The question is no longer how to get more ICT in teacher education, but how to use ICT wisely in a pedagogical and professional perspective.

The multimodal space of learning

Report from an ICT-project in teacher education at BUC/HiB - Norway

Tjalve Gj. Madsen and Marianne L. Eide
April 2014

Project-report April 2014

The multimodal space of learning (2012-2013)

Madsen, Tjalve G. and Eide, Marianne L.

Bergen University Collage

Abstract

This report describes an experimental development in teacher education. The main goal with the project was to increase the students' learning outcome by creating a better ICT-supported learning environment. The research question was focusing on how our variant of blended learning influenced the learning environment within the frames of teacher education in Norway. The didactical design was based on a mix of blended learning, flipped classroom, traditional lectures and strictly organized seminar-groups. The conclusions of the project focuses on how the challenges are no longer ICT-skills or hardware, but the need of pedagogical, professional judgment to act in a holistic, complex multimodal space of learning.

Introduction

Teacher education in Norway is under pressure to increase the use of ICT-tools in higher education. The underlying assumption is that ICT-tools and techniques will have a positive effect on learning outcome and the efficiency of higher education. More than ten years with ICT-based projects in teacher education has made us change focus from learning effects of isolated ICT-tools and methods, to how ICT can contribute to higher quality in the learning environment from a holistic perspective.

The digital development has enforced a new epistemological discourse in education. This discourse challenges roles, identity, status and the value of different kinds of knowledge in higher education. Pedagogical practice are being challenged by new technology. Although much have been done, we still experience the need to search for new ways of creating meaningful and well-functioning learning processes in this space of new media and communication modalities. The concept of "multi modal space" refers to a learning environment constituted by different modalities to inform, communicate and develop new knowledge. From the very start of introducing ICT in the educational system, it has been proclaimed that we are at the very start of a learning revolution with unlimited possibilities to collect, share and create new knowledge. ICT-tools obviously make it possible to collaborate

in knowledge production all around the world. Sounds fantastic, but why so hard to implement? Why is it so hard to convince many academic professionals to use ICT in their teaching and organized learning processes? Nearly 50% of the teachers and leaders in higher education do not believe in positive effects of using ICT in higher education (Ørnes 2011, page 189). How do we spread the use of ICT-tools and ICT-methods from the enthusiasts and true believers to the general, average teacher I higher education? ICT-reports and conference presentations often tell us that we do not use the potential that ICT-tools offer. And, if ICT-tools have been used, we often find that its mainly used for information and administration purposes or to continue old pedagogy and methods in an electronic version (Collins 2002, Stensaker 2002, Ludvigsen 2006, Nordkvelle 2010, Ørnes 2011). ICT-tools and techniques are in themselves obviously no guaranty for positive effects on the learning outcome or the learnings environments. The effects of ICT-tools in education depend on how they are used. No ICT-hardware, nor didactical techniques are better than the holistic, pedagogical idea and didactical practice they are a part of (FiBM 2006, Madsen 2011). Therefore, the question is still the same: How can we create learning environments that take advantage of the potentials that technology offers regarding collecting information and cultivating, producing and sharing knowledge?

This report describes the experiences from a project including 85 teacher training students and 3 teachers at Bergen University Collage (BUC)[1] in Norway. We tried to combine traditional, analog pedagogical methods with ICT-tools and techniques, often described as blended learning (Bonk 2006, Friesen 2012, Staker 2012). The discussions of the results in this paper have focused on three main areas: a) organization and structure, b) learning environment, ICT-tools and methods and c) effects and learning outcome. We have mainly used a social epistemological perspective combined with multimodal theoretical concepts to describe and discuss what happened in the project period. The intension of the project was primarily to develop the overall learning environment by combining the best from the analog and the digital learning culture.

Method
"The multimodale space of learning" is primarily an experimental development (OECD 2002, Olsen 2004, UHR 2010). OECD defines *Experimental development* as*;*

---

[1] Høgskolen i Bergen (HiB)

systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. (OECD 2002, p. 30)

The project used a phenomenological approach. The experiences was mainly documented through studying and analyzing a) student assignments, b) quantitative and qualitative student evaluations, c) exam results compared with a control group of 163 students and d) two semi structured group interviews with 9 students involved. The data was coded and analyzed thematically according to the thematic areas mentioned above[2]. The experiences during the project period were continuously discussed and revisions were made according to feedback from the students and the teachers involved.

To discuss and understand the terms and conditions for new practice and knowledge productions, we mainly used a social epistemological perspective (Popkewitz 1991, Krüger 1994, Krüger 2002). Theoretical models and concepts from multi modal theory was used to discuss and understand the production of meaning by using different learning activities (Kress and Van Leeuwen 2001, Kress 2003, Kress and Jewitt 2003, Løvland 2010, Selander and Kress 2010). And finally TEPAC was used as a model to understand the interaction, the ensemble of technology, pedagogic and subject content in the project (Mishra 2006). For further reading about these theoretical perspectives, see later paragraph "Theoretical foundation".

The project including the data collection was reported and accepted by NSD[3].

Project experiences

With respect and awareness of the limitations of a small scale project and a short project period, we still mean to have done some useful experiences;

Organization and structure;

- The learning management system was essential to administrate and attend the students learning activities in the multimodal space of learning

---

[2] a) organization and structure, b) learning environment, ICT-tools and methods and c) effects and learning outcome

[3] NSD - Norwegian Centre for Research Data. http://www.nsd.uib.no/nsd/english/index.html

- Compulsory seminar-groups (7-10 students) did function best when they were "personalized", given to a specific group in a strict structure
- Compulsory seminar-groups with a high degree of self-governed students, needed attention and support from teachers to secure the quality of the learning activities
- The teachers experienced that the change from traditional class-activities (one teacher and 30 students) to smaller student-controlled seminars made it difficult to keep a personal teacher – student contact

Learning environment, ICT-tools and methods;

- The multimodal space of learning contributed to more student active learning processes
- Most students did not work with organized assignments if they could avoid it
- The multimodal space of learning contributed to more varied learning activities
- The students evaluated the "process-videos" as the most efficient digital learning-tool
- Students generally responded positive to varied learning activities, but their response depended on their personal learning preferences
- Multimodality was in itself no guaranty for a better learning environment
- The teachers' professional judgments and decisions in a complex, multimodal space of learning were the core, the most important guaranty for a good learning environment

Effects and learning outcome;
- A more digitalized learning program was in itself not a cost efficient project
- The final exam did not show a significant increase in the "project-students" learning outcome compared with student following a traditional learning-program
- The learning effect of a multimodal learning environment depended on the context, the design of the program and the ability to adjust the program when needed.

The multimodal space of learning

The project "The multimodal space of learning"[4] included 3 teachers and 87 students in their first year of teacher education at Bergen University collage (BUC). The project was limited to the subject "Pedagogy" [5], 15 ect. the year 2012-2013 . Although the main intention was to increase the learning outcome by developing the quality of the learning environment, we also

---

[4] Also commonly called «The seminar model»
[5] PEL110, GLU 1-7, 15 ect.

wanted to a) develop the digital competencies among the students and the teachers, b) contribute to a more varied pedagogical practice and finally c) increase the students working efforts. In the last years we have developed an increasing concern regarding more and more students going through the system and being certified as professional teachers with less and less demands and efforts. Teacher students[6] reported in 2013 that the average time of study was 24 hours a week (NOKUT 2014) . The student parliament wanted and had asked for higher standards to be set. The question was how to do it in a meaningful way.

The teacher education at BUC includes about 250 new teacher students every year preparing for certification to work in primary and secondary school. The students are traditionally organized in groups/classes with 25-35 students where most of the lectures and learning activities find place. Normally it's organized as 3 hours lectures and activities every week. There are also some 2 hours lectures organized in groups of 125 or 250 students. Normally there is a recommended, specific literature to each lecture. But it's been an ongoing problem that most of the students meet more or less unprepared to the lectures.

The project "The Multimodal Space of Learning" *organized* the students in three different groups: seminar groups (7-11 students), class-groups (25-35 students) and lecture-groups (87 students). We wanted to develop the learning environment by increasing the student activity both before and during the campus activity. The main design was simple and at a first glance very traditional;

1) Introduction and motivation for new themes in lecture groups 2) learning activities organized as individual work called "learning mission" out of campus before the lectures/campus work, 3) seminar groups two hours every week at campus. Former students were involved as teacher assistants in the seminar groups. The teachers rotated among the seminars, stimulating, helping where it was needed. Each teacher had the responsibility for 3-4 seminar-groups, 4) these 3-4 seminar-groups were gathered in a class-acitivty one hour each week. This weekly meeting was used to summarize the student's preparation at home, answering student questions and evaluate the learning activity in the seminar groups and finally 5) at the end of the theme worked with, we summarized the period and introduced the next theme in the lecture group. (Fig. 1)

---

[6] GLU 1-7 and 5-10

1)	2)	3)	4)	5)
Lecture group (87 students)	Individual work	Seminar groups (7-10 students)	Class-activity (24-35 students)	Lecture group (87 students)
2 hours in the beginning of a new period (4-5 weeks)	A weekly assignment	2 hours a week	1 hour a week	2 hours at the end of the period
Introduction and motivation for the new theme/periode	"learning mission"	Strict, organized program	Summarizing, evaluating the weekly seminar activity	Summarizing the theme/working period. Prepare for next theme/period

Fig. 1

Ideas from flipped classroom (Lage J. M. 2000, Bergmann and Sams 2012) were used to organize student preparation before the lectures. Every week there was given a so called "learning missions", assignments which should be done before the campus activity. It was especially in the "learning missions" that the ICT-tools played an important role. The seminar groups at campus were used to activate and involve the students in higher learning processes, collaboration, discussions and problem solving. There was a detailed program for every seminar-meeting. We wanted to use the teachers' competence to support the activities in the seminars by challenging and impelling the students in active learning processes, not repeating what could be read in the literature.

The *ICT-tools* played an important part of the project. The learning missions would be impossible to organize without an ICT-based administrative system. We used the learning management system It's Learning to send messages, distribute learning resources, administrate assessments including debates and chats, making tests, surveys, program evaluations and collecting the students' portfolio. We also used varying applications for digital maps, wikies, picture- and video-productions. The learning resources included links to electronic texts, illustrations and traditional videos on the open web. We also developed what we called "process-videos" including video-feedback on the students' assignments. These process-videos turned out to be very popular among the students. They were made as small 5-15 minutes welcome messages, triggers for at special learning activity, theme introductions or

explanations of difficult subject matters. If the students had trouble with comparing different learning theories, they could ask the teacher to make a small video explaining or summarizing the points presented in the lecture group. These small process-videos[7] were surely no "Oscar-productions", frankly from a media point of view, very dull pieces of learning material. But the students liked them and found them useful. We also tried full video-recording/streaming of the lectures, but the main productions were small sequences of 5 to15 minutes.

The project tried to vary the learning activities with a special focus on student active learning. This was both promoted through varied assignments connected to the learning missions and by a rather strict control of the learning activities in the seminars, prepared and guided by the teachers. The activities in the learning missions varied from traditional text-studies or traditional literature reading to producing digital maps, composing texts to electronic debates/chats and responding to fellow students' statements and making written summaries which should be distributed through the learning platform or on the wiki-space made for the involved students. The seminar-programs could for instance be organized as a debate connected to a chosen problem or an ethical dilemma. Other seminar activities could be defining and discussion of central subject concepts, doing small exercises practicing different learning strategies, making small presentations or discussions of actual media postings. The seminar-programs had formulated both subject goals and social group-related goals. The members of the group rotated being the moderator, the timekeeper and the note taker.

Theoretical foundation

The project needed a theoretical foundation which could illuminate the diversity and interaction that constituted the learning environment. As already mentioned we used social epistemology theory, multimodal theory and the TPACK-modell as tools for understanding what we experienced during the project. We clearly saw that traditional learning theories like social cultural learning perspectives and associated network theory were relevant and could be interesting in the discussion on how learning took place. But this perspectives has not been the main focus in our project.

Social epistemology

Social epistemology focus on how knowledge develops in structural relations. The main focus is moved from the individual to the social practices, structures and physical conditions that

---

[7] The prosess-videos were mostly screensavings using the tool "Camtasia Relay" administrated through Uninett.

constitute what is possible or not possible in an organizational culture. Through organizational and structural patterns and relations, there is created a space with standards for what is legitimate and acceptable knowledge and ideology. Kruger uses the term "Curriculære rom" to explain that knowledge is situated and closely connected to time and culture (Krüger 1994). Popkewitch (Popkewitz 1991 p.3) emphasizes the strong connection between power and knowledge. In this way he continues the cultural- and educational, sociological tradition from Bourdieu and Foucault. Different kinds of practices fight to get in position in the cultural space where the discourse is going on. The term discourse is here understood as the accepted rules, standards and styles of reasoning that operates through the teacher, and structure what the teacher do (Kincheleoe 1922 ref Krüger 1999). The struggle of power and influence can exist between individuals or groups within the system. These mechanisms will also function as an internal regulating force in each individual. It will make an understanding of what is good or bad and what is desirable and possible to do. This discourse has in itself a potential to create needs and cognitive interests. Further on it can turn out to be an important part of the social and professional identity among the involved participators. In these situations, change can be a challenging exercise because of the bindings to personal and professional identity and situations often rooted in historical and well established institutions.

Multimodal theory

Learning is strongly connected to meaning. Multimodal theory is a part of semiotic theory. Semiology focuses on social based systems of signs and how these create meaning. A modality is a sign or a resource that creates meaning. Multimodality focus on how different systems of signs or resources together create meaning. Multimodality theory uses a set of concepts to analyze and understand the interaction between culture, situation and multimodal expressions (Kress and Van Leeuwen 2001, Kress 2003, Kress and Jewitt 2003, Kress 2005, Løvland 2010). The theory refers to the different ways we communicate values, meanings and knowledge. But the modalities can express different and contradictive perspectives within a field of knowledge. In these situations, meaning is developed in the dynamics, in the interaction between different modalities that constitutes the space of learning. Multimodal theory has also been used to analyze education and learning. Kress and Leeuwen uses the concepts: *discourse, design, production and distribution* (Kress and Van Leeuwen 2001, Selander and Kress 2010). Their understanding of the discourse is very close to the social epistemological definition mentioned above. And they also emphases that a person can have different alternative discourses. The involved participants will use the alternative which is

most convenient and effective in each specific situation. The design must be based on the discourse in order to develop some content and expressions to be shown in the production. The design is therefore in between the content and the production. The design is an abstraction in between, but nevertheless an activity that demands professionalism, high subject competence and creativity. The design implies a) an interpretation of what kind of learning aims or themes which are possible within the discourse, b) the knowledge and ability to choose between alternative didactical strategies and activities in the learning situation, and finally c) enough practical and technical knowledge to understand how to create meaning by using different tools in the learning process. It can easily create frustrations and conflicts if there is a mismatch between discourse and design. A typical example is if there is no coherence between the ideas and expected use of educational methods and the frames that constitutes the learning environment (intentions, aims, teacher competence, student needs, hardware, software, etc.). Production refers to the practical implementation of the design. A good design should in theory make it possible for anyone to realize a premade learning program. This surely rise a wide range of questions regarding learning, knowledge and roles in the learning processes. Distribution refers to how the result of the production, is communicated to the actual recipients.

Technology, Pedagogy, Content and Knowledge (TPACK)

TPACK describes the links and the dynamics between technology, pedagogics an content knowledge (Mishra 2006) . The model is developed from Shulman's Pedagogy, Content, Knowledge (PCK) who focused on the interaction between pedagogy and the subject content. While the pedagogical principles and much of the subject knowledge are reasonable stable, the technological knowledge has developed in a pace that makes it impossible for any individual to claim control or fully updated. Education has faced a new kind of professional challenge: a mix between practical technics, knowledge-building and communication culture with fundamental pedagogical consequences.

Shortly summarized we can say that the social epistemology, the multimodal theory and TPCK are all context-oriented, holistic and dynamic. They focus on the creating of meaning in a complex, social situation. A situation where the teachers and the students are exposed by different kinds of inputs they just partly can control. Tensions develop in the discourse, in the dynamics between a) individual professional values, competences and experiences and b) the collective, cultural understanding of knowledge building and professional development.

Experiences and comments

One of the main challenges in pedagogical research and development is the complexity of a learning environment. Focusing on one method or topic can surely give positive effects regarding one limited subject area. But at what costs? Priority of time is a recurring problem. What is being excluded when new themes or methods are introduced? We experienced the challenge of the TEPAK balance. Developing new digital competencies including implementation of new technological tools and methods must be argued on the basis of the overall aims of the teacher education. Evaluations of learning programs in a holistic perspective have to raise the fundamental questions of what are the core competencies in the actual subject we are working with. What kind of discourse is underlying the demand of more ICT-competence in the teacher education? In a social-epistemological perspective; is this discourse a result of ideological, economical, pedagogical interests or research? What kind of epistemological views underlie the idea of prioritizing digital content and digital communication competences in teacher education? How can the use of ICT develop or undermine the students' communication competence? What kind of communication is developed through different ICT-based modalities (sounds, pictures, videos, texts)? What kind of communication competence is important to develop a productive student – teacher relation? What kind of communication is important for different kinds of learning? Is ICT-based communication more functional working with natural science compared with humanistic subjects like philosophy or esthetic subjects? Can time used on new technical ICT-methods like video-production, be more efficient than using traditional learning methods such as reading and writing? It is definitely dangerous to draw general conclusions discussing the quality of different learning methods. The digital monitor from "Norgesuniversitetet"[8] refers to research on the learning output. They conclude that there are big variations among the different research reports. It is often low coherence between the use of technology and the learning output. And, it is difficult to isolate the effect of ICT from the effect of other actions or variables (Ørnes 2011).

Organization and structure

It might seem banal, but in an organization with 2400 students and 225 teachers, the lack of seminar rooms and a complex timetable was a real challenge. The architecture, the physical structure at the campus communicated a pedagogical idea that had clear consequences for the pedagogical practice at campus. Former projects at the faculty which organized small

---

[8] Norwegian Agency for Digital Learning in Higher Education

seminar groups, had to be stopped because of lack of suitable rooms. Our project was possible simply because only 87 students were involved. In a social epistemological perspective, it is interesting how the physical room-structure communicates a learning philosophy.

We also needed a design, a meaningful structure were the introduction lectures were followed by learning missions and seminar activities. The resources and activities had to create meaning (Kress and Van Leeuwen 2001, Kress and Jewitt 2003). The teacher had to deliver a weekly learning mission in time for the students to do the assignments and deliver them on the LMS. This was again essential information for the teacher, in order to check out what the students actually understood and so design a meaningful seminar-program. The project started with a relatively open seminar structure where much of the time was used discussing more or less spontaneous problems connected to the learning missions or the thematic literature. The student-evaluation stated that the learning outcome varied too much and they wanted a more structured seminar-program. We ended up with a rather rigid structure and strict, detailed program. The student evaluation was clear: meaningful, effective seminars depended on "personalized", relevant assignments and a strict structure. To make relevant assignments, the teachers had to get feedback from the students' learning mission to know how to focus.

The project was based on a pedagogical idea of students as responsible, active learning partners and teachers as the facilitators. This discourse ended up in a dilemma. Could we trust the quality of the student's content knowledge? Could we certify these students to professional teachers with responsibility for our children? In the middle of the project period the teachers had a growing concern about the quality of the activity in the seminar groups. We had payed "hand-picked" teacher assistants among the "senior" students from last year program. They surely did their best and the students were satisfied. The student evaluation stated the positive effect of meeting experienced students who could explain difficult subject matters in an understandable way. But in the second half of the project, we ended up with more emphasis on the teachers' summarizing.

The teachers had responsibility for 3-4 seminar groups (25-35 students) in this project. But in addition to that, teachers in teacher education are normally involved in and have responsibility for at least 50 to 100 other students[9]. When much of the learning activity was organized in small seminar groups, the teachers felt that the teacher – student contact turned difficult. It is been claimed that online-courses and ICT-communication methods brings the teacher and the

---

[9] This depends on what program the teachers are involved in.

student closer, the feel they know each other better than they normally do with traditional on campus-programs. This was not our experience.

In a multimodal perspective it is interesting to experience how the design itself was little guaranty for quality. The design needed an expert-teacher to adjust the program according to the feedback from the students involved. It can surely be claimed that a better design would minimize the need to adjust the activities. But the seminar-groups were indeed different, depending on the students and the different group-mechanisms that developed during the project period. It was also essential for the teachers involved to cooperate in order to have a common understanding of the learning missions and seminar programs. Again, a better design might have avoided these kinds of different interpretations, but a totally rigid program would probably be more of a hindrance than a help. Like the seminar-groups, the teachers were indeed different and had their personal, professional preferences. The teachers looked at this as a team-quality; A common understanding of the overall learning goals, a created, basic trust among the teachers and consequently an acceptance for variations in the more detailed teaching practices.

We wanted more student learning activity. To keep up the student activity we had to have an efficient system for spreading information and communicate with the students. In this situation the learning management system (LMS) was a must[10]. There are surely many different tools that can be used. For us, it was essential to have an integrated system, where we could inform, discuss, organize student assignments, assess, evaluate and collect students work. We could also check what kind of documents and resources the students actually used. It was no problem combining the LMS with different ICT-tools outside the platform when it was convenient. The LMS supported all three sectors of the TEPAC model, but had mainly an administrative function, organizing the learning activities.

Learning environment, ICT-tools and methods

Kruger refers to Kincheleoe and say that a discourse has the potential to create needs and cognitive interests. Kress claim that a person depending on the situation, can change within different alternative discourses. We just mentioned how the teachers turned from the pedagogical idealist to a more controlling role figure when they were confronted with student certification. We also experienced that the student changed when they were put under pressure. The student evaluation reported that the project and specially "the learning

---

[10] Its Learning is the system used at BUC

missions" forced them to spend more time on the pedagogics compared to the time spent on the parallel subjects during the actual two semesters. When the exam-period approached, there was a clear tendency to act strategically. The focus changed. The question was now; What happen if we don't do the learning missions? The written curriculum stated that to be able to present oneself for the final examination, the students had to document five "learning missions" in their portfolio. Many of the students showed a more negligent attitude to the "learning missions" when they found out that they already had produced satisfied the minimum demand. This also effected learning environment at the seminars. Unprepared students had a negative effect on the learning outcome. The teachers argued that the learning missions were made to help the students' learning processes, the learning missions was not made to please the teachers. The situation did not turn better when the teachers also had to inform that there would be minimal teacher response at some of the assignments. It was a matter of economic resources. In some cases it would be possible and effective to organize fellow student feedback. To a certain degree it functioned, but many of the students expressed disappointment of too little teacher response to their work. In situations where the students were put under pressure, idealistic pedagogical theory showed to be hard to practice. The students found it necessary to orient themselves to discourse based on how to survive the nearest exam.

Pressure of time and final exams also showed how ICT-tools as wikis and common resource-bases on the LMS helped the students to study and cooperate more effective. Digital mind-maps with subject content overviews were asked for to put the different parts of the curriculum into a whole. But the students had now left the focus on content quality learning and entered the discourse of strategic exam-survival.

The student evaluation of the different learning methods had one unchallenged winner; "The process videos" was the most effective learning tools. "The process videos" was short screen casting videos of five to fifteen minutes. It could be triggers for new themes, small explanations of difficult parts of the prior lecture or comments to discussions that had developed during the seminars and class-activity. We also took digital pictures of drawings and notes on the traditional chalkboard during lectures. The videos could also be a way to combine these pictures with prior powerpoint-presentations and show how these themes were connected. Finally we tried video-feedback on the students' assignments. This was popular among the students and timesaving for the teacher.

The multimodal space of learning contributed to more varied learning activities. The learning missions were used to introduce and practice different tools, both digital and analog, relevant for school-practice. But we soon experienced that some of the students reacted negative to some of the methods. Some proclaimed that they preferred lectures, some wanted group-discussions or role-plays, and others preferred working with mind-maps, and so on. The students had their personal learning preferences. The design was based on an idea that in teacher education ICT- and varied methodical competences were an important quality in itself. But the students argument was that even if the methodical point of view was relevant, they most of all needed help to understand the knowledge content of the pedagogical theory they needed to pass the exam.

Multimodality is in itself no guaranty for å better learning environment. We experienced that the enthusiasm of a teacher who had discovered a new collaborative text-editor or test-software, necessarily didn't mean that it was a good idea to introduce these tools to the student group. During the project period some of the students expressed frustration of the introduction of too many different ICT-tools used in the "learning missions" and the seminar groups. They would prefer to learn a few tools better instead of struggling with new tools all the time. It is obviously a balance between the wish to introduce a wide range of tools which the students can handle quite superficial or the introduction of a few tools which the students over time can handle with confidence.

In the struggle to find an optimal learning environment, we surely ended up searching the balance between technology, pedagogy and the subject content (TEPACK). The design had to be negotiated in a dialog with the students during the production. Even if the main design was stable, adjustments were vital to keep motivation and legitimacy for the learning processes. In this kind of experimental development there were a lot of experiences we could not foresee. From a TEPAC-perspective, we easily end up with the subject content as the most fragile part. The teachers' professional judgments were again the key to navigate between the different considerations to be taken.

Effects and learning outcome

The project with emphasis on digital design and production were in itself not a cost efficient task. From an administrative, economical perspective we had hoped to discover some cost effective benefits. But, what we gained by effective, digital information procedures, digital tools or using large group seminars did not compensate the teachers' workload regarding the

collaboration in designing and production, searching and introducing new learning tools, the video-productions, "personalizing" and administrating the "learning missions", guiding the teacher-assistants, seminar assistance and the continuously program evaluation with following adjustments. Another year with the same design and new students could surely be more efficient in some aspects. But years with ICT-projects (Knudsen 2003, Madsen, Høgskolen i Bergen et al. 2008, Madsen 2009, Madsen 2010) have told us that the ICT-competence is not gained once and forever. The continuously technological development always leads to new possibilities and challenges. Being updated on the field seems to be a time consuming lifestyle more than a project with a beginning and absolute end.

The final exam did not show any significant increase in the "project-students" learning outcome compared with the control group following a traditional learning program. All students were examined by the same oral exam with focus on pedagogical theory and didactics. ICT-competence was not a special focus or theme during the exam. There were obviously differences within both groups regarding prior academic school results, choice of specializing subject in the teacher education, gender and motivation for the coming role as a teacher. Our experiences support the prior mentioned problem to isolate the ICT-effect regarding learning outcome (Ørnes 2011). The project did not analyze these aspects but simply concluded that the introduction of seminar-organization and more intensive use of ICT-tools did not result in better theoretical results at the final exam. The final exam did not show a significant increase in the "project-students" learning outcome compared with students following a traditional learning-program. The results are interesting because they conclude the same way as we did in the PLUTO-project ten years earlier (Knudsen 2003). The students were then introduced to digital portfolios and a new LMS. They used quite a lot of time learning the ICT-tools and complained that this was time-consuming. They obviously learned a lot of ICT-competence but we could see no positive effects at the exam in the subject "pedagogical theory". ICT should be a tool to improve the students' competence in pedagogical theory but ended up being a learning objective in itself. It is also interesting to notice that in the latest national survey the majority of the students were satisfied with how and how much ICT was used in the organized learning processes in higher education (NOKUT 2014).

The learning effects of the multimodal learning environment obviously depend on the total frame and the basis for introducing new student active methods and modalities. Variation is normally a well-accepted hallmark of pedagogical quality (Kunnskapsdepartementet 2009) .

The multimodal practice was introduced to help the students to get a deeper understanding of pedagogical theory and didactics. Although, it is relevant to ask if the reasons for introducing the different methods and modalities were well enough communicated. Were the students aware of the importance of contributing in organized web-discussions? What was the point of using digital maps? Even if the teachers tried to explain, it seems like too many of the students did not see the connection between the methods and the content knowledge needed for high quality performance at the final exam. It is surely also relevant to ask if the central defined learning outcomes in pedagogical theory was relevant in a multimodal space of learning. The learning outcomes described in pedagogical theory say very little about ICT-competence linked to professional, digital development. In a TEPACK perspective we also had to ask if the technology in our project had too much focus compared with the content knowledge and the pedagogy.

Conclusion

The challenge in a technology supported learning environment is no longer the accessibility of technical tools. The question is now, how to choose and select the right tools and use them wisely in a design that is based on a holistic, pedagogical judgment of the subject content, the practical frames and the students' and teachers' competences. The learning value of the different tools depend on how they are customized and argued to help the students to create meaning and theoretical and practical knowledge relevant for their future profession as teachers.

The discourse in media seems to create an expectation among students and the public opinion that a modern and sustainable pedagogy needs a high degree of ICT-involvement. Surely, ICT is a helpful tool to create meaning and understanding working within different subjects or themes. But ICT is totally dependent on a highly professional specialist to produce and continuously adjust the design to fit a productive learning environment relevant for the students. The question is no longer how to get more ICT in teacher education at BUC, but how to use it wisely in a pedagogical and professional perspective.

References

Bergmann, J. and A. Sams (2012). Flip your classroom: reach every student in every class every day. Eugene, Or., International Society for Technology in Education.

Bonk, C. J. a. G., C.R. (2006). The handbook of blended learning environments: Global perspectives, local designs. San Francisco: Jossey-Bass/Pfeiffer. .

Collins, B. v. d. W., M. (ed.) (2002). "Models Technology Change HIgher Education. An International comparative survey on the current and future use of ICT in higher education. Center for Higher Education Policy Studies (CHEPS), Enschede.".

Friesen, N. (2012, 05.01.2014). "Report: Defining Blended Learning." 2012, from http://learningspaces.org/papers/Defining_Blended_Learning_NF.pdf.

Knudsen, I. M. (2003). Prosjektet FORIKT (FORsøksklasseIKT); "Det åpne rommet for læring og samspill". Mot en digital kompetanse i lærerutdanningen (sluttrapport). Bergen, Høgskolen i Bergen.

Kress, G. (2003). Literacy in the new media age. London, Routledge.

Kress, G. (2005). English in urban classrooms : a multimodal perspective on teaching and learning. London, RoutledgeFalmer.

Kress, G. and C. Jewitt (2003). Multimodal literacy. New York, Peter Lang.

Kress, G. and T. Van Leeuwen (2001). Multimodal discourse : the modes and media of contemporary communication. London, Arnold.

Krüger, T. (1994). Musikklærerutdanningen som et sosialt felt : Noen refleksjoner om hva som påvirker kunnskapsinnholdet i utdanning og i egen undervisningspraksis. Oslo, Ad notam Gyldendal: s. 177-208.

Krüger, T. (1999). Undervisning som et ensemble av diskursive praksiser. Pedagogikk normalvitenskap eller lappeteppe. Y. m. f. Nordkvelle. Lillehammer, Høgskolen i Lillehammer. **Forskningsrapport**.

Krüger, T. (2002). Lærerutdanning; makt, viten og betingelser for endring. Den 7. Nordiske Lærerutdanningskongress. Bergen

Kunnskapsdepartementet, N. (2009). Læreren: rollen og utdanningen. [Oslo], [Regjeringen].

Lage J. M., P. J. G., Treglia M. (2000). "Inverting the classroom: A Gateway to Creating an Inclusive Learning Environment." Journal of Economic Education.

Ludvigsen, S. (2006). Læring og bruk av IKT i høyere utdanning: forventninger og resultater. Oslo, Cappelen akademisk forl.: s. 215-231.

Løvland, A. (2010). "Multimodalitet ogmultimodale tekster." Viden om læring **nr. 7**.

Madsen, T., G. and Tobiassen, Tormod (2009). Nettverksrapport HiBergen. Lærende Nettverk ITU. ITU.

Madsen, T. G. (2010). Pedagogisk bruk av digitale tavler i klasserommet. Rapport fra et prosjekt i Bergen kommune. Bergen, HiB.

> De digitale tavlene har en klar innvirkning på læringsmiljøet. De utfordrer lærernes profesjonalitet og tilhørende selvbilde gjennom sin synlighet i læringsrommet. De digitale tavlene brukes primært som et lærerverktøy, men prosjektet mener å har sett stort læringspotensiale i å involvere elevene mer i aktiv bruk av tavlene. Tavlene ser ut til å endre etablerte kommunikasjonsformer i læringsrommet der grensen mellom individuell og felles kommunikasjon/veiledning delvis viskes ut. Tavlene bidrar til økt fokus på læreren og forsterker lærerens rolle som bindeledd mellom lærestoffet og eleven. Tavlene legger til rette for stor grad av modellering i utvikling av både faglig-, sosial- og digital-kompetanse. Det er fortsatt et stort utviklingspotensiale i å utnytte de metodiske verktøyene som ligger i de digitale tavlene.

Madsen, T. G., et al. (2008). Digital portfolios: student learning or student control?

ALT-C 2008: Rethinking the digital divide : 15th International Conference 9-11 September Leeds, UK : Conference Introduction and Abstracts**: 75-76.

> A survey of the use of digital portfolios in higher education in Norway and influence on students learning processes.

Mishra, P. K., M. . (2006). "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge." Teachers College Record **108, Number 6**: 1017 - 1054.

NOKUT (2014). Studiebarometeret 2013.

Nordkvelle, Y. (2010). Kunsten å ile langsomt: et problemnotat om organisering av pedagogisk bruk av IKT i norsk høyere utdanning. Tromsø, Norgesuniversitetet.

OECD (2002). "Frascati Manual. The Measurement of Scientific and Technological Activities."

Olsen, T. B. (2004). Utdrag fra OECDs "Frascati Manual" i norsk oversettelse. Oslo, NIFU.

Popkewitz, T. S. (1991). A political sociology of educational reform : power/knowledge in teaching, teacher education, and research. New York, Teachers College Press.

Selander, S. and G. Kress (2010). Design för lärande : ett multimodalt perspektiv. [Stockholm], Norstedts.

Staker, H. a. H., M.B. (2012, 04.01.2014). "Classifying K-12, Blended learning." 2012, from http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/05/Classifying-K-12-blended-learning2.pdf.

Stensaker, B. (2002). Bruk av IKT i høyere utdanning: institusjonelle valg og organisatoriske konsekvenser. Oslo, NIFU.

UHR, U. o. H. (2010). Forskning + utdanning = sant, The Norwegian Assisiation of Higher education Institutions.

Ørnes, H. (2011). Digital tilstand i høyere utdanning 2011: Norgesuniversitetets monitor. Tromsø, Norgesuniversitetet.