

The Relative Merits of PBL (Problem-Based Learning) in University Education

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In Australia, academic workloads are increasing, and university funding is decreasing. Academics and university managers are engaging in risk adverse behavior and tending to focus on customer satisfaction and student retention, potentially at the expense of academic standards. Conventional approaches to pedagogy minimize adverse student feedback, but may not prepare graduates for the workplace (Savery, 2006). By contrast, PBL (problem-based learning) is generally thought to produce better student outcomes and performance, but can be more demanding in terms of academic workloads. PBL uses realistic scenarios which may not be well defined and the methods students use to solve the problems are often as important as their answers. PBL is grounded in constructivism (Ernest, 1993) and student-centered learning (Ally, 2004). This paper critically evaluates the claims made for PBL and provides arguments for its use in university teaching. Two research approaches were employed to inform this paper: the first is a meta-level review of PBL-oriented papers and the second is hermeneutic phenomenology in which the author gives an account of his experiences using PBL in university education and makes recommendations for its deployment. It is concluded that there are no academic or logistical grounds that support the use of PBL, but that it may still be regarded as a worthwhile exercise.

Keywords: PBL (problem-based learning), constructivism, student outcomes, pedagogy, academic workloads.

Introduction

PBL (problem-based learning) may take many different forms (Woods, Duncan-Hewitt, Hall, Eyles, & Hrymak, 1995), some involving teamwork and others to be undertaken independently. The simplest would be an independent research project intended to improve students' understanding of a particular subject area, such as the logistical issues associated with telemedicine in remote parts of Australia. Another form is guided design in which a small group of students work through a set of interrelated PBL tasks, progress to subsequent tasks depends upon successful completion of the current task and usually involves feedback or debriefing by an academic or industry supervisor. Many engineering schools make use of full design exercises in which students will design and build a specific product, e.g., a wheelchair capable of climbing stairs. Schools of medicine and dentistry have long made use of PBL to give students experience of diagnosis and planning treatment regimes. Probably, the most widely used form of PBL, most notably in business schools, is the case study (Sawyer, Tomlinson, & Maples, 2000). Obviously, PBL can be eclectic and practitioners "mix and match" according to need and academic discipline. In recent times, another form of PBL has come to the fore, that of simulation. Here use is made of role/game-playing in a realistic context (or mediated via ICT (information and computer

technology)) in order to encourage situational/experiential learning. It must be asked what evidence or arguments exist to support the use of PBL.

The Case for PBL

The proponents of PBL argued that it promotes “authentic learning” (Major & Palmer, 2001) and that it engenders metacognitive awareness (Benson, 2003). Barr and Tagg (1995) noted that PBL helps students to develop critical thinking skills as did Sawyer et al. (2000) who discussed in depth the criteria for good case studies and the benefits to be gained. The links among behaviorist, cognitive and constructivism have been well covered by Ally (2004), while many academics believe that workloads increase if PBL is used (Benson, 2011). Sukotjo, Thammasitboon, Howell, and Karimbux (2008) demonstrated that they could reduce laboratory, and lecture time could be reduced with no reduction in the quality of student outcomes. Newman (2006) noted a moderate improvement in student outcomes, but suggested that PBL was better suited to social sciences and similar subject areas. Felder (1995), like Sukjoto et al. (2008), stated that academic workloads actually decreased once staff had carried out all the necessary preparatory work. Pawson, Fournier, Haight, Muniz, Trafford, and Vajoczki (2006) identified positive benefits for students, academic and institutions and noted that students developed lifelong skills and found PBL a more enjoyable experience. This in turn leads to improving job satisfaction for academics. Where there is support for using PBL for academic reasons, it appears to be qualified with most authors reporting only a moderate improvement when compared to more traditional methods (Sanson-Fisher & Lynagh, 2005; Colliver, 2000).

The Case Against PBL

PBL has many detractors. From an academic perspective, it has been reported that some academics have used PBL as a substitute for lecture and laboratory teaching with students receiving little or no feedback and supervision (Woods et al., 1995; Felder, 1995), and this is unlikely to enhance the student experience. Finucane, Johnson, and Prideaux (1998) stated that costs increased, because there was a greater demand on staff time and resources if PBL is to be properly integrated into pedagogy. Several medical schools have criticized PBL because of the emphasis that it places on the problem rather than the patient. In addition, the problems used in medical schools can be too well defined, in reality, differential diagnosis may not be clear cut, and patients often present with more than one condition and may have symptoms which are unrelated or may lack symptoms usually associated with a condition. The dilemma then lies in among problems so ill-defined that they are useless for any kind of summative assessment and problems which are too well-defined to be of educational value. In Australia, there has been a change in the student demographic and student expectation. Many Australian students are obliged to work to support themselves whilst studying and a culture of “student as customer” prevalent in some universities encourages higher expectations of the level of support that should be provided to students. Attendance at lectures and seminars is reducing, and universities have enabled this by setting policies that lectures should be recorded and made available via the Internet. Australian academics reported that students are often unwilling to take responsibility for their own learning or become self-directed learners (Richards & Cameron, 2008; Benson, 2010; Schmidt & DeVaries, 1992), and the financial imperatives (the need to retain students) can result in academic standards being compromised, and organizational pressures which focus on customer satisfaction rather than student outcomes can also discourage academics from implementing PBL, because they fear that adverse feedback may affect job security and tenure/promotion

prospects (Benson, 2010). The need for conformance documentation and quality processes imposes logistical difficulties when re-engineering the curriculum, difficulties which many academics prefer to avoid.

Overwhelmingly, the most vociferous detractors of PBL are students. Green, van Gyn, Moehr, Lau, and Coward (2004) noted that students often went through the stages associated with trauma or grief: shock, denial, strong emotion, resistance, withdrawal, acceptance, return of confidence, and (finally) integration. The resistance on the part of students to PBL can be extreme especially from those who have little experience of PBL and those for whom English is not their first language (Benson, 2011). Linguistic challenges and culturally engendered shyness can limit engagement with PBL and diminish the ability to achieve good grades (Woods, 1996; Felder, 1995). Given the dissonance between student expectation and the reality of PBL implementation, conflict is inevitable (Benson, 2011) and the student group most likely to be hostile towards PBL is that of mature students and most notably female mature students (Brodie, 2007; Benson, 2011). Resentment also runs at high levels in mature students engaged in group work who complain about other team members failing to contribute their “fair share” or at the right level. Complaints about “value for money” are not uncommon (Felder, 1995).

PBL for Online Education

The author’s ongoing association with a Canadian university provided an ideal opportunity to implement PBL in distance mode. The cohort of 15 comprised mature students seeking accreditation or promotion and studying for credit or vocationally. The course is delivered via a Web portal with bulletin boards and chat systems to facilitate communication between themselves and with their tutor/lecturer. Online students are not expecting face-to-face support or traditional teaching; hence this seems conducive to a PBL approach. Care was taken to ensure that the supporting materials and exercises aligned closely with a textbook.

The non-trivial problem given to students was as follows: A motor vehicle sales and services company wishes to develop an additional income stream by using their used vehicle and demonstrator fleet as the basis for a car rental operation. Supporting documents relating to company history, multi-branch operation, organizational structure, etc., were provided. Students had to identify systems’ requirements, develop a data model, develop a process model, specify an interface and develop a project implementation management plan. Minimal information was provided to encourage course participants to research independently, but feedback and model answers were provided at appropriate intervals. Students were told nothing about PBL and were provided with weekly questions and exercises which allowed them to develop and practice their skills. These exercises were not assessed in order to decrease student anxiety. However, model answers for these exercises were not provided and students were encouraged to use the bulletin boards to exchange ideas, insights and comments. Besides having targeted forums, a social forum was created to allow students to comment on non-course related matters. For the first run of the course in its new format, the student cohort comprised 15 mature age students seeking accreditation or promotion, studying for credit or vocationally. In order to ensure a consistent academic direction, all the supporting materials were very closely aligned with a textbook.

At the end of the course, only three students gave positive responses to the course, nine were “unreceptive” to PBL and three were actively and extremely hostile towards PBL and the author, questioning the basis of the assignments and the contribution required of them. These three were sufficiently motivated to write letters of complaint, try to mobilize support for their demands in the rest of the cohort and demand that the author be removed from the faculty. Overall, assignments grades were better than that in previous semesters

and significantly better in the three hostile students.

The next time the course ran, the author took great care to ensure that students were informed about PBL and its potential benefits and students were provided with PBL references and resources, and students were told that they could have telephone support if they needed it. Following this, grades improved by 6% on average with approval ratings in excess of 80% (a significant improvement on earlier instances of the course) and fewer than 10% were dissatisfied with the course. No student requested telephone support. Subsequent runs of the course have been uneventful and have shown similar improvement in grades. It would seem that student who visits to the Web portal were more lengthy and frequent after the introduction of PBL with visits increasing in frequency by roughly 20% and duration of visit increasing by around 15%.

Conversations with previous students in Canada suggested that knowledge retention was improved, though it was not possible verify this directly without an objective test. Enquiries six to 12 months after completion indicated that students came to appreciate PBL in retrospect, highlighting independence, confidence and improved communication and organizational and problem-solving skills: 13 (83%) positive, two (11%) neutral and three (16%) adverse responses. Comparisons were made by interviewing a sample of students who had studied similar courses in distance mode at the author's university, but in a non-PBL framework: five (25%) positive, four (20%) neutral and 11 (55%) adverse responses. The findings were based on convenience samples and suggested the need for more rigorous and detailed research with larger sample sizes, though a controlled experiment may not be feasible. In short, it is acknowledged that any claim the author makes regarding the superiority of PBL over traditional methods cannot be justified using quantitative methods.

Real Time PBL

The author has also experimented with PBL in seminar/laboratory situations and can offer the following personal insight: Students are less stressed and more receptive to PBL if frameworks are used. Having well defined processes and a structured approach reduces the potential for conflict (Benson, 2011). For example, Woods proposed a five-stage process: (1) goal setting—students are given a problem statement, identify and prioritize issues which in turn can be used to define learning objectives and tasks; (2) presentation meeting—each student returns to their group to present findings and progress; (3) feedback meeting—students compile ideas/data and present them to other students whose answers may be peer assessed; (4) consolidation—subject representatives of the student groups meet and exchange insights; and (5) elaboration/reflection—when students have completed the tasks, they are required to identify similar problems that could be solved using the same techniques and reflect on what and how they learned. Many medical schools tend to neglect the feedback and consolidation aspects perhaps in the belief that the high caliber students they attract are capable of working independently (Green et al., 2004).

If PBL is to be used effectively in a classroom setting, then academics need to have interpersonal, communication and conflict resolutions skills at a high level. Many of the problems that arise in PBL are directly related to group dynamics, e.g., students who do not attend meetings, are disruptive, do not deliver the work promised, make minimal contributions/fail to engage with the course materials and yet expect to pass—class management skills are mandatory. There are also cultural issues to be considered; students from a non-English speaking background may lack the confidence to question and contribute. It is the author's experience that trying to make student groups mirror the class demographic is futile, a single non-English background student in a native English speaking group is likely to be inhibited. A group comprising

non-English speakers is more likely to be productive (Benson, 2003). Embedding PBL principles into course documentation can specify the skills that students must develop, as course/unit objectives is also helpful and may be regarded as obtaining “informed consent”. Additionally, parallel objectives for subject knowledge and process skills should be clearly specified, frequent and honest feedback regarding student performance will assist in the development of these skills.

Some Recommendations

While no proof is offered for the superiority of PBL, the author can make some recommendations for its successful implementation. The approach here is that of hermeneutic phenomenology (Taylor, 1997) in which experiences are shared. No claim to narrative omnipotence is made, and instead of proof, the author strives for resonance and advocacy. The intention is to present ideas which may be useful to other academics. There are some recommendations as follows:

- (1) Before using PBL, research the topic and find useful libraries and resources;
- (2) Engage in reflective practice, keep a professional journal, review this frequently and improve performance (Benson, 2003);
- (3) Start small, a few successful PBL projects will be much better received than one large unsuccessful one;
- (4) Full disclosure in advance, students need to be told what will be learned and how. In particular, tell students how they can expect to feel;
- (5) Be aware of the target demographic, too much exposure to PBL too early in university life can cause problems, the second and third year students are often better placed to engage in PBL;
- (6) Consider avoiding conflict by using PBL in non-assessed coursework components;
- (7) Deploy online, while online students are easier to handle than their on campus counterparts, exercise care in the design of websites and minimize the number of links (Niederhauser, Reynolds, Salmen, & Skolmoski, 2000; DeStefano & LeFevre, 2007);
- (8) Integrate, to be effective PBL needs to be integrated into a course rather than being a “add on”, and this will require some re-thinking and re-engineering of content and pedagogy;
- (9) Non-exclusivity, PBL may work better when used in conjunction with conventional methods.

Conclusions

Any claim that PBL improves academic performance is speculative, context dependent and almost impossible to prove. Farrow and Norman (2003) stated that educational contexts are so complex and varied that controlled trials are not appropriate, and this has been a factor in “the difficulties in coming to a definitive answer” to the question “Is PBL superior to conventional pedagogy?”. Although the author’s account is subjective and likely to introduce confirmation bias into any research, the author saw no ethical issues in deploying PBL and seeking to make use of the Hawthorne effect, after all, it is hard to argue against improving student outcomes. However, the author concludes that PBL is useful as a complementary method, especially in undergraduate scenarios. Courses which rely on PBL exclusively may disadvantage some student groups and it is important not to lose sight of the bigger picture. The author has not encountered any quantitative papers which can substantiate a claim of the superiority of PBL over conventional pedagogy; indeed, all the useful accounts of PBL the author has found seem to be qualitative/subjective/ethnographic in nature. These accounts serve as sounding boards, sources of ideas and they inform communities of educational practice. It may be that

change, innovation and variety are more important than curriculum and ontology when it comes to enriching the student experience. The improvement PBL gives in academic outcomes as measured by conventional means, i.e., assessment and examination, is moderate/marginal at best and such improvement is open to question. The author recommends the use of PBL as a complementary method. The main reason for adopting PBL from an academic's perspective is job satisfaction (Benson, 2011). Viewed from a student's perspective, students' mood, attendance and attitude are found to improve (Vernon & Blake, 1993; Albanese & Mitchell, 1992). It is the combination of the academic and student viewpoints that reveals the benefits to institutions. PBL is concerned with personal development of students and an enhanced university experience, both of which are important for marketing purposes and "branding" of universities. In the author's view, these two facts are to justify the continuing use of PBL.

References

- Ahlfeldt, S., Mehta, S., & Sellnow, T. (2005). Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. *Higher Education Research and Development*, 24(1), 5-20.
- Albanese, M. A., & Mitchell, S. (1992). Problem based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*, 68(1), 52-81.
- Ally, M. (2004). Foundations of educational theory for online learning. In T. Anderson, & F. Elloumi (Eds.), *Theory and practice of online learning*. Athabasca: Athabasca University.
- Barr, R., & Tagg, J. (1995). From teaching to learning: A new paradigm for undergraduate education. *Change*, 27(6), 12-25.
- Benson, S. (2003). Hunting the snark: A luest for excellence in information systems (Unpublished doctoral dissertation, Curtin University of Technology).
- Benson, S. (2010). Apocalypse now: Information systems in Australian universities. *Journal of Systems and Information technology*, 12(3), 222-229.
- Benson, S. (2011). Does problem based learning deliver the goods? Paper presented at *the IADIS Multi Conference on Computer Science and Information Systems*. Rome, Italy, July, 2011.
- Brodie, L. (2007). Reflective writing by distance education students in an engineering problem-based learning course. *Australasian Association of Engineering Education*, 13(2), 31-40.
- Colliver J. A. (2000). Effectiveness of problem-based curricula: Research and theory. *Academic Medicine*, 75(3), 259-266. Educating Physicians: Research Reports.
- Conant, J. B. (1949). *The growth of the experimental sciences: An experiment in general education*. New Haven, C. T.: Yale University Press.
- DeStefano, D., & LeFevre, J. (2007). Cognitive load in hypertext reading: A review. *Computers in Human Behavior*, 23(3), 1616-1641.
- Ernest, P. (1993). The one and the many: Constructivism in education. In Tobin (Ed.), *The practice of constructivism in science education* (pp. 459-486). Hillsdale, New Jersey, Pub.Lawrence Earlbaum.
- Farrow, R., & Norman, G. (2003). The effectiveness of PBL: The debate continues. Is meta-analysis helpful? *Medical Education*, 37(12), 1131-1132.
- Felder, R. M. (1995, Winter). We never said it would be easy. *Chemical Engineering Education*, 29(1), 32-33.
- Finucane, P. M., Johnson, S. M., & Prideaux, D. J. (1998). Problem-based learning: Its rationale and efficacy. *Medical Journal of Australia*, 168, 445-448.
- Green, C. J., van Gyn, G. H., Moehr, J. R., Lau, F.Y., & Coward, P. M. (2004). Introducing a technology-enabled problem-based learning approach into a health informatics curriculum. *International Journal of Medical Informatics*, 75(3), 859-867.
- Major, C. H., & Palmer, B. (2001). Assessing the effectiveness of problem-based learning in higher education: Lessons from the literature. *Academic Exchange Quarterly*, 5(1). Retrieved from <http://www.rapidintellect.com/AEQweb/mop4spr01.htm>
- Newman, M. (2006). Fitness for purpose evaluation in problem based learning should consider the requirements for establishing descriptive causation. *Advances in Health Sciences Education*, 11, 391-402.
- Niederhauser, D. S., Reynolds, R. E., Salmen, D. J., & Skolmoski. (2000). The influence of cognitive load on learning from hypertext. *Journal of Educational Computing Research*, 23(3), 237-255.

- Pawson, E., Fournier, E., Haight, M., Muniz, O., Trafford, J., & Vajoczki, S. (2006). Problem-based learning in geography: Towards a critical assessment of its purposes, benefits and risks. *Journal of Geography in Higher Education*, 30(1), 103-116.
- Rebeiz, K. S. (2011). An insider perspective on implementing the Harvard case study method in business teaching. *US-China Education Review*, 1(5), 591-601.
- Richards, D., & Cameron, L. (2008). Applying learning design concepts to problem-based learning. In L. Cameron, & J. Dalziel (Eds.), *Proceedings of the Third International LAMS and Learning Design Conference 2008: Perspectives on Learning Design* (pp. 87-96). December 5, 2008, Sydney: LAMS Foundation. Retrieved from <http://lams2008sydney.lamsfoundation.org/papers.htm>
- Sanson-Fisher, R. W., & Lynagh, M. C. (2005). Problem-based learning: A dissemination success story? *Medical Journal of Australia*, 183, 258-260.
- Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-based Learning*, 1(1), 9-20. Retrieved from <http://docs.lib.purdue.edu/ijpbl/vol1/iss1/3>
- Sawyer, A., Tomlinson, S., & Maples, A. (2000). Developing essential skills through case study scenarios. *Journal of Accounting Education*, 18(3), 257-282.
- Schmidt, H., & DeVaries. (1992). Comparing problem-based with conventional education. *Annals of Community Orientated Education*, 5, 193-198.
- Sukotjo, C., Thammasitboon, K., Howell, H., & Karimbux, N. (2008). Student perceptions of prosthodontics in a hybrid PBL curriculum. *Journal of Prosthodontics*, 17(6), 495-501.
- Taylor, P. C. (1997, March). Telling tales that show brush strokes. Paper presented at *the Annual Conference of the National Association for Research in Science Teaching*. Oak Brook, Illinois.
- Vernon, D. T., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine*, 68, 550-563.
- Woods, D. R. (1996). *Problem-based learning: Helping your students gain the most from PBL* (3rd ed.). McMaster University Bookstore, Ontario.
- Woods, D. R., Duncan-Hewitt, W., Hall, F., Eyles, C., & Hrymak, A. N. (1995). *Tutored versus tutorless groups in PBL*. Chemical Engineering Department, McMaster University, Hamilton ON L8S 4L7.