NEW SCHOOLING WITH PROJECT-BASED LEARNING ON VIRTUAL LEARNING ENVIRONMENTS

By

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ABSTRACT

In order to characterize the trend and exploit the opportunity provided by Information and Communication Technologies (ICT), the paper argues that a new schooling approach that would not only incorporate learner-centric learning curricula and personalized learning service, but also meet the need of nurturing the 21st century skills is definitely on demand to the digital generation.

Project-based Learning (PBL) has been around for decades in the field of education. But it needs new ingredients and upgrade in practice in the digital era. The paper first contends a new paradigm of PBL, which exploits strength of digital storytelling, community of practice, and virtual learning in a convergent manner. For fulfilling the promises of the new paradigm of PBL, design and implementation of a virtual learning environment are discussed and presented later on in the paper with respect to the new schooling approach.

Two preliminary experimental studies were conducted during the past year to explore and evaluate the claims of the proposed new paradigm of PBL. The studies focused on issues pertaining to teacher professional development and student knowledge transformation respectively.

Keywords: Project-based Learning, Digital Storytelling, Virtual Learning, Networked Learning Environments, Community of Practice.

INTRODUCTION

Current school kids are the generation of digital natives and they learn best with Information and Communication Technologies (ICT) (Prensky, 2001; Oblinger & Oblinger, 2005). In the meantime, the proliferation of the Internet is challenging the limitations in the current practice of bricks-and-mortar traditional schooling (EDUTOPIA, 2009). No doubt that there are numerous claims about the need for new schooling approach to the digital generation (MacArthur Foundation, 2010). But what is the best new schooling approach for the digital generation? The criteria for choosing the new schooling approach are that which could not only take advantage of capabilities of ICT, but could also transform the traditional one seamlessly. As a result, instead of focusing on hardware facilities intensively, it is suggested based on the education history not to look beyond the principles of instructional design while considering the new schooling (U.S. Department of Education, 2010).

There are two pillars in terms of instructional design, teacher-centric vs. student-centric (Bonk, & Cunningham, 1998). Due to its strong ties with constructive learning theory, the student-centric principle has been widely advocated in the field of education recently (Ravitz, 2008). Project-based Learning (PBL) is an instructional strategy that embodies student-centric principles, which are endowed with inquiry learning, learning by doing, authentic learning, active learning, and collaborative learning strategies (Buck Institute for Education, 2009). A PBL course or curriculum usually is composed of five sequential phases. First of all, it needs a driving question or some kinds of hypotheses to guide the corresponding inquiry learning activities. The driving question or hypotheses should be presented with an authentic scenario for raising the learning motivation and creating connection with personalized learning context. Secondly, inquiry plans or experimental tasks should be devised based on the driving question or hypotheses with responding them in mind. The inquiry plans or experimental

tasks could be parts of course design provided by teachers initially or outcomes of collected efforts from teachers and students involved in the learning course. Thirdly, collaborative learning activities should be taken following the inquiry plans or experimental tasks in order to collect experimental or proven data from the field. Proper analysis or aggregation to the collected data is needed with the purpose of responding to the driving question or hypotheses outlined in the first phase. In essence, all of these four phases are in a recurrent fashion for accommodating the dynamic circumstances of inquiry activities. Furthermore, it is preferable that they are carried out in a collaborative learning manner. Finally, at the closing phase, after requirements for answering driving question or hypotheses are met, final products or artifacts of the inquiry should be presented in public. Imperatively, peer evaluation should follow the presentation for provoking the process of discussion and reflection among learners. Figure 1 depicts the five phases of a PBL.

Essentially, there are three assertions claimed by PBL: (i) Knowledge is constructed by students: PBL utilizes learner-centric, inquiry-based, and problem-solving learning activities. (ii) Knowledge is constructed in a context: PBL needs to be placed in an authentic leaning setting. (iii) Knowledge is constructed socially: PBL encourages interpersonal interaction and collaboration during learning courses (Ravitz, 2009).

1. The New Paradigm of PBL

Due to its potentials in fulfilling the promises of constructivism, PBL is getting momentum in the wake of

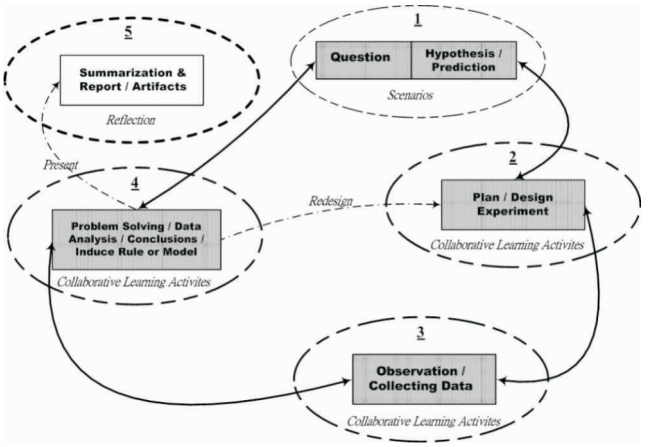

Figure 1. The 5 Phases of PBL

education reform recently (Ravitz, 2008). Its strong evidence on learning outcomes also helps its boom in popularity among K-12 schools. However, with the continuing advent of ICT and sophisticated evolvement of global context, the expectation of schooling is higher than ever worldwide (U.S. Department of Education, 2010). For instance, the world leaders and scholars are urging the needs of meeting the challenge of achieving the 21st Century Learning Skills and Competencies of our education (Partnership for 21st Century Skills, 2008). In this regard, it seems that the current practices of PBL are lagging behind in the incorporation of ICT. As a result, the learning space is strained inside walls of schools with limited connection with society, not to mention the global context. In addition, the quality of interpersonal interaction, which is essential to the success of PBL, is dismal due to lack of ICT support. Without tapping into the strength of ICT, the practices of skills in both knowledge management and transformation, which are critical to PBL, are also absent.

For tackling the aforementioned issues, it is obvious that a new paradigm of PBL is needed. The paper asserts that tapping into ICT tools extensively and expanding learning space into the virtual worlds both are critical to the exercise of new paradigm of PBL. In other words, ICT and virtual learning are essential agenda to the schooling of digital generation.

In respect to taking advantage of ICT tools in the new paradigm of PBL, there is one emerging technology, which is the Digital Storytelling (DST),catching the attention among educators and professionals in the field (Michael, 2005; Lambert, 2007). DST has been widely acknowledged with its intuitive and authentic applications of multimedia technologies on narration of stories of all kinds (Porter, 2004). But how could DST merge into the PBL learning scenarios properly?

2. The Significance of Digital Storytelling

DST weaves the strength of oral storytelling with multimedia and communication tools in the perspectives of learning. It is not only a new form of presentation that leverages the power of music, image, video, and narration to create stories about people's lives, their work, and experiences, but also a compelling learning tool of constructivism that

provokes the process of reflection (Tsou *et al.*, 2006; Lambert, 2007).

Why DST is significant to the success of the practice of the proposed new paradigm of PBL? The adage pertaining to using DST with PBL is that every curriculum is a story (Michael, 2005). It is contended that all educational or learning activities should be arranged following a story line, which is the result of consensus among stake holders of the learning events. Moreover, different groups involved could come up with their own experiences or outcomes in the same learning events and share their stories with each other at the end respectively. These scenarios make DST a profound learning technology for converging and sharing learning experiences and outcomes among stake holders of the learning events. In essence, DST could be a terrific technology for documenting the whole processes of a PBL event as indicated in Figure 1. Ultimately, the product of a DST is a perfect digital asset for administering peer evaluation and exchanging insights into the processes of a PBL event among members of learning community. The merit of using DST together with PBL could be further broken down into several aspects in terms of the 4P of DST, which are planning, production, presentation, and peer evaluation.

2.1 Facilitating Learning Engagement and Deep Learning while Planning Storyboard

The first phase of the DST is designing and writing a storyboard for the PBL events. This planning phase of DST is a task that requires students to prepare a draft of the storyboard ahead of learning activities taking place. But sealing up the final version of the storyboard has to wait until the PBL event is concluded. It implies that preparing the storyboard for DST is somewhat a revisiting tour of the PBL events, or a story recall about the PBL events.

Based on the study of Tsou *et al*. (2006), recalling story events has proven to be a viable means of estimating understanding. Specifically, story recall provides children with the opportunity to reorganize the sequence of events, to use the vocabulary of the story and expand children's comprehension of the world as well. This kind of practice is necessary for children to develop deep learning on the study subjects (Barrett, 2006). Tsou *et al*. (2006) also claim that story recall allows children to revisit the tale and refine their understanding. It requires a child to engage actively in the process of interpreting and integrating knowledge into his/her schema. Children's comprehension on the study subjects is enhanced when they are involved actively in the reconstruction of their own PBL stories.

2.2 Incorporating Collaborative Learning and ICT Skills in Production of DST

In the phase of DST production, students need to shoot pictures and video following the draft of storyboard before going on to edit them with video editing software, such as MS Movie Maker. As the term implies, it is no doubt that DST demands ICT skills in terms of editing and producing the video clips. Meanwhile, all of these tasks are done in an authentic manner in terms of practicing ICT skills. Furthermore, while students are performing these tasks they usually are confronted with collective efforts such that collaborative learning taking place naturally among them.

2.3 Unleashing Reflection in Presentation and Peer Evaluation of DST through Community of Practice

From Figure 1, the final phase of PBL is to present the outcomes in public and administer the follow-up peer evaluation. The goal of this phase in PBL is unleashing reflection, which is a critical element in constructive learning. Reflection is the capability of personal growth and awareness. It can further trigger off metacognition, the ability to predict and self-assess of performance, comprehension and subject mastery, which is an essential component for construction of new knowledge. It is asserted that without reflection people become passive and superficial, accepting faulty logic, untested ideas, and allowing to be swayed by deceptive arguments and polemics (Lathem *et al.*, 2006).

The best instructional strategy for nurturing reflection and knowledge construction is to enable students to share experience and feelings through writing, computer-mediated communication, guided reflection activities, discussions, learning portfolios, and storytelling in the sense of community of practice as suggested by the PBL principles (Bonk & Cunningham, 1998). But why and how that DST can do to help here? DST differs from oral storytelling or narrative in their permanency in digital form

with regard to learning artifacts. Unlike story passed orally and therefore subject to varying interpretation and emphasis, a digital story is a finished product, a work of art that captures a moment in time. It represents one rendition of an experience and is alterable only by a new digital creation. A digital story becomes an object that stands alone, making it accessible for reflection and critique. It implies that the artifact of DST is a real object in digital format, which is able to convey information or message in a persistent manner. It is also accessible and deliverable through Internet that open up opportunity for facilitating and fostering the community of practice as a result. DST, therefore, can serve to reinforce and magnify one's ability to reflect on experience and personal growth.

In essence, DST will help students to document their PBL learning process, problem solving strategies, and outcomes with narration. The artifacts of DST created by students are solid objects for sharing with their peer students through Internet in the sense of learning community of practice (Barab, 2003). Best of all, during the process of creating the DST, students learn how to use ICT in an authentic context. DST preserves and connects human emotion with experience with the help of digital technologies on amplifying the effect of learning outcomes.

2.4 DST in Teachers Professional Development

Studies reveal that (i) teacher-awareness of effective technology applications, (ii) availability of teacher-mentors or other peer support, and (iii) opportunities for educators to communicate with peers in other schools are among the list of significant factors in successful professional development programs (CARET, 2004; Lathem, 2005). The claims correspond with the view of teacher profession development that moves beyond skills training and generic models of delivering workshop training to a more flexible model of learning that includes continuous engagement with other experts in the field in person or online, which is the community of practice (Riel & Fulton, 2001). It indicates that profession development of teachers should provide continuous opportunities for peers to collaborate and learn from each other in addition to normal or regular training modules (Boss, 2009; Darling-Hammond *et al*., 2009). In this regard, the virtual teacher community can be the source of intellectual stimulation, the vehicle of reflective dialogue, and a place where teachers feel they belong (Barab *et al*., 2001; Lathem, 2005).

As professional practitioners, teachers usually are eager to learn from each other. For instance, the ILF (2008) project reveals that when teachers were asked what they would like to do for their own professional development, most of their responses were to see someone else teach. While it is difficult to do during the school day, the combination of Internet and DST might make it possible for teachers to "visit" other teachers' classrooms at a time when it is convenient for them. DST has the capability to induce teachers to join virtual learning community with personalizing experiences and share success or failure stories of their professional practices. It could provide a channel for teachers to collaborate and learn from each other, moreover, to watch and engage in approaches that they are expected to emulate (Riel & Fulton, 2001). Obviously, DST could be an instrumental tool for teachers to increase their awareness about ICT when creating it and build peer support and collaboration when sharing it online. DST enables teachers to establish their connection to professional community that they were unable to reach (Lathem, 2005). In summary, it is imperative in the fast-break digital era to encourage teachers to use DST to document their facilitation in PBL and share experiences and reflections on PBL with their colleagues through the Internet in the sense of learning community of practice.

In order to expand the learning space beyond the bricks-and-mortar schools and take advantage of capacities of ICT, the proposed new schooling approach needs to create a virtual learning space on the sky and foster a virtual learning community on it to create a virtual learning environment for the practice of the new paradigm of PBL.

3. Design and Implementation of a Virtual Learning Environment

The Community of Practice is an educational web site (the COP web site, http://cop.linc.hinet.net/) devoted to K-12 students and teachers for practice of the proposed new paradigm of PBL. The COP web site serves as both of virtual

learning environments and learning manage system (LMS) in terms of digital learning. Figure 2 depicts the structure and services of the COP web site. It is constituted with Digital Library, My Office, My Study Room, My Studio, and Community Center. These tools or services could be further categorized as shared space, private space and social space respectively in terms of accessibility. The COP web site provides different access rights to users based on their roles in education, which are teachers, students, parents, and the public respectively. Teachers are granted to access their own My Office private space. Every student has his/her own study room upon signing up on the web site. As to the rest of people other than teachers and students, each person has his/her own studio. Digital Library serves as the repository of the shared PBL courses. As to the Community Center, it is the social space for users.

In practice, every teacher has a virtual office in COP web site. Teachers are encouraged to use the PBL Template, which is a tool for editing PBL lesson, to design PBL courses online and share them to the Digital Library with virtual colleagues. As the name implies, Digital Library is a warehouse of PBL courses designed by teachers. Teachers can search and review PBL courses with multiple searching methods in the library and then store favored ones in their own Teaching Pad for reference. The library also provides the functionality of peer evaluation on PBL courses. Everyone is invited to provide comments and rating to courses after reviewing them. When teachers are ready to incorporate the PBL courses to their classes, they just assign the selected copies of PBL courses stored in their own Teaching Pad to their classes with a mouse click. The course materials will appear immediately in the Study Pad of their students. Students then are expected to follow the design of the course materials to conduct PBL online with their classmates in the sense of collaborative learning. Upon completion of the learning tasks, students can upload their artifacts to their personal digital portfolio before submitting to their teachers. On the other hand, artifacts submitted by students will show up in Teaching Pad of their teachers. Teachers then can review and evaluate artifacts and provide feedback to them right away.

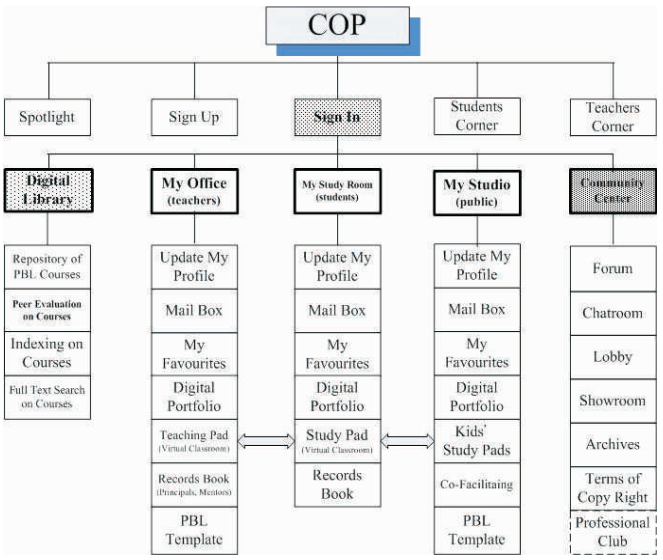

Figure 2. The System Framework of COP Web Site

Studies show that students do much better in school when their parents are actively involved in their education (Houtenville, & Smith Conway, 2008). But the issue of parental involvement has long been an unsolved agenda in education. With the help of virtual learning space, this is a propitious time to tackle the hitherto untouchable issue. In COP web site, a Kids' Study Pad connection is provided to parents for accessing their kids PBL courses. With this service, parents have opportunities to be members of learning community with their kids together.

Overall, the COP web site is a virtual space for teachers to design and share their PBL courses. It is also a learning management system (LMS) for teachers to facilitate their PBL courses. As to students, the COP web site is a networked learning environment to conduct PBL with their peers which supports both teachers and parents. Ultimately, the COP web site is implemented with community of practice in mind and everything that occurs on the web site are all deliberately tracked down and aggregated as shared assets.

4. Evaluation on the New Paradigm of PBL

Two preliminary empirical studies were conducted during the past year on the COP web site with the goal of evaluating the claims of the new schooling approach, which is the practice of the proposed new paradigm of PBL. These studies targeted on issues pertaining to teacher professional development and student knowledge transformation respectively.

4.1 Teacher Professional Development on PBL with DST

The goal of the study is to investigate the feasibility of strategy in teacher professional development on both designing and incorporating project-based learning courses along with digital storytelling. There are three hypotheses in the study: (i) Reviewing and rewinding of the process and outcomes of their own PBL courses while creating digital storytelling to document courses probably could result in professional reflection. (ii) The sharing of digital storytelling among colleagues through Internet might have the same effect as personal observation at the classroom. It may also further promote and foster the development and practice of teacher community due to the power of digital storytelling on conveying concrete and compelling instructional examples. (iii) Both producing and sharing the digital storytelling about PBL courses might help teachers to improve their ICT skills.

In order to verify the aforementioned three hypotheses, the study first organized a teacher workshop on the design of PBL courses and production of digital storytelling with over 20 volunteered teachers from different schools. These teachers were then asked both to carry out their PBL courses to their own classes on COP web site and create digital storytelling video to document their courses afterward respectively. The video of digital storytelling were shared on COP web site and follow-up peer evaluation on video was conducted online. Finally, five senior teachers were selected for interview. Based on the results of interview, all five teachers approved the three hypotheses of the study. Therefore, the study concludes that incorporating digital storytelling to document the PBL courses has positive impacts on teacher professional development.

4.2 Student Knowledge Transformation in PBL with DST

The goal of the study is to investigate the strategies and content of knowledge transformation of students in PBL while incorporating digital storytelling technology to document and showcase learning process and outcomes. There were 43 of the 11th grade female students who participated in a PBL course, which was composed of 8 periods of class span and featuring on environmental protection issues. Video editing training was also included in the course. In addition, the course was carried out on the COP web site with collaborative learning exercises in mind. At the end of the course, participants presented their team-based artifacts, which were produced with digital storytelling technology, in the class. The artifacts were also shared to the COP web site for peer evaluation. As to the methods of collecting and analyzing research data, the study combines the 4P phases in the process of the digital storytelling, proposed by Lin (2010), which are planning, production, presentation, and peer evaluation, with the CIES model of knowledge transformation, proposed by Nonaka and Takeuchi (1995), which is constituted with combination, internalization, externalization, and socialization four strategies in knowledge transformation, to evaluate and categorize the outcomes of the course qualitatively. After the analysis of the collecting data, the study reveals that the process of 4P in digital storytelling technology could facilitate and enhance students' knowledge transformation under the CIES model, as shown in Figure 3.

Figure 3 illustrates that the process of DST starts with the planning phase. In this beginning phase, students need to compose their scripts about PBL learning events in the form of storyboard. The task facilitates knowledge transformation in the aspect of combination, which elicits tacit knowledge into the state of explicit knowledge. In the production phase of DST, students produce video clips with their ICT skills following the written scripts. The task triggers the

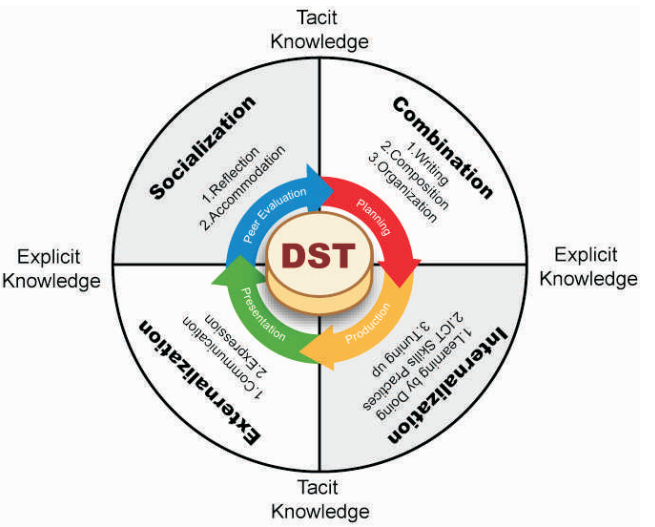

Figure 3. Knowledge Transformation with DST

knowledge transformation in the aspect of internalization, which transforms the explicit knowledge into the state of tacit knowledge. In the following presentation phase of DST, students incorporate their communication skills to demonstrate what they have done in PBL to their peers. The task conveys the knowledge transformation in the aspect of externalization, which crystallizes tacit knowledge into the state of explicit knowledge. At the final process of the DST, which is peer evaluation, students reflect and accommodate their thoughts while reviewing artifacts of DST shared by their peers. The task is the catalyst of knowledge transformation in the aspect of socialization, which moves explicit knowledge into the state of tacit knowledge.

Conclusion

The paper proposes a new schooling approach, which is based on the rationale of new paradigm of PBL, for the digital generation. In the new paradigm of PBL, in addition to the principles of PBL, incorporation of ICT is the key. In order to exploit the opportunities provided by ICT and amplify the outcomes of PBL, the paper argues the significance of DST and virtual learning to the practice of the new paradigm of PBL. DST plays the role of catalyst in new paradigm of PBL that could ignite reflection and deep learning in both teachers and students. In addition, DST is capable of fostering the community of practice (COP) and integrating ICT to the courses of PBL seamlessly. It is fare to state that without DST, the new paradigm of PBL would be shallow in practice. Figure 4 depicts the imperative role of DST behind the new paradigm of PBL. However, most of the promises of DST exist only when it exercises in the virtual learning space as demonstrated in the two empirical studies.

The practice of virtual learning could create a learning context that is unbounded to physical limitation and constraint. The feature in turn opens up opportunities for innovative patterns of learning strategies. In addition to these valuable benefits, practitioners in the field of the virtual learning are increasingly noting an additional advantage of online learning: nurturing the 21st century skills (INACOL, 2008). Practicing PBL on virtual learning environments requires that students understand how to get

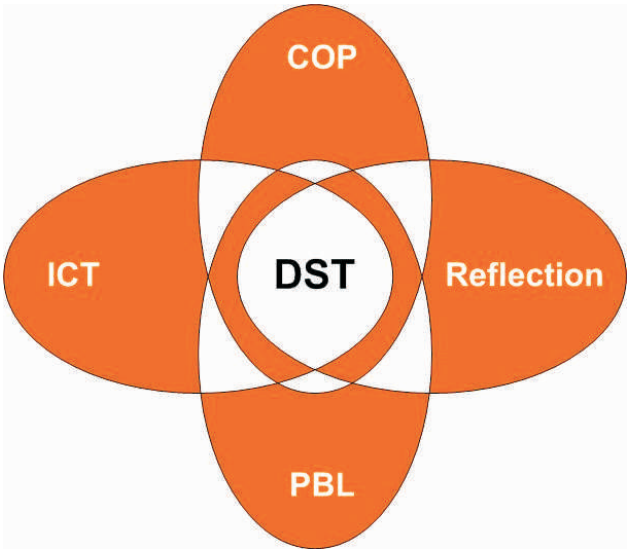

Figure 4. DST is the Catalyst of the New Paradigm of PBL

online, communicate and collaborate using ICT tools, and access information via the Internet – all skills that are tremendously important throughout most professional careers. Also, students in the cyber space sometimes are required to interact with peers from across the country or even beyond. Students not only gain the course content knowledge, but also embody online collaboration and global citizenship. Best of all, virtual learning also make parental involvement in learning processes possible. It is highly expected that the power of virtual learning could be amplified in multiple folds with the help of cloud computing new technology in the near future.

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