

What Good Teachers Do to Promote Effective Student Learning in a Problem-Based Learning Environment

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ABSTRACT

This qualitative study examines the attributes of effective teachers in a problem-based learning (PBL) classroom, specifically in a polytechnic context in Singapore. The educational beliefs, approaches and strategies of a group of PBL facilitators who have received teaching awards are examined to understand how critical thinking, collaborative and self-directed learning are promoted in a PBL environment. Data from classroom videos, teaching portfolios, student feedback, and certification feedback letters of 12 award recipients are analysed and coded using the constant comparative method to identify common themes in facilitation attributes and actions. Findings reveal three themes influencing the quality of teaching and learning in the PBL classroom: [1] questioning techniques of facilitators; [2] timeliness of facilitator response; and [3] facilitator awareness of unique learning goals and situations. The result of this study suggests that staff development programmes in PBL settings should focus on creating opportunities for reflection on practice, guided practice through feedback, and clearer articulation of standards and exemplars of good facilitation as resources for peer learning.

Keywords: problem-based learning, facilitation, critical thinking, collaborative learning, self-directed learning

INTRODUCTION

Polytechnics in Singapore are institutions of higher learning for post-secondary learners pursuing diplomas in key and emerging industries, and are strategically positioned to support an economic demand for skilled employment and middle-level professionals (2008, p. 72; Yip, Eng, & Yap, 1997). One polytechnic has adopted a problem-based learning (PBL) approach in response to preparing its learners for new technologies as well as new forms of knowledge and professionalism (Alwis & O'Grady, 2002). Its infusion of problem scenarios modelled after work, social, and industry contexts into a structured curriculum requires learners to distil learning issues, scope the parameters of the problem, find relevant resources, and collaborate in small teams to develop sound solutions (Barrows & Tamblyn, 1980; Savin-Baden & Major, 2004). This immersion of learners in an authentic problem-solving environment necessitates a teaching approach that emphasises the learning attributes of critical thinking, collaborative learning and self-directed learning, so as to nurture graduates who are able to adapt and contribute to a fast-paced, knowledge-driven world (Field, 2006). Hence, the teaching faculty at this polytechnic take on the role of a PBL facilitator instead of a passive lecturer to ensure students are equipped with the relevant specialised knowledge, skills and professional aptitude to thrive in this environment.

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Given the pervasiveness of this pedagogical approach across diploma programmes and throughout the three years of diploma study at this polytechnic, a Certificate in Facilitation programme was designed in 2003 to articulate, develop and evaluate the competencies and attitudes required of a good PBL facilitator (O'Grady & Ong, 2007). These attributes are well-documented by PBL researchers in the area of medical training (Barrows & Tamblyn, 1980; Dolmans et al.2003; Schmidt & Moust, 2000) and higher education (Evensen & Hmelo-Silver, 2000; Savin-Baden, 2003; Wilkerson & Gijsselaers, 1996): they cite an effective PBL tutor as one who is able to guide learners in actively constructing knowledge in collaborative, self-directed and critically reflective ways. These key characteristics and expectations are captured in the polytechnic's Certificate in Facilitation framework, which incorporates a teaching portfolio and classroom video recording assessment, and a panel interview for candidates to demonstrate evidence and critical reflection of good facilitation practices.

Since the inception of the Certificate in Facilitation programme in 2003, over 400 academic staff members at the polytechnic have attempted the certification process. Candidates are assessed for their ability to both articulate and enact their understanding of the key principles of PBL in these broad dimensions: guiding the learner through the process of constructing deep knowledge; managing the learning environment; and fostering self-directed and collaborative learning. A facilitator must be able to choose and apply appropriate questioning and discussion strategies to meet the desired learning goals of the lesson, and demonstrate critical awareness of the strengths and possible challenges or limitations of the chosen facilitation approaches and interventions to support learning.

In addition to certifying academic staff as PBL facilitators, the polytechnic instituted an annual teaching award – the “Outstanding Facilitation Award” – in 2004 to recognise exemplary facilitation among its certified pool of facilitators and encourage a culture of reflective practice and role-modelling. From 2004 to 2012, there were a total of 25 recipients of this award out of an average pool of 200 eligible certified facilitators, all from diverse disciplinary backgrounds such as applied sciences, engineering, information technology, sports education, and media and communication studies. They were nominated by their heads of department or the certification panel after reviewing the quality of their teaching through evidence such as student feedback results, certification feedback, and peer observations and recommendations.

Literature Review

The shift towards learner-centred models of teaching like PBL means different roles in engaging with knowledge. While students take on new roles as knowledge collaborators rather than knowledge receivers, teachers assume new roles as facilitators of learning as opposed to knowledge transmitters. Savin-Baden (2003, p. 27) described the role of the PBL facilitator as “necessarily ambiguous” because “facilitation is not about procedures or rules, but about creating different possibilities for learning, particularly one that resists reductionist accounts and techniques for becoming.” Thus, good facilitation is not about methods, but about possessing an astute awareness of the unique learning situations in the classroom, and being able to respond appropriately to each situation such that possibilities for learning are created. Indeed, what really goes on in the PBL classroom is complex, with teachers often struggling to enact the well-defined attributes of a good facilitator in a dynamic and often unpredictable classroom.

In an earlier qualitative study (Goh, 2009a), interviews with ten facilitators who achieved certification on their subsequent attempts revealed initial uncertainty over how they were evaluated, and attributed their later success in achieving certification to a commitment to personal reflection, peer feedback, and guided practice. The work of Boud & Feletti (1991), Murray & Savin-Baden (2000) and Kolmos (2002) in the area of professional development in PBL settings highlights the urgent need to respond to the range of challenges PBL facilitators face in making a successful transition to a student-centred, problem-based model of teaching and learning. A more recent and specific study of PBL in a polytechnic context emphasises the value of cognitive congruence in teachers – or the ability to express ideas in ways that students can comprehend – as a significant predictor of situational interest in students in active-learning classrooms (Rotgans & Schmidt, 2011).

From the literature review, the critical gap in the research on PBL facilitation is in how the attributes of good facilitation are translated into action. In other words, what do effective facilitators actually do and say? What are the characteristics of effective facilitation in classroom practice? This

paper addresses this gap by examining empirical data on a group of recipients of the polytechnic's "Outstanding Facilitation Award" in order to describe their discourse and actions, and conceptualise these into a framework for effective facilitation practices.

The Present Study

To gain insights into what good PBL facilitators do in the classroom, the present study analyses the teaching behaviours and approaches of 12 recipients of the "Outstanding Facilitation Award" through empirical data from their certification documents. Patterns in their discourse, dispositions, and actions are extrapolated from the data to formulate themes for further analysis.

METHOD

Participants

The certification data of 12 unique recipients of the "Outstanding Facilitation Award" between 2005 and 2010 were selected for this present study. The data set for each participant included a four-hour classroom video recording of a PBL lesson with a class of 25 students, a teaching portfolio (which included a teaching philosophy, critique of the video-recorded lesson, samples of student reflection illustrating evidence of self-directed learning, and an analysis of student feedback) and a certification feedback letter detailing the outcome, strengths, and areas for improvement of the candidate. Each classroom recording was a demonstration of an actual lesson facilitated using the polytechnic's "one-day, one-problem" PBL framework (Alwis & O'Grady, 2002; Yew & O'Grady, 2012), in which a lesson is organised over three formal meetings interspersed with two study periods, during which students engage with the problem presented, conduct their research, and present their findings or responses for critique (see Appendix A).

At the point of certification, each award recipient had amassed two to three years of facilitation experience at Republic Polytechnic and attended at least 100 hours of PBL-related staff development training, including a mandatory 40-hour pre-service PBL foundation programme for new staff. Seven award recipients in the study group were female and five were male. They represented five academic schools from across the polytechnic: applied science, engineering, information technology, technology for the arts, and health, sports and leisure. None of the participants possessed a formal teaching or education-related qualification – which is not unusual among tertiary educators employed primarily for their disciplinary or industry knowledge (Johnston, 1999; Yen, 1988) – and had worked in their respective industries prior to joining the polytechnic. Ten award recipients in this study group had attained certification on their first attempt, while two had attained certification on subsequent attempts, with an interval of about one-and-a-half years between these attempts.

Procedures

Schmidt and Moust's (1995) comprehensive description of how subject-matter experts in different disciplinary fields demonstrated cognitive and social congruence in their interactions with their learners was used as a basis for a theoretical framework for analysing the data in this study. From their description of effective tutors, five broad categories of PBL facilitator attributes were extrapolated to ease the coding of the data: [1] engaging learners in key concepts, issues, and themes according to the lesson objectives; [2] helping learners reason effectively and develop deep understanding; [3] helping learners collaborate meaningfully with their peers; [4] helping learners to be self-directed in their learning approach; and [5] helping learners to be reflective about their learning process.

Using the constant comparative approach, empirical data from classroom videos and teaching portfolios were examined to identify patterns in discourse, reflections and actions in how these 12 facilitators enacted the five categories of PBL facilitator attributes. These were then compared with data from a student feedback survey and certification feedback letters from the certification interview panel to check for consistency in external perceptions of what constituted favourable facilitator attributes.

While demographic information pertaining to experience and qualification was collected at the initial stage of the study, specific names were omitted during the reporting stage, with only key trends

and observations summarised in the findings below. Permission to extract relevant certification data for the purpose of this study was also sought from the institution's ethics review committee prior to the start of the research.

RESULTS

The classroom videos of the 12 facilitators were examined and coded to identify occurrences of the five PBL facilitator attributes enacted during the recorded PBL lesson. Table 1 shows examples of how these five constructs were demonstrated in the videos:

These enactments were observed to be consistent across the videos of the 12 facilitators, despite the range of subject matter – science, mathematics, programming, design, and sports media – taught in class.

In addition, the 12 facilitators demonstrated sophisticated levels of critical reflection-in-action (Schön, 1998) in their teaching portfolios, especially in their teaching philosophy and critique of how they facilitated the video-recorded lesson – they commented on how they managed their challenges as a PBL facilitator and how they anticipated and overcame shortfalls in their teaching biases. They also showed high levels of empathy towards the different motivations and abilities of their learners in the way they listened and responded to their varied learning needs, and did not pre-judge or dismiss them. They were able to adapt to unexpected learning situations such as learners misinterpreting the lesson objectives, by being flexible and quick-thinking in their adoption of alternative strategies and questioning approaches to scaffold learning. They were also conscious of the effect of their words on shaping their learners' motivation and actions.

While these personal commentaries on teaching philosophies and facilitation approaches were also frequently present in the portfolios of other certified staff, what set these 12 award recipients apart from their peers was the congruence of their words with their teaching actions, as corroborated by their student feedback and feedback from the certification interview panel, which showed further observations of facilitation actions that promoted critical engagement, collaborative learning, self-directed learning, and reflective thinking.

Table 1: Examples of facilitator actions in relation to PBL facilitator attributes

PBL facilitator attributes	Examples of facilitator actions in the classroom
1. Engaging learners in key concepts, issues, and themes according to the lesson objectives	<ul style="list-style-type: none"> - Connect with learners' starting point and use appropriate scenario settings such as contexts or examples familiar to learners. - Scaffold learning by making connections between prior and new knowledge in order to gradually to help learners reach the next level of understanding. - Use appropriate language, references, and analogies to help learners overcome the challenge of difficult terms.
2. Helping learners reason effectively and develop deep understanding	<ul style="list-style-type: none"> - Prompt learners to justify their claims and provide examples when explanations are vague or unconvincing. - Encourage learners to critique ideas by considering their value and limitations within the context of the problem scenario. - Comment on the quality of arguments presented.
3. Helping learners collaborate meaningfully with their peers	<ul style="list-style-type: none"> - Help learners build on one another's knowledge by modelling how feedback and constructive criticism are given. - Include reticent or quieter learners in group discussions. - Create opportunities for shared meaning across groups to take place.
4. Helping learners to be self-directed in their learning approach	<ul style="list-style-type: none"> - Identify learning obstacles and suggest strategies to manage them. - Sharpen learners' research and information management skills. - Develop professional habits of working in learners such as agenda-setting and action-planning.
5. Helping learners to be reflective about their learning process	<ul style="list-style-type: none"> - Set clear criteria so that learners can evaluate themselves. - Draw attention to blind-spots, misconceptions, and weak reasoning so that learners can address them. - Give feedback regularly.

Student feedback data on these 12 facilitators measuring perceptions of subject-matter expertise, cognitive congruence, and social congruence, showed that their quantitative scores were generally above the institutional mean, although not in the upper range, suggesting that student perception of outstanding facilitators was not a determining factor in the selection of award recipients. Qualitative student feedback of the 12 facilitators, however, indicated a student preference for facilitators who showed care and patience; who were able to bridge knowledge gaps between experts and novices; who generated interest in learning and open sharing; and who recognised effort and incremental progress.

Feedback from the certification interview panel also highlighted similar attributes observed from the video and during the interview, with panel members commenting on facilitators' abilities in developing students' ownership of their learning; using a wide range of questions to promote deep learning and reasoning; supporting weaker learners; and showing flexibility in adapting teaching strategies to address specific learning issues such as surface understanding of content or weak team work.

DISCUSSION

The findings from the certification data analysis suggest that exemplary PBL facilitators have a high level of critical awareness about themselves and their learning environment, and are discerning in their ability to apply sound judgment in the classroom when interacting with their learners. Three key themes emerged from the data analysis that describe the strategies and strengths of these PBL facilitators: [1] their range of questioning techniques when responding to different learning issues; [2] the timeliness of their response to unexpected learning obstacles; and [3] their awareness of unique learning goals and situations for individual learners.

From a staff development perspective, the question that follows is whether these qualities are 'teachable' – i.e. can we develop facilitators into problem-solvers, to recognise 'teachable moments', and to be sensitive to the various learning styles and motivations of their learners? As there is no significant difference between their years of facilitation experience and hours of PBL-related training from those of their peers, this implies that more classroom practice or more formal training alone do not necessarily lead to increased competency as a PBL facilitator.

This echoes the insights of researchers in the area of PBL staff development that there is a need for greater reflection, modelling, and metacognition to be built into lesson activities for facilitators. Little (1991, p. 118) highlights the need for "meta-level discussions" to take place so that knowledge, skills and experiences are overtly raised, transferred and applied, while Kolmos (2002, p. 72) reminds us of the systemic importance of facilitating change in an organisation in order to build a "culture based on reflection on action". In addition, Savin-Baden (2003, pp. 80-81) urges us to take an educational development rather than a "how-to" staff training approach that allows educators to immerse themselves in a culture of problem-based learning.

In other words, a mechanistic training model of staff development appears limited in its effectiveness when it comes to developing confident and competent PBL facilitators. Dialogue and reflective space are critical to a successful PBL staff support programme – activities should encourage space for participants to share ideas and practise a skill with the opportunity for immediate feedback; discussion topics should model authentic problem solving so that shared strategies are perceived as specific and relevant; and good facilitation skills need to be articulated overtly and made accessible through role-models and shared resources such as classroom video recordings and peer observations.

CONCLUSION

This study sought to investigate the attributes of PBL facilitators by examining the teaching data of a group of 12 "Outstanding Facilitation Award" recipients. Data analysis of their classroom videos, teaching portfolios, student feedback, and certification feedback letters revealed specific teaching actions and strategies adopted by these facilitators to help their learners engage in conceptual understanding, reason effectively, collaborate meaningfully, and become self-directed and reflective in their approach to learning. Three themes influencing the quality of learning in a PBL environment emerged from the data analysis: their range of questioning techniques when responding to different learning issues; the timeliness of their response to unexpected learning obstacles; and their awareness of unique learning goals and situations for individual learners.

With this description of PBL facilitator attributes, this study hopes to create a deeper understanding of what exemplary PBL facilitators do so that more effective staff development programmes can be designed to develop the professional competency of PBL facilitators, and support them in their transition from an apprentice or transmission model of teaching to a more student-centred one. The results of this study suggest that staff development programmes in PBL settings should move away from skills-training alone and focus on creating opportunities for reflection on practice, guided practice through feedback, and clearer articulation of standards and exemplars of good facilitation as resources for peer learning. These need to be incorporated into both formal and informal professional learning and staff education programmes to develop a culture of reflective practice, open sharing, and transformational learning.

The next critical phase of research is to study the efficacy of staff development programmes and initiatives that support teachers in facilitating effectively in a PBL setting. With the articulation of clear standards and exemplars to describe good PBL facilitation, there is a corresponding need to investigate how facilitators can work towards achieving these outcomes in a sustainable way. A current study on the impact of a structured foundation programme for new academic staff to measure the extent to which teacher self-efficacy and approach to teaching differed before and after the programme will provide important insights, while a follow-up exploratory study on the attributes, teaching practices, and peer coaching experiences of PBL practitioners, offers another platform to evaluate the effectiveness of professional development in PBL settings.

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APPENDIX

This table outlines the teaching and learning structure of Republic Polytechnic's PBL framework.

Daily Structure	Learning Outcomes and Actions
Meeting 1 <i>(guided by PBL facilitator)</i>	Exploration of problem Students are presented with the problem trigger for the module. They activate their prior knowledge and raise learning issues to organise and scope the problem.
Study Period 1 <i>(independent work)</i>	Research and discussion Students carry out further research and examine resources and other forms of scaffolding to address learning issues and generate possible hypotheses.
Meeting 2 <i>(guided by PBL facilitator)</i>	Strategy-formulation and meta-cognitive processing Students share their initial findings, ideas, and learning obstacles and devise strategies to help them work more effectively on the problem.
Study Period 2 <i>(independent work)</i>	Consolidation of ideas/argument Students agree on a problem approach in their groups and consolidate their findings, arguments, and rationale into a suitable presentation format.
Meeting 3 <i>(guided by PBL facilitator)</i>	Presentation of solutions/defence and critique of argument Students present their group responses and have the opportunity to respond to questions and comments from their facilitator and peers. The facilitator presents a closing review.
Assessment <i>(daily grade & feedback given)</i>	Reflection journal, self & peer evaluation Students complete their individual and peer assessment and review their understanding of the day's content through a quiz. The facilitator makes a judgment about each student's quality of learning, provides individual and group feedback, and assigns an individual grade.