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A Review of Video Triggers and Video Production in Higher Education and Continuing Education PBL Settings

Päivi Rasi and Sari Poikela (University of Lapland)

Higher education faces the challenges of bridging education and authentic work. In addition, it needs to respond to the highly multimodal and participatory communication and content creation practices, preferences, and cultures of present and future students. The aim of our article is to discuss how the use of video triggers and video production in PBL can help to respond to these challenges. Based on a literature review, we present and discuss the uses and outcomes of video triggers and video production within PBL contexts and related higher education and continuing education contexts. The research evidence reviewed in this article clearly illustrates the advantages of video triggers and video production in PBL settings while at the same time pointing out several conditions of their effective use.

Keywords: problem-based learning, PBL, higher education, continuing education, video, students-as-video-producers

Introduction

The key idea of problem-based learning (PBL) is to maintain the connection between education and authentic work. Learning occurs by dealing with problems, triggers, and themes that arise from authentic professional practice. Authentic, ill-structured problems, which are understood as learning tools, are encountered by small groups before any study has taken place (Barrows, 1996; Hmelo-Silver & Barrows, 2006). Collaborative knowledge construction in tutorial groups is the core of the learning activities (Poikela, 2003). The tutor's, facilitator's, or teacher's role is to enable this collaborative knowledge construction (Hmelo-Silver & Barrows, 2006; Poikela, 2003). The tutorial scripts/processes vary between institutions (see, e.g., Hmelo-Silver, 2004; Poikela & Poikela, 2006), while the general principles remain the same.

In addition to bridging education and authentic work, higher education faces the challenge of responding to the highly multimodal and participatory communication and content creation practices, preferences, and cultures of present and future students. The aim of our article is to discuss how the use of video triggers and video production in PBL can help to respond to the aforementioned challenges that higher education is facing. We will begin with discussing the affordances of information and communication technologies (ICTs) for video use, after which we will present the cyclical PBL model, which has informed our own work. Thereafter, based on a literature review, we will discuss video triggers and video production in higher education and continuing education PBL settings through practical examples and existing research evidence.

Affordances of ICTs for Video Use

The rapid development of ICTs has opened possibilities for PBL. During the past decades, video has become a user-friendly medium, and nonspecialist teachers and students are now able to produce, view, share, comment, and annotate videos through online applications and "video collaboratories" (see Pea & Lindgren, 2008). Additionally, massive open online courses (MOOCs) rely strongly on short video lectures (see, e.g., Multisilta, 2014a).

Virtual learning environments (VLEs, also known as a learning management systems, LMSs) are used as a forum for providing learning resources such as videos and facilitating, supporting, and evaluating learning (de Leng, Dolmans, van de Wiel, Muijtjens, & van der Vleuten, 2007; Poikela, Vuoskoski, & Kärnä, 2009). However, VLEs have been criticized for building on asymmetric teacher-student relationships in that the tools to organize and create learning resources are richer for the teachers than for the students, and second, for offering one-size-fits-all learning environments instead of individualized environments tailored to students' personal needs and priorities (Wilson et al., 2007; see also Vuojärvi, 2013). Accordingly, personal learning

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environments (PLEs) have received increased attention as a means to enhance students' control over their learning process using the new Web 2.0 and social media applications they prefer to construct their learning environments (Rahimi, van den Berg, & Veen, 2015). Student-centric instructional approaches, such as inquiry-based learning and PBL, no longer use only VLEs, but also social media applications for collaborative content production, sharing, commenting, reviewing, annotating, and communicating (e.g., brainstorming) as well as for playing and acting in virtual 3-D worlds (e.g., Moeller, Spitzer, & Spreckelsen, 2010; Portimojärvi, 2006; Savin-Baden, 2007; Savin-Baden & Wilkie, 2006; Tambouris et al., 2012; Rahimi et al., 2015). For example, Tambouris and colleagues (2012) combined higher education PBL practices with Web 2.0 technologies by developing a learning platform in which learners and teachers have the same degree of flexibility and control for using the offered Web 2.0 tools, such as blogs, wikis, and forums. The platform makes it possible for both teachers and learners to, for example, upload, share, tag, bookmark, retrieve, and rate resources.

The advantages of video in higher education and continuing education PBL settings are its ability to illustrate real-life problems, make PBL cases more authentic, trigger discussion, and bring out relevant issues and tacit beliefs (Chan et al., 2015; Lu & Chan, 2015; Schwartz & Hartman, 2007). Video can be used as a stand-alone tool in, for example, PBL tutorials; it can be embedded in more complex VLEs or PLEs with text, pictures, graphics, and so on (e.g., Hmelo-Silver, Nagarajan, & Derry, 2006); or it can be part of immersive simulation environments (e.g., Kuure & Miettinen, 2013).

Cyclical PBL Model

The process of problem solving within various PBL models is structured in different ways, and therefore it is not possible to identify a single model of PBL (Barrett, 2005; Lu & Chan, 2015; Poikela, 2003; Savin-Baden & Howell Major, 2004). Two of the most well-known models were developed by Barrows at the University of McMaster, Canada (e.g., Barrows, 1985; see also Barrett, 2005). Another well-known model is Schmidt's (1983) "seven jump" model and its variations.

Our own practical cases of integrating video into PBL presented in this paper made use of Linköping University's cyclical PBL model, as modified by Poikela and Poikela and tested and further refined within the context of Finnish higher education in several organizations (e.g., Poikela, 2003; Poikela & Poikela, 2006). Therefore, we will use this model as a framework to present the roles of video in PBL. A PBL cycle (Figure 1, see next page) consists of collaborative learning achieved in two tutorial sessions in which the tutor and seven to nine students gather approximately once a week. During the *first stage* of the PBL cycle, students have to find a shared understanding of perspectives and conceptions of the problem. The purpose of the *second stage* is to elicit and elaborate upon previous knowledge about the problem. This is achieved by brainstorming about possible ways to deal with the problem. The *third stage* starts with grouping similar types of ideas together and naming them. During the *fourth stage*, the most important, actual problem areas are negotiated. The aim of the *fifth stage* is that students form the learning task and the objects of study. The *sixth stage* is a period of information seeking and self-study between tutorials. The second tutorial begins *the seventh stage,* during which freshly acquired knowledge is used to tackle the learning task and is then applied in constructing the problem in a new manner. During the *eighth stage*, the whole problem-solving and learning process is clarified and reflected in the light of the original problem.

Unlike in several other tutorial scripts (e.g., Hmelo-Silver, 2004; Moust, Van Berkel, & Schmidt, 2005), assessment, placed in the middle of Figure 1, is not included as a separate stage; rather, it is integrated in each stage. Tutorial sessions close with an assessment discussion, during which students get information and feedback about their learning, group processes, and problem-solving skills (Poikela & Poikela, 2006).

Integrating Video Into a PBL Cycle

Video can be integrated into each of the PBL stages (Figure 1). It can be integrated into the first three stages to *represent the problem* at hand and to *trigger* the problem-solving process. During stages four to six, video can be used as an *information resource*, and students can use their personal mobile devices for instant online searches for information such as terminologies, pictures, and video clips (e.g., Chan et al., 2015; Jin, Bridges, Botelho, & Chan, 2015). During the *sixth stage* of the PBL cycle, students may also *produce videos* themselves as a way to learn about the phenomena being studied (Hakkarainen, 2007, 2009, 2011) as well as a way *to present and explain one's solutions to a problem* (e.g., Leahy & Walshe, 2005; Mayberry et al., 2012) after the knowledge acquisition, during *stages seven and eight*. In the following two sections, we will discuss in more detail the use of video triggers and video production in higher education and continuing education PBL settings.

Video as a Trigger for Problem Solving and Learning

Practical Examples of Video Triggers

Video can be integrated into the first stage of the PBL cycle to *trigger* the processes of problem solving and learning (Elliott & Keppell, 2000; Keppell, 2005; Lu & Chan, 2015). In PBL, a problem is a starting point and basic unit for learning. Problems can be defined as challenging issues that do not always have single correct solutions. As a concept, "problem" is similar to "research problem." It guides the process of learning and problem solving (Poikela & Poikela, 2006). The problem can be presented in the

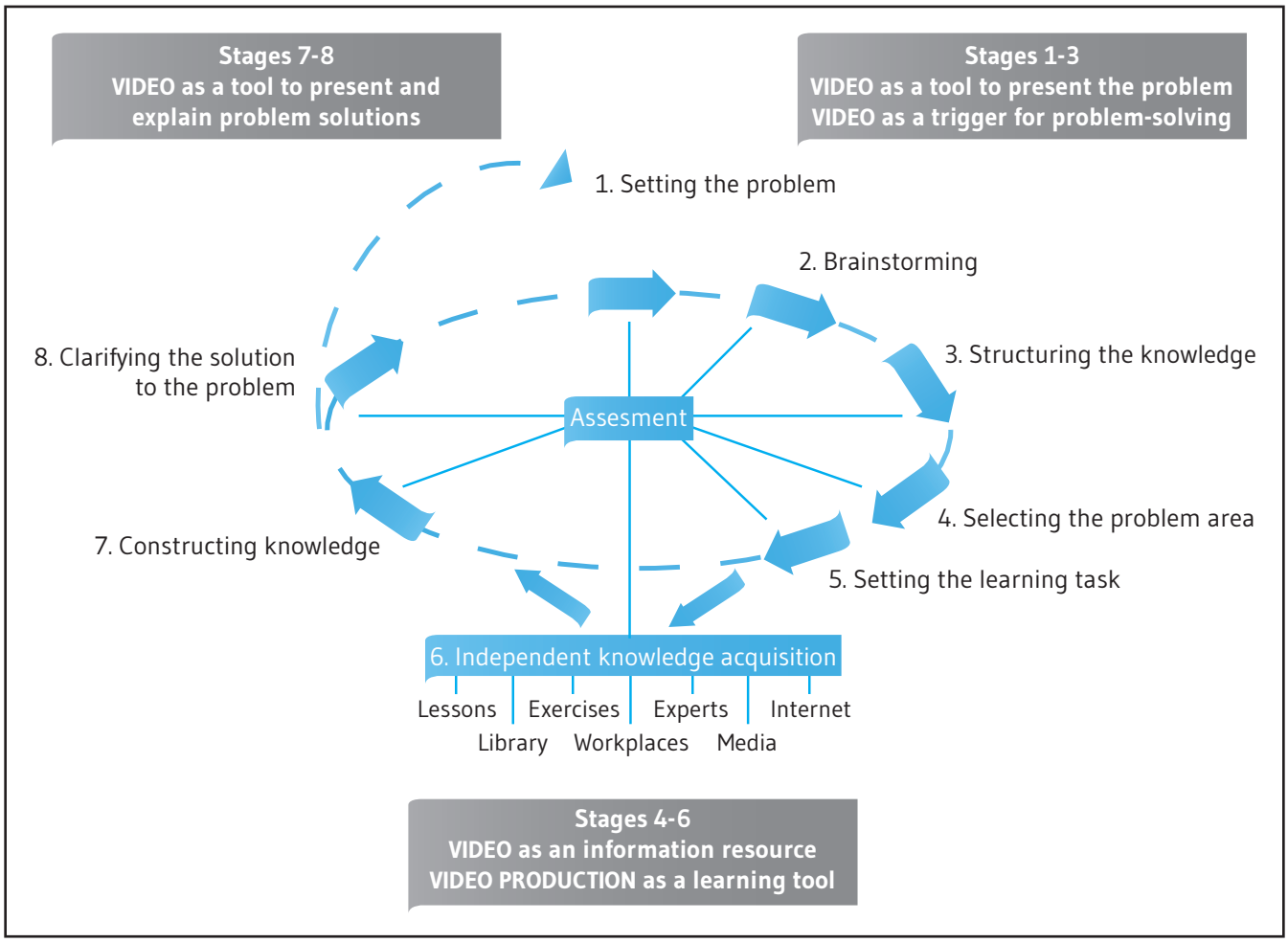

Figure 1. The PBL cycle and the potential roles of video (modified from Poikela & Poikela, 2006, p. 78).

form of a trigger or a case, for example. The function of a problem is to increase students' interest in the phenomena at hand, elicit ideas about it, and begin conversation and problem solving.

A trigger type of problem can be a drama, an excursion, a poster, a photograph, a poem, a clip of a cartoon, a piece of a conversation, or a video (Barron, Lambert, Conlon, & Harrington, 2008; Poikela & Poikela, 2006; Savin–Baden, 2007). When videos are used as triggers, they can be called *video triggers* or *trigger films*. The role of videos is to present the problem or case at hand and trigger the problem-solving process. Video triggers are typically short, emotionally charged descriptions of unsolved interaction episodes (Boud & Pearson, 1984). The viewed episode demands emotional and intellectual reactions and encourages active learning.

Video triggers are presented to students on screens in tutorials, but more richly simulated, immersive experiences may be created as well, with panoramic video (see, e.g., Multisilta, 2014b) or in laboratories such as the University of Lapland's Service Innovation Corner (SINCO), a prototyping and creative collaboration environment for service design (see http://sinco.fi/). Service design is a human-centered approach for developing, for example, educational services and social services. Service design involves collaboration between service users and service providers, and it proceeds through an iterative approach where service solutions are collaboratively developed through testing and evaluation (Kuure & Miettinen, 2013). SINCO consists of the physical environment, technological equipment, and digital material (such as photos, videos, and sounds) necessary to create the atmosphere of actual service episodes (Figure 2). In problem-based medical education, video cases present problematic situations that students may encounter in their future work. The aim of the video cases is to promote students' ability to recognize, identify, and solve problems. Problem-based medical education often integrates simulations of patient encounters into the learning process (Elliott & Keppell, 2000). The simulations may be paper-based or draw on the use of multimedia, including audio, graphics, still images, and video. Video may present and illustrate doctor–patient encounters, provide ac-

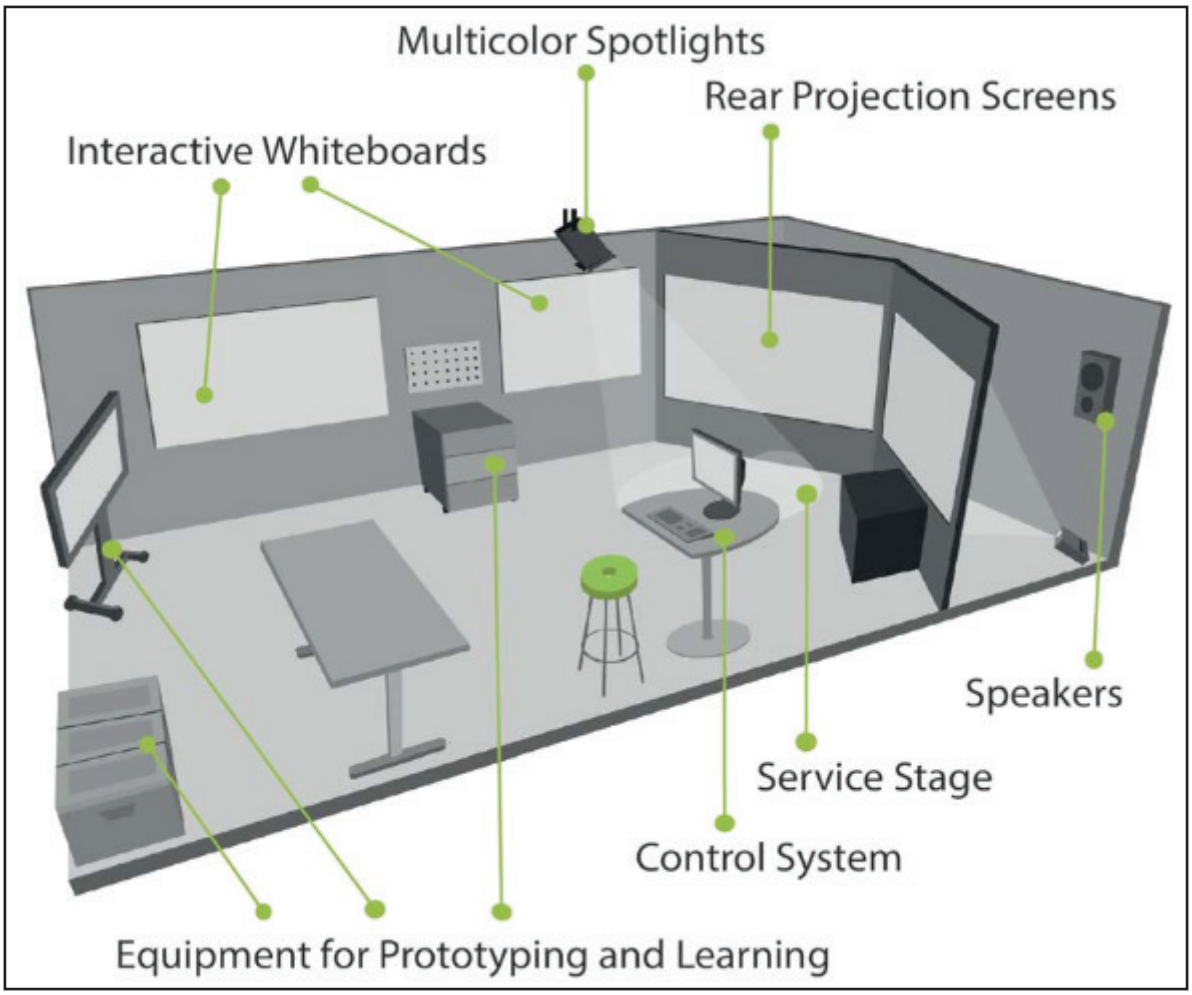

Figure 2. SINCO laboratory (Kuure & Miettinen, 2013).

cess to real events, or give background information in the form of documentaries or interviews (see, e.g., Bergdahl, Fyrenius, & Persson, 2006; de Leng et al., 2007; Elliott & Keppell, 2000; Kerfoot, Masser, & Hafler, 2005; Koponen, Pyörälä, & Isotalus, 2012; Langford, Korin, & Wilkerson, 2011). Videos have been used to portray patient encounters, and they have featured staff members, amateur actors, and even patients (e.g., Bergdahl et al., 2006). Examples of video cases include simulated or real patients in pain with a variety of symptoms, a registration of an advanced trauma life support procedure after a motorcycle accident, and a complete consultation (history taking, physical examination, and evaluation) of patients with arthrosis by an orthopedic surgeon (de Leng et al., 2007).

Outside medical education, case-based multimedia and hypermedia learning materials that include video have been used to trigger the problem-solving process in the fields of, for example, social work education (Knowles & Ballantyne, 2007), teacher education (e.g., Brophy, 2004; Hmelo-Silver et al., 2006), architecture, and engineering (McLellan, 2004). Whereas medical education typically uses video triggers that portray patient encounters, teacher education may use, for example, video triggers that depict lessons or parts of lessons that students are encouraged to redesign (see Hmelo-Silver et al., 2006). In social work education, for example, a fictional but realistic child protection case was used that consisted of five short videos offering the different perspectives of key players (played by professional actors) in the case (Knowles & Ballantyne, 2007).

Our own first practical example of the use of video triggers in PBL comes from a continuing education program entitled *Masters of Storytelling* (25 European Credit Transfer System credits) that was implemented in Finland at the University of Lapland's Faculty of Education during 2010 and 2011. Students ($N = 20$) enrolled in the program were professionals (e.g., gold miners, artisans, wilderness guides, shamans) working in the field of Lappish tourism and hospitality management, and willing to broaden their competence in Lappish history and story heritage. The second author of this paper served as the designer, leader, and PBL tutor of the program. The use of video triggers within this program is presented in the vignette below.

Vignette: The use of video triggers in the *Masters of Storytelling* continuing education program.

The core idea of the professional program was to appreciate Lappish cultural traditions and deepen the participating tourism professionals' knowledge of it. The program was based on the role of professionals as storytellers who teach tourists something new about the environment and living conditions through stories. Therefore, we can talk about "learning tourism." A story needs to have its roots in local history, nature, and everyday living.

The program included eight face-to-face meetings that occurred approximately once a month. Between the meetings, a Finnish virtual learning environment, *Discendum Optima* (http://www.discendum.com/optima_en), was used. Only a few of the participating professionals had previous experience in online learning. That is why we decided to use names for the study activities that were different than the traditional terms used in the context of PBL. For example, tutorials were called "knowledge workshops." The design and presentation of stories were rehearsed in "story workshops" during face-to-face meetings, and stories created by participants were tested and evaluated collaboratively in "product huts" in which stories were connected to different kinds of objects (e.g., aquarelle paintings, reindeer bone handicrafts, Lappish jewelry). The participants' skills were put to the test in different real-life situations, such as an international folk music and dance festival in Rovaniemi, Finland.

The problem that students were working on, with the theme "Living in the wilderness, hunting and fishing grounds," was presented by means of a video trigger. The trigger film was an 11-minute short film, "Fishing Market," that was made in 1961 by Vuoristo and Heino. It describes a unique annual autumn fishing event in Sodankylä in central Lapland. The event involved many boats and fishermen as well as women and children as the audience. In autumn, a huge amount of fish were located in a very narrow part of the nearby river, making fishing easy. The theme was investigated in three "knowledge workshops" (i.e., tutorials), and the second writer of this article acted as a tutor for one of the groups.

"Fishing Market" was a motivating trigger, and the knowledge workshop began well. After brainstorming, similar types of ideas were connected (stage 3), and categories and shared learning tasks (stages 4 and 5) were created, such as "How are fishing and hunting viewed in Lappish culture?" This was divided into three sub-themes: (a) myths and beliefs, (b) Finnish law and Lappish (local) law, and (c) nature and everyday life in the rural area. Information acquisition lasted for the four weeks before the next face-to-face meeting. During that time, group members posted messages to the discussion area in *Discendum Optima*.

Summary of Outcomes

"Fishing Market" inspired students to work intensively and was a good start to their information acquisition (for a more detailed description of the program and its outcomes, see Poikela & Poikela, 2010). However, it seemed that students found too many printed resources, such as historical books about Lappish tradition and customs, and were overwhelmed. The challenge for the tutors was to encourage participants not only to read as much as possible, but also to use other types of resources. It was proven that it is more motivational to gather information by interviewing older people and watching old documentaries. These resources helped online discussions and made the next face-to-face knowledge workshop more effective. All in all, "Fishing Market" was assessed by the participants and the tutors as one of the best of the seven triggers used during the program. Other triggers included a nature photo, a nature walk, a painting, and a written case.

Outcomes of Using Video Triggers in PBL

Using video cases in medical PBL has been the focus of many researchers, although Roy and McMahon (2012) concluded that their focus was limited to "the advantages of video in terms of its abilities to create a holistic narrative, afford authenticity, convey emotions and body language, and emphasize the patient's perspective, rather than examining the effects upon students' cognition" (p. 427). However, several studies have noted the positive effects of video cases, as compared to written cases, for the quality of students' cognitive processes (e.g., Balsley, de Grace, Muijtjens, & Scherpbier, 2005; de Leng et al., 2007; Kamin, O'Sullivan, Deterding, & Younger, 2003). Balslev and colleagues (2005) found that a brief video case, as opposed to an equivalent written text, improved university hospital residents' cognitive and metacognitive processes of *exploration, theory building,* and *theory evaluation*. The case that students analyzed involved Sturge–Weber syndrome, and the 2.5-minute video recording showed "a drowsy

2-month-old infant with a haemangioma on the forehead and an ongoing partial motor seizure on the right side of the body" (Balsley et al, 2005, p. 1088). Similarly, de Leng and colleagues (2007) reported that video cases used in the preclinical phase of undergraduate PBL medical education at the Maastricht University Medical School were generally perceived as a valuable stimulus for group discussions and were appreciated by students because of their authenticity, illustrative ability, comprehensiveness, and power to motivate. In addition, students were better able to *remember* and *apply in practice* actions and procedures that they had watched in the video. The first two years of the Maastricht University Medical School's curriculum include 12–15 video cases of 3–20 minutes' duration, featuring either simulated or real patients. The video cases vary considerably in terms of content. For example, a video can portray "a strong emotional appeal from a patient who is in a great deal of pain" or "a complete consultation (history taking, physical examination and evaluation) of patients with arthrosis by an orthopaedic surgeon" (de Leng et al., 2007, p. 183).

Research has found that detailed, realistic video triggers may launch students' problem-solving processes better than triggers that students experience as staged or less realistic (Boud & Pearson, 1984; Elliott & Keppell, 2000). In general, studies have indicated students' preference for video cases over text cases (Chan et al., 2010; de Leng et al., 2007; Knowles & Ballantyne, 2007; Roy & McMahon, 2012). For example, in the field of social work, students' experiences in a PBL setting with a multimedia case scenario enhanced their learning and were more enjoyable, realistic, engaging, and motivating than a text-based scenario (Knowles & Ballantyne, 2007). However, in their study, Ghanchi and colleagues (2013) received contrary results: more than 90% of students participating in their study "found paper cases interesting, engaging, and helpful in enhancing the group discussion [and] dynamics" (p. 1131). Approximately the same percentage of students found written cases more helpful than video cases in improving their *thinking processes* as well (Ghanchi et al., 2013).

Roy and McMahon (2012) investigated preferences for video or written cases and the effect of each format upon medical students' critical thinking in PBL. The videos portrayed interviews with patients, and they included only "psychosocial elements," not physical signs. The results indicated that even though students and teachers reported a preference for video cases, the video cases resulted in significantly lower frequencies for *critical thinking* than for *superficial thinking*, particularly when students were engaged in *problem exploration*. Lu and Chan (2015) studied how medical students who used video triggers "identified and described problems, and how they built shared cognitions that lead them to diagnose and solve problems." The researchers concluded that the video triggers led to more *active* communication; students who used video triggers put more effort into communicating their understanding of the problem and relevant knowledge in order to reach common understanding and make a diagnosis.

A study performed at Maastricht University in the Netherlands with second-year undergraduate medical students by de Leng and colleagues (2007) identified four conditions for the productive use of video cases. First, the content of the video cases should not be too complete or directive to have things for students to investigate and perform. The diagnosis should not be given. Second, the degree of difficulty of the video case should be appropriate for what students already know. Third, the video cases should be watched in a structured manner, which highlights the role of the tutor in helping the students to focus their attention on specific things in the video. And fourth, the video cases should be short and unique in that their structure should not be identical and they should not repeat what has already been stated in other learning materials.

Presenting patient cases by means of videos may evoke both positive and negative thoughts in students (Leppänen & Vähämaa, 2006). Some cases may be so detached from students' life-worlds that they experience the cases as artificial, even though similar cases may be typical in clinical work (Boud & Pearson, 1984). Clinical video cases are more realistic and authentic than written cases and can therefore result in excessive cognitive load in students (see Roy & McMahon, 2012). Video cases may be more suitable for students who already have clinical experience. According to Albanese (2005), "video cases offer a splendid transitional mechanism" as students gain more clinical experience (p. 1082; see also Lu & Chan, 2015).

Student Video Production as a Learning Tool

During the *sixth stage* of the PBL cycle, students may also *produce videos* themselves. Student video production can function as a way to learn about the phenomena being studied (Hakkarainen, 2007, 2009, 2011) as well as a way *to present and explain one's solutions to a problem* (e.g., Leahy & Walshe, 2005; Mayberry et al., 2012) after the knowledge acquisition, during *stages seven and eight*. The rationale for students' own video productions is that when producing videos about the phenomenon they are studying, students will learn content as well as transferable skills such as collaboration and problem solving (Jonassen, Howland, Moore, & Marra, 2003; see also Hakkarainen, 2007, 2009, 2011; Multisilta, 2014a). Additionally, video productions provide students with opportunities to achieve a more multimodal, learner-centered, motivating, active, engaging, and productive role in their learning process (Jonassen, Howland, Moore, & Marra, 2003; see also Hakkarainen, 2007, 2009, 2011; Multisilta, 2014a). Students can no longer be viewed as only passive consumers of knowledge, but also as producers and "prosumers" (Lee & McLoughlin, 2007; see also Multisilta, 2014a).

Practical Examples of Student Video Production

Numerous case studies from higher education settings report on student-produced videos of various genres, such as interviews (Bonk & Khoo, 2014; Ellis, Lee, & Tham, 2004; Schwartz & Hartman, 2007), audiovisual tours (Lee & McLoughlin, 2007), drama performances (Hakkarainen & Vapalahti, 2011), mini-documentaries (Bonk & Khoo, 2014; Hakkarainen, 2009; Nordstrom & Korpelainen, 2011), illustrations of scientific concepts or principles (Hargis & Marotta, 2011; Mayberry et al., 2012), or videos demonstrating solutions to problems (Mayberry et al., 2012). At Trinity College, Dublin, Leahy and Walshe (2005) reported on a PBL-based speech and language therapy module in which students presented their solutions to a problem using a variety of presentation formats, including videos, role-plays, and oral presentations. At Mikkeli University of Applied Sciences, Finland, students enrolled in the Civic Activities and Youth Work degree program produced and recorded two drama performances (9 and 12 minutes in length) about elderly people's use of alcohol, with the video recordings used first as learning tools for the student producers themselves and later as video cases for social work students (Hakkarainen & Vapalahti, 2011).

Often, student-generated videos will later be *reused as instructional materials* (learner-generated content) by their peers (see, e.g., Ellis et al., 2004; Hakkarainen, 2011; Hakkarainen & Vapalahti, 2011). An important way to motivate students is to let them produce learning assignments that involve a sense of purpose and ownership; according to Bonk and Khoo (2014), "learners are driven to complete some high-quality, tangible product for others to see, share, use, comment upon, or remix" (p. 258). Student-generated videos may have value for students, other peers, and possibly the wider community (Lee & McLoughlin, 2007).

Our own practical example of using video production as a learning tool in PBL comes from a course entitled Digital Video, which was implemented as part of the University of Lapland's master's degree program in Media Education (for a more detailed description of the course, see Hakkarainen, 2011). The aim of the eight-week course was not to turn students into professional educational video producers, but rather to prepare them to work as media pedagogy experts (e.g., designers, educators, researchers, coordinators) in various settings, such as in professional educational video production teams or in projects promoting the use of video in educational settings. The use of video production within this course is presented in the vignette below. The first author of this paper served as the designer, researcher, and PBL tutor of the course.

Vignette: The use of video production in the Digital Video course.

The course included three PBL tutorial cycles that were realized through five tutorial sessions. The course employed a combination of strategic performance problems and design problems (see Jonassen, 2000). During the first cycle, the students ($N = 7$) solved the following problem: How can you use and produce digital videos to support meaningful learning? During the first PBL cycle, students did not engage in video production as a means of knowledge acquisition. During the second and third cycles, the students solved the following problems: How can you use creativity to break the mold of traditional educational videos? How do you make sure that the target audience experiences the video how you would like them to experience it?

The course built on a "video production-supported PBL approach" that drew on a combination of problem-solving tutorial sessions and a practical hands-on video production project in which the students designed and produced educational videos about the phenomena they were studying, specifically, the relationships between videos and learning. Students' video production projects were seen as one form of independent knowledge acquisition. The course followed the PBL script presented earlier in this article (see Figure 1). During cycles two and three, students engaged in independent knowledge acquisition through video production and related workshops on scriptwriting (8 hours), filming (8 hours), and video editing with Adobe Premiere (8 hours). The workshops were supervised by a teacher who was knowledgeable about video production and video expression, whereas the PBL tutor was more knowledgeable about the educational uses of video. All students had at least some prior experience with filming and editing videos.

Students could choose the genre of their video (e.g., mini-documentary, demonstration). In the written instructions we provided for students, we highlighted that "instead of an essay or other written report, you will now be presenting your understanding of the course topic by means of a video." During the course, students produced 2–10-minute videos about the phenomena under study. Student-produced videos have included: interviews of professors and experts in the field, student interviews, a mock advertisement about the benefits of instructional video, a news story about the course, and a mini-documentary about the use of video when trying to learn Nordic walking.

Summary of Outcomes

Knowledge acquisition and presenting one's understanding of the target phenomenon by means of a video is not a straightforward endeavor for university students who are used to writing and orally presenting their knowledge. Evaluations of the course indicated that the assignment was considered "difficult," "somewhat puzzling," and "challenging." However, the results also indicated that video production forced students to illustrate theoretical concepts with practical examples, which supports learning for understanding instead of rote learning.

All in all, students assessed the course very positively. They reported that the course supported meaningful learning, especially its collaborative, cooperative, conversational, emotional, and creative aspects. They saw video production as a highly collaborative process that was associated with enthusiasm, interest, and joy. However, collaboration also meant that some aspects of groups were negative and resulted in feelings of stress and frustration.

We concluded the study that focused on this course (Hakkarainen, 2011) by highlighting that a video production project about the subject matter may promote learning outcomes that might not be promoted to such an extent by PBL tutorials and more traditional independent knowledge acquisition methods only. In addition to offering students opportunities to learn about the phenomenon under study, video production offers students a collaborative learning space, which may teach important lessons about collaboration, work-life, and oneself as a group member. However, all video production teams found it difficult to bridge theory and practice by representing abstract theoretical ideas in a video rather than writing a traditional essay. The challenge for tutors and teachers is therefore to guide students to connect their theoretical arguments within the content and form of their videos. Ideally, this can be supported through cooperation and, preferably, shared teaching practices between the content expert (tutor/teacher) and the video production expert.

Outcomes of Using Student Video Production in PBL

Research on integrating students' own video productions into PBL is not extremely prevalent. However, research on teaching approaches with a focus on authentic, ill-structured problems is relevant for PBL. Case studies have indicated that integrating university students' video productions into PBL (Hung, Keppell, & Jong, 2004), case-based teaching (Hakkarainen, Saarelainen, & Ruokamo, 2007), and drama pedagogy (Hakkarainen & Vapalahti, 2011) has supported meaningful learning for students. In the visual arts, it was found that creating videos explaining the theories of 2-D design promoted students' understandings of these theories and related concepts (Mayberry et al., 2012). Student video production has been demonstrated to be an effective learner-centered strategy for learning introductory engineering mechanics (Ellis et al., 2004). Furthermore, in engineering education it has been demonstrated that allowing students to use nonconventional tools such as videos for preparing their assignments can promote deep learning of scientific facts as well as creativity and motivation (Nordstrom & Korpelainen, 2011).

Hakkarainen (2009, 2011) reported on the integration of student video production into an higher education PBL setting, concluding that video production may contribute positively to students' positive emotional involvement and therefore their learning motivation. However, helping students to deal with video production and supporting them in the expression of their understanding of the subject matter in the form of a video requires collaboration between the teacher of the content (i.e., the PBL tutor) and the video production teacher, preferably through shared teaching practices (see also Ellis et al., 2004). According to Hakkarainen (2009, 2011), the video production-supported PBL approach may be of interest to higher education teaching staff intent upon providing students with opportunities for the multimodal expression of their understanding of the problem being solved.

Conclusion

Based on a literature review, in this article we presented and discussed the uses and effects of video triggers and video production within PBL contexts and related higher education and continuing education contexts that feature authentic problems. We described the core ideas of PBL and the practical ways in which video triggers and student video production can be integrated into PBL procedures.

The research evidence reviewed in this article clearly points out the advantages of video and video production in PBL settings. With the rapid development of video technologies, we are witnessing more and more authentic ways to simulate work-life, for example, panoramic videos with 360-degree images. Although these are not yet widely used for learning, they offer the potential to present complex interactions in which high-resolution images are not a priority (Multisilta, 2014a, 2014b).

However, the research also points out that the uses of video need to be considered critically, acknowledging, for example, that the use of a realistic video may result in a large cognitive load for some students, and that learning by video—both viewing and producing—needs to be guided and supported by PBL tutors, facilitators, and teachers.

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