

# Effective Strategies for Integrating E-learning in Problem-based Learning for Engineering and Technical Education

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## Abstract

E-learning, through any Learning Management Systems (LMS), can be used to enhance and aid the implementation of problem-based learning (PBL). In UTM, an open-source LMS, Moodle, is being used. Through e-learning, learning can take place anywhere and anytime through the communication tools that it has. This feature provides a channel of communication among students and lecturers that is not bounded by the class time and physical presence. Therefore, e-learning has been identified as a learning system that can greatly enhance the implementation of PBL among university students. The purpose of this paper is to put forth effective strategies for utilizing e-learning in PBL for engineering and technical education. Some effective strategies that have been identified are: (1) the use of online assignment tool to deliver PBL problems to students, (2) the use of both synchronous communication tools (such as chatting) and asynchronous communications tools (such as forum and journal) for discussion and assessment, (3) lecturer-initiated communication for the PBL case on the e-learning platform, (4) frequent availability of lecturers online for facilitation, and (5) the use of online journal for reflection and assessment. These strategies enable a more efficient and effective implementation of PBL.

*Keywords: Problem-based Learning, e-learning, Learning Management System*

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## 1. Introduction

Most educators plan and aim the best for their students. They will always reflect their teaching style in term of its effectiveness in helping students to learn. This is a normal process that should happen among educators. They will keep searching the best teaching and learning process should be implemented in their classes. According Krynock & Robb (1996), educators search for ways to make curriculum and learning more relevant to their students. There's always too much to teach and too little time. One of the ways to make the learning process more meaningful is through a Problem-based Learning (PBL) approach.

According to Boud (1985), PBL is a learning process that is centered on 'a problem', a query or a puzzle that the learner wishes to solve'. In PBL, a problem acts as a stimulus for learning where students have to understand and analyze the problem from multi-

perspectives individually or in groups. The problem will drive the learning where students are not only required to seek a correct answer for the problem, but they have to interpret the problem, gather needed information, identify possible solutions, evaluate options, and present conclusions that are related to the problem. While going through the PBL process, students will construct knowledge with the help from knowledge they have gained previously (Cross, 1998). In group discussion they will get benefits from working together, and they may learn best from teaching each other (Annis, 1983; McKeachie, et al., 1986). According to Ewell (1997), students learn best in the context of a compelling problem where they will learn through experience (Cross, 1999).

PBL is one of the learning approaches with underpinnings on cognitive and social constructivist learning theory (Jee Park, 2001). Through PBL, a learning process will be more active compared to the

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traditional learning situation which is based on a lecture method. Figure 1 shows the differences between lecture and PBL approaches.

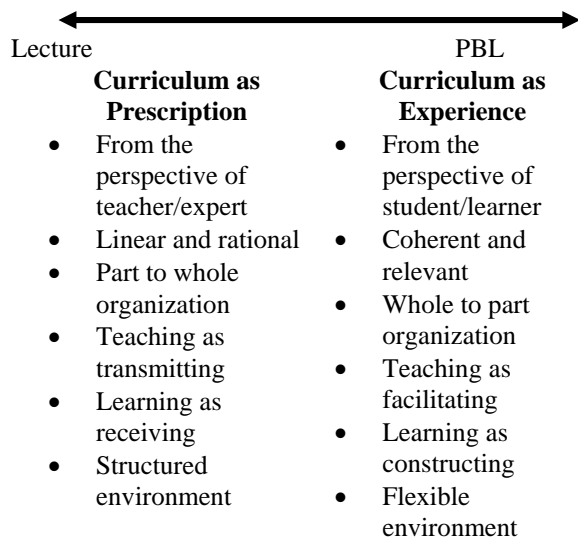


Figure 1. Differences Between Lecture and PBL Methods (Source: Illinois Mathematics and Science Academy (IMSA) (2005))

Many researches have shown the effectiveness of PBL in enhancing students' performance in learning. According to Albanese & Mitchell (1993) students in PBL courses often report greater satisfaction with their experiences than non-PBL students.

Norman and Schmidt's (1992) review found that students taught with PBL curricula were superior in knowledge retention but inferior in overall knowledge and competence when compared with students taught by traditional curricula. Vernon and Blake (1993), concluded that PBL students' attitudes, class attendance and mood were better than those of students in traditional teaching institutions. The review by Nandi et. al, (2000) concluded that PBL students consistently find their course more enjoyable and demonstrate better interpersonal skills compared with traditionally trained students. The most recent review, conducted by Newman (2003), indicated that PBL students report greater satisfaction and employ more productive approaches to study.

### 1.1 E-learning and PBL

Bristol University (O'Leary et., al., 2003) defines e-learning as

*The use of electronic technology and media to deliver, support and enhance teaching, learning and assessment. It includes elements of communication within and between communities of learners and teachers, as well as provision of online content, which may be locally generated or developed elsewhere (draft e-learning strategy)*

From the definition, it indicates that e-learning not only involves the process of delivering information but includes the elements of communication between lecturers and students, as well as the strategies used in the online content.

Nowadays, information that was once only available in textbooks, conferences and journals is now making its way onto the World Wide Web. Students are now commonly regarded as consumers and come to learning institutions with expectations of a quality learning experience. If they experience anything less than what they want, there are other institutions that are willing and able to accept them. Up until recently, the used of e-learning has worked well enough for universities around the globe including Malaysia. Learning can take place anywhere and anytime through the communication tools in e-learning. With this, e-learning has a potential to be integrating in PBL learning environment. The integration of e-learning in PBL would not change the principles of PBL itself. It will, in fact, enhance the implementation process of PBL in terms of delivering a PBL case to the students and facilitate communications among students and also the lecturer.

There are currently several PBL implementations in engineering and technical classes in UTM that is integrated with e-learning. In the Faculty of Education, e-learning was used with PBL in several subjects under the Multimedia Department. In Faculty of Mechanical Engineering, e-learning was used for facilitation outside of classroom. For PBL induction, e-learning is heavily utilized in a first year chemical engineering subject to develop skills for PBL. Forums and assignments were designed to develop students' reading and thinking skills, articulation and delivery of ideas, team building and team working, and communication skills.

The purpose of this paper is to put forth effective strategies for utilizing e-learning in PBL for engineering and technical education. This paper also will discuss students' perceptions toward the integrating of e-learning in PBL among students.

## 2. Research Objectives

The objectives of this research are:

- i. To identify students' perceptions toward integrating e-learning in PBL
- ii. To identify effective strategies for integrating e-learning in PBL for Engineering and Technical Education

## 3. Research Methodology

This research used a qualitative research design i.e. a case study method. About 49 students from Faculty of Education in a technical subject called "Authoring Language". Data had been collected from students' conversation texts in the electronic forum, chatting and electronic journal in the e-learning system itself. Questions relate to integration of e-learning in PBL had been posted in an electronic forum and students are required to respond to those questions on voluntary basis.

## 4. Data Analysis and Results

The qualitative data that has been collected has been analyzed based on the common themes that have been identified. The constant comparative method has been used to analyze the qualitative data.

Findings showed that students' perceptions toward PBL through e-learning were positive in terms of Relevance (mean = 4.19), Reflective Thinking (mean = 3.69), Interactivity (mean = 3.26), Tutor Support (mean = 3.87), Peer Support (mean = 3.24), and Interpretation (mean = 3.59) (Zaidatun et.al, 2005).

### 4.1 Perceptions Toward Integrating E-Learning In PBL

Two questions have been posted in an online forum. Below are some of the responses that have given by the students. From the responses, several common themes have been developed

Question 1:  
Combination of e-learning and PBL? What do you think about it?

Theme 1:  
Encourage students to take part in their learning activities.

*S1: The combination of PBL and e-learning can encourage the students to take part in their learning activities and always be alert about the up-coming PBL.*

*S4: ...encourage us to interact with the lecturer and fellow course mates .we might not be able to do these kinda things in class (maybe some of us are introverts, malu-malu kucing, suddenly jadi inarticulate dlm kelas*

Theme 2:  
Give chance to students to work on their own.

*S2: ... I have to say that i really like the combination of PBL and e-learning.it gives us a chance to work out things, solve problems, (and really learn!) on our own. okay, ..*

*S9: .. encouraging the students to share their view points and ideas in the forums anytime they want ... it gives opportunity to me to work on my own.*

Theme 3:  
Good Idea.

*S3: PBL and elearning, hm...it's good to apply PBL through elearning. Faster, individualised and clear.*

*S7: it's an good idea where students get to do brainstorming ...*

Theme 4:  
New idea.

*S2: emmm.. it's a new idea!!*

*S4: Fresher idea instead of depending too much on lecture.*

Question 2:  
Are you ready to use e-learning in PBL?

Theme 1:  
Yes

*S8: Yes, of course.*

*S1: Yes. Definitely*

Theme 2:  
No

*S10: No... because my room has not have Internet line.*

*S13: I think I'm not unless we had internet facilities in every room. but of course I support the usage of e-learning in PBL.*

From the responses, it can be concluded that students expressed positive comments on the given questions.

#### 4.2 Effective Strategies For Integrating E-Learning In PBL

For the second research objective, three questions have been posted in an online forum. Below are some of the responses given by the students. From the responses, several common themes have been developed.

##### Question 1:

What kinds of strategies that you think the lecturers should use in integrating e-learning in PBL?

##### Theme 1:

The use of online assignment tool to deliver PBL problems to students

*S1: Well through e-learning, we can get the PBL case faster than the last time.*

*S2: The best way is.... Post the PBL case through assignment tool in the e-learning.*

##### Theme 2:

The use of both synchronous communication tools (such as chatting) and asynchronous communications tools (such as forum and journal) for discussion and assessment

*S4: Lecturer has to use chatting to facilitate us in understanding the PBL problem... we are waiting in the chat room... if the lecturer can't online coz busy... while use forum.*

*S5: I hope the lecturer can always response to my questions in the forum and also the journal...*

##### Theme 3:

Lecturer-initiated communication for the PBL case on the e-learning platform

*S6: ... If the faculty wants the students to correlate e-learning in PBL process, the lecturers should practice the use of it first e.g. post notes from classes online, hold a discussion/forum etc.*

*S8: After received the PBL scenario... usually we are waiting for the lecturer to start first the discussion through any communication tool that e-learning has. Thank God.. she did it.*

*S4: I always will wait the lecturer to start first the discussion on the given problem... before I start giving my ideas... Well at first no idea lah... wait and see first.*

##### Theme 4:

Frequent availability of lecturers online for facilitation

*S7: Sometimes while discussing the scenario... we always face some problems and at that time we need our lecturer... so lecturers should always online.*

*S9: Our lecturer always online I think... twice a day... to help us in understanding the case. Sometimes she put a schedule when she will be online in the chat room waiting for us. I'm not going to miss this... usually.*

##### Theme 5:

The use of online journal for reflection and assessment

*S2: Based on my experience using online journal before this... it is one of the best strategies that e-learning offer for PBL. From the journal... I can reflect my thinking.*

*S9: This semester my lecturer use online journal for self-reflection. I think the journal really help my group to understand the problem... It's like one to one discussion between a student and a lecturer in a room.*

##### Question 2:

What are your advices (in term of strategies should be used) to other lecturers who plan to use the e-learning in PBL?

##### Theme 1:

Be patient

*S1: Don't be frustrated if students did not involve actively in the forum... sometimes we also busy with other classes... just a word.. be patient*

*S8: I hope other lecturers that plan to use e-learning in PBL ...must always patient with students because sometimes we like to make jokes and not taking the learning seriously.*

##### Question 3:

Which communication tools that really help your group in solving a PBL problem?

##### Theme 1:

Online forum

*S1: Communication tools that I like most are email and forum coz i don't like chatting!*

S2: *the communication tools that i like most? hm...lemme see...forum?*

S4: *the forum is the coolest part as we get the chance to go through different types of discussion from each and every different individual.*

S5: *I prefer...forum,because can give own opinions, more learner-centred.*

S6: *forum....allowing students to ask questions.*

## 5. Conclusion

From the themes that have been identified, students show positive perceptions toward integrating of e-learning in PBL where the integration:

- i. Will encourage students to take part in their learning activities.
- ii. Will give chance to students to work on their own.
- iii. Is good and a new idea

Most of the students are ready to use e-learning in PBL except a few of them who are not ready due to lack of Internet access in their room.

Some effective strategies that have been identified for integrating e-learning in PBL are: (1) the use of online assignment tool to deliver PBL problems to students, (2) the use of both synchronous communication tools (such as chatting) and asynchronous communications tools (such as forum and journal) for discussion and assessment, (3) lecturer-initiated communication for the PBL case on the e-learning platform, (4) frequent availability of lecturers online for facilitation, and (5) the use of online journal for reflection and assessment.

Although PBL has been seen as one of the method to nurture employability skills, according to Savin-Baden & Major (2004), it has to be seen as an approach to learning that really does help students to engage with and live in a complex world.

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