

Problem-Based Learning Online: Challenges and opportunities in design and delivery

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Abstract

Problem-based learning (PBL) has emerged from its origins in face-to-face classroom formats as an appealing option for online delivery. This appeal stems not only from the successful track record of applying problem-based learning in many disciplines, but in the perceived suitability of problem-based approaches to the unique qualities of online delivery. This paper describes the challenges and opportunities afforded by a re-design of an online MBA research methods course to a PBL format and includes student reflections captured in online project logs (“blogs”). The lessons learned from this experience are guided by Savery and Duffy’s (1995) constructivist principles, especially student reflection, and are discussed in a manner to inform future applications of problem-based learning designs in the online learning environment.

A Brief Introduction to PBL

Problem-based learning was conceived at McMaster University in the 1960s as a means to train medical doctors in diagnostic skills. Its early successes quickly fueled its spread to other disciplines and applications. With PBL, knowledge of specific subjects is joined, and sometimes displaced (Healey, 2005), by the importance of meta-learning processes as the desired learning outcomes. Instead of having students learn by considering a series of questions posed after a review of subject matter, PBL presents small groups of students with a real-world problem at the very beginning. This intentionally places students in an uncomfortable state where they must recognize not only what they need to learn, but how to learn it. A first step students must take in this process is deciding what questions they need to ask themselves and where they may find the answers. Groups must quickly organize around the various facets of the problem and delegate responsibilities. These problem-solving and critical thinking skills are necessary to solve the simulated real world problems found at the core of problem-based learning. Although the early generations of PBL did not necessarily live up to their billing in terms of their ability to facilitate transfer to professional practice (Norman & Schmidt, 1992), new curricula that integrate transfer as one of the skills to be mastered (Neville & Norman, 2007) show promise in realizing the speculated potential of PBL. This defines the essence of lifelong learning.

Designing an Online PBL Course

Pre-existing online courses may be candidates for re-design into a PBL model. Considerations include faculty and student dissatisfaction with the relevancy and applicability of a more traditional top-down curriculum. At this point, a course review should include examination of course resources to evaluate their suitability for achieving the learning outcomes.

In a business course, this includes applicability to any major Master's project and to the students' future business careers. One indication that PBL may be a worthwhile consideration is the lack of any applied components in the course. Lastly, if textbook chapters are the central focus for how the course is organized and students evaluated, the stage may be set for a course re-design into a more applied, constructivist approach.

According to Savery and Duffy (1995), problem-based learning exemplifies the constructivist learning environment. They described eight instructional principles (p. 33-34) that can be used to guide course design and instruction. These principles are illustrated using design and course management considerations based on the re-design of one online MBA course to include a 13 week PBL component:

1. Anchor all learning activities to a larger task or problem.

Developers of PBL course content will quickly realize the priority placed on the quality of the initial problems to be given to students. Problem design for a business course differs from problems presented in the medical PBL model. The observable phenomena of the patient and resulting diagnosis in a typical medical problem now take the form of a business curiosity or dilemma prompting the need for a management decision. Writing the problem becomes a juggling act of making it complex enough to provide a rich learning experience, yet relevant in scope and nature to the students' world. Even though developed under the guise of real world business problems, the likelihood of students ever encountering the same dilemmas faced in their PBL business course after they finish their degrees is almost nil. This contrasts with the medical origins of PBL, where student doctors refined their diagnostic skills using simulations that could possibly reappear in their professional practices. So what becomes the larger task or problem for business problems? If it's not life or death, it needs to be the business-world equivalents:

sustainability, social responsibility, global awareness, and respect for individual privacy. These themes can anchor the problems used in PBL business courses.

2. Support the learner in developing ownership for the overall problem or task.

Part of this principle speaks to the independence of each learner within a small group. Each PBL problem in an online course needs to be sufficiently complex so students can select those aspects of the problem most suited to their skills and interest. With a solid group, individuals will fully engage to complete their responsibilities so as to not let their team members down. Weaker online groups may need instructor/facilitator support to help segment the initial problem into distinct roles so everyone does not try to do everything.

The online classroom readily adapts to these segmented roles. The online learner is both distally remote and connected at the same time. Students do not have to bring resources to a common physical location but can work independently for extended periods of time and share resources with their team peers electronically only when there is a need to do so. The challenge for the online student is to sift through the volumes of information and bring only those necessary, summarized elements his team needs to see. Of course, this can also lead to invisibility and lack of progress. Although this is primarily a group issue, support from the instructor may sometimes be necessary. At the minimum, groups should be aware of any team conflict resolution processes put in place by the institutions so they may initiate action if certain members are non-responsive or failing to meet group expectations for deliverables.

3. Design an authentic task.

The problems need not be lengthy or complex, but they must approximate authentic situations suitable for the program of study. Course designers can use either real or hypothetical

problems. In non-medical fields, such as business, the use of real problems introduces complications. Students devote time and resources to finding whether real solutions already exist for their business scenario. Indeed, it is a case where the plethora of information available online works against PBL learning objectives, which do not lead to one answer. By designing real problems based on fictitious businesses, students know that the answer does not exist in its entirety anywhere on the Internet, but the steps must be pieced together towards a solution to their dilemma in true PBL fashion.

Problem sets given to groups need to be designed with a diversity of content but a consistency of depth. Providing the same problem to each group is a simple solution to this design challenge; however, this rules out the potential benefits to be had from a unique problem for each group. First, instructor interest is more easily sustained when each group is working on a distinct topic. Next, collisions from high demand for library and other resources are reduced or eliminated. Finally, if the course design includes sharing of group deliverables or a common reflection phase, students will potentially benefit from exposure to the diversity of problems addressed by their peers.

Online instructors need to be prepared to explain the process and the problem repeatedly to the whole class, groups, and individuals. While the problem sets should suffice in terms of the information needed to launch most teams into the project, the process itself presents a steep learning curve for students not familiar with PBL or unsure of their group or individual responsibilities. The online environment has the potential to make starting the problem seem like an unfillable void and the silence from any gaps in communication deafening. While this may be authentic for virtual teams in a real business, it is a harsh reality for many online learners, most of whom do not work solely online in their work environments.

4. Design the task and the learning environment to reflect the complexity of the environment they should be able to function in at the end of learning.

It would be difficult, if not impossible, to recreate the complexity of a single business environment in the online classroom, nevertheless the diversity of environments found among all student groups in the PBL exercise. However, it is possible to re-create the social complexity commonly found in business. Project teams and consultants are roles widely understood by business students. The problems place students in the position where their groups assume the role of consultants to the business. Their PBL deliverable becomes running a project to address the business dilemma outlined in their assigned problem. This structure allows students to use the tools of business, such as Gantt charts and project management software, as well as team communication and group authoring skills in an authentic simulation of a common business environment. Being an online course does not mean students cannot avail themselves of opportunities to use non-online resources to facilitate their projects. Telephone and face-to-face meetings, where possible, are options, as are the real-time communication modes available online such as chat and electronic whiteboards. As common business tools, these reinforce the authenticity of the problem.

5. Give the learner ownership of the process used to develop a solution.

An essential component of the course is a hands-off stance taken by the instructors. Witnessing team struggles with decision making and task definition in asynchronous online discussions is sometimes painful. The asynchronous components of the online learning environment are good for offering opinions, sharing content and resources, and student reflection, but not effective at fostering collaboration, convergent thinking, or facilitating decision-making. Teams may reach out to the instructor for answers. It is usually not necessary

to assist with the problem itself, but to offer guidance regarding the problem-solving process. Where necessary, instructors may need to contact team leaders or entire teams to offer support, usually in the form of helping them recognize when they have everything they need to make a decision and move forward. This role is automatically assumed by more competent group leaders. These teams normally seek guidance only on procedural matters, such as the timing of course elements.

6. Design the learning environment to support and challenge the learner's thinking.

The ill-structured nature of the business dilemmas intentionally places learners in an uncomfortable state that requires they immediately identify what they need to know, seek that knowledge, and then apply it to the solution. This "cognitive conflict or puzzlement" is one of the defining propositions in Savery and Duffy's (1995) philosophical view of constructivism and is closely linked to their eighth instructional principle, reflection.

Placing students who are in online groups in this state of disequilibrium may be additionally unsettling because of time lags and fragmented communication. Groups may wish to revert to real-time communication options, if possible, during initial periods of intense group planning and decision making. Because a vital component of PBL is the ability of groups to work together and, with only 13 weeks within which to deliver a typical semester long University course, group formation needs to occur well ahead of the start of the course to avoid time lost to group designation and reorganization. Even if existing groups enter the course, inevitable group changes and problems need to be anticipated and dealt with swiftly. Online courses may not get off to a quick start as individuals take varying amounts of times to log in for the first time. Unfortunately, with PBL this detains the entire group from moving forward.

A possible technique to offset any potential stalls at the beginning of the course is the

distribution of a pre-course bulletin approximately 1 month before the course is due to begin. This communication could underscore the importance of timely attendance once the online course begins and team check-in. The bulletin could address the nature of the PBL project in general and urge teams to appoint team leaders tasked with organizing team responsibilities within the first few days of the course. This is also an important point to assess a team's readiness to embrace this self-directed nature of the PBL format. Teams without strong leaders or who are dependent on conventional learning tools will become quickly apparent, perhaps even before the course begins. At this time, the instructor can discuss organizational strategies, such as team roles and responsibilities, with stalled teams and stress the importance of team communication.

7. Encourage testing ideas against alternative views and alternative contexts.

The online learning environment presents a dichotomy of forces with regard to hearing individual voices. On the one hand, group and community formation is a priority in an environment where social presence is diminished (Rovai, 2002). However, over time, it has been shown that learner messages in an online discussion regress and start to show convergent writing styles, which may be an unwanted effect of online group learning (Nichol et al., 2003) or a result of group identity formation (Wegerif, 1998). One method to stimulate alternate viewpoints is a suggestion to online teams that they assign a contrarian role to one of their members. This individual has a responsibility to question the others, causing them to justify their decisions and consider other options. This has the potential to work well for both the PBL processes and group authoring tasks.

8. Provide opportunity for and support reflection on both the content learned and the learning process.

Understanding how and why reflection originates in learners is important to both this

discussion of PBL and online learning and is the focus of the remainder of this discussion.

The definition of reflection often begins with Dewey's classic work: *How We Think*. Here, Dewey conceived of reflection as "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends" (1933, p. 9). For Dewey, reflection also had similarities to how we perceive conflict. Reflection was "...a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates" (Dewey, 1933, p. 12). Thus, the process of reflection began when an individual recognized his current state has encountered a situation requiring him to reconsider.

Current research has reified Dewey's abstractions in numerous theoretical and empirical adaptations. Mezirow proposed that reflection, which he termed *critical reflection of assumptions*, is "...a critique of a premise upon which the learner has defined a problem" (italics in original, p. 186) and "...the way an individual learner gains insight in dealing with a disorienting dilemma" (1998, p. 196). Boyd and Fales (1983) identified reflection as an unintentional state, or an "an inner discomfort" (p. 106) that something is amiss, leading to deliberate action. Linder and Marshall defined reflection as "*a particular way of thinking* about things that [is] needed when trying to resolve the situation of doubt, perplexity and confusion" (2003, p. 277).

The voices of more contemporary theorists are nevertheless still reminiscent of Dewey's "...active searching, hunting, inquiring, to find material that will result the doubt, settle and dispose of the perplexity" (1933, p. 12). Boyd and Fales (1983) point out that changed perceptions can be incorporated into our selves while we concurrently make an independent decision whether to act immediately, or at all, on these solutions to the puzzle. In total, this disequilibrium, or "perspective transformation" (Mezirow, 1978), sets the stage for learning.

The merger of the widely-recognized and used blog format with the online classroom distinguishes online PBL from its face-to-face counterpart. Blogs, or *web logs*, have emerged as a widely accepted, both public and personal communications environment among youth and adults. The number of blogs has reportedly risen from 60 million in May 2005 (Riley, 2005a) to 100 then 200 million in October 2005 (Riley, 2005b) and February 2006 (Riley, 2006) respectively and have appeared in online learning environments for at least the past 5 years (Wagner, 2003).

The small group format of PBL adds additional perspective to how reflection unfolds in the online learning environment. Hatton and Smith (1994) found that individuals need the presence of a trusted other for shared reflection to occur, while simultaneously being able to step back from their experiences. The computer, with its place-within-a-place presence and its mediation of communication, gives students both separateness and connectedness through which they can safely voice their reflections on our learning. Through preserving student reflections in an ongoing fashion as students choose to communicate in their blogs, the online learning environment may provide enhanced opportunities for peer reflection to occur.

Sample Student Reflections

The use of blogs in online classrooms is relatively recent development in education; however, their early successes seem to indicate a natural pairing with the coincidental movement of PBL into the online format. These blog entries represent a valuable learning tool in self-regulated learning for the blog writers and readers. Because the blogs were posted on public blog websites, the audience potentially included student peers, the instructor, and the Internet community at large. In the student reflections, many of the challenges outlined thus far from an

instructor's perspective are heard again in a student's voice.

Students reflect on the initial planning and goal setting stage of their projects:

Student 1: For me as an adult learner this was both refreshing and frustrating since I always like to know where the goal posts are in advance of planning my strategy.

Student 2: Through this team project I learned planning and having a good design is the most important part of doing a job before starting to do anything. It was a team work and without having an appropriate plan many of efforts would be in vain.

Not surprisingly, learners often focus their blog reflections on their frustrations and what to do next to address this conflict:

Student 3: It is confusing because there really isn't alot of research that is directly related to our dilemma but there is a whole lot of other stuff out there. It's a bit like mining. You spend days digging through the dirt. Most days there is nothing, just more dirt. Other days there might be one or two gems. The thing with internet gems is that if they are worth something you have to pay. Nothing more frustrating than finding one item that is dead on what you're looking for but full text is not available on line.

The unsettled nature of the PBL environment may lead to some reflections detailing group dissent:

Student 4: There are a few interpretations which are significantly different than my own

Student 5: The devising of the survey questions was certainly a challenging task. Perhaps the most difficult thing was getting consensus from the team as to the purpose of the investigation. There was some uncertainty and plenty of confusion as to such things as the difference between the research question and the manager's dilemma. I believe the pain led to gain as we explored the issues we will be looking at in greater depth.

Other entries contain evidence of changing perspectives as a result of linking the PBL simulation to real world considerations:

Student 6: As I considered the possible measurement questions to my research question, and their possible responses, the direction of my research shifted several times. This caused me to go back to square one a few times to ask, "What

is it I am really wanting to learn from this enquiry?"

Student 7: I am reminded that the work environment will not always support taking the "ideal" approach and that there is often as much magic in reading and adjusting to operational realities.

Knowing what they know and need to find out are key components of PBL:

Student 8: I am definitely weak in the statistics area and will need to really deepen my understanding of how to apply specific formula the information.

Students also documented how the processes they were learning within the PBL project applied to other tasks and situations:

Student 9: I learned that, in group processes, consensus building is not always the best approach if you are limited in time and resources. We had these problems in this and other course assignments. Often a controversial decision may be the best decision.

A concluding point to note at this juncture is that the sample blog entries represent those reflections that students chose to share with a wider audience, which may have included their instructor, their team members, other students, and any other person on line. Yet, their communication seems personal and self-directed. Whether the student addresses his audience or keeps his communication directed inwardly reflects the type of relationships perceived by the student within the group, of which he is a part. For example, asking rhetorical questions is typically seen as a form of self-talk as opposed to the more socially demonstrative acts of changing perspectives or addressing the audience directly (Fowler & Kress, 1979). Despite the public nature of the blogs, no comments from either group members or others were recorded; thus, blog writers did not have any tangible evidence their entries were being read by others.

Online classroom blogs are evolving as a unique discourse form shaped by social, cultural, academic, and technological factors. They represent an appealing option for PBL educators to combine the reflective qualities built into the PBL structure and the online

environment. Blogs create a supra-curricular environment where all students can observe, model, and exchange reflections as they explore their learning in any subject, their out-of-school environments, and the learning process. Reflective writing, such as blogs, can prove useful to educators as a means to monitor student representations and reflections on their learning and the PBL process itself.

Conclusion

The potential of the online PBL environment to stimulate and capture an emerging form of student reflection is clear. It would appear that learning how to learn and the processes related to problem solving and critical thinking may be more important outcomes in an online PBL course. Processes include meta-learning skills linked to individual and group learning as well as skills transferable to future encounters with similar problems. The difficulties faced with group formation, collaboration, and decision making are a shared responsibility of the instructor and the students themselves and must be closely monitored with novice or disorganized teams. This opens up the possibilities afforded by the eight principles from Savery and Duffy (1995) to guide the design and implementation of an online PBL course within a constructivist framework. Adapting a PBL approach for non-medical and ill-structured online post secondary programs is a challenging decision, but the rewards are enriched interactions with students and the opportunity to witness the inner processes of the students as they share their learning experiences through their enduring reflections.

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