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## Integrating Web 2.0 Technologies into Face-to-Face PBL to Support Producing, Storing, and Sharing Content in a Higher Education Course

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# THE INTERDISCIPLINARY JOURNAL OF PROBLEM-BASED LEARNING

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## VOICES FROM THE FIELD

### Integrating Web 2.0 Technologies into Face-to-Face PBL to Support Producing, Storing, and Sharing Content in a Higher Education Course

Jaana Virtanen (Toranki School) and Päivi Rasi (University of Lapland)

#### Abstract

In this article we present and discuss the process of developing and implementing a PBL-based course entitled Moving Images in Teaching and Learning that was held at the University of Lapland, Finland. In the course of the project, this fairly traditional face-to-face course was redesigned into a blended PBL course by integrating Web 2.0 applications into the course. The pedagogical rationale was to support students' meaningful learning in various phases of the PBL process, and to enable easy storage and sharing of the ideas produced by the students. In addition, the rationale was to create more opportunities for students to report on their process during their independent knowledge acquisition phase and for the teacher to monitor and support students' information searching processes. We focus mainly on students' experiences of the implementation and conclude with ideas about our next steps.

*Keywords:* higher education pedagogy, Web 2.0 applications, video production

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#### Introduction and Background

In this article we present and discuss the process of developing and implementing a PBL-based course entitled Moving Images in Teaching and Learning (5 ECTS European Credit Transfer system credits) that was held at the University of Lapland, Finland during 2014. In the course of the project, this fairly traditional face-to-face course was redesigned into a *blended PBL course* (see also Moeller, Spitzer, & Spreckelsen, 2010) by integrating Web 2.0 applications into the course to support students' learning in various phases of the PBL process and to make students' learning process more visible to the teacher. Students' experiences were then collected through a questionnaire and a focus group discussion. The first author of this article worked as the PBL tutor, and the second author was her supervisor in the project and observed the PBL sessions.

#### The Affordances of Web 2.0 Technologies in PBL

Student-centeredness, small-group work, and the tutor's role as a facilitator are some of the core characteristics of PBL (Barrows, 1996; Hmelo-Silver, 2004; Poikela & Poikela,

2006). The tutor's role is to facilitate this collaborative knowledge construction (Hmelo-Silver & Barrows, 2006; Poikela, 2003). Web 2.0 applications such as chats, blogs, and wikis can be useful tools for supporting collaborative knowledge construction for PBL tutors/facilitators and students. Face-to-face, online, and blended PBL practices utilize virtual learning environments (VLEs), personal learning environments (PLEs), as well as Web 2.0 and social media applications (e.g., chats, blogs, and wikis). The environments and applications are used for the purposes of facilitating, producing collaborative content, sharing, commenting, reviewing, annotating, and communicating (e.g., brainstorming) as well as for playing and acting in virtual 3D worlds (e.g., Grippa, Secundo, & Passiante, 2009; Moeller et al., 2010; Poikela, Vuoskoski, & Kärnä, 2009; Ryberg, Glud, Buus, & Georgsen, 2010; Tambouris et al., 2012).

Donnelly (2005, p. 158) argued that educational technologies can benefit PBL practices by (1) bringing real-world projects and problems into the classroom, (2) providing scaffolds, tools, and resources to enhance learning, (3) providing more opportunities for feedback and reflection, and (4) expanding opportunities for learning through collaboration

and discussion. When integrating Web 2.0 applications into PBL practices, the focus can be on either online courses or blended learning courses, in which applications are integrated into face-to-face teaching and learning. There is variation in how much and in which phases Web 2.0 applications are being utilized (e.g., Bridges, Botelho, & Tsang, 2010; Delialioglu, 2012; Delialioglu & Yildirim, 2007; Donnelly, 2005; Judge, Osman, & Yassin, 2011; Moeller et al., 2010; Tambouris et al., 2012).

### **The Outcomes of Using Web 2.0 Tools in Higher Education PBL Settings**

Previous studies indicated that the use of Web 2.0 tools (e.g., blogs, podcasting) in an international master's program, which utilized project-based learning; supported students' collaboration and sharing of ideas and files with peers, tutors, and mentors; and made the learning assessment phase easier to perform (Grippa et al., 2009). Moeller et al. (2010) examined the effects of using different combinations of Web 2.0 tools (i.e., wiki, chat, and a collection of links to expert sources) in a blended PBL university setting (bPBL). They concluded that the wiki supported a positive change in students' communication, which turned out to be deeper and longer lasting. The students who had used the wiki also felt that they were better prepared for the examination and that the course was easier, compared to the students who had not used the wiki during the course. Conversely, the chat did not correspond to the original hypothesis of creating more efficient communication or fostering the collaborative effect of PBL in enhancing students' satisfaction. As a conclusion, the researchers argued that bPBL profits most from supporting asynchronous communication, in this case, wikis.

Tambouris et al. (2012) developed a Web 2.0 learning platform and examined university students' and professors' experiences of using the platform. The results indicated that the students seemed satisfied with the learning platform due to its user-friendliness and the means it offered for communication and collaboration. Overall, the researchers stated that "PBL practices may be enhanced by the usage of Web 2.0 tools" (p. 249). However, one of the challenges identified was the difficulty of adapting to new ways of working: students were not as active online as the researchers expected and seemed to prefer face-to-face collaboration in their group assignments (see also Dohn, 2009; Glud, Buus, Ryberg, Georgsen, & Davidsen, 2010). Several researchers (Dohn, 2009; Glud et al., 2010; Tambouris et al., 2012) have highlighted that simply integrating various Web 2.0 applications into teaching practices does not guarantee students' active and self-directed studying, and that the tools can be used in a very conservative and teacher-centered way.

Previous research has also focused on the roles of Web 2.0 tools in supporting collaboration and learning in between the face-to-face PBL tutorials. Research findings by Judge et al. (2011) highlighted the benefit of asynchronous online discussions that took place between face-to-face PBL sessions in a university-level biology course. Integrating online discussion into the PBL practice helped to improve students' oral group communication skills "as students were more confident, organized and prepared" (p. 1549) to present their problem solutions. Similarly, Kärnä and Kallioniemi's (2006) study showed the benefits of asynchronous online discussions during the independent knowledge acquisition phase of the PBL process. They found out that online discussions during students' independent knowledge acquisition phase reached a theoretical level, whereas in the face-to-face session following this phase students provided more practical, concrete examples and experiences about the topics under study. Online discussions proved to be useful for understanding the topic before the face-to-face session after the independent knowledge acquisition phase of the PBL process (see also Rovai & Jordan, 2004).

Studies performed by Hao-Chang (2009) and Rovai and Jordan (2004) focused on higher education (HE) blended PBL practices that took advantage of Web 2.0 tools (MSN, blogs, wikis) to support both asynchronous and synchronous communication and knowledge building between the face-to-face PBL sessions. They concluded that the online tools supported students' communication, knowledge building, and problem solving. However, face-to-face encounters are also highly important to prevent misunderstandings and to offset the feelings of distance and the sense of unreality that may be experienced in fully online courses (Hao-Chang, 2009). Rovai and Jordan (2004) reported that face-to-face encounters allowed students to become acquainted with other students, and hence may have supported the interpretation of following text-based online communication during the online part of the PBL course.

## **The Development and Implementation of the PBL Course**

Moving Images in Teaching and Learning (previously entitled Digital Video) is an optional PBL-based course within the minor subject studies of Information and Communication Technologies in Teaching and Learning at the University of Lapland's Faculty of Education. The course is graded 1–5, with 5 being the highest. The aim of the course is to enable students to analyze the pedagogical functions of producing and using videos and to produce and use videos to support learning. The aim is not to make professional educational video producers out of the students but rather to prepare them to work as pedagogical media experts in various settings.

### Video Production–Supported PBL model

The course builds on a video production–supported PBL model, that is, a combination of face-to-face tutorial sessions and independent knowledge acquisition through hands-on workshops, where students produce videos about the phenomena under study (see Hakkarainen, 2011). The video production–supported PBL model was developed based on the Swedish Linköping University PBL model, as modified by Poikela and Poikela (2006; see also Hakkarainen, 2009). A PBL cycle (see Figure 1) consists of collaborative learning achieved in two tutorial sessions, and independent knowledge acquisition is situated between the two tutorial sessions. The problems that are dealt with arise from professional practice.

Learning and problem solving are supported by the dynamic interaction of the tutorial sessions and students' independent knowledge acquisition. Outside the PBL cycles, an introductory meeting and a final assessment meeting can be scheduled. Video production is integrated into the problem-solving cycle as a form of knowledge acquisition about the subject matter. Other forms include, for example, acquiring knowledge through libraries, the Internet, or attending lectures. During the PBL cycle, students work through setting the problem (phase 1), brainstorming (phase 2), structuring the ideas generated during the brainstorming (phase 3), selecting the problem area (phase 4), and setting the learning task (phase 5) to which students seek answers during the independent knowledge acquisition (phase 6) (Poikela & Poikela, 2006; see also Hakkarainen, 2009). The second tutorial session, which takes place after students' independent knowledge acquisition, focuses on sharing the knowledge acquired to tackle the learning task and assessing how well students have succeeded in their knowledge acquisition (phase 7). At the end of the session, students clarify the constructed knowledge and compare it with the original problem (phase 8).

The course has been the focus of several case studies that have explored how the course supports students' meaningful learning (see Hakkarainen, 2009, 2011). The previous studies have indicated that *students* experienced the course as highly collaborative, cooperational, and conversational, and that their emotional involvement in learning was positively toned. The studies also indicated several refinement needs such as the need for the subject matter teacher (i.e., the PBL tutor) and the video production teacher to collaborate, preferably through shared teaching practices (Hakkarainen, 2011).

During the spring 2014 implementation, we decided to focus on a teaching challenge not indicated by the previous research (Hakkarainen 2009, 2011), namely, on a challenge experienced by the responsible teacher, who was also the PBL tutor of the course. The teacher experienced that the traditional classroom tools (e.g., whiteboards, sticky notes) used in the PBL process did not enable *easy storage* and *sharing* of the ideas produced by the students during phases 1–6 of the PBL cycle. The ideas and learning tasks that students produced were previously written in sticky notes or on whiteboards and photographed in order to be stored, shared, and revisited later by the teacher and the course students. In addition, during the independent knowledge acquisition phase, there were not enough opportunities for students to report on their process and for the teacher to *monitor* and *support* students' information searching processes. Therefore, we wanted to redesign this fairly traditional face-to-face course into a *blended PBL course* (see also Moeller et al., 2010) by integrating the following Web 2.0 applications: a blog, an interactive online wall, an interactive whiteboard, a backchannel chat, and an online mind mapping tool (Table 1). The pedagogical rationale for using these applications was to further support students' communication in various phases of the PBL process, and to make their learning process and outcomes *more visible* to the tutor, to their peers, and to a wider audience.

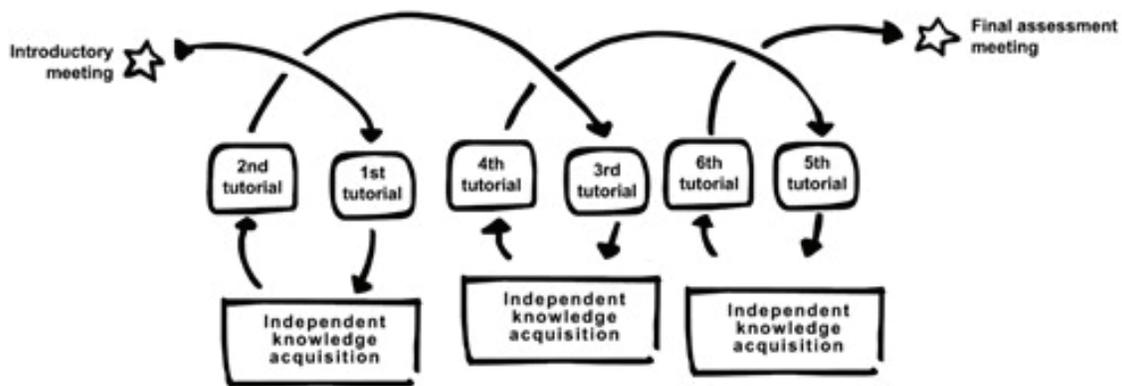


Figure 1. The cyclical PBL process in the moving images in teaching and learning course.

## Course Implementation

Moving Images in Teaching and Learning is a voluntary course with 8–12 students enrolled in each of its previous implementations during 2006–2011. In the spring of 2014, the number of students was somewhat smaller: a total of 5 students (3 female, 2 male) between 20 and 50 years of age enrolled in the course. All of the students were students from the Faculty of Education, four of them were enrolled in the international Media Education Master's Program, and one student was an international exchange student. As Finnish was not the native language of all students, English was used as the language of instruction.

All students were avid users of Web 2.0 applications in their free time, but most of the students were not familiar with the applications integrated into the course. The course consisted of an introductory meeting (3 hours), six PBL tutorial sessions (4 hours each), 8 workshops (3 hours each), and one final meeting (3 hours), where the student-produced video

was viewed and assessed collaboratively. The first author of this paper worked as the PBL tutor, and the workshops were supervised by a teacher whose expertise was in the area of video production and video expression. The students were responsible for the entire video production process: writing the synopsis and manuscript, planning the shoots, filming, and editing (using *Adobe Premiere* editing software). During the PBL tutorials, the students focused more on the theoretical aspects of using videos in teaching and learning, while in the workshops they covered the production process more thoroughly and concretely by producing their own video. Besides working on the problem and producing a video, the students were also expected to write a report that presented and discussed the pedagogical rationale for their video.

The old technologies used in the previous implementations of the course as well as their Web 2.0 replacements are presented in Table 1, according to the PBL phases and students' learning activities.

Table 1. Integration of web 2.0 technologies into the PBL processes on the moving images in teaching and learning course.

Phase of the PBL cycle	Students' learning activity	Previous course technologies	New Web 2.0 application
1. Defining the problem	Students familiarize themselves with the problem to be solved.	Tutor's PowerPoint slides, which are projected on classroom screen.	Blog ( <i>WordPress.com</i> )
2. Brainstorming, explicating thoughts and ideas	Students produce ideas about the problem and how to solve it.	Post-it notes on classroom walls, doors, and whiteboards.	Interactive online wall ( <i>Padlet</i> )
3. Grouping ideas	Students group their ideas.		Interactive whiteboard ( <i>Qomo</i> )
4. Focusing/choosing the interest area	Students choose the area about which they need to learn more.	Classroom whiteboards and students' personal notes.	Interactive online wall ( <i>Padlet</i> )
5. Formulating the learning task	Students formulate their concrete learning task: about what topic will they be searching for information?		Blog ( <i>WordPress.com</i> )
6. Independent knowledge acquisition	Students search information from a variety of sources.	—	Blog ( <i>WordPress.com</i> ) Backchannel chat ( <i>Today's Meet</i> )
7. Constructing and negotiating new knowledge	Students construct a shared understanding about the results of their knowledge acquisition phase	Classroom whiteboards and students' personal notes.	Online mind mapping tool ( <i>MindMeister</i> ) Interactive whiteboard ( <i>Qomo</i> )
8. Clarifying, comparing	Students produce a synthesis of their knowledge	Classroom whiteboards and students' personal notes.	Blog ( <i>WordPress.com</i> )

During the first tutorial, the students were given the first problem in the form of a case describing a university teacher who faces a problematic situation. The teacher feels that she has nothing new to give to the students, and that every year the student groups are the same—they do not seem to be interested in lectures. The problem was presented to the students via the course blog, which was projected onto the classroom screen. During phases 2–5, an interactive online wall (*Padlet*) and an interactive whiteboard (*Qomo*) were used to support brainstorming, grouping ideas, choosing the area of interest, and formulating the learning task. The students formulated their learning task as: *How can student-made instructional videos inspire students and teachers?* The learning task was then published on the course blog.

After the first tutorial session, the students started their independent knowledge acquisition phase, during which they posted their findings on the course blog. The backchannel chat (*Today's Meet*) was set up for the course to help students communicate what kind of information sources they were using in their independent knowledge acquisition to avoid a situation where everyone was using the same information sources. Only two students used the chat. The beginning of the next tutorial covered phases 7 and 8, during which the students presented and discussed the results of their knowledge acquisition using an online mind mapping tool (*MindMeister*) with the interactive whiteboard (*Qomo*). The students finished the first PBL cycle by forming a synthesis to answer the original problem. After the evaluation of phases 7 and 8, the next cycle began with a new problem, which was a continuation of the original case.

During the second and third PBL cycles, the students created the following learning assignments: *What is required from the teacher to evolve the learning process with student-made videos? What kind of music can be used in educational videos? How can it evoke feelings and emotions?* The workshops followed the PBL tutorials every week and also provided more information for the students to use during the knowledge acquisition phase.

## Lessons Learned

We collected students' course experiences through the teaching and meaningful learning (TML) questionnaire (see Hakkarainen, 2009, 2011). All five students enrolled in the course completed the questionnaire prior to the final assessment meeting. The questionnaire included 30 statements concerning the learning process, learning resources, and learning outcomes (Table 2, next page). The students were asked to evaluate the statements using a five-point Likert scale (1 = disagree, 2 = moderately disagree, 3 = neither disagree nor agree, 4 = moderately agree, 5 = agree).

In the second part of the questionnaire, we asked the students to evaluate statements focused on the *emotions* they experienced

during the course on a five-point Likert scale (0 = not at all . . . 4 = to a great extent). Students were also asked to specify reasons for experiencing the emotion in question. The emotions appearing on the questionnaire were chosen from those proposed by Kort and Reilly (2002) as possibly relevant to learning: worry, comfort, boredom, interest, frustration, uncertainty, dispirit- edness, disappointment, satisfaction, enthusiasm, tension, and embarrassment. In addition, the questionnaire included the following emotions: trust, sense of community, irritation, joy, stress, relief, feelings of inadequacy, and challenge (Figure 2).

In addition, research data was collected through a focus group interview with four of the course students. The length of the interview was 121 minutes, and it was audio recorded with permission from the students. Both authors of this paper participated in the interview: the responsible teacher and PBL tutor (first author) of the course and the researcher (second author). The topics and a portion of the interview questions were specified in advance. The topics included: students' previous experiences in PBL and Web 2.0 technologies; experiences of the PBL sessions, knowledge acquisition, and workshops; and students' experiences, emotions, and development ideas concerning the use of Web 2.0 technologies during the course. Interview questions included, for example: Would you have needed more support in using these applications? Did these applications meet the purpose from the viewpoint of the course? The audio data were first transcribed verbatim by the first author, after which the authors read the transcripts several times to identify interview passages in which the students talked about issues related to meaningful learning, emotions, and the use of Web 2.0 technologies during the course.

From students' self-reports we learned that the video production-supported PBL model supported their meaningful learning. In the questionnaire, students gave the highest ratings for the statement measuring the *active* ( $M = 5.0$ ), *multiple perspectives-oriented* ( $M = 4.8$ ), and *creative* ( $M = 4.6$  and  $M = 4.8$ ) characteristics of meaningful learning. Also, the *collaborative*, *cooperational*, and *conversational* characteristics of the course were rated favorably ( $M = 4.0$ – $4.8$ ).

Interestingly, the focus group discussion revealed some additional insights into students' experiences of the *active* and *self-directed* characteristics of their learning process. Even though all the course students agreed that they were in an *active role*, as measured with the questionnaire statement "students' role was to actively acquire, evaluate, and apply information," they had experienced that this role was not always realized in practice as students did not always come to the tutorial session well prepared following their independent knowledge acquisition phase. In addition, even though students reported on the questionnaire that their learning process had been self-directed, in the group discussion they critically assessed their self-directedness, including time management skills (see also Hakkarainen, 2009, 2011),

during the independent knowledge acquisition phase (pseudonyms used for all students; A2 = Author 2):

*Ann:* Hmm . . . [sighs] . . . actually I'm not that satisfied with my work because I originally . . . for example, like two days before the deadline for the next lesson [tutorial session], and I realized that "Oh my God, I have to read something!" [laughs]. Yes, and it was so frustrating actually, so I'm not so satisfied with myself. I

should have started earlier, you know [laughs]. Yeah, time management skills, they need to be improved.

*Jane:* Yeah, I suppose it was one thing that we agreed on, that we should start [the independent knowledge acquisition] earlier, but everybody was posting them [knowledge acquisition results] on Sunday or on Monday morning [laughs] [. . .]

Table 2. Questionnaire statements concerning the learning process, learning resources, and learning outcomes.

#	Questionnaire statement
	Following areas helped me to learn:
1.	script and filming workshops
2.	PBL tutorials
3.	producing the video
4.	materials and resources available in the course blog.
5.	It was possible for me to study according to my own personal style that suits me.
6.	I was able to utilize my prior knowledge about the course topics.
7.	I was able to apply my own practical experiences during the course.
8.	I was able to evaluate my own learning during the course.
9.	The course helped me to understand different perspectives related to the topics under study.
10.	Studying enabled the achievement of my personal goals.
11.	The students were committed to collaboration.
12.	I am able to utilize the knowledge acquired in this course in other connections.
13.	The course deepened my understanding of what I had learned before.
14.	The course promoted the learning of skills and knowledge needed in working life.
15.	Students' role was to actively acquire, evaluate, and apply information.
16.	On the course practical examples were studied in a theoretical framework.
17.	The students directed their own studying process in the PBL sessions.
18.	Activities of the tutor during tutorials supported the group's learning.
	Studying in the course developed:
19.	my problem-solving skills
20.	my critical-thinking skills
21.	my knowledge acquisition and knowledge evaluation skills
22.	my collaboration and communication skills
23.	my project management skills
24.	I was able to influence the content and realization of our video assignment.
25.	Cooperation with my group was successful.
26.	The targets of learning were examined through several forms of presentation (text, diagrams, pictures, video, etc.).
27.	The PBL tutorials encouraged creative thinking.
28.	I was able to utilize my own experiences as starting points for learning in the PBL tutorials.
29.	I learned about the contents of the video during the production.
30.	Our video assignment enabled creative thinking.

However, students clearly appreciated the PBL practices for “forcing” students to take an active role with respect to acquiring, evaluating, and applying information.

As found in the previous research on this course (Hakkarainen, 2009, 2011), students’ questionnaire ratings showed that they experienced positive emotions during their learning process (Figure 2). In the questionnaire, the students indicated the extent (0 = not at all, to 4 = to a great extent) to which they had experienced a given emotion during the course.

Of the positively toned emotions, *trust* ( $M = 3.8$ ), *interest* ( $M = 3.2$ ), *challenge* ( $M = 3.2$ ), and *satisfaction* ( $M = 3.0$ ) were the most intense emotions experienced. Of the negatively toned emotions, *worry* ( $M = 1.8$ ) and *irritation* ( $M = 1.8$ ) were the ones with the highest values. These were associated with time management and group processes during video production (see also Hakkarainen, 2009, 2011), studying with PBL for the first time, the professional editing software, and forgetting one assignment. None of the students reported feelings of dispiritedness or boredom, which

have been shown to be detrimental to students’ motivation (Pekrun, Goetz, Tizt, & Perry, 2002).

All of the four students who participated in the focus group discussion had a positive attitude toward and experience of the integration of Web 2.0 applications into the course. As the students reported:

*Ann:* I was very excited about using all of these things [applications], because I haven’t used them before. And I would like to learn more about them.

*Mary:* It was kind of a challenge to start using them [applications], but I think they were really interesting, and I would love to work with them in the future.

*Mike:* Everything was new for me, but [. . .] I enjoyed it very much.

The *blog* was used during PBL phases 1, 5, 6, and 8. One of the students referred to the blog as “a home base” that supports students’ independent knowledge acquisition:

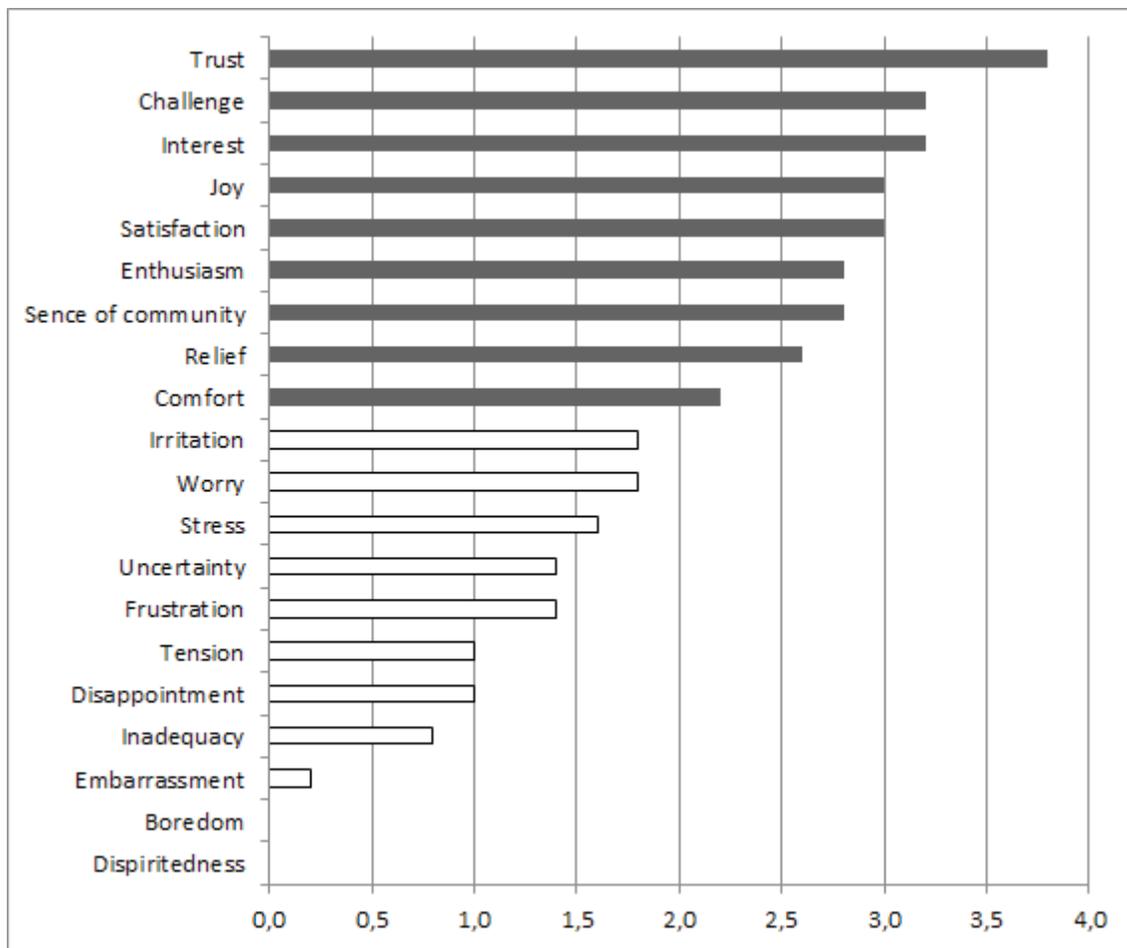


Figure 2. The students’ ratings of the emotions they experienced (0 = not at all . . . 4 = to a great extent) during the 2014 implementation of the moving images in teaching and learning course.

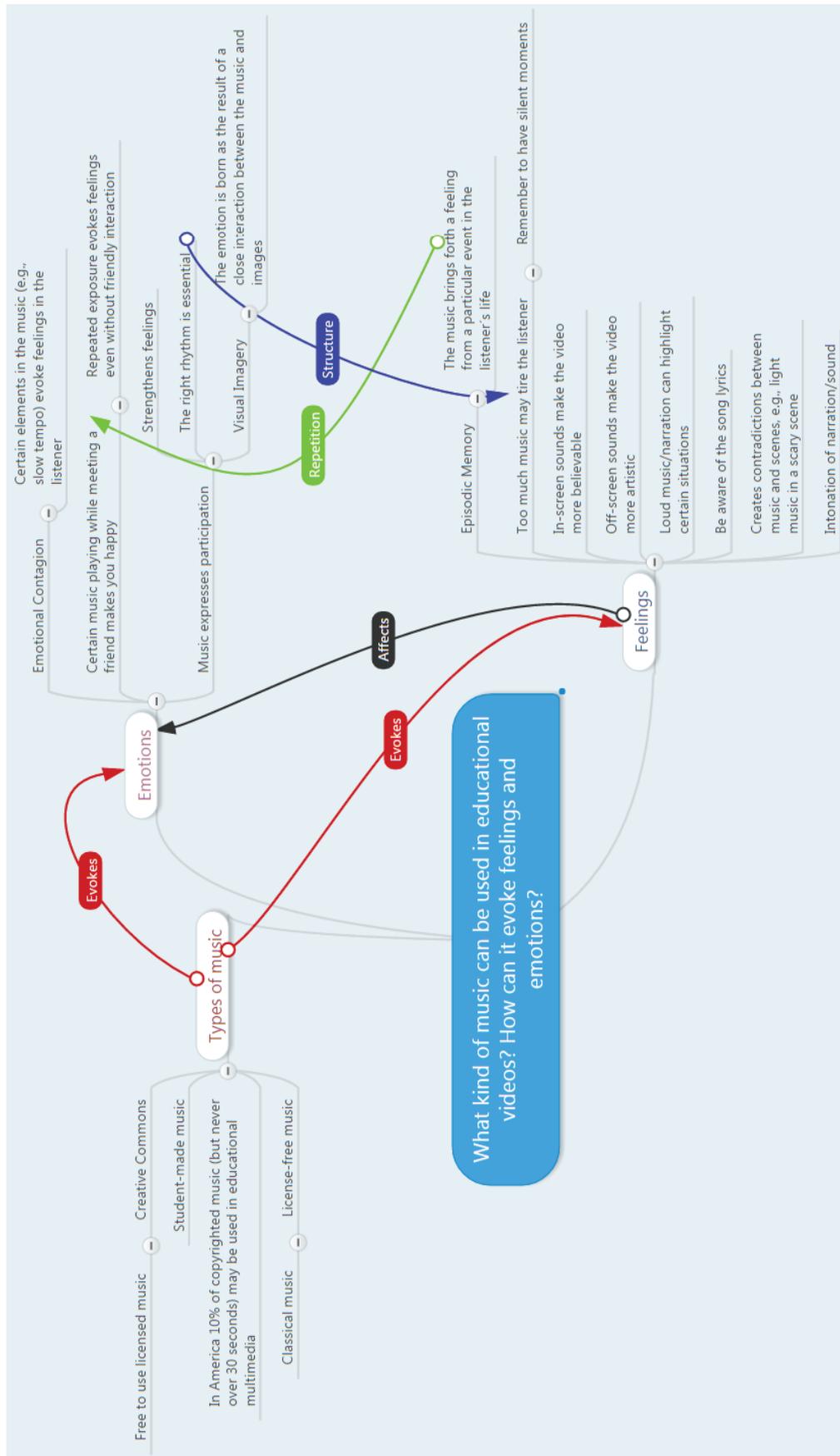


Figure 3. A mind map produced by the students in a tutorial session after their independent knowledge acquisition phase.

*Jane:* Well, I think it was good that it was in a blog, in the Internet, that everybody could get easy access and everybody . . . the results and the also the course literature was there. So it was a kind of a home base for your work.

Students felt comfortable about posting the results of their independent knowledge acquisition in the blog, but at the same time they had different opinions about what they would *not* want to publish in a course blog:

*Mary:* I probably wouldn't want my essays to be there . . . just, I don't know. I think I'm just used to sending them to the teacher. In a way it could be good because, I mean, you could get more comments on the essay, but I still don't really, I mean, I don't really feel comfortable about it though.

*Jane:* Well, I wouldn't mind [publishing an essay]. Actually in one course we had to write an article and I actually posted it in my own blog, because it was just general considerations about the matter.

A2: What about Mike, would you want to publish your essays on the Internet for everyone to see?

*Mike:* Umm . . . I don't like to publish now, because . . . umm . . . because of the English grammar and my English language.

In his comment, Mike is referring to his status as an exchange student and the fact that English is not his first language. For him, this created an inequality between him and students who were native speakers. Contrary to the course blog, the *backchannel* chat (*Today's Meet*) that was set up for students to support their independent knowledge acquisition proved to be unnecessary. Students explained that they were aware of what information sources their fellow students were using because they were able to talk face-to-face in the course workshops.

The interactive online wall (*Padlet*) was used on the interactive whiteboard (*Qomo*) to support brainstorming (phase 1), grouping ideas (phase 2), and choosing the interest area (phase 3). Students considered the application "useful," "more enjoyable than traditional pen and paper methods," and "definitely a lot more accessible because you can just go to your computer after the class and just check it out there." The online wall, however, lacked some technical functionality that the students had expected. The application showed only final postings, and it did not allow the users to see if some other user was *in the process* of writing on the wall. Also, the application did not identify the postings according to the users, which created an interesting discussion in the

interview about whether this lack could actually be considered a benefit for the brainstorming process, since it might help students to produce ideas more freely:

*Mary:* Yeah, because you can just throw around some stupid ideas and no one will know it was yours [laughs].

A2: Right. When you think about it, do you feel that it might have a role? That you can just, as you said, throw ideas?

*Jane:* Well, in that phase when you don't really know your group yet, but when you learn to know and if you trust, trust each other and atmosphere is relaxed and then you are able to express yourself and I'm thinking it might help.

Students used the online mind mapping tool (*MindMeister*) with the interactive whiteboard (*Qomo*) in the classroom to construct a shared understanding about the results of their knowledge acquisition phase (Figure 3, next page).

The highly interactive and colorful features of the online mind mapping tool were very much appreciated by the students:

*Ann:* My favorite part during this [course]? Hmm . . . smartboard [laughs], yes, it is actually. When you put some ideas there and when you move it, yes, sometimes you have some new ideas coming to mind by moving these, yes, it's nice [. . .]

*Jane:* Well, I have to agree with you. I'm not fascinated with the whiteboard anymore, I've done that part, but [. . .] when everybody was prepared and the process went on smoothly, that was very good. You feel that things are going on [laughs] and you are getting somewhere. So it was a very good feeling.

However, they reported that it took some time to learn how to use all of its functionalities. Students felt it might have benefited their learning if they had been provided with a brief tutorial explaining the use of the new Web 2.0 tools integrated into the course.

From the teacher's perspective, the new Web 2.0 tools enabled easy storage and sharing of ideas, learning assignments, and knowledge syntheses that the students had created in the face-to-face PBL sessions. In addition, the use of the course blog provided more opportunities for the teacher to monitor and support students' information-searching processes that took place between the PBL sessions. Students posted comments on the blog about how their knowledge acquisition was proceeding: which information sources they had found and read, what kind of answers they had found for the learning assignment. In

the previous course implementations, students' independent knowledge acquisition processes were not visible to their peers or to the teacher, let alone to a wider audience.

## Summary and Next Steps

Student experiences as well as our own experiences of the course implementation are in line with the results of the previous case studies focusing on the Moving Images in Teaching and Learning course (see Hakkarainen, 2009, 2011). Students reported that they experienced the course as highly *active, creative, collaborative, and cooperational*. Students' self-reported emotional involvement in learning was positively toned (see also Strobel & van Barneveld, 2009).

As to the question about the outcomes of integrating Web 2.0 technologies into the course, students' perspectives were highly positive. Students clearly preferred the new, interactive, accessible Web 2.0 tools to the older ones such as classroom whiteboards, sticky notes, and PowerPoint presentations. This is in line with previous research indicating that the integration of technology into PBL can support student satisfaction and engagement in learning (e.g., McFalls, 2013; Donnelly, 2005). From the teacher's perspective, these tools proved useful in that they clearly supported the students' learning process and made it more visible to the teacher, especially during students' independent knowledge acquisition phase. Also, they made the teaching and learning process visible to other people such as colleagues. However, there is still need to provide more support and feedback for students during their independent knowledge acquisition phase between the face-to-face tutorial sessions, as the students reported difficulties related to time management. Therefore, we will continue using the blog, the interactive online wall, the interactive whiteboard, and the online mind mapping tool. However, in the future, we will provide students with a brief tutorial explaining the use of the new Web 2.0 tools integrated into the course.

During our project we also learned that there are limitations regarding how students want to use the Web 2.0 tools. For example, the project clearly indicated what some of the students would *not* want to share in a course blog. In the future implementations of the course, we need to be mindful about the fact that some international students with English as a second language might be uncomfortable with posting their comments and ideas on the blog in English. Furthermore, our next steps will involve careful planning in terms of integrating synchronous Web 2.0 tools to support communication. In the future implementations of this course, we will not be using the *backchannel* chat (*Today's Meet*), because it did not prove useful for students as they were able to keep one another posted in face-to-face settings during their independent knowledge acquisition phase.

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