

Rethinking problem-based learning to better understand what and how students learn

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This paper argues that problem-based learning (PBL) is an effective learning strategy in a management discipline, where learning how to think critically and how to problem-solve 'messy' situations, are core principles for the future of management (Hamel, 2007). This paper reflects upon and explores the facilitation of a student-centred problem-based learning approach in a postgraduate business course. The focus of this reflection is guided by the goal to explore the nature of individuals' experiences with learning and teaching in a PBL setting. Of particular interest is the identification of basic indicative factors that can impact on the assessment of problem-based learning. Being able to articulate these factors is an important step in guiding tertiary educators' scholarship of teaching and in assisting others gain knowledge of PBL facilitation and assessment. The study investigates: (1) how students experience the PBL context (2) student perceptions of PBL assessments and (3) what type of learning arises from PBL assessments. Examples from a Masters course designated as problem-based learning are provided as initial empirical data. Further, the paper briefly describes an interpretative evaluation of the problem-based teaching and assessment system conducted using narratives from the students' reflective-learning journals.

Keywords: *problem-based learning, postgraduate learning, management creative thinking tools*

Introduction

The influential business thinker, Professor Gary Hamel, in his latest book *The future of management* (2007) raises concerns about the practicality of management today. Hamel (2007) argues that the management field is at risk, if business leaders do not start loosening the reins of control and fully engage the talents of every individual by encouraging and practicing – among other things – freedom to think, creativity and initiative. He exposes the future of management as a highly resilient system, in which business leaders are adaptable, innovative and develop a passion for big problems. Hamel further argues that the success and effectiveness of this highly resilient system can be assured if the following six essential human management capabilities exist: passion, creativity, initiative, intellect and diligence. This paper makes some observations on whether students benefit from problem-based learning (PBL) and find it an effective strategy from which to learn Hamel's 'six essential management capabilities and skills' (please note that for the purpose of this paper, these tasks will be referred to as 6Cm).

There is a significant body of research confirming that throughout the experiential learning process that PBL offers, the learner is actively engaged in experimenting, investigating, reflecting, being creative and innovative, solving problems, assuming responsibility and constructing meaning (Coombs & Elden, 2004; Boud & Feletti, 1997; Anderson, 1993). Taking this experiential learning process into account, it appears that some of the actions and

reflections the students engage with while learning in a PBL setting can potentially equate to Hamel's 6Cm. Therefore, the use of PBL can prove to be an integral approach to learning and teaching in the management field. However, critical to PBL success is its assessment. Three core questions are explored: (1) how students experience the PBL context (2) student perceptions of PBL assessments and (3) what type of learning arises from PBL assessments. With these questions in mind, students from a project management course (PP2) were asked to share their learning experiences: what they liked or disliked about the PBL context, what they considered as important factors that would make PBL meaningful for their learning and what type of learning they believed occurred from their PBL-project assessments. Categories derived from students' responses were used as a baseline to identify conditions to promote effective learning and identify how students benefit from PBL assessments. A qualitative comparative analysis methodology was used in order to report the results of these conditions and further analyse similarities and differences within the recorded experiences. This paper will conclude with an open discussion for future research, recognising the significance of Hamel's 6Cm and tabulated outcomes.

Problem-based learning (PBL) and innovative management (Hamel's 6Cm)

PBL was first designed to support deductive reasoning in the medical discipline and since then, other disciplines have widely adopted it. However, PBL has received much less interest from Management educators (Joham, Clarke & Rogers, 2007). In PBL, students learn by reflecting on realistic, but often ill-structured problems. Learning is triggered by the process of reflection, the integration of students' own experiences into the complexities of the problem, conducting self-directed research, integrating information from multiple perspectives and disciplines and solving realistic, but often ill-structured problems (Duffy & Cunningham, 1996; Savery & Duffy, 1995; Barrows & Wee Keng Neo, 1980). The success of PBL has encouraged researchers to evaluate the effectiveness of teaching and learning by identifying the unique properties of PBL and the setting where learning actually occurs. Of particular interest in this research is the identification of PBL properties that underlines what and how management students learn.

The Center for Problem-Based Learning housed at the Illinois Mathematics and Science Academy (IMSA, 2008) defines problem-based learning as:

... an educational approach that organizes curriculum and instruction around carefully crafted 'ill-structured' problems. Students gather and apply knowledge from multiple disciplines in their quest for solutions. Guided by teachers trained as cognitive coaches, they develop critical thinking, problem solving, and collaborative skill as they identify problems, formulate hypotheses, conduct data searches, perform experiments, formulate solutions and determine the best 'fit' of solutions to the conditions of the problem. Problem-based learning enables students to embrace complexity, find relevance and joy in learning, and enhance their capacity for creative and responsible real-world problem-solving.

Messy problems are characteristics of management and therefore require leadership capabilities, multiple perspective thinking and innovative ideas to problem solve (Camilllus, 2008). PBL has been characterised as an example of constructivist and creative thinking (Savery, 2006) and one that assists with messy problem resolution. One of the ways it implements creative and constructivist principles is through the design of educational assessments within a real project situation, that characterises the skills that management students need to learn to become business leaders. This realism draws out students' creativity,

initiative and freedom to think, all of which go beyond the dependent book-chapter student relationship and prescriptive learning approach. The future of management, as described by Hamel (2007) is in danger of these kinds of dependencies – memorising facts and theoretical ritual. There is an urgent call to develop new ways of management thinking but more critically, there is an urgent call for a framework that starts in our universities and proactively integrates theory and practice to help our students develop constructivist and creative thinking skills. Such skills give students the confidence and encouragement to perform like managers in the field to analyse, evaluate and integrate the facts and skills into a cohesive approach to solve problems and more importantly, to engender management innovation.

Management innovation refers to new ways to encourage energy, creativity and human potential in businesses. It also refers to businesses' continuous improvement where employees are empowered to solve systematic complex problems and self-organise themselves to respond to changes (Hamel, 2007, p. 212-240). There is a clear need for practical experience and meaningful and experiential learning in today's management field. However, this approach would constitute a challenge for students if they are forced to learn in an instructor-dependent setting and face the demand of just theoretical assessments. Management assessments should integrate all aspects of PBL learning such as facilitation, questioning, creative and critical thinking, problem-solving, cooperative learning, team building, active learning and discovery-based learning to truly provide for holistic learning experience and develop strong *6Cm* and skills.

The study: context and participants

The PP2 course was run as a three hour per week interactive seminar over ten weeks. Thirty-two students were enrolled in the course. Most were graduate students from accountancy, management, administration, health science and tourism and hospitality programs. Twenty-six of the thirty-two students already held jobs in their fields and seven had previously participated in a problem-based learning experience. The twenty-six students self-grouped themselves into four groups of four students each and two groups of five students each. The rest of the students were directed by the instructor into groups. The criterion for the voluntary self-selection into a group was common interest in the types of learning environments and field of work.

In weeks one and two, the class was introduced to the concept of PBL and its links to the course and assessment structure and the project-problem to be addressed. The PBL problem was based on a real-life business situation and was introduced in four phases by the systems manager of the business. Each phase of the problem-project situation was then broken into weekly sections and was aligned with PP2 core theory. A total of nine weekly systems thinking exercises were conducted to aid the students to particularly develop critical and creative thinking skills. A total of ten small group activities were also conducted as a vehicle for teaching a course on scope definition, as it addressed the current issues faced in project management. These group activities were based on De Bono's (2007) creative problem-solving approach and were referred to as *PBL* creative thinking tools. PP2 assessments comprised a critical thinking project proposal (35%), a set of three topic-guided entries via an online reflective journal (15%) and a project final plan (50%) which was further developed from the nine weekly systems thinking exercises.

PBL, in the context of the course PP2, placed the students in the active role of problem-solvers confronted with, on a weekly basis, messy and realistic issues brought into the class

by the business problem. Weekly systems thinking exercises aided in testing students' hypotheses addressing the business project and stimulated in-class dialectics. Figure 1 shows the PBL model intended for the PP2 teaching and learning environment.

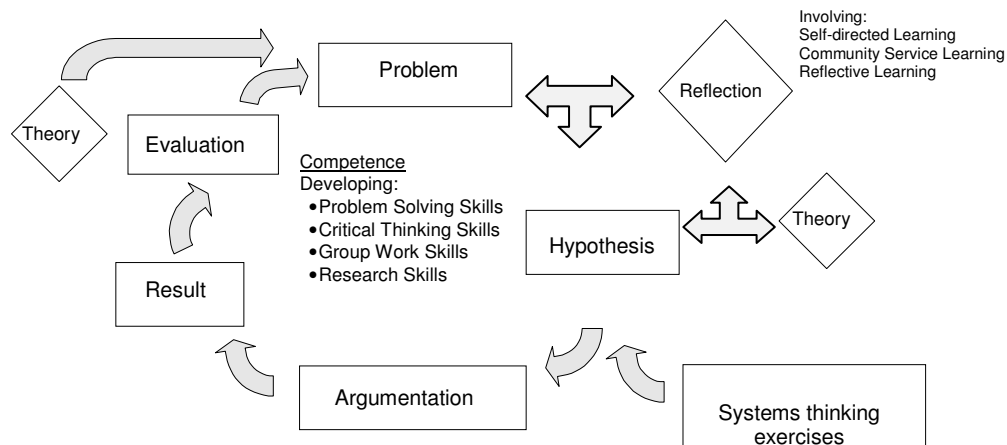


Figure 1: PBL weekly learning approach. Source: Author

Research approach and results

The research methodology was based on an analysis of qualitative data obtained mainly from two sources: students' survey and students' reflective journal. One of the journal entries requested students to share their learning experience within the PP2-PBL course context and in particular, what they considered to be key factors making PBL meaningful for their learning. Six common conditions were present: problem-solving scenarios, group assessment, creativity, active participation and involvement, freedom of learning and thinking and consistency. A qualitative comparative analysis (QCA) methodology was used in order to report the results of these conditions and further analyse similarities and differences within the recorded experiences. The core idea was to identify the existence or absence of each key factor in each of the student's learning journey. QCA is one of the few techniques available today, that addresses qualitative data configuring logic between similarities and limited diversity conditions. This configuration of conditions uses truth tables to represent and analyse causal complexities and assess the differences in the existing data (Drass & Ragin 1992). This method was found appropriate for this study, as the purpose of this pilot research was not only to focus on the net effects of causal conditions (i.e. key factors identified by the students) to make PBL meaningful for teaching and learning, but also to focus on the potential findings of their combined effects. Table 1 is a QCA truth table indicating the causal conditions required to make PBL meaningful for teaching and learning from which 'problem-solving (P)' skills has been adopted as a true indication of 'meaningful learning'. This table shows the causal combinations representing the sample data. Please note that QCA is an analytic technique that uses Boolean algebra to implement principles of comparison using only original qualitative data. Therefore, the results (i.e. conditions) from Table 1 are computer generated algorithms developed by the QCA software (Ragin, 1987) but are based on multiple comparisons of key factors emerging from qualitative data (i.e. student's journals).

Table 1: An Indicative Truth Table (Y/N) reporting the results of the condition that makes PBL meaningful for teaching and learning

Student ID	Reflection of Creative thinking/ cognitive mental tools (assimilator) (C)	Engagement/assessment (Group Commitment) (E)	Problem solving (P)	Active learner (<i>inquisitive behaviour</i>) (A)	Self-learning (Ss)	Subject-oriented (<i>vs. problem-centred</i>) (S)	Novice (PBL experience and consistent exposure to this approach) (N)
1	yes	no	no	yes	yes	no	yes
2	no	yes	yes	no	no	no	no
3	yes	yes	no	yes	yes	yes	no
32	no	yes	yes	yes	yes	yes	no

Analysis of this truth table produces the following Boolean algorithm/condition:

C.E.N.S.Ss + C.A.e.s + C.A.n.s.Ss \longrightarrow P Please note that these acronyms correspond to the conditions listed in row 1 (ref Table 1 above). Multiplication is indicated by (.); (+) indicates addition of alternate combinations of logical conditions; and () indicates “is sufficient for”.

There were many logically possible combinations of causal conditions (7=32). However, only 17 had empirical instances of mainly three key factors (i.e. combined logical conditions) that are sufficient to make PBL meaningful for teaching and learning. The software (QCA) calculated only one simplified assumption of the above generated algorithms: C+A.E. This solution is the most comparative possible and establishes the endpoint of the complexity (that is to say the parsimony continuum of the two final causal conditions of C.A.E and C+aE)

C+ A.E \longrightarrow P <i>Significance:</i> problem-solving skills (P) develop when reflection and creative tools (C) are present + the student engages with the course assessments (E) and is an active learner (A). However, A.E must be combined to report this condition.
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Discussion and student perceptions of PBL

Two main clusters were prevalent from the data (i.e. reflective journals and surveys).

Cluster A (twenty-two students) developed a successful solution for the business problem-based task. The cluster members developed a high level of divergent thinking through their experimentation with systems thinking tools and PP2 group activities. This enabled them to recognise most of the issues underpinning the problem and linked these with the core theory of PP2. They demonstrated engagement and commitment to the group assessments (i.e. project report 50%) which was designed specifically to develop creativity, leadership and innovation skills. Three of Hamel’s 6Cm were present: creativity, initiative and diligence. This cluster showed self-directed learning, yet they were often sceptical about the PBL creative thinking tools and constantly sought relevancy. An indication of this cluster students’ perception of PBL follows:

The first couple of weeks provided some thinking tools that could be used to analyse situations... I can see a real benefit in my current role, in regards to analysing various scenarios (S13-week 4).

The last two weeks exercises had a focus on completing assignment one. After week three, I discovered how much I didn't know about critical thinking....I could see the complexities of this problem... I also developed a greater appreciation of the thinking tools and appreciated the exposure to them, rather than going through the introductory theory of [x] that is available in any [x]text (S24-week6).

Cluster B (ten students) had a commonality of work context in PP2 project management skills, but initially lacked a commonality of purpose and lacked understanding of the complexities surrounding the business problem. They showed great dependency to other group members and often sought direction from the instructor. This cluster reached the point of sharing assignment tasks and drafts with members of other teams, seeking new ideas. They had low accommodation to group assignment (i.e. low aim for completion). However, this cluster showed strong participation and interests in the *PBL* creative thinking tools. Two of Hamel's 6Cm were present: passion and creativity. An indication of this cluster students' perception of PBL follows:

I can see the importance of multiple perspectives, but I find it difficult to see its relation with the course theory (S28-week 4).

When I had the business problem figured out [x another team member] showed me the other two issues affecting core stakeholders... Still on week 6 and I cannot understand the scope of this project... I need more instructions and perhaps more structure in alignment with the project theory... I hope this will change later on in the course (S6-week 6).

In the first three weeks of the course, there was a strong expectation that the lecturer would provide a prescriptive learning framework through course materials and lectures, which would in turn guide the groups to the 'correct' answer to the project problem and thus, a good overall grade in the course. However, after the first online reflective journal entry (i.e. assessment 2) in week four, students accepted responsibility for their own learning and started to analyse the critical issues of the project-problem situation. This suggests that encouraging a reflective process in the early stages of a course will result in a solid foundation for self-learning and problem-solving skills.

As stated above, problem-solving skills develop when reflective and creative teaching and learning activities are present in a course. However, for this condition to be factual, the student should also engage with the course assessments and be an active learner. In the PP2 course, learners were actively engaged in the business project problem that was carried out throughout the course and were also in charge of the learning that took place. Most importantly, as assessments were linked to the weekly *PBL* creative thinking tools, students were engaged in a cooperative and self-directed learning approach demonstrating three of Hamel's 6Cm: initiative, creativity and diligence. There was also an indication of self-awareness and openness to new learning approaches in both clusters. However, the common scepticism about new information, particular of cluster A, helped students develop inquiry skills and made them more active learners than students from cluster B.

The students' opinions regarding their PP2 learning experiences, suggests that it is necessary to implement meaningful learning assessments to promote creative thinking, their engagement and quality in the context of problem-based learning. Consistent with PBL theory, real problems must be aligned with the nature of students' professional activities and must also be

reflective of the course assessments. Providing these kinds of problems and the necessary cognitive tools for students to develop self-directed learning skills, is a decision that helps students engage in a deep level of learning and supports the development of their 6Cm. These findings are consistent with experiential learning theory that suggests that students are more actively engaged in immediate knowledge applications and in assessments which acknowledges their own cognitive capacity, prior experiences and own interests (Barrows & Wee Keng Neo, 2007; Felder and Brent, 2005).

Recommendations and future research

There is no doubt that creativity is the most important human resource of all. Without creativity, there would be no progress, and we would be forever repeating the same patterns” (Edward de Bono, 2007. p. 12).

Requiring students to modify their fundamental beliefs about the nature of learning can be ineffective if appropriate instructional methods for critical thinking and problem-solving are not in place. In PBL courses, we are asking students to leave their comfort learning-zone and ask them to face new challenges while learning how to learn; therefore it is our responsibility to establish instructional strategies to help students meet these challenges (Biggs, 2003; Swan, 2003). Inductive teaching and learning methods, such as PBL, can support students’ cognitive development by:

- Helping to make assessment relevant to their professional field
- Motivating intellectual growth and a more systemic problem-solving approach
- Providing choice in learning tasks
- Modelling real practice; real business projects
- Providing assessment methods that emphasise conceptual understanding (i.e. freedom to think and initiate knowledge, cooperation, creativity and experimentation)
- Finding an appropriate balance between structure and flexibility

Students have various ways of learning; various methods of instructions to which they respond best. However, this study suggested two necessary conditions for students’ intellectual growth: reflection (Kolb, 1984) and tasks that call for thinking outside prescriptive memorised theory. While these conditions may appear logical, they must be especially considered while designing PBL assessments. Instructors may not be able to design assessments to support all human management capabilities of the future manager (i.e. passion, creativity, initiative, intellect and diligence: Hamel’s 6Cm), but they can certainly create a teaching and learning environment that lead students to experiment and learn from the conditions listed in Table 1. The study summarised in this paper and the research that remains to be done can help instructors gain awareness of what and how students learn. However, future research is needed to either support or refute claims of the effectiveness of PBL in achieving desired problem-solving skills and outcomes in the management discipline. Moreover, the future of management calls for instructors to rethink PBL.

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