Implementation of Problem Based Learning in Higher Education Institutions and Its Impact on Students' Learning

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Abstract

Problem-based learning is a teaching strategy which emphasizes active learning. This study aims to identify the strategies and the effect of PBL in teaching and learning in higher education institutions. In addition, the study also aims to identify the level of students' satisfaction towards the use of PBL in their learning. This study combines quantitative and qualitative methods with descriptive design. The instrument consists of a set of questionnaires and semi-structured interviews. The questionnaire was administered to 226 undergraduates in an institution of higher education who were chosen randomly. Interview sessions were carried out on eight selected respondents. Quantitative data were analyzed using descriptive statistics while content analysis was adopted to analyse qualitative data. The results show that students were able to solve the problems presented using lecture approach, group activities, lecturer guidance and independent learning. The findings also show PBM could enhance soft skills particularly on students' motivation, communication skills, collaboration and independent learning. Students also found to have positive perceptions towards the implementation of PBL in their learning process. In conclusion, PBL is a teaching strategy that needs to be applied in the process of learning in higher institutions towards the development of students who are brilliant and skilled.

Keywords: Problem Based Learning. Higher Education, Teaching and Learning, Teaching Strategies;

1. Introduction

Problem Based Learning (PBL) was first introduced in the world of education in the 1960's by Professor Dr. Howard Barrows at McMaster University, Canada in the medical field (Hung, et al, 2009; Norhaslini, 2011). It was then expanded to other medical schools around the world, such as Michigan State University in the United States, Maastricht University in the Netherlands, and Newcastle University in Australia (Barrows (1996) in Hung, et al, (2009). Consequently, PBL is then expanded in other fields such as engineering, economics, science, language, history and education. Currently, problem-based learning approach and the use of real cases or PBL has been one of the very popular curriculum innovations in education. It is because this approach encourages students to be transparent, flexible, having diversified ways of thinking and is considered as a paradigm of multidisciplinary studies. It also integrates learning content with real-life applications through the context of a particular problem or. Accordingly, PBL has become a major focus of education researchers in the development of civilization in the 21st century.

Problem Based Learning (PBL) is a learning method which uses 'real problem' as a trigger in problem solving. Through PBL, students actively identify learning needs with the help of facilitators. Barrows and Tamblyn (1980) defines PBL as a direct result of the learning process to understand or solve a problem. Problem discovery is the first step in the PBL learning process. This problem serves as a boost and by focusing on the use of problem-solving skills and reasoning, students are encouraged to find new information and organize existing knowledge. Consequently, the problem is finally resolved.

Tan (2003) states that PBL design focuses on first solving problems presented to students. The second aspect is seen in terms of the role, expertise and guidance of a facilitator. Moreover, if viewed in terms of the students' role, the main focus is the involvement of students which shift from being passive to actively solve a given problem. According to Graaff and Kolmos (2003), PBL education strategy can solve problems during learning process. Goodman (2010) also supported the idea by stating that (2010) through the use of problems in PBL, students are motivated to learn concepts and ideas. Usually the problems starting from the day-to-day issues and customized based on the objectives and criteria of education. The process of learning using problems can be summarized as Figure 1.

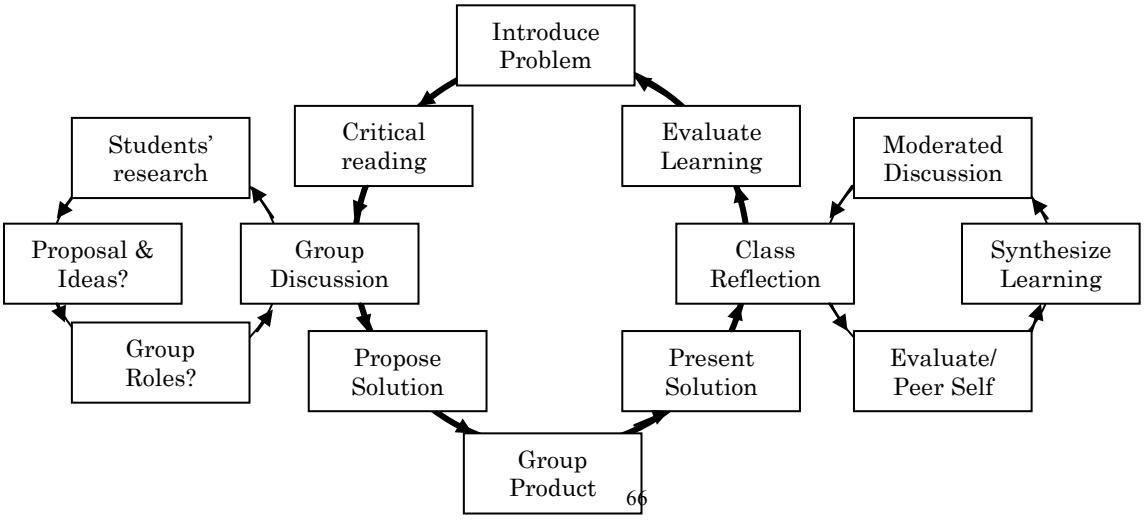

Figure 1. Problem Based Learning Process

Based on Figure 1, PBL process starts by submitting critical reading and identifying problem and then followed by a group discussion. In groups, students conduct research; formulate ideas in groups until reaching proposed settlement. Through process improvement, outcome is presented in class and discussed. Assessment is carried out in the class, followed by group learning and discussion of the proposed conclusion. Finally assessments are done either through implementation of successful problem solving goals. In other words, PBL is an inductive learning methods, namely the learning of specific things that lead to more general (Goodman, 2010). Now, PBL is ranked as one of the alternative strategies in teaching either at school or higher education institutions.

1.1 Problem Based Learning in Higher Education Institutions

Perspectives on learning in higher education (HE) involve the implementation of a curriculum that is abstract and requires high level thinking skills. Knowledge in HE needs to be delivered until the facts can be applied to a related situation (Wood, 1997). Thus, the activity of critical and creative thinking should be found in every university course in order to ensure the application of knowledge. However, a study showed that the application of higher-order thinking is very limited as most of teaching and learning methods in HE using lectures (Lyle et al (2001).

Lectures are based on the theory of deductive approach that considers learning as a process of knowledge transfer from a lecturer to students. Students will gain only the validity and accuracy of information presented without the need to think more about it. In fact, learning is defined as permanent changes in human behaviour due to interaction with the environment. Learning is a change in an individual as a result of experience. People began to learn since they were born, and learning is related to experience (Slavin, 2005). These changes occur in cognitive structure established by the process of assimilation and accommodation as a result of the interaction between a person and the environment (Hill, 2002).

Class activities which require students to listen passively and recall information will not promote critical thinking (King and Kichener, 1994). As a result, institutions of higher learning cannot produce graduates who possess high level of thinking and fail to meet the criteria set by their potential employers. Courses in higher education should employ appropriate teaching and learning approach. The approach should utilize the basics of high-level thinking and enable students to manipulate information and ideas. Consequently, it can encourage students to find meaning and implications when they attempt to connect between facts and ideas.

In order to achieve this purpose, PBL is considered as one of the strategic ways to improve higher-order thinking. The implementation of PBL involves teaching through problem solving in groups on real life situations which require students to think critically to solve given problems. PBL nature of the research process is able to guide students to learn the concepts or content effectively. PBL conclusion is needed to ensure future graduates have life-long learning skills. In addition, PBL produces graduates who have the skills to solve problems and also possess analytical and critical thinking. In addition, PBL graduates will be able to integrate knowledge and skills in various disciplines, acquire soft skills and able to work in teams.

1.2 Importance of PBL to Improve Soft Skills Among Students

Communication Skills

Students had indicated in a study that good communication and interaction between groups of friends is the most important factor that can promote their learning in PBL. Interaction with a group of friends is important in PBL because students have to turn and share information while they try to solve a given problem. So indirectly PBM can implement and enhance good communication skills among students. This is supported by Barrows and Tamblyn (1980) which states one of the main objectives in PBL is that students will be able to enhance their communication skills.

Cooperation Group

According to Wee (2004), to be a student and a skilled workforce, a person needs to have strong communication skills and decision-making skills are also necessary in order to be a competent workforce. What is certain every student should have an outstanding achievement in whatever endeavor. The study also found that atmosphere in PBL group discussion which encourages collaboration can also influence students interest in PBL. Furthermore, findings in a study showed 79% of students agreed that activities which promote discussion enhance their interest in PBL (Drawn Norbaizura, 2009; Gibbon and Wall, 2000). A study by A. Nafis (1999) highlighted that students agreed that the atmosphere in group discussion and the act of collaboration influenced their academic performance. Consequently, the students earned grade point average from 3.50 until 4.00.

Similarly, in a study that was conducted by Mpofu et al (1998), 27 students preferred to work in groups since it can affect their learning. According to Wee (2004), excellent individuals can improve and overcome any weaknesses. Influence on individual and group is certainly one of the elements found in PBL process. If students work in teams, it will be easier to solve problems than working individually. Thus, the students will be more brilliant and mature as compared to those who go through traditional mode of learning.

Self Learning Skills

Norbaizura (2006), found that respondents agreed that one of the advantages of PBL is that it can promote self-learning skills in them. This was supported by A. Nafis (1999) who obtained a similar result. According to Wee (2004), the objectives and advantages of PBL are promoting independent learning skills. Through management of a given problem, students are responsible for their own learning. Linking existing knowledge as the first step to manage the problem, students will know their limits and what is needed for learning. They will learn to find, evaluate and synthesize new learning from a variety of credible sources, including books, journals, magazines, internet, qualified advisors, facilitators and experts in related fields.

Independent learning is relevant to be adopted by students because it will yield effective results. Students will be able to update their learning and skills effectively and efficiently. As a result, students are able to cope with new challenges that lie ahead, especially in the future working environment. In addition, other advantages of PBL is that they can learn something new through past mistakes as PBL is not a linear process (Wee, 2004). Existing processes in PBL allow students to obtain relevant information and relate the information obtained with the existing information. They also will discuss and debate the information. In addition, they will also identify whether the knowledge gained is adequate or not to solve a given problem. Students are also encouraged to reflect and always ready to solve new problems.

Perception refers to the views of students on several aspects of Problem Based Learning (PBL). Siti Norbaizura (2006) conducted a study to examine students' perception on PBL. Majority of students felt that PBL encouraged them to learn independently. A study conducted by Gibbon and Wall (2000) found that 75% of students agreed that PBL increased their motivation to learn. This is because, self-study creates independent students. Students are able to pursue knowledge independently especially in terms of acquiring information technology skills which can assist them in understanding topics of study.

According to Rogers (1994) in Mok (2003) self-study is equal to the change and growth of a person since naturally all people have the desire to learn. During self-study, lecturers can only act as facilitators, who perform tasks such as building positive learning environment and explain the purpose of learning, compile and build the source of information. In addition, facilitators also serve to balance between intelligence and emotional components as well as share their feelings and the views of students. Besides this, students felt that PBL encouraged them to learn continuously. This notion was found in a study by A. Nafis (1999). This effort is vital to the government's mission to promote lifelong learning culture among its citizens.

Critical and Creative Thinking Skills

In addition to the above points, the study conducted by Siti Norbaizura (2006) showed that students felt that they needed to apply their Critical and Creative Thinking Skills (CCTS) in order to solve the problems in PBL. According to Mok (2003), critical thinking is defined as the use of operational thinking which forms the basis for analysing. The operational use of thought is interpreted as the basis to analyze, interpret and evaluate an argument. Poh (2000) stated that critical thinking skills can be divided into two smaller components namely; analyse ideas and analyse arguments. Analysing and comparing ideas include the ability to distinguish, classify, and examine the relationship between overall ideas or sequence. Analysing arguments include finding causes and conclusions or make assumptions. Assessing skills are also divided into two sub-components namely; evaluating information and assessing the reliability of information. Making analogies and conditional reasoning also includes assessing element inference. It is clear that all the components of thinking skills can be generated through the use of PBL in teaching and learning. This is because all of the components of such skills are needed during a given solution.

PBL has the potential to enhance the effectiveness of teaching and learning, particularly in developing higher-order thinking skills and promoting soft skills among students. However, the question lies in the strategy of PBL implementation and the impact of the implementation in the process of teaching and learning in higher education institutions. What about the level of student satisfaction towards teaching and learning using PBL approach? Therefore, a study was carried out in higher education institutions to:

1. Identify the implementation of Problem Based Learning in the process of teaching and learning in UTM.
2. Describe the effect of the implementation of Problem Based Learning in teaching and learning in UTM.
3. Identify the level of students' satisfaction towards teaching and learning using Problem-based learning approach.

2. Research Methodology

This study uses quantitative and qualitative methods with descriptive design. Descriptive explanations explain the phenomenon while the quantitative method was supported by interviews to strengthen the findings. The study population consisted of 226 students from an institution of higher education who were chosen randomly. Data were obtained using questionnaires and interview questions. A set of questionnaire with 31 items examined strategy, impact and level of students' satisfaction towards the teaching and learning process using problem-based learning approach. Five-point Likert scale was used for the collection of information. Data were analysed using Statistical Package for Social Science (SPSS 17.0) to obtain mean value. Interviews were conducted on 15 selected undergraduates. Pre-recorded interview data were transcribed and analyzed using content analysis techniques.

3. Results and Discussion of Study

3.1 Problem Based Learning Implementation Strategy

Table 1. Strategy implementation of PBL in higher education institutions

No.	Some of your subjects will be taught using problem-based learning (PBL) approach. At this stage, how often do you think you will be doing the following activities in the PBL subjects?	1	2	3	4	5	MEAN
1	Attend lectures using PBL	0	9	17	130	70	4.15
2	Work in a PBL group led by a teacher	0	0	9	130	87	4.35
3	Work in unsupervised PBL groups	0	43	52	87	43	3.58
4	Find resources on-line/library to solve problems in PBL	0	17	26	122	61	4.00
5	Write PBL individual reports	0	17	87	122	0	3.46
6	Write PBL group reports	0	0	26	148	52	4.12
7	Work in a PBL laboratory/workshop	0	0	26	130	70	4.19
8	Sit exams and tests in PBL courses	0	17	52	122	35	3.77
9	Give presentations in PBL class	0	0	9	174	43	4.15

(1=never, 2 =rare, 3= sometimes, 4=often, 5=always)

Collaboration lectures and group activities based on problem

The results showed that the PBL sessions were dominated by lecture sessions (mean = 4.15) as well as group work (mean = 4.35). Regular lecture activities were implemented as university lecturers and students were expected to accomplish the credits based on the courses taken. Lecture activities were also implemented to provide a brief guide of the problem presented and the concepts to be learned by students. However, lectures were no longer dominated by a strategy of chalk-and-talk only. Instead lecture activities became the medium for lecturers and students to submit problems to be solved in group activities. This is further described by the following interview transcript:

Students: We present the lecture session ... lecturer will explain the problems we need to solve ... lecturers also guide us in group discussions on strategies to solve the problem, such as what the important issues that should be known and the information should be sought ...

Active learning

The results also show that students were given active roles in problem-based learning such as learning in groups (mean = 4.35):

Researcher: Describe the activities undertaken during the implementation of PBL.
Students: We were divided into small groups ... I have a group of 4 and 5 ... then we were asked to discuss ... appointed as leaders, loggers, and search information ... during the discussion, faculty members will come and ask for the issue and the information we have obtained ...

The transcript indicates PBL implementation based on active learning in groups. This is in line with Zaleha and Daliyanie, (2011) who suggest that PBL is a method implemented in collaborative learning, where students will not be given content. Thus students are encouraged to play an active role during the learning process in order to obtain information and knowledge to solve problems. Zaleha and Daliyanie (2011) also add that students often find their own information related to the problem presented in Problem Based Learning.

Guidance to students

The findings also indicated that there existed process guidance to students and monitoring processes particularly in group activities. The majority of students stated that they sometimes were asked to work without a guided group (3:58).

Researcher: Did lecturers provide guidance?
Student: There is ... time in the group, particularly, the lecturer asked us to list the issues that have been known, not known and need to know...
Researcher: What happened in large lecture?
Student: Lecturer gives a lot of motivation and strategy to solve the problem in an orderly fashion..
Researcher: Did you need coaching from lecturers?
Student: Yes ... We do not know if there a way to start ... do not know the right way to solve the problem...

This shows that students still need help and guidance from lecturers when accomplishing group assignments. Lecturers play important role in the success of group discussions. Zaleha and Daliyanie (2011) support the issue when they said that students still need guidance and attention while conducting PBL. Teachers are important in promoting and guiding students' participation in PBL activity.

3.2 The Effect of Applying The Problem Based Learning Among UTM Students

This study focused on the effect of the implementation of problem-based learning discussion on motivation, self-learning, collaborative and communication skills. The data are shown as Table 2.

Table 2. Effect of PBL among students

No.	Motivation in PBL Class	1	2	3	4	5	Mean
1	I am studying with full of interest during PBL class.	0	9	35	104	78	4.12
2	I enjoy learning chemistry because of the use of PBL approach.	0	9	52	113	43	3.88
3	University learning environment raise my interest and motivation in learning in PBL.	0	0	26	148	52	4.12
	Self Directed Learning (SDL in PBL Class	**1**	**2**	**3**	**4**	**5**	**Mean**
1	I learn a lot by reading books in PBL class.	0	35	35	139	17	3.62
2	I am finding information in the library during PBL.	0	35	70	122	0	3.38
3	I am finding information on the internet during PBL.	0	0	17	139	70	4.23
4	I manage my time effectively during PBL.	0	9	87	122	9	3.58
5	I can identify my learning goals without depending on my supervisor during PBL.	0	52	52	122	0	3.31
6	I take responsibility for my own learning during PBL.	0	17	43	122	43	3.85
	Collaborative skills in PBL Class	**1**	**2**	**3**	**4**	**5**	**Mean**
1	I am working well in a PBL team with other people.	0	9	26	104	87	4.19
2	Working as a PBL team helped me in learning academic content	0	0	26	104	96	4.31
	Communication skills in PBL Class	**1**	**2**	**3**	**4**	**5**	**Mean**
1	I am good at writing reports/ essays in PBL class.	0	0	113	113	0	3.50
2	I speak well in front of a group in PBL class.	0	0	35	156	35	4.00

(1=totally not agree, 2 =not agree, 3= neutral, 4=agree, 5=strongly agree)

Increase student motivation

The survey indicated that majority of students were motivated to learn chemistry using PBL. It also helped to increase intrinsic motivation, and built skills for higher knowledge. Majority of students (mean = 4.12) believed that learning environment was the primary influence in increasing students' interest and motivation to learn through problem-based learning (PBL).

Researcher: Is PBL increase motivation?
Student A: Yes ... cause we are more prepared ... its fun when we can solve a problem...

The findings support previous results which show PBL gave positive results in students' motivation or attitude towards science courses (Diggs, 1997, Ram, 1999; Senocak, Taskesenligil & Sozbilir, 2007; Tarhan & Acar, 2007; Rajab, 2007; Serin, 2009; Kelly & Finlayson, 2009). However some respondents denied that they were motivated to learn because of PBL.

Researcher: Does PBL increase your motivation?
Student B: I do not know ... I think PBL is more difficult ... there are so many things to do ... we have to find our own information ... we have so many assignment ...

The transcript shows that most students were burdened with PBL implementation that somehow reduced their motivation. Similarly, a number of previous studies indicate that PBL does not affect motivation (Kocakoglu, 2008). It was also acknowledged by Sungur (2004) that PBL does not have a positive impact on students' exam anxiety, self-efficacy and belief learning.

Increase self-study

Results of this study also show that PBL can improve independent learning skills. Majority of students can search online reference and information individually without supervision in an effort to solve the problems presented. This self-paced learning is actually able to build inquiry skills and curiosity among students thus creating a level of confidence and believe in them. Furthermore, most students agreed that PBL able to cultivate the skills to find information in the library, create efficient time management, set a goal to learn on their own and be responsible for learning (mean = 3.38). The results also show students are more likely to get information from internet sources than search for information in the library (mean = 4.23). Internet access facilities at institutions of higher learning in addition to the many resources that are available to solve the problem.

Researcher: Does PBL help independent learning?
Student: Yes.
Researcher: Can you explain more?
Students: We have to find own information ... mostly we get on the internet ... no part of the book, looking at the library or borrow books lecturers ... he he ...
Researcher: What about time management?
Students: We manage time ... a lot of time running out in the discussion ... make notes and presentations ...we must know how to solve the problem...

This finding is in line with the statement by Zimmerman & Schunk (2001) who claim that self-learning strategy is decisive for the achievement of quality learning.

Enhance group learning

More than 20 respondents believed that enhancing collaborative skills are also an effect of PBL. Students prefer to work in groups because it can help students to learn academic content better. Lynda and Megan (2002) states that through group learning, a variety of skills can be formed It is also supported by Murray, Curtis, Cattley and Slee (2004) who state that PBL process give ample room for students to develop collaborative skills . Cooperation which existed in collaborative skills form positive student behavior and draw their attention to learn.

Communication skills

According to Stefl-Mabry and Powers (2005), the view from one of their respondents was that collaborative learning is the key to communication. Communication is a skill that is important for the student to share ideas and form new ideas. It helps to correlate existing knowledge with new knowledge. Communication is not limited to words. Ideas and concepts presented in visual presentations also show the importance of communication. Communication skills are not only in terms of skills in writing reports (mean = 3.50), but also verbal communication among students. The findings showed that students were confident when communicating among other partners (mean = 4.00).

Researcher: Does PBL improve communication skills such as writing and speaking?
Student: Yes ... I do individual reports, journal reflection and group reports ... does improve writing...
Researcher: What about verbal communication?
Student: Had to present ... first fear ... but after some time its ok ... have to make a lot of discussion ... PBL improve communication

This finding was also supported by Simranjeet et. al. (2011), who state that PBL encourages students to read the given problem, gather feedback from their friends, find solutions and finally do group presentations. All of these steps require communication skills throughout the PBL process.

3.3 Level of Students' Satisfaction on The İmplementation of Problem Based Learning in UTM

Based on the studies conducted by previous researchers, PBL has been identified as a catalyst to improve students' achievement (Achilles and Hoover, 1996). The study discusses the implementation of PBL in the level of satisfaction among students. Studies show that majority of students gave a positive feedback on the implementation of PBL.

Table 3. Levels of students' satisfaction in the learning process

No.	Satisfactory level in PBL approach	1	2	3	4	5	Mean
1	I learned more in PBL compared to traditional lecture	0	0	26	104	96	4.31
2	I will recommend PBL in other subject	0	0	43	113	70	4.12
3	I will attend another course using PBL	0	0	35	148	43	4.04
4	I like tackling unfamiliar problems in PBL	0	26	87	113	0	3.38
5	In PBL, I have developed many useful strategies to help me in my learning.	0	0	43	174	9	3.85
6	My lecturer gives me regular feedback during PBL on how I am doing with my project.	0	0	52	139	35	3.92
7	I am able to get help from my lecturer whenever I need it during PBL.	0	17	17	130	61	4.04
8	PBL learning environment helps shaping me to be good at thinking critically.	0	0	43	113	70	4.12

(1=totally not agree, 2 =not agree, 3= neutral, 4=agree, 5=strongly agree)

Students positive outlook on PBL

The findings showed that majority students agreed that more things can be learned in PBL as compared to traditional lecture method (mean = 4.31). It is because in PBL, students will not only be exposed to capture content in education, but also must master a variety of thinking skills, especially the ability to think critically and creatively in order to find the right solution to a shared problem (Kenneth and Williams, 2001). Furthermore, majority of students also agreed that PBL is always included in other subjects (mean = 4.12). PBL is an effective method to develop students' thinking process skills because students are exposed to scientific inquiry thinking and are able to develop skills in giving reasoning that require good understanding of content in order to solve problems (Dorothy and Diane, 1986; Kenneth and Williams, 2001). The results also showed that the respondents agreed that they preferred to face and solve problems which were uncommon (mean = 3.38).

Researcher: Are you satisfied using PBL strategies?
Student: Hm ... satisfied. Much can be learned.... More independent ... better understanding compared lecturers teach ordinarily ... Quite challenging ... Worth it although little tired but...

This finding was consistent with a recent study conducted by Keller (1987) who suggested that PBL can be considered as a challenging learning approach. This is also in line with natural human instinct that tends to dominate challenges and obstacles. In addition, learning environment at the university also help students in the development of the diversity of their learning strategies (mean = 3.85). Reasoning process is one important element in PBL. Learning in problem-based learning environment is not as

simple as collecting the facts alone. As recommended by Dunlap and Grabinger (1996), abilities and cognitive processes are required for activity in PBL. These activities stimulate higher order thinking skills and can ensure better knowledge transfer in the future.

PBL learning environment also encourages independent learning among students which simultaneously help the students to become good thinkers. Most respondents (mean = 4.12) believed that they were stimulated to be good thinkers as a result of teaching approaches practiced by the lecturers in UTM. In PBL, students have the role to trigger their own learning, asking questions and solving problems during the learning processes. Therefore, they are no longer acting as passive recipients of information. In PBL, students not only need to reassess their roles but they also need to modify their past study habits. Norman and Schmidt (1992) found that undergraduates will be more independent thinkers and more responsible for their own learning and the notion was supported by a study conducted by Jonassen (2006). Researchers in other studies also (Lo, 2004; Martin et al., 1998; Schelton and Smitd, 1998) found that more students were able to integrate theory with actual situations after learning through PBL.

4. Implications of The Study

Studies demonstrate that PBL brings positive impact in increasing students' motivation, self-learning and soft skills. It is because, PBL use learning problems as a catalyst to encourage students to think critically. Group learning activities and leadership roles help to develop students' communication and collaboration skills. Thus, this strategy is suitable for implementation in higher education. However, there were complaints from some students about the challenges they faced in solving problems and mastering the content. Time constraint and multiple tasks that must be completed for each course created these issues. In this case, the lecturer has an important role to motivate students and provide effective guidance to them. Among the guidance can be implemented include:

1. submit a strategy to understand the problems presented using cognitive tools such as table learning issues (what is known, what is not known, what needs to be known). Cognitive tool to focus the student to understand the problem as a whole and realize the task that must be executed to solve the problem effectively.
2. gives a hint (hint) to students in the monitoring process implemented during the lecturer-student meeting as well as providing encouragement and motivation that encourages them to learn to be more active and organized.
3. arrange a meeting schedule and monitor the progress of students from time to time. Use social forums such as e-learning for this purpose as well as group discussion throughout the learning process.

Overall it can be concluded that many students agree with the implementation of PBL in higher education institutions due to its effectiveness in the learning process. Finally, the students are satisfied if problem-based learning continues to be implemented in chemistry education courses, but many of them agree that PBL should be used for all courses in higher education institutions.

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