

*Theme of potential for tablet-didactics (PD).* There are four cases in which the alignment of the five elements of a DDD differ and the technology integration ranges from a medium to low extent of tablet-use, but it does not limit learning (the result of the (non-)aligned elements together with the extent of tablet use is 3 or 4. There is a potential to develop a stronger alignment to enrich the student learning experience (4 classes). In this theme, the classes have in common that the alignment of the five DDD elements differ and range much and the added values of and why using media tablets were not clear. It showed a rather weak connection. The classes did not limit learning but did not apply a constructive alignment rather a non-constructive alignment. The classes used the media tablets in a medium to low extent to enhance learning and the potential for a stronger constructive alignment was obvious.

*Theme of re-alignment of a digital didactical design; better without media tablets? (RE).* The data reveals three cases in which the integration of media tablets reduced the students learning experiences and restricted instead of enhanced learning. The media tablet hinders the learning processes and added a degree of a complicated complexity that was not useful for the whole learning scenario instead the use of the tablet caused technical workarounds, and the learning process was interrupted. It was a time consuming phase without any benefits for the learners. The elements of a DDD are not aligned or very weak connected, and a low extent of tablet-integration (the results of the aligned elements together with the extent of tablet use is only 1 or 2). The applied designs reduced the possibility of learning and restricted learning (3 classes). The use of the media tablets and the didactical designs in those classes were not connected in such a way that it would be beneficial for students learning. Instead it seems that the media tablet was applied in a

way that restricts the learning activities to reach the teaching aims. Either a re-alignment of a DDD is required or it is better without media tablets.

## Discussions

The findings reveal a richness of different forms of digital didactical designs (DDD) in practice. It is not a surprise that the usage of technology in some of the classrooms and courses did focus on enhancing deeper learning and others supported surface learning. In some cases the applied design even limited the chance that learning can take place (as in theme “RE”). As any new technology, the *adoption* of new technology matters and lead or doesn’t lead to different digital didactical designs - this is what our study illustrates.

Our research studies illustrate how teachers create new designs to do teaching and to support learning. They show new design principles and themes of Digital Didactics in co-located arenas where ICT and the classroom have been merged into new teaching spaces. The different projects contribute to a revised understanding about designs of digital didactics and inform new designs for learning from the perspective of “Didaktik”. Our findings illustrate three key principles.

The teachers’ digital didactical designs embrace (Jahnke et al. 2013)

- new learning goals where more than one correct answer exists (it supports deeper learning),
- focus on learning as a process in informal-in-formal learning spaces using guided reflections,
- making learning visible in different products (e.g., text, videos, podcasts, digital stories).

These key points can be called a change from traditional course-based learning into learning expeditions. We argue that in order to progress in educational development of surface and deeper learning, its needs a change towards digital didactical design thinking.

However, secondly, there are the other teachers who don’t apply digital didactical designs. From them the project learnt that there is a gap in the didactical designs, what teachers “want” and really “do”, a gap between their didactical design thinking and doing with and without ICT. The study reveals that there is a practice of a teacher-students-loneliness in educational institutions. There is the trend to neglect the importance of creating a reflective teacher’s community of practice where teachers discuss their situations, didactical designs and learn from it. We argue that in order to progress in educational development towards both professional teaching as well as surface and deeper learning, it needs a change towards teacher’s learning that they can learn how to create and apply didactical design thinking. In Odder, they have thought of this problem and started a network among teachers and IT coaches. In addition, the Odder municipality in Denmark is one good example how to overcome the teacher-student-loneliness; the created a meta-reflection model for teachers where they share situations and challenges in classrooms and discuss solutions.

We just started with studying emergent technologies in different contexts and settings and we see some advantages but also challenges and problems. Technology might have an important impact on re-imagining and re-designing higher education.

- One advantage is that new technology helps to reflect established teaching routines and supports the re-thinking on new didactical designs towards learning expeditions.
- A teacher needs to have a clear purpose for the technology, what it will support or facilitate in an activity when designing the teaching activity. The add-on of a technology needs a clear benefit within a teaching and/or learning activity.
- One must be prepared to that bringing IT and new forms of technology into known work processes often generates the need to break through established routines and/or adapt the work processes to new ways of working, teaching and learning in higher education.
- A teacher needs to be flexible and have different solutions when problems occur; teachers become jongleurs of different design elements - didactical and technical solutions. Teachers become jongleurs and needs skills in both the didactical areas as well as in technical areas. You cannot have one without the other. First experiences shows that the teachers got the didactical ideas to trigger different student learning action and engagement, but when it comes to technical solutions, well, then it is a completely different complexity for the teachers.

## Practical implications - A radical new design thinking on education

We have heard a lot of predictions about what ICT technology or ICT-enabled culture will mean for education and higher education in particular, during the last 15-20 years. Computer-based training, e-learning, digital natives, learning objects, blended learning (Norberg & Jahnke, 2014) and the possible impact of global MOOC-structures are just few examples. Things surely change, however often neither as fast as expected nor as total in a short perspective but maybe in a little longer perspective it is more interesting and disruptive development.

Higher education is like an old building repaired, augmented, patched and partly rebuilt many times (Jahnke & Norberg, 2013). The elements don't harmonize so well any longer. It is like a really big unfinished puzzle where the small pieces don't fit to each other.

We feel that some higher order discussion about what ICT in the long run means for higher education is urgently needed, instead of just using ICT tools for specific tasks within an old frame of perception about what university teaching is about. For instance, the *room* for learning is still a very dominating idea. Even when it is not there, as in asynchronous web-based courses, the room is the dominating idea. Although, ICT integration helps digitalizing lectures, it also recreates classroom structures in a virtual learning environment, talking about the classroom 2.0, envisioning a "virtual" university, sometimes very concrete as in Second life and similar environments but still has a "room" as central metaphor for learning.

We argue for a more critical-constructive view on sociotechnical-pedagogical processes to identify digital didactical designs for quality learning. Two concepts might be useful to start with:

- The *learning walkthrough* presupposes a rather designed learning landscape more closely guided by teaching but with a greater variation and more student options to work and learn than the traditional course.
- While *learning expeditions* could stand for more open-ended, problem-based learning paths, and/or for goal/objective-oriented learning (to master X or understand the implications of Y) where the learning methods and instruments very open.

Due to our research in different studies (Digital Didactics, GoogleGlass, Telepresence Robots, tablet-mediated learning, learning situations from the students view, etc.) we argue, we need a more all-in-one design what we call Digital Didactical Design that is useful to design teaching towards student learning expeditions in higher education, especially in teacher education. We envision a more thorough retake on how to turn from course-based learning into learning expeditions.

## 6. REFERENCES

- Biggs, J. & Tang, C. (2007). *Teaching for Quality Learning at University*. 3rd, New York.
- Bergström, P. (2012). *Designing for the Unknown. Didactical Design for Process-based Assessment in Technology-Rich Learning Environments*. Umeå University Press.
- Caputo, J. D. (1997). *Deconstruction in a Nutshell: A Conversation with Jacques Derrida*. New York: Fordham University Press.
- Cohen, L., Manion, L., & Morrison K. (2011). *Research methods in education. 7th edition*. New York: Routledge.
- Duffy, T. M. & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. *Handbook of research for educational communications and technology*, 171.
- Hauge, T. E., & Dolonen, J. (2012). Towards an Activity-Driven Design Method for Online Learning Resources. In A. D. Olofsson & O.J. Lindberg: *Informed Design of Educational Technologies in Higher Education*. Hershey: IGI Global, pp. 101-117.
- Jahnke, I. & Kumar, S. (2014). iPad-Didactics - Didactical Designs for iPad-classrooms: Experiences from Danish Schools and a Swedish University (chapter 15). In Charles Miller & Aaron Doering (Eds.). *The New Landscape of Mobile Learning: Redesigning Education in an App-based World*. Routledge.



- Jahnke, I. & Norberg, A. (2013). Digital Didactics - Scaffolding a New Normality of Learning. In: *Open Education 2030 - contributions to the JRC-IPTS Call for Vision Papers. Part III: Higher Education*, pp. 129-134. <http://blogs.ec.europa.eu/openeducation2030/category/vision-papers/higher-education/>
- Jahnke, I., Norqvist, L., & Olsson, A. (2013). Designing for iPad-classrooms. In *Adjunct Proceedings of the European Computer-Supported Cooperative Work (ECSCW)*, Cyprus.
- Jahnke, I., Norqvist, L., & Olsson, A. (2013). Digital Didactical Designs in iPad-classrooms. In *Proceedings of the European Conference on Technology-Enhanced Learning, ECTEL 2013*, 17-21 September 2013, Cyprus.
- Jahnke, I., Bergström, P., Lindwall, K., Marell-Olsson, E., Olsson, A., Paulsson, F., & Vinnervik, P. (2012). Understanding, Reflecting and Designing Learning Spaces of Tomorrow. In: I. Arnedillo Sanchez & P. Isaias (Eds.). *Proceedings of IADIS Mobile Learning 2012*. Berlin, pp. 147-156.
- Jahnke, I. (2012). Technology-embraced informal-in-formal learning. In A. Ravenscroft, S. Lindstaedt, C. D. Kloos, & D. Hernandez-Leo (Eds.) *21st century learning for 21st century skills. 7th European conference of technology enhanced learning* (pp. 395-400). Heidelberg: Springer.
- Jahnke, I. (2011). How to Foster Creativity in Technology Enhanced Learning. In B. White, I. King, & Ph. Tsang (Eds.), *Social Media Tools and Platforms in Learning Environments*. NY: Springer. pp. 95-116, DOI 10.1007/978-3-642-20392-3\_6.
- Jahnke, I. (2010). A Way out of the Information Jungle - a Longitudinal Study About a Socio-technical Community and Informal Learning in Higher Education. In *International Journal of Sociotechnology and Knowledge Development (IJSKD)*, No. 4, pp. 18-38. DOI: 10.4018/jskd.2010100102.
- Jahnke, I., Ritterskamp, C. & Herrmann, T. (2005). Sociotechnical roles for sociotechnical systems: a perspective from social and computer science. In *AAAI 2005 Fall Symposium on Roles, an Interdisciplinary Perspective (Roles'05)*, AAAI Technical Report (Vol. FS-05-08). Menlo Park, CA: AAAI Press.
- Kember, D. (1997). A reconceptualisation of the research into university academics' conceptions of teaching. In: *Learning and Instruction*, 7(3), pp. 255-275.
- Klafki, W. (1963). *Studien zur Bildungstheorie und Didaktik*. Weinheim: Beltz.
- Koehler, M.J., Mishra P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education*, 49, pp. 740-762.
- Loveless, A. (2007). Preparing to teach with ICT: subject knowledge, Didaktik and improvisation. In *Curriculum Journal*, 18:4, DOI:10.1080/09585170701687951, pp. 509-522.
- Lund, A. & Hauge, T. E. (2011). Designs for teaching and learning in technology-rich learning environments. *Nordic journal of digital literacy*. (4), pp 258-272.
- Mårell-Olsson, E. & Hudson, A. (2008). To Make Learning Visible: In what way can ICT and Multimedia Contribute? In *Tidskrift för lärarutbildning och forskning*, no 3-4, 2008 pp 73-90.
- Norberg, A. & Jahnke, I. (2014): Are you Working in the Kitchen? European Perspectives on Blended Learning. In: Anthony G. Picciano, Charles D. Dziuban, & Charles R. Graham, (Eds.), *Blended Learning - Research Perspectives. Vol. 2*. New York: Routledge, pp. 251-267.
- Olofsson, A.D. & Lindberg, O. J. (2012). *Informed Design of Educational Technologies in Higher Education: Enhanced Learning and Teaching*, Hershey: IGI Global.
- Pleul, Ch., Terkowsky, C., Jahnke, I., & Tekkaya, A.E. (2011): Tele-operated Laboratory Experiments in Engineering Education. The Uniaxial Tensile Test for Material Characterization in Forming Technology. In: Javier García Zubía & Gustavo R. Alves (Eds.), *Using Remote Labs in Education*. Bilbao: University of Deusto Press, pp. 323-34.
- Selander, S. & Kress, G. (2010). *Design för lärande - ett multimodalt perspektiv*. (Designing for learning - a multimodal approach). Norstedts.
- Wildt, J. (2007). On the Way from Teaching to Learning by Competences as Learning Outcomes. In Pausits, A., & Pellert, A. (Eds.): *Higher Education Management and Development in Central, Southern and Eastern Europe*. Münster: Waxmann, pp. 115-123.

## 7. AUTHORS' BIOGRAPHIES

Dr. Isa Jahnke is Professor of ICT, Media and Learning at the Department of Applied Educational Science, Umeå University, Sweden. She studied social sciences, was PhD student at IuG (Informatik and Society), and post-doctoral researcher at the Ruhr-University Bochum, IMTM, Germany. In 2007, she visited the L3D Center for Lifelong Learning, University of Colorado at Boulder. Her first professorship was with the Center for Research on Higher Education, TU Dortmund, Germany. Currently, she is scientific leader of the research group ICTML:Digital-Didactics. Her research interests are socio-technical systems & learning, digital didactical designs and learning expeditions. Website: <http://www.isa-jahnke.com>

Andreas Olsson has been working as a lecturer at Umeå University since 2002, mainly in courses dealing with the topic of ICT and learning but also in more traditional courses within the teacher education program. In the autumn of 2012, he started as a PhD student in the research field of educational with a main focus on mobile learning and mobility in and between different learning contexts. The thesis will include both a teacher perspective as well as a learner perspective, especially regarding strategies for teaching, learning and the understanding of the term knowledge. Website: <http://iml.edusci.umu.se/ictml/>

Anders Norberg is doctoral student at Umeå University. He is a former philosophy teacher and principal in upper secondary school, working since almost 15 years with development of Campus Skellefteå, a multi-institutional campus in Northern Sweden. He has also worked in numerous EC-funded projects, regional and transnational, and is now also a doctoral student at Umeå University in Applied Educational Science, researching questions in educational access through blended/ICT-integrated learning, identifying new patterns of educational logistics. Website: <http://iml.edusci.umu.se/ictml/>

Lars Norqvist is a doctoral student at Interactive Media and Learning, Department of Applied Educational Science, Umeå University in Sweden. He has a Bachelor of Education and worked as a primary school teacher for 12 years. He also has a background as a trainer in the European programme Youth in Action, contracted by the Swedish National Board for Youth Affairs and included Youthpass, where he is a trainer supporting volunteers within the European Voluntary Service (EVS). His research interests are creative learning in formal, non-formal and informal learning settings supported through technology and designs for learning. Website: <http://iml.edusci.umu.se/ictml/>