PBL : FUTURE CHALLENGES FOR EDUCATIONAL PRACTICE AND RESEARCH

By

ROOPASHREE. B.J

Assistant Professor, Sri siddaganga Post Graduate Department of Education, Tumkur University, Karnataka, India.

ABSTRACT

Problem based approaches to learning have a long history of advocating experience based education. Psychological research and theory suggests that, by having students learn through the experience of solving problems, they can learn both content and thinking strategies. Problem Based Learning (PBL) is an Instructional method in which students learn through facilitated problem solving. In PBL, student learning centres on a complex problem, that does not have a single correct answer. Students work in collaborative groups to identify what they need to learn in order to solve a problem. They engage in Self Directed Learning (SDL) and then apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies employed. The aim of this paper is to demonstrate that, PBL has the potential to prepare students more effectively for future learning because it is based on four modern insights into learning such as Constructive, Self-Directed, Collaborative and Contextual. In addition, available research is reviewed and solutions for educational practices are described.

Keywords: PBL, SDL, Collaborative, Contextual etc.

INTRODUCTION

It is said that, there is nothing as practical as good theory. It may also be said that, there is nothing as theoretically interesting as good practice. Thus, theory and practice are the two faces of the same coin. One doesn't gain importance without the other. Hence, in the instructional task, practical experience is to be emphasized. In this direction, Problem-based learning is meaningful experiential approach of instruction which advocates experience-based education and which helps the students to learn by solving problems and reflecting on their experiences, thereby helping students to become active learners by placing them in real-world problems which makes students responsible for their learning. Even it also helps the students to procure content and thinking strategies. Hence, PBL is an instructional method in which students learn through facilitated problem solving or it can be otherwise described as a student-centered instructional model that simultaneously develops both problem solving strategies and subject matter by having students confront real-world problems with limited information provided by the teacher.

As per C.E.Engel, University of Newcastly, PBL is a "process of acquiring knowledge, understanding, skills and attitudes in the context of an unfamiliar situation, and applying such learning to that situation." Thus students with this method learn through facilitated problem solving. This is a general model that was developed in medical education in the early 1970s and since that time it has been refined and implemented in over sixty medical schools. The most widespread application of the PBL approach has been in the first two years of medical science curricula where it replaces the traditional lecture based approach to anatomy, pharmacology, physiology etc.. This model has been adopted in an increasing number of other areas including Business Schools, Schools of Education Architecture , Law etc..

Objectives of PBL

- To help the students to develop flexible knowledge, which helps them to enrich and adopt their knowledge as per the demands of the context.
- To encourage students to adorn their personality with effective problem-solving skills.
- To imbibe the students in the self-directed learning skills.

- To promote effective collaboration skills with the students.
- To accelerate intrinsic motivation.

Criteria for the selection of the problem in PBL:-

As the students are confronted with the problem to accomplish the objectives, the instructor should be cautious that it should,

- Raise the concepts and principles relevant to the content domain.
- Be real.
- Be in accordance with the curriculum.
- Strengthen their character to mould the students into a productive person within one's sphere of influence
- Encourage socialization

Special features of PBL

Although PBL differs in various schools, three features can be considered as essential such as,

- Problems as a stimulus for learning
- Tutors as facilitators
- Group work as stimulus for interaction

Problems as a stimulus for learning

Problems are the motive behind students' learning in PBL and are used to engage students actively in their own learning. Problems are used in PBL to stimulate students to construct new knowledge actively that is linked strongly with their previous knowledge. In order to stimulate students' learning, students in PBL are confronted with problems. These problems consist of a description of some phenomena that need to be explained. When trying to explain the phenomena in the problem, students discover what they already know about the problem, but they also discover what they do not yet know or which questions still need to be answered and required to study. Thus the use of problems in PBL makes learning in PBL as a constructive and contextual process.

Tutors as facilitators

One must reconsider what students really need to learn and the environment in which they learn. Much of the enthusiasm for the problem-based approach to learning comes from the instructors who feel revitalized by the creative energy that it releases.

A second important feature of PBL is that teachers are facilitators who stimulate students towards self-directed learning. The tutor's task is to keep the learning process in action, to probe the students' know ledge deeply, to ensure that all students are involved in the process, to monitor educational progress of each student in the group and to modulate the challenge of the problem. The role of the tutor is to scaffold student learning, which implies that the tutor stimulates elaboration, integration of know ledge and interaction between students by means of asking for questions, asking for clarifications and application of knowledge. In order to stimulate students towards self-directed learning, a tutor should not transmit his expert knowledge to the student, but should probe students' knowledge by encouraging specific kinds of cognitive activities. The role of the tutor as being a facilitator of the learning process in PBL, makes learning in PBL as a self-directed process.

Group work as stimulus for interactions

A third important characteristic of PBL is that learning takes place in small groups. In PBL, problems are discussed in small groups of students. In this collaborative learning environment, students learn from interacting with each other, e.g. by explaining the materials to another student and by asking and answering questions and by discussion. In PBL groups, students work together to construct collaborative explanations. In addition, students learn to work together, which may help them to become better collaborators. Finally, a group emerges to motivate themselves. Thus, the tutorial group work in PBL makes learning in PBL a collaborative process aimed at stimulating students towards interactions that are intended to have a positive effect on learning [2].

The PBL Cycle

The PBL learning cycle (shown in Figure 1) is enacted through the tutorial process that begins with the presentation of a problem and ends with student reflection. A PBL tutorial session begins by presenting a group of students with minimal information about a complex problem. From the outset, students must question the

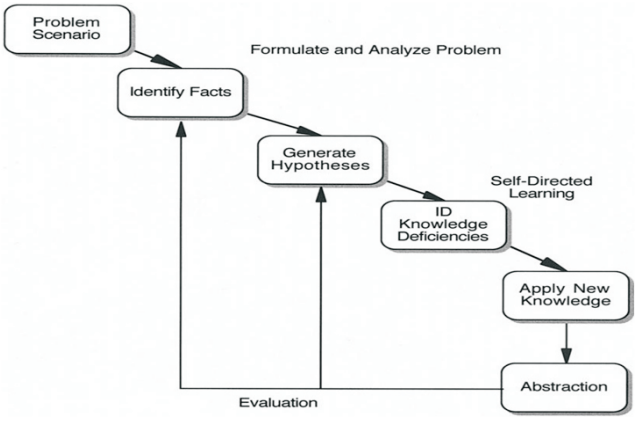

Figure 1. The problem-based learning cycle.

facilitator to obtain additional problem information; they may also gather facts by doing experiments or other research[6]. For example, a group of eighth standard students can be asked for the reason behind gargling using concentrated salt solution during throat infection. At several points during their problem solving, students typically pause to reflect on the data they have collected so far. In this example, students will collect the information where and all the concentrated salt solution will be used, generate questions about those data like why are pickles, goose berries, mangoes stored in concentrated salt solution, and hypothesize about underlying causal mechanisms that might help to explain the data about why concentrated salt solution is used in order to add taste for longer period, to prevent the growth of some organisms, to maintain the colour and flavour, to enrich the juicy nature etc. Students also identify the concepts that they need to learn more in order to solve the problem, labelling these concepts as "learning issues." ie., types of concentration, potential gradient, nature of liquid, types of membrane etc. After considering the problem with their new knowledge, students independently research the learning issues what they have chosen. They regroup to share what they have learned, reconsider their hypotheses, and/or generate new hypotheses in light of their new learning. When completing the task, learners deliberately reflect on the problem to abstract the lessons learned about the problem and about their SDL (Self Directed Learning) and collaborative problem-solving processes.

While working through the problem, students use whiteboards to record their evolving ideas. The whiteboard is divided into four record keeping columns to facilitate problem solving. The Facts column holds information that the students gleaned from the problem statement such as what the problem is and where it occurred. The Ideas column serves to keep track of their evolving hypotheses about solutions. The students place their questions for further study into the Learning Issues column. They use the action plan column to keep track of plans for resolving the problem or obtaining additional information. The four columns provide for scaffolding and communicating the problem solving process in PBL. The whiteboard serves as a focus for negotiation of the problem and as a forum for students to co-construct knowledge. The whiteboard helps students to externalize their problem solving and allows them to focus on more difficult aspects of the problem-solving process. It provides a model of a systematic approach to problem solving and supports student planning and monitoring as they identify what needs to be recorded on or later removed from the board [10].

Nature of assessment in PBL

Overall, PBL is an effective method for improving the students' problem-solving skills. Students will make strong connections between concepts when they learn facts and skills by actively working with information rather than by passively receiving information. Problem-based learning is based on processes leading to a variety of outcomes and the challenge is to use assessment to contribute to more effective learning, not merely to lead to marks or grades. There may be a lot of 'un-learning' and letting go to be done by both students and tutors before there is genuine alignment of assessment with the learning goals and principles and practices of Problem-based Learning.

PBL assessments should be authentic, which is to say that they should be structured so that students can display their understanding of problems and their solutions in contextually-meaningful ways [5]. Clearly, multiple-choice assessments and even short-answer or essay questions that require rote repetition of facts will be of little value in assessing the extent to which students have internalized holistic approaches to complex problems.

Macdonald and Savin-Baden (2004) [4] list some of the forms of assessment that have been used successfully with

Problem-based Learning and which also move away from the need to have outcome-based examinations. These include: group presentations, individual presentations, tripartite assessment, case-based individual essays, case-based care plans, portfolios, triple jump, self-assessment peer assessment, patchwork texts, examinations, etc.

Group presentations

Students can be asked to take role or work within a particular context or scenario, ideally in which one is as authentic as possible. These may be difficult to mark and it needs to be made clear on what is being assessed – content, how the group 'performed' on some combination of both.

Individual presentations

Students are asked to present the components of work they have researched for their contribution to the overall solution or management of the problem scenario.

Tripartite assessment

Firstly, the group submits a report for which they receive a mark. Secondly, the individual submits the piece of work on what they researched. Finally, the individual writes an account of the group process that is linked to the theory of group work. These three components are added together to form the overall individual mark. The advantage of this is that, it does not privilege some students who do less work and an individual student will be responsible for gaining two-thirds of the marks and therefore most students perceive this kind of grading as being fair.

Case-based individual essay

The student is presented with a case scenario for which they respond to in the form of an essay or report.

Case-based and care plan based in clinical practice/client-led project

Students are presented with a real life scenario to solve / manage for a client.

Portfolios

These can be unwieldy if not managed well and may be difficult to mark. They are fine if they are well-designed. Portfolios have been used in a number of programmes that educate students for the professions. In recent years, the requirements for these have been refined away from a vast quantity of materials towards a more concise version that offers greater reflection and criticality than before. Students should also be required to draw out conclusions and synthesise the materials contained in the portfolio.

Triple jump [2]

Individual students are presented with a problem and expected to discuss the problem and their learning needs with an oral examiner. Students then locate research material and later discuss their findings with the examiner and are rated on problem-solving skills, self-directed learning skills and on their knowledge of the problem area. This method is obviously time and resource-intensive, though these elements might be reduced with the use of peer tutoring and assessment or using elements of group work.

Self-assessment and feedback

This works well with enquiry and Problem-based Learning, but students must be equipped to undertake it through explanation and experiencing the learning benefits on small tasks, before engaging in large activities where marks 'count'. Self-assessment allows students to think more carefully about what they do and do not know, and what they additionally need to know to accomplish certain tasks.

Peer assessment and feedback

This provides a good fit with enquiry and Problem-based Learning as it more closely replicates the team-based situations in which most professionals will find themselves in the future. This kind of assessment emphasises the cooperative or collaborative nature of the enquiry and Problem-based Learning environment. However, many students find it difficult to adapt to this approach having come from a more competitive, individualised school or college environment [11].

Viva Voice Examinations

These were used very effectively before enquiry and Problem-based Learning was widely in use. They have been adopted by several curriculum designers for use with enquiry and Problem-based Learning. However, they are best done in practice situations and although they are very effective, they can be costly, time consuming and

extremely stressful for the student. A major benefit is that they do allow the assessor to ask follow-up questions, which is not possible in more formal, written formats.

Reflective (online) Journals [13]

Students hand them in or post them online each week and receive a mark at the end of each term/semester. Students tend to be more open and honest about their learning than one would expect and these can be criterion referenced. They might also be linked to other electronic communications activities such as conferencing or providing feedback to peers.

Reports

Written communication is an important skill for students to acquire. Requiring written reports allows students to practice this form of communication, particularly if the word allowance is short and it is used in the final year, as it can promote succinct, critical pieces of work. Alternatively, students might be asked to provide an executive summary for assessment, accompanied by a portfolio of supplementary back-up evidence which could be sampled rather than marked in full.

Patchwork text [2]

This is a way of getting students to present their work in written form. Students build up text in course work over a number of weeks. Each component of work is shared with other students and they are expected to use different styles, such as a commentary on a lecture, a personal account, a book review.

Examinations

The author sees nothing wrong with examinations but they need to be problem-based examinations. The students should engage in pre-examination activities which reflects the type of learning activities that they have experienced previously, including working in groups. Treat the examination as a time-constrained activity (anything from 30 minutes to a week) where the students may have to work individually with new data or scenarios and have to make sense of the new situation. The students should not have to do 'revision' in the traditional sense of learning by rote, though they will have to prepare for the examination. A second challenge would be to have students spending a substantial proportion of the time thinking, working with ideas and not simply writing down the facts they have remembered.

Electronic Assessment

These approaches are becoming increasingly more sophisticated and can be used for simulations, scenarios and other time-constrained activities, often linked to a virtual learning environment providing access to a range of resources and communications opportunities.

Self, Peer and Collaborative Assessment

The use of self, peer and collaborative assessment is worth a little more consideration, though some lecturers prefer to limit the use of this approach to assessment for feedback rather than allocating marks.

Self Assessment

Self-assessment involves students judging their own work. It may include essays, presentations, reports, and reflective diaries. However, one of the difficulties with self-assessment is the tendency for students to make judgments about what they meant, rather than what they actually achieved. Boud has defined self-assessment as the involvement of students in identifying standards and/or criteria to apply to their work and making judgments about the extent to which they have met those criteria and standards. (Boud, 1986) [7].

Peer Assessment

Peer assessment, by contrast, involves students making judgment about other students' work. This is generally used for presentations and practical, but it can also be used for essays and exam scripts. Using peer assessment with essays is really useful and also highly informative for student and tutor and it can be used at various points in the learning and assessment process to give feedback before completing the final piece of work for submission. Ideally, the students design their own assessment criteria and use them to assess each other, but in many programmes, they are designed by staff. Students learn how to make better sense of assessment criteria if they have to give feedback and/or marks against them. Giving and receiving feedback is an important aspect of student learning and will be valuable skills for them in professional contexts and for future learning.

Collaborative Assessment

In collaborative assessment, the student assesses her/himself in light of the criteria agreed with the tutor. The tutor assesses the student using the same criteria and they negotiate a final grade and perhaps even the feed forward comments.

Review Studies on PBL

Several review studies have appeared in the literature on PBL in the early 1990s and since 2000. In 1992, Norman and Schmidt reviewed the evidence behind some theoretical advantages claimed for PBL. They conclude that there is evidence that, group discussion in PBL stimulates the activation and elaboration of prior knowledge which facilitates increased retention of knowledge. Thus, PBL stimulates students towards constructive and collaborative processes which influence learning[7]. Another important review in the early 1990s was written by Albanese and Mitchell. They examined the effects of PBL and reviewed many studies conducted between 1972 and 1992. They concluded that, PBL produced some very positive outcomes in schools, in that students are highly satisfied. In addition, graduates of PBL curricula view themselves as being better prepared in independent learning skills and some studies demonstrate that PBL students demonstrate self-directed study behaviour [1].

Since 2000, several new reviews have appeared in the literature. In 2000, Colliver reviewed eight studies on PBL conducted in the period 1992–1998. All eight studies involved comparisons of curriculum tracks. Three studies were randomised and five were non-randomised. Based on these eight studies, Colliver concluded that, the literature revealed no convincing evidence that PBL improves knowledge and clinical performance, at least not of the magnitude of effectiveness hoped for with this major curriculum intervention [4]. A more recent review was conducted by Newman and others in 2012 [8]. In this review, only randomized controlled trials and quasi experimental studies were included in which student performance or other outcomes are objectively measured. They identified 91 citations, but based their conclusions on only 14 studies that met the inclusion criteria. Based on these 14 studies they concluded that, outcomes for students in the PBL groups were less favourable than those in the control group. In these reviews, only whether PBL works in terms of end-goals is investigated, but the underlying theoretical foundations of PBL are not addressed. They focus too much on scientific methods and less on the process of science or theory-building [3].

How to solve problems with PBL in Educational Practice

The problems of educational practice described above might convince critics of PBL that PBL does not work. However, we would argue that these problems are in fact implementation problems. Due to poor implementation of PBL, the learning process does not stimulate students towards constructive, self-directed, collaborative and contextual learning. In the followings, the author explains how the three problems described above need to be solved in practice, in order to implement more effectively the learning principles behind PBL.

In order to stimulate students towards constructive and contextual learning, more complex, realistic, open-ended, and ill-structured problems are needed that fit with the students' prior knowledge. In addition, students should be confronted with contrasting problems, because they are helped to appreciate the critical features of new information, to evaluate new information critically and to change their views when necessary. Steinert investigated students' perceptions about effective small group teaching and found that students emphasized on the importance of clinical relevance of problems and that they appreciate tutors who expanded the problem to another clinical situation.Steinert investigated students' perceptions about effective small group teaching and found that students emphasized on the importance of clinical relevance of problems and that they appreciate tutors who expanded the problem to another clinical situation. Arts, Gijselaers and Segers conducted a study in which they redesigned a PBL course by optimizing the authenticity of the problems and used ill-structured real-life information, gave students increased control over their learning as they worked more independently and in which they had to work in small groups and measured the outcomes [9]. They found that the redesigned PBL format contributed significantly to improved cognitive gains compared to the

regular PBL setting.

In order to challenge students and stimulate them towards self-directed learning, there should be a constructive friction between the degree of student and tutor regulation. What is needed in PBL is a transition from tutor regulation, or external guidance through shared guidance in which the student and the tutor together guide the learning process to student regulation or internal guidance. This implies that PBL curricula should be characterised by more tutor guidance at the beginning through shared guidance of both the student and the tutor to more student guidance at the end. A tutor should orientate his teaching towards the students' learning process. The best tutor knows when and how to intervene and has students' learning as his top priority [12].

In order to improve tutorial group functioning and stimulate students towards collaborative learning, tutors should evaluate the functioning of their group on a regular basis. Furthermore, tutors should learn how to deal with problems of group dynamics. If the problems used are more complex and ill-structured and if there is constructive friction between student and tutor guidance, there is a better chance that interactions in the group that enhance student learning and the collaborative learning process will occur. In addition, learning and assessment should be better integrated, which implies that assessment instruments need to be used that are consistent with the learning principles described above. This implies that more authentic assessment, more self-assessment, more peer assessment, group assessment and assessment of professional behaviour is needed.

Implications for teaching-learning process:

- PBL is an effective method for improving students' problem-solving skills. Students will make strong connections between concepts when they learn facts and skills by actively working with information rather than by passively receiving information.
- PBL promotes students' confidence in their problem-solving skills and strives to make them self-directed learners. These skills can put PBL students at an advantage in future courses and in their careers.
- Teachers who provide a good learning community in the classroom, with positive teacher-student and student-student relationships, give students a sense of owership over their learning, develop relevant and meaningful problems and learning methods, and empower students with valuable skills that will enhance students' motivation to learn and ability to achieve.
- PBL stimulates students towards constructive, self-directed, collaborative and contextual learning.
- It provides students with opportunities to consider how the facts they acquire relate to a specific problem at hand. It obliges them to ask what they need to know.
- PBL offers the potential to help students become reflective and flexible thinkers who can use knowledge to take action.

Conclusion

It has been presented in this article the details of problem based Learning that can contribute significantly to the successful learning of the students. It is not only a vehicle for developing logical as well as reflective thinking, but it can also provide students with a context for enhancing transfer of skills to unfamiliar situations and it is adorable in itself. A problem-based learning can provide a vehicle for students to construct their own ideas and to take responsibility for their own learning. PBL gives scope for the tutor/instructor/facilitator to grow cognitively along with their students. As it demands the students to envisage the problem in all possible ways, it keeps the teacher abreast with new developments related to the problem, there by keeping both the tutor as well as the student to be active throughout the learning process. The challenge for teachers, at all levels, is to develop the process of thinking and reasoning alongside the knowledge and to seek opportunities to present even routine tasks in problem based learning.

References

[1]. **Arámbula-Greenfield, T. (1996).** "Implementing problem-based learning in a college science class: Testing problem-solving methodology as a viable alternative to traditional science-teaching techniques." *Journal of College Science Teaching, Vol.*26(1),pp.26-30.

[2]. **Cindy E. (2004).** *Hmelo-Silver Problem-Based*

Learning: What and How Do Students Learn? Rutgers, New Brunswick, New Jersey.

[3]. Diana H J M Dolmans, Willem De Grave, Ineke H A P Wolfhagen & Cees P M van der Vleuten (2005). Problem-based learning: future challenges for educational practice and research, *Medical Education,* Vol.39,pp.732–741.

[4]. Dion, L. (1996). *"But I teach a large class."* Available online at: http://www.udel.edu/pbl/cte/ spr96-bisc2.html.

[5]. Knight, P.T. (2001). A Briefing on Key Concepts: Formative and Summative, Criterion and Norm-Referenced Assessment. LTSN Generic Centre Assessment Series, No.7. Available at on the Higher Education Academy's Resource Database at: www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=7

[6]. Macdonald, R.F. and Savin-Baden, M. (2004). "A Briefing on Assessment in Problem-based Learning," LTSN Generic Centre Assessment Series. Available on the Higher Education Academy's Resource Database at: www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=349

[7]. MacKinnon, M. M. (1999). "Core elements of student motivation in problem-based learning." In M. Theall (Ed.), *Motivation from within: Approaches for encouraging faculty and students to excel* (pp. 49-58). San Francisco: Jossey-Bass.

[8]. White, H. (1995). "'Creating problems' for PBL."Available on-line at: http://www.udel.edu/pbl/cte/ jan95-chem.html.

[9]. The Buck Institute <http://www.bie.org/pbl/trai.html>

[10]. Center for Educational Technologies (NASA's Classroom of the Future) http://www.cet.edu /profdev/main.html

[11]. Illinois Math and Science Academy <http:// www.imsa.edu/team/cpbl/cpbl.html>

[12]. Education by Design <http://www.edbydesign.org /assoc/courses.html>

[13]. The University of Delaware <http://www.udel.edu /pbl/>

ABOUT THE AUTHOR

Dr. B. J. Roopashree is presently working as an Assistant professor in the Post Graduate Department of Tumkur University. She worked under the Kuvempu University and Davangere University from 2004 to 2010. She has guided more than 30 M.Ed students dessertations and presented papers in many National and International conferences. Her interested research areas are constructivism, creativity, self efficacy belief and innovative methods of teaching.