DEVELOPING STUDENT ENGAGEMENT IN NETWORKED TEACHING AND LEARNING PRACTICES THROUGH PROBLEM- AND PROJECT-BASED LEARNING APPROACHES

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Abstract
Teaching and learning practices at universities are challenged by new communication technologies. Inspired by problem- and project-based learning, this paper focuses on how learner engagement can be facilitated through use of social media and communication technologies. The development of students' information literacy is considered an important factor in establishing their study competence and creating student engagement. The paper discusses examples of new roles for students as well as teachers that may develop through innovative ways of applying new technologies in teaching and learning. The discussions are based on the authors' experiences during ten years of teaching and supervising at the Danish Master's Programme of ICT and Learning (MIL), where students study in groups within a networked learning structure. The paper reflects on the varied dimensions of the teacher role, and the challenges for students as both independent *and* interconnected learners.
Keywords: Information literacy; teacher role; problem based learning; project based learning; networked learning technologies.

Internationally, new pedagogical approaches emphasizing collaboration or learning in networks have been developed following the introduction of new technologies, especially the spread of social media (e.g. Anderson 2008, Siemens 2005). These approaches of building on student learning in networks will be in focus in this paper, and we will discuss these pedagogical developments in relation to similar approaches, developed from the traditions of organizing university studies through student-driven project work and problem-driven learning approaches, which have been developed at the Danish universities of Roskilde and Aalborg (Olsen & Pedersen 2005, Kolmos, Fink & Krogh 2004). Following this, the paper reflects on the need for students to develop information literacy as part of their general study competence, and discusses the new roles for teachers and students that emerge in networked problem- and project-based learning environments.

PROBLEM- AND PROJECT-BASED NETWORKED LEARNING

The problem- and project-based learning approach is characterized by collaborative project work in groups. In their learning process related to this kind of project work the students have to be actively engaged and relating to their teacher, who acts as a supervisor. Within this framework the students have to find and raise by themselves an academically relevant research question at the beginning of the study process. Also they have the responsibility to collect relevant material, data and information to deal with in their project work, and through discussions to find relevant theories and methods to use in their analysis.

This approach has in Denmark been labelled *Problem Oriented Project Pedagogy* (Dirckinck-Holmfeld 2002, Olesen & Jensen 1999). It was originally introduced in the early 1970s and further developed at the new 'reform universities' at Roskilde and Aalborg, Denmark. It shares certain characteristics with *Problem-Based Learning (PBL),* but it also differs from this approach (Kolmos et al. 2004, Barrett & Moore 2011).

Problem-based learning also dates back to the early 1970s, developed primarily in the U.S. and Canada, but in Europe also in Maastricht, The Netherlands, and Linköping, Sweden. According to Barrett and Moore "a key characteristic of PBL is that problems are presented to students at the start of the learning process rather than after a range of curriculum inputs. The PBL problem can be a scenario, a case, a challenge, a visual prompt, a dilemma, a design brief, a puzzling phenomenon some other trigger to mobilise learning." (Barrett & Moore 2011: 4). As we see it is the responsibility of the teachers to *present to the students* the problems to be dealt with in order *to mobilise learning.* Put briefly and with the risk of simplifying, in PBL the teacher finds and decides the questions and themes with which the students can work. It is the responsibility of the teacher as an expert to demonstrate how students in a constructive way can relate curriculum and theories to praxis. The teacher assists the students in finding problems and challenging tasks in order to make it possible for them to work actively with theories and concepts. Barrett and Moore continue: "It is important for us, as PBL practitioners, to continually find new ideas for selecting and designing relevant, motivating, challenging, interesting, multi-faceted and up-to-date problems for our students" (Barrett & Moore 2011: 5). Within this framework designed by the teacher, the students are offered the opportunity to deal with some of the presented problems and shed light on the problem field using the recommended literature presented by the professor.

In *problem oriented project work*, on the other hand, the starting point for a student group is to choose a topic or problem to investigate that the group is not yet familiar with and that represents a challenge for them. The process of defining a problem involves questions such as: "What is the meaning and sense of this problem in the first place? Why should I try to solve it? How did it emerge? Who designed it, for what purpose and for whose benefit?" (Engeström 1987: 151). Working with questions like these can be a challenging, but productive process. Following the development of the research question, the group members embark on a dialogically organized process in which they collect relevant material, data and information; analyse it; and, guided by relevant theories and methods, work to transform this material with the goal of investigating and answering the research question; during this process continually reflecting on and clarifying the research question. The students draw conclusions that represent the range of differences in understanding among them, and they create a product that communicates their collective divergent insights to others.

As mentioned above, problem oriented project pedagogy is characterized by collaborative project work in groups; it is an active kind of learning that is participatory-directed in a dialogue between students and the teacher as a supervisor. The teacher's role is to give the students critical constructive feedback as well as facilitating them in their learning processes. Furthermore, it is interdisciplinary in that it combines knowledge and ideas from different kinds of academic fields (Olsen & Pedersen 2005). According to an article by Frank & Barzilai (2006) students working in a PBL environment are likely to engage themselves in processes of active learning and gain multidisciplinary knowledge. Building on Green (1998) they note that "project learning increases motivation to study and helps students to develop long-term learning skills. Students know that they are full partners in this learning environment and share the responsibility for the learning process" (Frank & Barzilai 2006: 40). They also refer to Hill and Smith (1998) for finding "that the PBL environment in their courses increased students' self-confidence, motivation to learn, creative abilities, and self-esteem" (Frank & Barzilai 2006: 40).

We have similar experiences, but it is important to acknowledge that such study processes are also characterized by contradictions and challenges for the persons involved. During study periods the level of frustrations can be high. The Danish learning theorist Knud Illeris states: "The learning process may take the form of coming through a crisis, in which the learner struggles for a certain length of time with a problem which is of urgent subjective importance" (Illeris 2002: 58). Illeris is drawing parallels to concepts like Engeström's expansive learning, or Mezirow's transformative learning (Illeris 2002: 59), which also deals with processes that are characterized by reflection and meta-learning.

Students with their different backgrounds, skills and qualifications may have great difficulties in understanding one another and the processes of dialogue, discussions and negotiations may be laborious. Referring to Piaget such challenging study processes can be considered as example of accommodative learning (Piaget 1972). The process of accommodation involves altering the students' existing schemas, learning patterns, ideas, as a result of new information or new experiences. Even new schemas may also be developed during this process. Summarizing it is important to have in mind the contradictions at play for the students involved in such learning processes.

From a dialogic perspective on education, inspired by Bakhtin (1986), the differences between students can be seen as having a learning potential. The Norwegian psychologist Rommetveit emphasizes that asymmetry between participants in a dialogue can be supportive of discovering new perspectives (Rommetveit 1996: 95). A creative learning environment is thus not necessarily characterized by harmony and consensus, but rather by asymmetry and difference. In reflections on a course helping new teachers in taking advantage of technological resources for mediating teaching and learning, Mahiri notes that students were helped in changing their perceptions of themselves and others through the dialogic relationships in the class and their collaborative writing of texts (Mahiri 2004: 230).

The students we meet today often have a diverse practice of employing digital media for enjoyment, communication, file sharing, and establishing of knowledge. To a greater or lesser extent, they may find it relevant to employ the communication channels they know in their educational practice, and may feel acknowledged by study programs that offer easy and flexible networked facilities to support their study activities. Wegerif & De Laat argues that designing groupware that focuses specifically on facilitating the collaborative learning processes may help students in developing group dynamics and regulate their discussions (Wegerif & De Laat 2011: 322). The MIL program discussed below aims to integrate educational technology in various ways that support student collaboration.

In problem- and project-based learning, the students ideally achieve an understanding of important aspects of the academic subject with which they are working, through the acquisition and application of theory and method. The work with theories and concepts goes beyond the specific project, thus helping to build and consolidate the students' broader study competence. The goal of problem oriented project pedagogy is that students relate their new insights to their previous experiences and hence through the study process construct new valuable skills and experiences. This goal can also be found in PBL and may prove beneficial in the students' future work and activities. According to Barrett & Moore (2011) "[e]mployers regularly highlight the importance of key skills, which include: communications, teamwork, information literacy, critical and creative thinking, and problem solving, together with self-awareness, self-assessment, ethical behaviour, reflection, and responsibility for continuous development." (Barrett & Moore 2011: 7).

STUDENTS' DEVELOPMENT OF INFORMATION LITERACY
When students are involved in self-directed study practices as discussed above, their reflective processes of searching and selecting information and new knowledge is of utmost importance for their learning outcome. In the problem oriented project pedagogy, the students are themselves responsible for identifying which problem to work with, and the very act of formulating a problem is a large part of the learning process. To work in a group means that students must learn to work together in order to make decisions, and they must figure out how to share and coordinate work. Through these study processes, the students learn how to plan, manage, and evaluate projects. We see this as part of the development of their study competences, which must also involve the ability to handle the large amounts of information that are within reach through libraries, databases, and the Internet. It is therefore crucial that students learn to be information literate. Information literacy requires not only that that students are able to locate data and information, but also that they are able to select critically within this huge body of information; that they are able to judge and evaluate the use of the information; and that they are able to eventually succeed in letting the information contribute to the construction of knowledge within the group. This understanding builds on the American Library Association, ALA, who in 1989 reached this definition of information literacy:

> "To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information […] information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them." (American Library Association 1989).

This definition emphasizes that the concept of information literacy does not only deal with how to search for information and literature, but more generally with learning how to learn. In practice, however, you often find information literacy used in the narrow sense of learning good ways of searching and finding information. And even though this is indeed an important aspect of the learning process, then – according to the definition above – there is a crucial step that lies before this; before being able to search for something, you must have reached an understanding that there is something you need to find out.

Therefore the question of realizing that you actually have a need for new information or knowledge, and recognizing what kinds of information or knowledge you need, is necessary before you begin the practical level of searching. You have to be aware what kind of non-knowledge you have. Only then you may start acquiring knowledge on how these needs can be met, and begin the actual search process as part of your learning process. The development of information literacy is therefore a way to handle finding out what it is that you do not yet understand. And this has implications for the specific ways of searching that you engage in. Therefore, without taking this phase of recognizing what kind of knowledge you need into consideration, information literacy is at the risk of being reduced to an instrumental tool of optimizing search queries.

Thus we see information literacy in relation to the modern, complex society, which demands as a fundamental quality to be able to reflect on your knowledge in relation to new developments and challenges. Developing information literacy in this context means not only knowing how to search for new information, but having learned how to learn. For students, the development of information literacy and their broader study competence can be seen as closely related concepts, for example when students are developing their project work, defining a specific field of study, and formulating the research questions to investigate further through the project.

In library contexts, the ALA definition above paved new ways through its coupling of information handling and learning. Libraries were able to orient their practice even closer to the practice of educational institutions (Egeland 2004: 37-38), and to change focus from merely being a provider of information to more actively support learning processes.

In 2006, as part of a project exploring the possibilities for strengthening relations between educational institutions and educational libraries, we conducted a study on information literacy in students' project work (Nielsen, Andreasen, & Jørgensen 2006). In the study we carried out a small survey of the experiences and search practices of 21 students from Roskilde and Aalborg University, enrolled in classes that were involved in the project. The study showed that the students had a limited knowledge of some of the central library services that were available; only half of the students knew at the time of the study that they had online access from home to the electronic resources of the library, and only 10 percent knew about 'the library guard' ('Biblioteksvagten'), an online 'ask-a-librarian-service' through e-mail or chat. Furthermore, some of the problems that the students reported on finding relevant information dealt with not knowing where to search, or difficulties in phrasing search terms that would bring useful search results (Nielsen, Andreasen, & Jørgensen 2006: 16-17).

The study showed that there is still a need of developing ways of improving students' knowledge of possible ways of finding relevant information. This means that even though we above criticized focusing only on the "how-to-search"-part of developing information literacy, then this should still be seen as a very important part of the process.

One way of learning how to search effectively would be to develop the traditionally technical and more abstract library courses (Skov 2004), in a way that would make them more relevant to the students' learning processes. It seems important to treat the development of information literacy as an integrated part of the students' project work. Instead of being introduced on an abstract level to the principles of search queries and how a database work, there is a need of giving time for the students during the library course to bring the research questions, they are currently working on, and explore what would be relevant search terms and relevant databases. It might be a challenge for the students to be specific in phrasing relevant keywords, and it might be a challenge for the librarians not to stick to the general introduction, but to target the specific groups of students. But the result might be that students will gain concrete results that support the study they are busy working on, instead of walking away from the course with an intention of trying to use the library resources "a day we have time for it". Such library courses should be closely related to the students' study processes, in the same way as curriculum-based classes, courses and lectures must be perceived by the students as meaningful and productive in relation to their project work activities.

Breen & Fallon from Dublin City University argue that the acquiring of information literacy should be connected to the students' actual study level, and should be integrated "within the context of course curricula, and not separated from it" (Breen & Fallon 2005: 182). The concept of information literacy is hereby focused more in a dynamic direction than a static. An aspect of information literacy is to learn search techniques, but what is equally important is that such a competence is part of a reflection and a critical attitude towards the information you are presented for.

THE MIL PROGRAM AS AN EXAMPLE OF NETWORKED LEARNING
Our primary focus will be on the postgraduate Masters program in ICT and Learning (MIL), where students from all over Denmark within a networked learning structure are studying in groups. As teachers and researchers we have been engaged in the MIL program for 11 years. Thus, we have first-hand experience with the learning environment. The examples we will be referring to should be considered as generalized examples from our practice. The structure of the program combines on-site seminars (four during a study year) with independent and challenging virtually organized online periods of course activities and project work. MIL was established in 2000 and was a continuation of a research network comprising a group of researchers from all over Denmark. Following this, the joint Master program is collaboration among four universities across Denmark. The MIL program can be seen as an example of a dialogue oriented and discussion-based approach (Dirckinck-Holmfeld & Jones 2009: 261) closely associated with the social constructivist approach of networked learning, in contrast to the Open University model which can be seen as a large scale teacher steered approach primarily with organized courses, classes and clearly defined curriculum based courses and tasks to be met.

The study program implements new educational technology, which has made it possible to have flexible communicative patterns building upon the problem- and project-based pedagogical model within the structure of a networked learning environment. The virtual learning environment based on the First Class conference system is an integrative part of the study structure. Students are organized in groups and have their own folders within First Class, which they are free to design according to their needs. Here they are able to write, store, and organize their contributions. They constantly have dialogues and discussions both with their group partners and also with other students belonging to the cohort.

Furthermore, they have access to synchronous video (Adobe Connect), peer-to-peer tools and web 2.0 (Skype, Windows Messenger, Google Docs, blogs), and tools to support project and course work (Camtasia). They can also engage in discussions with their teachers during their group-based online project work, through the periods with online courses, and when they meet at the four yearly f2f-seminars.

Within the networked learning environment there has been a need of creating and further developing a changing role for the teachers involved. We can see the team of teachers involved – approximately 20 – as being part of an ever evolving community of practice (Wenger 1998). The different locations and cultures represented among teachers and the placement of students from all over the country made it necessary to implement varied forms of ICT. The development and maintenance of a community of practice can support the teachers in coping with this change and these challenges.

Among the MIL teachers we have through the years recognized and experienced how important it is to be part of an inspirational, social and supportive community. Here it has been possible to share our experiences, our challenges and thus being able to inform our teaching practice and social relationships among members of the four different participating universities – we share ideas, pose questions to one another, also in relation to the challenges and uncertainties related to using different kinds of communication technologies to enrich and support our role in facilitating students' study processes within the virtual environment. As participants we share our understandings of work, responsibility, and knowledge in relation to our mutual practice.

Kim (2000) asserts that "a community is a group of people with shared interest, purpose or goal, who gets to know each other better over time" (Kim 2000: 28). According to Wenger three essential characteristics must be in place talking about communities of practice: mutual engagement, shared repertoire, and joint enterprise (Wenger 1998). *Mutual engagement* implies that the members of the community are involved in shared activities, whilst maintaining their identity through developing social relationships, and providing reciprocal and overlapping capabilities to the group. The boundaries and ideas about practice can be extended through *joint enterprise* as the members share a common purpose. A community negotiates meaning through its *shared repertoire* that is the "pool of resources that members not only share but contribute to and therefore renew" (Wenger 1998: 388).

THE TEACHER ROLE: BEING ACADEMIC LECTURER, DESIGNER, AND FACILITATOR
The role of the supervisor within the framework of project studies is different from the role of the traditional teacher, who instructs, assigns works, finds texts, makes decisions regarding curriculum, and evaluates the contributions of the students.

As a teacher acting as a supervisor for students involved in their self-directed study processes you have to be open, capable of assisting the students in their work, facilitating, being dialogically minded, and receptive to the needs of the students. At the same time teachers should be able to act as a coach, mentor, discussion partner, and to support *and* challenge the students in their project work. The productive supervisor can be understood as functioning as a catalyst that initiates processes. He or she should be inviting and willing to include the students in the academic community, take the background and experience of the students seriously, and have an eye for the resources of the students, a readiness to engage in new technologies, gadgets, or applications that are proposed or introduced by the students. To accomplish this will not necessarily be an easy task for us as professional academics having in mind the traditional expert role we have carried out so far.

Donald Schön, in discussing two different notions or contracts between the professional and the 'client', outlines this *traditional expert role* in contrast to that of a *democratically oriented, reflective practitioner*. In our context, these two types of attitudes can shed light on the teacher–student relationship.

The professional person taking on the traditional *expert role* has the conviction that "I am presumed to know, and must claim to do so, regardless of my own uncertainty". Furthermore he or she deliberately keeps distance from the client and hold onto the expert's role. "Give the client a sense of my expertise, but convey a feeling of warmth and sympathy as a "sweetener"". Finally such an expert is looking for deference and status in the client's response to his or her professional persona (Schön 1983: 300).

A contrasting approach can be seen with the *reflective practitioner*, who has a more open or democratic attitude. "I am presumed to know, but I am not the only one in the situation to have relevant and important knowledge. My uncertainties may be a source of learning for me and for them". This kind of person tends to seek out connections to the student's thoughts and feelings and to allow the student's respect for the supervisor's knowledge to emerge from the student's discovery of it in the situation. Finally this kind of attitude does "look for the sense of freedom and of real connection to the client, as a consequence of no longer needing to maintain a professional facade" (Schön 1983: 300).

As supervisor facilitating the students' project work the teacher should at the same time be capable of showing and demonstrating for the students possible ways to go, being initiating without taking too much responsibility in relation to the students' projects. The reciprocity in the teacher-learner relation is of great importance. The picture regarding this new role is utterly complex: The teacher fundamentally also is an academically schooled research person, who has a responsibility for the overall outcome of the students' activities. He or she should be able to provide leadership and to be a good communicator. Teachers have the responsibility for designing the overall framework and with regard to courses, lectures and seminars to plan and implement the activities, but also – which may seem difficult and contradictory – to try to include the students as co-designers in the varied activities.

Different Roles for Teachers as Supervisors
While students are working on their projects, they are receiving supervision from a teacher. As a supervisor you should be able to accommodate three different positions: *Instructive* giving professional advice as experts, stressing the importance of the student report to be coherent and expression of a sound academic work with the 'right' answers to the research question at stake. This kind of teacher position has primarily focus on the students' final project (Nielsen & Danielsen 2012: 263). Another position is more related to *methodological* aspects and the whole learning process, and the continuing evaluation of the knowledge process. Formative evaluation here plays an important role. The supervisor aims to guide the group towards the final project through stimulating discussions, supporting the students' effort to reach a fruitful integration of the empirical data collected by the students and relevant theoretical positions. Important in this type of supervision is the students' heightened awareness of their study and work styles. Stressing this dimension of the supervisor role, students should be able to constantly reflect on their way of acting and working with the material, what kind of choices they make, and what they are writing (Nielsen & Danielsen 2012: 264). A third position is more related to the difficult and challenging elements of collaborative group work. When members of the group are talking at cross-purposes or even talking down to one another, the supervisor as a *social mediator* will intervene, for example, if students have difficulties making decisions and embarking on constructive dialogical processes, the supervisor will intervene. The method employed by this mediating supervisor is mainly inquiring and questioning in order to facilitate student engagement in explorative dialogues. The wellbeing of the group members is very important in this context (Nielsen & Danielsen 2012: 265).

In practice a good supervisor should be able to take on all three kinds of positions depending on the phases of the project work and the situational mood among the students. In order to be able to do this, teachers should constantly be aware of the way they are acting, they should try to take a look at themselves from outside so to speak in order to be more empathetic and raise their level of reflexiveness towards the students.

Teacher Acting Within an Online Learning Environment
When dealing with online learning activities, new roles and tasks appear for the teacher compared to the well-known practice of class room teaching. Teaching online creates a need of awareness – technological as well as social awareness. Teachers should be able to mobilize competence and readiness to be online, and to be visible and accessible through online discussion periods. But again at the same time allowing adequate and ample space for students to operate and navigate. Especially in online activities it is important to assist the students to stick to their work, to hold on to their plans, and to help keeping up the students' spirit. Within a distributed online environment it can be hard for some students to maintain motivation, be disciplined and therefore it's welcomed if teachers can assist and be supportive also in planning the scope of time. It's also a challenge for the teacher to make sure students understand the tasks and activities to embark on. In relation to the extent of the work and the assessment, clear criteria and standards should be worked out. When providing written feedback, it is of utmost importance to write concisely and clear – important not to be misinterpreted. As is the case for face-to-face supervision, the online supervisor must be capable of giving constructive feedback – through synchronous communication programs such as Skype or Adobe Connect. In order to teach and supervise students online, teachers must be willing to be flexible and sometimes to be available at odd hours.

Earlier a clear distinction was seen regarding online and on-site activities. Through our experiences we have found that the gap between acting online and on-site seems to be not as great as often assumed. With the multi-facetted communication modes within reach today, the distinction is to a lesser degree whether you are online or on-site, but may rather be whether you prefer to communicate synchronously or asynchronously. Both ways may today happen in speech as well as in writing, depending on the applications and facilities you choose to use.

DEVELOPING STUDENT ENGAGEMENT
The different approaches of problem- and project-based learning processes discussed in the paper are examples of ways of enhancing the relevance of the study activities in relation to the students' past and future experiences. Coping with and engaging in real-world problems are among the ways of promoting the development of student engagement. Other methods are to involve the students as co-designers or mediators during the course activities.

Another important dimension in creating student engagement is in relation to the continuing development of mobile or social media and other new technologies to integrate aspects of these in the learning environment of the study program or to provide easy and flexible solutions that meet the students' expectations of a contemporary university.

In their study process disagreements may arise among group members. This may be experienced as frustrating, but may as discussed above also have the possibility of being productive and of bringing different perspectives forward. To achieve this, however, demands among other things to understand the various, multi-facetted dimensions of the teacher role when acting as a supervisor.

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