A PROBLEM BASED LEARNING MODEL FOR IT COURSES

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ABSTRACT. A problem that always occurs in the implementation of PBL is inappropriate course assessment, the out-of-context conversation, unbalanced group formation and improper facilitation. In addition, a comprehensive PBL model that considers those factors has not been performed yet. Thus, this paper aims to determine the effective factors that might influence IT students' perception on the PBL practices. The study involved three (3) main phases: Initial Study, Modeling, and Validation. Four main factors have been identified: PBL Characteristics, Course Assessment, PBL Practices, and PBL Perception. Based on these four factors, a PBL model has been constructed. Four hypotheses were formulated and analyzed. All hypotheses have been proven significantly acceptable. The results show that the PBL Characteristics and Course Assessment factors significantly influence the PBL Practices and indirectly influence the students' perception on the PBL implementation for IT courses. This model can assist decision makers in enhancing the PBL teaching and learning strategy for IT courses.

Keywords: PBL practices, effective factors, student perception

INTRODUCTION

Recently, there has been a shifting from lecture-based teaching methods in the IT undergraduate courses to a more student-centered learning, such as problem-based learning (PBL). This evolution is one of the necessities to ensure our future IT human capital are able to render their higher order thinking, problem solving, and more interpersonal aspects of a career, such as communication, social, and team-work skills. The problem solving skill, which could be acquired through PBL experience, is important for formulating, identifying, and solving most problems. PBL is defined as constructivist pedagogic approach that encourages learners to apply critical thinking and problem solving skills along with the content knowledge in solving real life problems and issues (McGarrity-DeShwan, 2013; Bajwa & Mulcahy-Ernt, 2012; Greeno, Collins & Resnick, 1996). However, the existing PBL practices are unable to guarantee the successfulness of the future IT graduates to gain the required softskills. Therefore, an effecive PBL model needs to be constructed to ensure that the future IT graduates have all the required softskills. In fact, PBL has been applied globally in various educational levels (Chan, 2014; Wilkerson & Gijselaers, 1996). Generally, it can be applied in any content area, but it may look very different across subjects especially on the implementation factors that may influence its effectiveness.

However, time and resources are disadvantages in PBL implementation (Clark, Nguyen, Bray, & Levine, 2008). As an example, PBL takes more time for teaching; it requires clear policies, strong support from the top managers, and instructors who have the skills to facilitate PBL (Kelly, Haidet, Schneider, Searle, Seidel & Richards, 2005). In order to ensure effective PBL practice, the high capabilities factors must be identified. It involves group work, integration concept from different principles reasonable to the problem context, and the role of instructors (Sahin, 2007). The use of small learning groups can promote students to involve in group discussion and brainstorming. Further, through the change of ideas, problem solving can be hastened by combining and evaluating most possible ideas. Meanwhile the tutor/teacher can facilitate the group discussion activities by guiding students on how to tackle the problem by using their own knowledge. In addition, integrating related topics where reasonable for particular problem help provide guidance context for the tutor to facilitate the student.

The main aim of active learning in PBL can be simplified as assessing a student in terms of critical thinking, high motivation, problem solving, self-directed, self-reflective, and high decision-making ability. To achieve this aim, it is crucial to evaluate and develop the PBL program (Sahin, 2007). It is important to note that there are four factors influencing the PBL practices, which are resource, quality assurance, student factor, and teaching conception of faculty member (Lai & Tang, 2000). Until now, lack of study on the PBL effective factors that influence IT students' perceptions on the PBL practices. In addition, a comprehensive model to relate all the factors have not been found in the literatures. Therefore it is vital to conduct a study to investigate PBL factors and practices that might influence students' perception. Further, such model can assist decision makers in enhancing the PBL teaching and learning strategy for IT courses.

Thus, this study aims to determine effective factors that might influence IT students' perceptions on the PBL practices. The identified factors may contribute to the PBL constructive framework, in which the Constructivist Theory (Bruner, 1996) is the foundation theory. According to Bruner (1996), Constructivist Theory promotes active process, in which leaners construct new ideas or concepts based upon their current or pass knowledge. The criteria of the respondents are based on students who had attended the PBL courses at least one semester. In this study, the respondents are employed among students of undergraduate programmes, particularly Bachelor of Information Technology (BIT), Bachelor of Multimedia (BMM), and Bachelor of Education (IT Majoring) (B.Edu IT). Three courses have been identified applying PBL in teaching and learning process: System Analysis and Design, Component-Based Development, and Human Computer Interaction. The proposed PBL Model consists of four basic theory of PBL: 1) PBL Characteristics, which is measured by Self-Directed Learning, Self-Reflective, and Facilitator Assessment, 2) Course Assessment, composed of Peer Assessment and Self-Assessment, 3) PBL Practices, consists of Constructivism, Group Formation, Group Activity, Knowledge Sharing, and Task Assignment, and 4) Student's Perception.

METHODOLOGY

The research methodology is composed of three phases: Initial Study, Modeling, and Validation. The initial study phase focused on theoretical study and identifying the effective PBL implementation factors. Then the modeling phase involves model construction based on the identified factors, hypotheses formulation, questionnaire design, pilot study, and data collection. Meanwhile, the validation phase involves data analysis using SPSS Ver.19. The correlation among the factors were tested using Pearson's correlation coefficient. Eventually, the research model is constructed based on the identified factors, which can be seen in Figure 1.

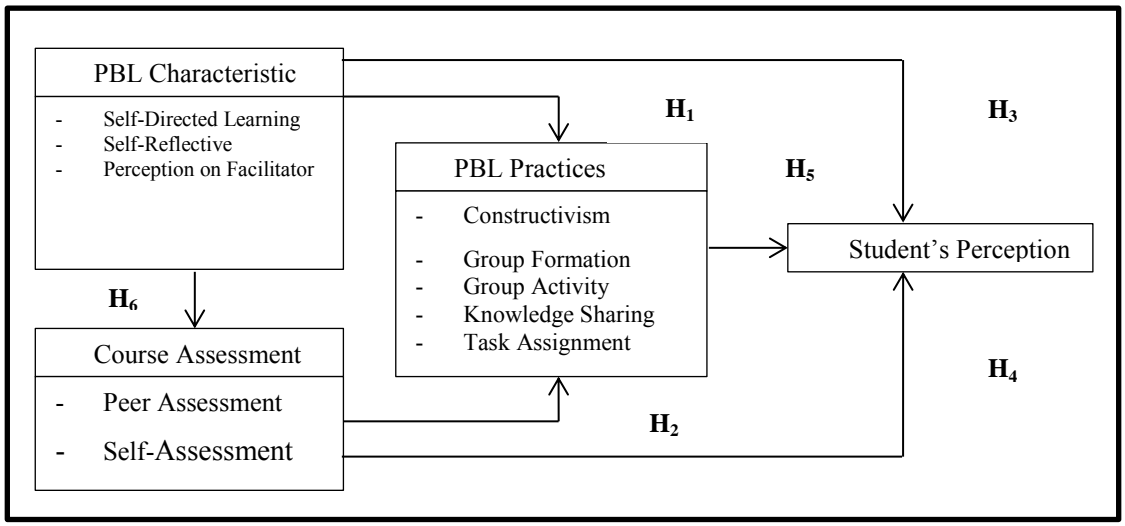

Figure 1. A PBL Model and its Constructive Framework

The model in Figure 1 showcases that it contains six hypotheses. Accordingly, they are detailed in the following.

H1 – PBL Characteristics may significantly influence PBL Practices by the instructors.

H2 – Course Assessment may influence the PBL Characteristics given by the instructors.

H3 – PBL Characteristics may influence the PBL Practices by the instructor.

H4 – Course Assessment may influence the PBL Practices given by the instructors.

H5 – PBL Practices may influence the Student Perception among the students.

H6 – PBL Characteristics may significantly influence Student's Perception.

Questionnaire Design

After formulating the hypotheses, the questionnaire was designed. Most items in the questionnaire were taken from or based on prior studies. The questionnaire is composed of four main factors with corresponding measurement items. Table 1 shows all items in the questionnaires. It uses the standard 5-point Likert Scale, in which 1 indicates Strongly Disagree, 2-Disagree, 3-Neither, 4-Agree, and 5-Strongly Agree. The questionnaires were distributed using self-administered approach. Having gathered the data through the returned questionnaire, statistical analysis was performed using SPSS Ver. 19.

Table 1. Questionnaire Design

Factors	Sub-Factors	Sources
PBL Characteristics	• Self-Directed Learning • Self-Reflective • Perception on Facilitator	Silvia (2006); O'Grady (2012)
PBL Assessment	• Peer Assessment • Self Assessment	Savery (2006); Santos and Soares

		(2013)
PBL Practices	• Constructivism • Group Formation • Group Activity • Knowledge Sharing • Task Assignment	Beasley and Ford, (2003); Sulaiman and Alias (2010); Kemp (2011); Wandel (2011)
Student's Perception	• The PBL approach makes me use previous relevant knowledge and experience. • The PBL approach helps me to interpret, analyze, and apply key concepts precisely and rationally. • The PBL approach encourages me to take an active role in the discussion. • The PBL approach furthers me in-depth understanding of IT knowledge. • The PBL approach motivates me to learn more. • The PBL approach stimulates my interest in learning. • The PBL approach encourages me to participate in the discussion. • The PBL approach promotes effective group collaboration.	Beasley and Ford (2003); Sulaiman (2011); Cheng and Mesbahi (2012)

Pilot Study

The pilot study was performed to 71 eligible respondents to test the reliability and validity of the measurement items in the questionnaire. The respondents were only selected among students who had attended the PBL courses at least one semester. Consequently, students in the STID3023 System Analysis and Design (SAD) class were selected because it is one of the core courses for the BIT, BMM, and B.Edu IT programmes. SAD has been totally applying PBL in its teaching and learning process since the last 10 years in School of Computing, Universiti Utara Malaysia (SOC, UUM).

Having gathered the data, the reliability of the questionnaires was tested. The correlation matrix and factor analysis were used to validate the measurement items in the questionnaire. According to Comrey (in Ali, 2005), the loading factor evaluation is based on this scale: Excellent >=0.71 (50% overlapping variance [R^2]); Very Good >= 0.63 (40% overlapping variance); Good >=0.55 (30% overlapping variance); Fair >=0.45 (20% overlapping variance); and Poor >=0.32 (10% overlapping variance). Based on the results of the reliability and validity test (detailed in the next section), the measurements items in the questionnaire were revised accordingly.

Eventually, the actual data collection managed to involve 191 eligible respondents, who were students of the same course. However, after going through the data-filtering process to eliminate invalid responses due to failure of completing the questionnaires, only 117 questionnaires were proceeded for data analysis.

RESULTS

The reliability test was based on 71 eligible respondents in the pilot test. The reliability test for the overall Cronbach's value, which is 0.984, indicating a high standard of reliability for the overall corresponding items in the questionnaire. It

shows the internal consistency reliability that reflects the stability of individual measurement items across replications from the same source of information; it was assessed by computing Cronbach's alpha whose coefficients for the four main factors were gfeater than 0.6, indicating a reasonable level of internal consistency among the items (Sekaran, 2009).

The research hypotheses were tested using Pearson's correlation coefficient to investigate the relationship among various constructs to verify the significance and influence of the relationships. The results show that all hypotheses are acceptable. The correlations among the observed factors are significantly strong, as seen in the summary in Table 2.

Table 2. Results of Hypotheses Testing

Hypotheses	Influence	Correlation (r)	Significant value (p) – 2 tailed
H_1	PBL Characteristics → PBL Practices	0.829**	P<0.001
H_2	Course Assessment → PBL Characteristics	0.830**	p<0.001
H_3	PBL Characteristics → PBL Practices	0.810**	p<0.001
H_4	Course Assessment → PBL Practices	0.826**	p<0.001
H_5	PBL Practices → Student Perception	0.828**	p<0.001
H_6	PBL Characteristics → Course Assessment	0.887**	p<0.001

DISCUSSION

This study has achieved the objectives where the effective factors of the PBL implementation have been identified: PBL Characteristics and Course Assessment as independent factors, PBL Practices as mediated factor, and Student Perception as dependent factor. The hypotheses that have been formulated from the research model were tested and proven significantly acceptable. Thus, the investigation factors in the model is valid and this shows that the PBL Characteristics and Course Assessment factors are significantly influencing the PBL Practices and indirectly influencing the students' perception on the PBL implementation for IT courses. Hence, the finding shows that the independent factors: PBL Characteristics that is composed of Self-Directed Learning, Self-Reflective, and Perception on Facilitator, and Course Assessment that consists of Facilitator Assessment, Peer Assessment, and Self-Assessment, can be improved to ensure the effectiveness of the PBL implementation.

CONCLUSION

In PBL, students are trained to be self-directed learners, functioning effectively in their respective teams to solve real world problems. This study has identified four effective factors for PBL implementation that may influence student's perception on the PBL implementation: PBL Characteristics, PBL Assessment, PBL Practices, and Student's Perception. Based on the identified factors, a research model PBL Instructional Model for IT students is constructed. This model is important to ensure all stimulating factors that influence students' perceptions on the PBL in their teaching and learning process in the university are taken into consid-

eration while implementing PBL in IT courses. Positive perception on the PBL practices among IT students is important to ensure that they are able to successfully attain the intended learning outcomes. Therefore, a proper design of the course and learning activities is essential in maintaining the student's motivation and positive perception to persist at the tasks given in PBL approach. In short, the findings in this study may help decision makers to strengthen the PBL teaching and learning strategy for IT courses.

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