

## Features and characteristics of problem based learning

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### Abstract

Throughout the years, there appears to be an increase in Problem Based Learning applications in education; and Problem Based Learning related research areas. The main aim of this research is to underline the fundamentals (basic elements) of Problem Based Learning, investigate the dimensions of research approached to PBL oriented areas (with a look for the latest technology supported tools of Problem Based Learning). This research showed that the most researched characteristics of PBL are; teacher and student assessments on Problem Based Learning, Variety of disciplines in which Problem Based Learning strategies were tried and success evaluated, Using Problem Based Learning alone or with other strategies (Hybrid or Mix methods), Comparing Problem Based Learning with other strategies, and new trends and tendencies in Problem Based Learning related research. Our research may help us to identify the latest trends and tendencies referred to in the published studies related to “problem based learning” areas. In this research, Science Direct and Ulakbim were used as our main database resources. The sample of this study consists of 150 articles.

Keywords: Problem based learning, literature review, new trends, technology

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## 1. Introduction: Features of PBL

Problem Based Learning(PBL) is a learning method through which the learners gain and develop upper level skills such as problem solving and critical thinking while eliciting information from personal real life experiences and acquiring determinate knowledge about their own learning (Wadani, 2014). It is a method utilizing a constructivist approach, with which students strive to solve daily issues in collaborative environments.

Problem based learning is entirely different from deductive teaching. In the former, in each case, learners face a new/different event/problem, which is undefined. Learners are asked to identify the essential knowledge required in order to comprehend the problem. PBL is a method that requires learners to work in groups. Thus, learners learn to work collaboratively to find solutions for real-life problems (Chagas et al., 2012; Wiznia et al., 2012).

PBL is an instructional method aimed at preparing students for real-world settings. With requiring students to solve problems as the main format of instruction, PBL enhances students' learning outcomes by promoting their abilities and skills in applying knowledge, solving problems, practicing higher order thinking, and self-directing and reflecting their own learning (Hung, 2013).

Cindy and Hmelo (2014), schematized the PBL process as a cycle which may loop several times until successful learning establishes.

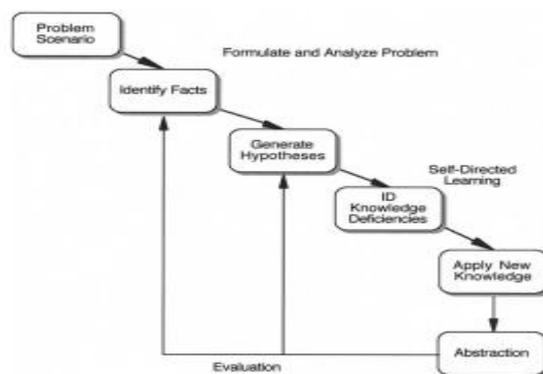


Fig.1. Problem-Based Learning (PBL) cycle

It has also been underlined that, PBL is designed with several important goals. It is designed to help students:

- 1) construct an extensive and flexible knowledge base;
- 2) develop effective problem-solving skills;
- 3) develop self-directed, lifelong learning skills;
- 4) become effective collaborators; and
- 5) become intrinsically motivated to learn.

(Cindy & Hmelo-Silver, 2014)

On the other side White on 2001, emphasized that while the content and structure of PBL courses may differ, the general goals and learning objectives tend to be similar. In his research, White (2001), indicates literature review shows that PBL is characterized by a student-centered approach, teachers

as “facilitators rather than disseminators,” and open-ended problems (in PBL, these are called “ill-structured”) are common. Learning is “student-centered” because the students are given the freedom to study topics that interest them the most and to determine how they want to study them. Students should identify their learning needs, help plan classes, lead class discussions, and assess their own work and their classmates’ work.

White (2001), emphasizes the role of the instructor in PBL, indicating that they play a critical role in helping students become self-directed learners and must create a classroom environment in which students “receive systematic instruction in conceptual, strategic, and reflective reasoning in the context of a discipline that will ultimately make them more successful in later investigations”.

In his research White (2001) also stresses that group work is also an essential aspect of PBL for several reasons. First, group work helps develop learning communities in which students feel comfortable developing new ideas and raising questions about the material (Allen, Duch & Groh, 1996). In addition, group work enhances communication skills and students’ ability to manage group dynamics. Finally, group work is interesting and motivating for students because they become actively involved in the work and are held accountable for their actions by group members (Cohen, 1994). For these reasons, group work can enhance student achievement. However, groups do not always work effectively without guidance. Usually the instructor facilitates and monitors group interactions because many students have not been taught how to work effectively in groups (Bridges & Hallinger, 1996; Wilkerson, 1996). Well designed, open-ended problems that require the input and skills of all group members also are essential to positive group work experiences (Cohen, 1994).

Yet, due to the individual nature of their responsibilities within the team, learners are also compelled to work in a student-based style. The learning process is far more active. The teacher has various roles in this educational approach, namely the teacher is the narrator, resource supplier, and coach. Moreover, the PBL approach develops learners’ critical thinking skills (Kong et al., 2014) and teaches how to solve complicated real-life problems. This is a process during which learners discuss, debate, write, and consequently learn to work collaboratively in a group (Akca, 2009).

As noted by White (2001), in PBL literature the term “ill-structured” is used to describe open-ended problems that have multiple solutions and require students “to look at many methods before deciding on a particular solution” (Shelton & Smith, 1998). Educationally sound, ill-structured problems “help students learn a set of important concepts, ideas, and techniques” (Gallagher, 1997, p. 338) because they provoke group discussion and give students experience solving problems encountered by experts in the field. Students recognize these problems as professionally relevant. Therefore, students are more likely to be motivated to work on them (as opposed to discrete problem sets or textbook exercises), not only because they realize that the knowledge they gain by thinking about these problems will be useful in the future, but also because students are typically given significant opportunities for creativity and flexibility in solving PBL problems (White, 2001).

Although predominantly employed in higher education, the PBL method was initially developed in disciplines with which it was compatible. Thus, it was mostly applied in faculties of medicine (Harris & Kloubec, 2014). Parallel to the development of new technologies, research results indicate that web-based PBL is being used more extensively in education (Bozic, 2011; Cosar, 2013).

## **2. Advantages and Disadvantages of using PBL**

Overall, these studies verify that problem-based learning has both its advantages and disadvantages. Teachers and learners can view these pros and cons differently. For example, while some researchers reflect on either teacher or learner perspectives only (Cheong, 2007), some others display their results on each stakeholder separately (Utecht, 2003; Tick, 2007).

The advantages of PBL for teachers and learners can be listed as follows:

- PBL allows learners to take the responsibility of their own learning
- Group projects allow learners to develop their adequacy in teamwork
- Individual homework allows advanced students to display their highest performance, leadership attempts, and creativity

(Kumar & Rafaei, 2007; Utecht, 2003; Cheong, 2007; Hung, 2013; Seng, 2012; Guzelis, 2006; Klegeris & Hurren, 2011).

Some research found which especially focuses on the advantages and disadvantages of PBL, has been done for the disciplines of Medical Studies and Chemistry Studies. The advantages in Medical Studies applications being:

- Using PBL makes curriculum content relevant
- PBL helps focus learning on core information
- Foster the development of valuable transferrable skills
- Facilitate trainees become responsible for their own learning
- Increased motivation
- Encourage a deep rather than surface approach to learning
- Use a constructional approach to learning (Jones, 2006)

The advantages of PBL in Chemistry Studies being:

- PBL helps develop working skills within groups
- PBL helps develop problem solving skills
- PBL helps build information that's more remembered
- PBL helps building alone learning skills
- PBL helps achieve collaborative learning skills
- PBL helps build a positive manner and motivation
- PBL helps students build communication skills
- PBL helps students increase their skills of using resources (Tatar, Oktay, Tuysuz, 2009)

The disadvantages of PBL in Medical & Chemistry Studies being:

- Difficulties for teachers in using PBL
- Difficulties for students in using PBL
- Less knowledge acquired through PBL
- More time required for students

(Jones, 2006; Tatar, Oktay, Tuysuz, 2009)

The limitations are:

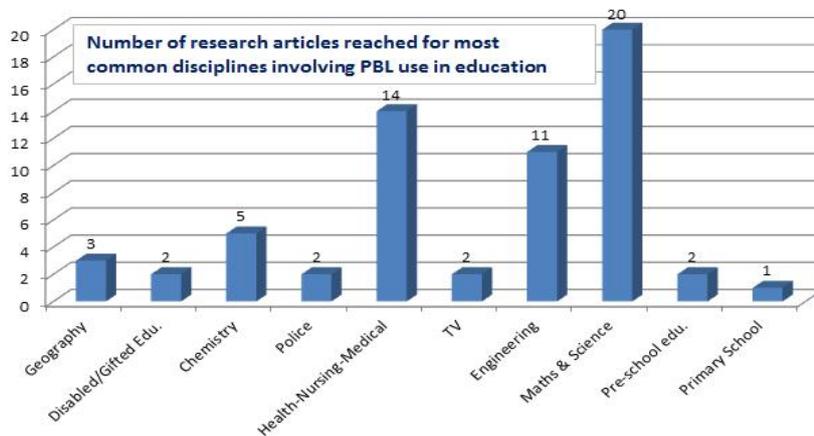
- Teachers might have difficulties adapting to new teaching styles
- Students might need more time to solve problematic issues

- Groups or individuals might complete their work earlier or later than originally planned
- PBL requires wealthier research resources and studies
- PBL may not be applied in all classes
- The dimensions of learning might need to be defined differently and more profoundly in each case

(Sindelar, 2002; Park & Ertmer, 2008)

### 3. Using PBL in different disciplines

Number of research articles reached for most common disciplines involving PBL use in education.



**Figure.2.** Number of PBL Research distribution referring to disciplines applied

This research shows that, Maths & Science education uses more PBL applications than others including the leading category Health for years. University/Engineering education applications follow them. Other disciplines either use less PBL research/projects or the outcomes are not being reflected to public as thesis or articles.

Discipline PBL is Used	Research Number	Number of results valued as satisfactory	Percentage (%)
Geometry	3	2	66
Disabled/Gifted	2	1	50
Chemistry	5	3	60
Police	2	2	100
Health	14	10	71
Media/TV	2	1	50
Engineering	11	5	45
Maths & Science	20	13	65
Pre-school	2	2	100
Primary	1	1	100
TOTAL	62	40	70,7

**Figure.3.** Distribution of PBL Applications research results evaluated as “successful”

The authors evaluation of success achieved in these researches as an average of all in total exceeds 70%, and this result may be assessed as satisfactory. It also appears that, there is very little Primary school and pre-school PBL applications ongoing or the findings for these disciplines are not being reflected to public as thesis or articles.

#### 4. Conclusion: New technologies and the future work for PBL

New technologies provide new possibilities to enhance and apply Problem Based Learning more successfully. A number of new tools introduced on this platform: video podcasting, wi-fi, networks, web & internet use in apps. are the most promising ones which were observed and discussed in research studies (Figure 4). The majority of associated results showed a clear success and promise for the future of using PBL. (Kay & Kletskin, 2012; Koray & Koray, 2013; Cosar, 2013; Blackbourn & Fri, 2008; Tsai, Lee & Shen, 2013; Hsu, Hwang, Chuang & Chang, 2012; Lee, Shen, Tsai, 2010; Lo, 2009).

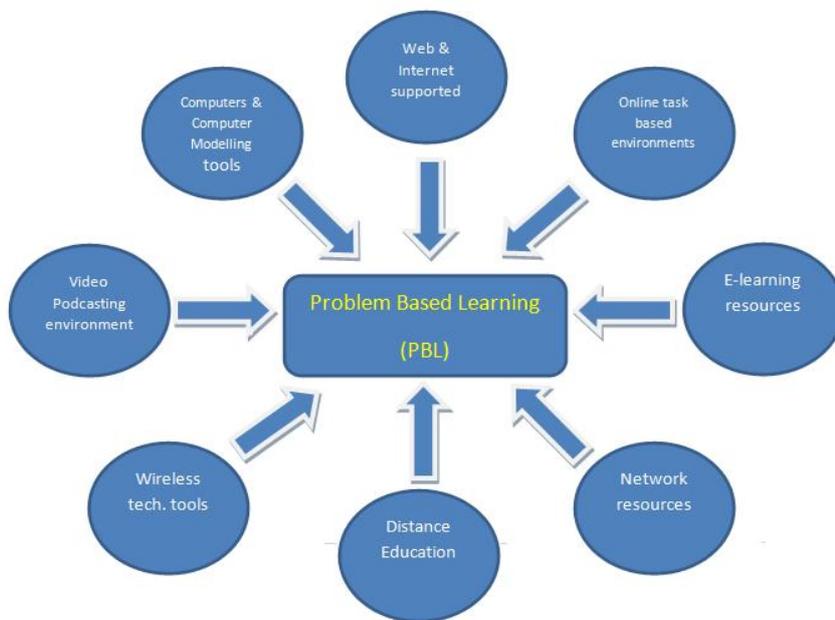


Figure.4. New technology support to PBL Applications and connections reflected to research

Trends of research in PBL between 1992-2002 was investigated by Dolmans and friends (2002) with some outcomes revealing that content expert tutors tend to use their subject-matter expertise more to direct the discussion in the tutorial group, whereas non-content expert tutors tend to use their process-facilitation expertise more to direct the tutorial group. Furthermore, a tutor’s performance is not a stable characteristic but is partly situation specific. It is concluded that a tutor should both know how to deal with the subject matter expertise and should know how to facilitate the learning process. Faculty and policy makers should put substantial efforts into designing curricula and cases and developing tutors’ skills by faculty development strategies that stimulate reflection. The research agenda should be driven more by modern educational theories of learning in which tutoring is a process aimed at stimulating constructive, self-directed, situated and collaborative learning by students. Furthermore, more qualitative studies should be conducted to gain better

insights in teachers' conceptions about the tutor role and student learning to better understand their behaviours (Dolmans & fri, 2002).

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