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Facilitating Adoption of Web Tools for Problem and Project Based Learning Activities

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Abstract

This paper builds on research directions from 'activity theory' and 'learning design' to provide 'facilitation' for students standing within decision making related to selection of web 2.0 tools and university provided web-based applications for supporting students activities within problem and project based learning. In the area of problem and project based learning, facilitation is the core term and the teacher often has the role as facilitator or moderator instead of a teacher teaching. Technology adoption for learning activities needs facilitation, which is mostly absent. Sustainable adoption might be facilitated based on tool appropriation with activities associated with courses and projects. Our mapping of different tools in a framework is reported based on interviews, observations, narratives and survey. A direction towards facilitation process for adoption is discussed as part of future scope of work.

Keywords

POPBL, PBL, Web 2.0, Task taxonomy, Facilitation, Learning Activities

Problem and Project Based Learning

Problem and project based learning (PBL) and teaching has become a widely adopted method in higher education for more than four decades (Kolmos, Du, Holgaard, & Jensen, 2008). The main pedagogical principles within the PBL model of Aalborg University (AAU) is shaped around problem-orientation, project work, inter-disciplinarily, and participant controlled learning. The ideal here is built around the students' enquiry into scientific and social problems as part of their entire learning process. Students need to identify or build hypotheses around problems. Further they need to understand and find a solution to the problem. Through this process the students go through different stages of systematic investigations: preliminary enquiries, problem formulation, theoretical and methodological considerations, investigations, experimentation and reflection (Dirckinck-Holmfeld, 2002).

In AAU, each semester is therefore organized around approximately 50% course work and 50% project work in groups, where students collaborate on writing their semester project. The students work closely together for an extended period of time. This time period is depending on their study programme, as different studies have different set-ups for the relation between courses and project work. Students work on formulating, identifying and 'solving' their problem, and writing a final project report based on integrated theoretical perspectives from their courses, experiments, reflections, etc. to their specific problem (Kolmos et al., 2008). Kolmos et al. (2008) have summarized PBL culture and practice, theories, models, and tools for reflection, analysis and development of staff role in the facilitation for students in their learning activities, specifically for Danish context and AAU saying that:

> "We have chosen to conceptualize this role of facilitation in a PBL environment in order to stress that in PBL culture, the students are playing an active part and make core decisions on their own. The role of academic staff is to motivate learning processes, to point out possible directions, to help in difficult situations, to empower the students and sometimes to answer students' questions. The difficult part is to find out which strategy is the right one for a given situation?" (Kolmos et al., 2008, p. 5).

"Facilitation" literally means "easing". The art of facilitation is in drawing out the wisdom already embedded and lying dormant in the psyche of the learner, and make the learner reflect, consider and aware of own

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knowledge. Facilitators are people with the skills to create conditions within which other human beings can, so far as is possible, select and direct their own learning and development. A facilitator is a "process guide" who works with a group to assist it to achieve self-defining purpose. The facilitator's philosophy informs their approach and it's manifested as a concern with the psychological growth of the person" (Gregory, 2002). This paper takes 'the complexity of facilitation' (Kolmos et al., 2008, p. 22) in consideration and urge the need for initiating strategies for 'facilitation for adoption of web 2.0 tools and university provided web-based applications in students learning activities', as "supervision" (Kolmos et al., 2008, p. 10) for academic disciplines do not ensure this role. While the versatility of diverse web 2.0 tools in academic activities has proven records as shown by Rongbutsri, Khalid & Ryberg (2011), the application context in PBL and facilitation for the same needs emphasis.

Problem and Scope of Work

Technology adoption projects of tertiary academic institutions lack focus on pedagogical and academic activities, teacher & student centeredness, and methodical approaches to prioritize web 2.0 tools for facilitation both in general and in a PBL approach. Simply, the problem is, that in the continuously evolving and changing web 2.0 world students and teachers adopt their own selection of tools as they encounter, experiment and exercise. At the same time there are focus on the students attending higher education as being the generation of digital natives having high information and communication technological (ICT) skills, but this approach to students can be discussed (Ryberg, Dirckinck-Holmfeld, & Jones, 2010). Using both quantitative and qualitative methods, an AAU-wide study showed that the majority of students 'do not know' about many of the web 2.0 tools that are being effectively used by some PBL project groups and students of different departments (Rongbutsri, Khalid, & Ryberg, 2011). Methods used and data collected in the work of Rongbutsri, Khalid & Ryberg (2011) are also considered as part of the primary data of this paper. From the data it was identified that appropriation of tools require significant amount of effort and different members of same group using different tools for same activity require adoption time to collaborate. These sometimes take away effort for the "collaborated academic activity" to the "tool testing and selection for collaborated activity".

'E-læringssamarbejdet ved Aalborg University (ELSA)' i.e. 'E-learning cooperation at Aalborg University' is responsible for providing technical, organizational and pedagogical support in the commissioning and operation of e-learning systems for education at Aalborg University (ELSA, 2011), who require a methodical approach to 'facilitate' students in appropriating PBL activities with web 2.0 tools. Technical teams of universities around the world intending to facilitate web 2.0 tools are in need of selecting tools, which they would train themselves and diffuse to facilitate learning activities. To address these problems and requirements, the authors attempted to build on research directions from 'activity theory' and 'learning design' in decision-making about web 2.0 tool selection for learning activities to provide 'facilitation' ELSA to the students and teachers.

Current research considers the changes in higher education, to draw strong attention towards students' learning activities. Educational institutes are not solely contributing to knowledge creation and dissemination, and learning of different forms occurs from the large sphere of society (Barnett, 1994). Educational institutes are no longer self-sufficient system in which students acquire knowledge, which they apply outside these institutes; instead, they are part of a broader and larger learning system (Wenger, 1998). Higher educational institutes have changed from 'producing and reproducing' to 'student-centred' learning. In teaching-learning practices, emphasis is given on the process of learning knowledge rather than the teaching process (Barnett, 1994; Bowden & Marton, 1998; Jarvis, 1995; Kolmos, 2002), which essentially is a facilitation process for self-paced learning. However, while emphasis is given on the importance and use of mobile devices (Weber, Yow, & Soong, 2005) and applications on the web (including web 2.0 tools) in academic activities, there appears a lack of "making awareness" about this. Along with the need to further support this awareness by a strategic 'facilitation process' which would enable students to make their decision to cater to needs of 'learning activities'.

The adoption of learning technologies for supporting higher quality learning activities than traditional approaches must be based on the psychological and pedagogical theories. Furthermore, in case of PBL, activities of student groups differ with discipline and background, but the underlying activities can be generalized. Therefore, this study focuses on the learning theories, learning activities and the PBL. The intention is to cover the aspects of individual learning and collaborative learning theories and generalize activities for associating relevance and importance of evolving web 2.0 tools.

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Learning within Different Perspectives - Review of Literature

Looking into literature Mayes and Freitas (2007) elaborated "the theoretical underpinning of e-learning, and to argue that, to be comprehensive, e-learning design must consider three fundamental perspectives, each of which leads to a particular view of what matters in pedagogy". They identify three broad perspectives of psychological theories into learning being: the associationistic/empiricist perspective understanding 'learning as activity', the cognitive and/or constructivist perspective understanding 'learning as achieving understanding' and the situated perspective understanding 'learning as social practice' (Greeno, Collins, & Resnick, 1996; Mayes & de Freitas, 2007). Seen from these perspectives our research takes the perspective of empiricist i.e 'learning as activity'.

According to these theoretical perspectives, learning could further be understood as:

1 Building concepts or competences in steps of increasing compositeness, such that they are manifested in external behaviour and internal representation is less important (i.e. associative);
2 Achieving understanding through experimentation or active discovery (i.e. constructive - individual);
3 Achieving understanding through dialogue and collaboration —in the zone of proximal development (i.e. constructive - social);
4 Developing practice in particular community and less attention is paid on the formal learning activity (i.e. situated)

These four understandings are based on the theoretical approach Mayes and Freitas have mapped in their analysis of how people learn and the context of e-learning design. (Mayes & de Freitas, 2007, pp. 221–227). In PBL each of the four perspectives are central referring to 'learning as activity' as central. For mapping web tools this paper takes 'activity' as its core.

Learning Activity and Learning Design

Several decades of research support the view that it is the activity in which the learner engages, and the outcomes of that activity, that are significant for learning (Tergan, 1997). "Design for learning should therefore focus primarily on the activities undertaken by learners, and only secondarily on (for example) the tools of material that support them" (Conole, 2007). Based on these research directions we map the web 2.0 tools students used for their learning activities within the problem and project based learning or AAU PBL pedagogical model as partially reported by Rongbutsri, Khalid, & Ryberg (2011).

Taking directions of Tergan (1997) and Conole (2007), and primary data of the work of Rongbutsri, Khalid & Ryberg (2011) we attempt to look into the web 2.0 tools students had decided to use, or ELSA had suggested and the learning activities could be performed using those tools. We further attempt to ground the activity-tool mapping with 'learning activity' and 'learning design' theories. In PBL context we perceived "a learning activity in a way that supports the design process, including the design decision to be made, the information to support these decisions, and how theories or principles can be applied" (Conole, 2007).

Our work is shaped by the activity theory (Engeström, 1999), which was proved as a productive approach in recent learning technology researches (Issroff & Scanlon, 2002) It might be argued that a student would be able to state the activities (s)he performed for learning and generalize the activities as activity type. For example, collaborative writing of a report may include brainstorming and mapping the thoughts, managing notes, collaborative writing, reference management, scheduling tasks and giving reminders, receiving notifications, communicating with each other, group meeting, data collection and analysis, translating information, publishing the report and getting feedback etc. It is therefore more productive to plan, conduct and measure the parameters of the activities.

The trend of e-learning research and development has shifted from 'learning object' (Polsani, 2003) to 'learning design', while passing though four levels of increasing complexity (Duncan, 2003; Littlejohn, Falconer, & Mcgill, 2008). Surveys reported on the multi-faced and complex ways of appropriating and personalizing technologies by the students (Gráinne Conole, de Laat, Dillon, & Darby, 2008; Creanor, Trinder, Gowan, & Howells, 2006), which have contributed to this shift alongside the technological innovations. These four levels of increasing complexity (Littlejohn et al., 2008), which have been summarized and adopted from (Conole, 2007) are:

- Digital assets – typically referred to a single file (e.g. an audio clip, image or a video), in some cases called a 'raw media asset';

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- Information objects – are structured collection of digital assets, which are designed particularly to present information for pedagogical or academic administration purposes;
- Learning activities – include the tasks performed by learning to achieve learning outcomes in a learning environment while interacting with people or resources
- Learning design – are structured and interdependent sequences of information and activities to promote learning.

Our work puts emphasis on 'learning activities' and not 'learning design', as we focus on the learning outcome and especially on the interaction going on among students themselves and students and teachers (as facilitators). In PBL both teacher facilitated activities and collaborative group activities are flexible in nature, where the learning activities are the building blocks. We believe that with learning activities use and adoption of web 2.0 tools are possible, while generalizing using 'learning design' becomes more complex. It had been consistently reflected in the studies and reviews of virtual learning environments (VLEs) that systems' design approaches promote content of learning materials or non-pedagogical course administration activities (Britain & Liber, 1999). Previous researches had reported some directions for facilitating or assisting teachers but not targeted to students (Barnett, 1994; Bowden & Marton, 1998; Jarvis, 1995) in facilitating them in their choice of web 2.0 based tools. Current paper is based on students' activities for learning and current process of facilitating web 2.0 tool adoption at AAU, with data and findings contributed by Rongbutsri, Khalid, & Ryberg (2011).

Diane Laurillard (Laurillard, 2001) mapped different learning mediating technologies and looked upon these related to which tasks or activities these technologies will be able to support and categorised them into six different categories. As a mapping technique, Grainne Conole (Conole, 2007, pp. 226–229) developed a tabulating tool which is 'the learning activity taxonomy' to relate 'traditional examples' and terminologies with 'electronic and mobile examples. The task or activity types are: narrative (assimilative, productive, both), communicative (synchronous, asynchronous), interactive, productive, adaptive, and integrative. However, the work did not map only web 2.0 tools as the technologies but included both online and offline tools. It was a theoretical approach to present a concept and not about making decision, the work was not based on data on currently used tools by students or teachers. Our paper attempts to bridge such gap by mapping only web 2.0 tools that are currently used by PBL engaged students at AAU, tools that are recommended by ELSA and based on the findings reported by Rongbutsri, Khalid, & Ryberg (2011).

Mapping Online Tools with Learning Activities

Rongbutsri, Khalid, & Ryberg (2011) reported a list of online tools used by or introduced to the students at AAU. The findings can be divided in two broad categories. These are (a) personally subscribed or used web 2.0 tools and, (b) university administrated or subscribed tools. These tools are summarized in table 1 and mapped based on task taxonomy of Grainne Conole (Conole, 2007, pp. 226–229). In Conole's taxonomy map, we narrow down by defining the following: Environment is 'web-based', pedagogical approaches include 'cognitive problem-based' and 'situative project based learning', interaction (who) is 'group-based' and role (which) is 'group participant'. We map the web tools against the task taxonomy 'type (what)'and 'technique (how)'.

Table 1. Web-based tools mapped to the task taxonomy ('type' and 'technique') for AAU students

Type (What)	**Technique (How)**	**Personally subscribed or used web 2.0 tools**	**University administrated or subscribed web tools**
Assimilative: Reading, Viewing, Listening	Reading, Viewing, Listening	All - by all we refer to the tools mentioned in this table	All - by all we refer to the tools mentioned in this table
Information Handling: Gathering, Ordering, Classifying, Selecting, Analysing, Manipulating	Concept mapping, Brainstorming, Buzz words, Crosswords, Defining, Mind mapping, Searching	MindMeister, Mindmap, Wiggio, Diigo, Etherpad, Doodle, Facebook, Box.net, Basecamp, Delicious, Digg, Lectio, Zotero, Twitter, Google Translator, Google Docs	Mahara, Moodle, Quickr, Adobe Connect, First class, AUB digital library, VBN (vbn.aau.dk), Projecter (Projektbiblioteket)

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Adaptive: Modelling, Simulation	Modelling, Simulation	Dabbleboard	SecondLife
Communicative: Discussing, Presenting, Debating, Critiquing	Articulate reasoning, Arguing, Coaching, Debate, Discussion, Fishbowl, Ice breaker, Interview, Negotiation, On the spot questioning, Pair dialogues, Panel discussion, Peer exchange, Performance, Question and answer, Rounds, Scaffolding, Socratic instruction, Short answer, Snowball, Structured debate	Google Groups, Google docs, Skype, SignApp Now, Messenger (MSN, Google & Yahoo), Facebook, LinkedIn, Twitter, Prezi, iGroups.dk, Wiggio, Google calendar, MindMap, MindMiester, Blogger, Wordpress, Lectio.dk, Mail (Gmail, yahoo, MSN etc.), TeamViewer, LogMeIn	AAU mail, Mahara, Moodle, Quickr, Adobe Connect, First class
Productive: Creating, Producing, Writing, Drawing, Composing, Synthesizing, Re-mixing	Artifact, Assignment, Book report, Dissertation/thesis, Drill and practice, Essay, Exercise, Journaling, Presentation, Literature review, MCQ, Puzzles, Portfolio, Product, Report/paper, Test, Voting	Dropbox, Evernote, Slideshare, Google Docs, One Note, Box.net, Dabbleboard, Wordpress, Blogger.com, Etherpad, LinkedIn, Prezi, Pageflakes, Blogger, Zotero	Mahara, Moodle, Quickr, Adobe Connect, First class, VBN (vbn.aau.dk), Projecter (Projektbiblioteket)
Experiential: Practicing, Applying, Mimicking, Experiencing, Exploring, Investigating, Performing	Case study, Experimental, Field trip, Game, Role play, Scavenger hunt, Simulation	SecondLife	SecondLife

PBL activities can be classified into two main activities: course work activities and project work activities. As mentioned earlier this paper investigates on activities in project work only. Web tools to support learning and group work collaboration are mapped into different learning activities. From this perspective we have looked further on the list of tools presented in table 1 both self-subscribed tools and institution-provided tools and compared these with the phases in PBL project work. Table 2 shows mapping of web tools in the different phrases of PBL project work. There are some common activities, which students usually do in most of the phases are shown in table 3.

Table 2: Samples of tools mapped to PBL project work activities

Phases	**Activities**	**Web tools**
Group Forming	Brainstorming	Twitter, Etherpad, Blogger.com, Wordpress
	Group creation	Email, Twitter
Problem Formulation	Brainstorming	Mindmap, vue.tufts.edu, Mindmeister,Google docs, EtherPad
	Literature searching	AAU digital library, Google scholar, Google, Bing
	Literature Storing	Dropbox, Zotero groups,Diigo, Digg, Mendeley
	Referencing	Wiggio, Refworks, Zotero, Mendeley
	Argumenting	Table3: Common activities

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	Writing	Table3: Common activities
	Presenting	Table3: Common activities
Task formulation	Scheduling	Google calendar, Doodle
	Diagramming	Table3: Common activities
	Resource allocation (tools, spaces, locations, people)	Basecamp, MS project
Data gathering	Data Collection	surveyexact.dk, Google docs
	Data Transformation	surveyexact.dk, Google docs
	Data Storing	surveyexact.dk, Google docs
	Data representation	surveyexact.dk, Google docs
Analysis	Data analysis	surveyexact.dk, MS Office
	Argumenting	Table3: Common activities
	Diagramming	Table3: Common activities
Design	Development/Production / Testing	Etherpad
	Experimenting	None
	Modeling	Dabbleboard
	Writing	Table3: Common activities
	Simulating	SecondLife
	Prototyping	Dabbleboard
	Diagramming	Table3: Common activities
Reporting	Report writing	Table3: Common activities
	Report submitting	Email, Google project, AAU project
	Presenting	Table3: Common activities
	Argumenting	Table3: Common activities
	Publishing	AAU projekt Projekter (Projektbiblioteket)

Table 3: Samples of tools mapped to PBL common activities

Common activities	**Technologies**
Sharing	Dropbox, Zotero, Diigo, Youtube, Facebook, Flickr, twitter, Blogger, Delicious, Digg, Box.net, Slideshare, LogMeIn, TeamViewer, LogMeIn
Discussing	Facebook,LinkedIn, Skype, MSN, Yahoo messenger, twitter, Blogger, Doodle, SignAppNow, Mahara, Moodle, Quickr, Adobe Connect, Lectio.dk, Microsoft OneNote, FirstClass
Reading	Google
Presenting	Prezi, Google docs
Writing	Google docs, Typewith.me, MS Office with Dropbox
Communicating	Facebook, LinkedIn, Youtube, Flickr

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	Skype, MSN, Yahoo messenger, twitter, Blogger, Doodle, SignAppNow, Mahara, Moodle, Quickr, Adobe connet, Lectio.dk, Microsoft OneNote, FirstClass
Reflecting	Facebook, LinkedIn, Youtube, Flickr Skype, MSN, Yahoo messenger, twitter, Blogger, Moodle, Mahara, FirstClass
Argumenting	Facebook, LinkedIn, Youtube, Flickr, Skype, MSN, Yahoo messenger, twitter, Blogger, Mahara, Email, Microsoft OneNote, FirstClass
Diagramming	Gliffy, Diagramly, Dabbleboard

Table 2 and table 3 can be used as a guideline for students to look for tools to support their learning activities. These also can be used for PBL group supervisors and IT support department e.g. ELSA to understand phases of PBL group work and tools which can be applied to each activity in each phase. Therefore, it can be a guideline for the supervisors to facilitate their students to pick up appropriated tools for each activity either based on PBL work group phases or the task taxonomy. Tools which are mapped into common learning activities in the task taxonomy in table 1 can be mapped to different learning pedagogies for different strategy to facilitate students' group work. However, the PBL phases shown in table 2 are for a general PBL group workflow.

Scope of Future work

This research has focused primarily on the collaborative project activities and not on the teacher facilitated classroom activities. Seen in relation to problem and project based learning we therefore could cover 50% of the activities performed by the students. Further research in this area could be to explore and map the web 2.0 tools used or recommendable for teaching-learning activities in classroom settings. In proportion to this it could be interesting to look further into what kind of activities going on around AAU in lectures (classroom settings) as part of the problem and project based learning model. Learning design may limit the opportunities of learning for students since the alternative to apply tools is based on the design and the designer, who may be a teacher. PBL institutions (e.g. Aalborg University) should guide students to number of tools to support each possibly learning activity instead of leverage the use by putting them in learning activities from learning design processes. Students should have the liberty to select tools from a pool of suggestions given to them. This paper makes a pool of tools mapped against the types of activities. This is to facilitate students. However, in future a systematic process has to be identified for providing students with some guidelines or tech support to ease adoption. About most universities including AAU has a team to provide facilitation for support design of e-learning (pedagogical, organizational and technical), yet teachers and students often state that "I do not know where to look for support, whom can I mail or call to get a pre-scheduled support". We are aware that this also influences the overall organizational politics within an institution, but we haven't gone into this discussion in this paper. Only stating that it will have some impact to establish and facilitate a pool of tools, and a policy around that will be needed in an institutional level.

In future, the authors intend to explore facilitation requirements for teachers in the PBL context, particularly in the Danish environment, based on primary data collection methods deployed at AAU.

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