

Problem-based Learning (PBL) Among Malaysian Teachers: An Evaluation on the In-service Training of Facilitation Skills

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Abstract

Problem-based Learning (PBL) is practised in Malaysian universities, but it is rarely carried out in Malaysian secondary schools. Hence SEAMEO RECSAM conducts PBL courses on a regular basis, to introduce teachers to PBL. The 32 respondents of this study were selected from a large group of Malaysian teachers who had attended the 2017 STEM Workshops at SEAMEO RECSAM. The literature showed that the benefits of PBL come at a price, in that PBL requires more ICT resources and facilitation by educators who have reported the task as difficult and frustrating. The author facilitated this class of PBL, and can thus share the first-hand experiences. Six research questions were answered in this study. The author found that although it was challenging to see to the needs of 32 individuals, it was not frustrating as there were positive findings. The respondents agreed that the PBL lesson was appropriately conducted, and was aware that the roles of the teacher and students have shifted in PBL. All the respondents (except for one) were willing and confident to practise PBL in some of their lessons with their students. This implied that certain educators adapted more easily to be a facilitator of PBL than other who was more difficult to be convinced. It is hoped that more teachers will be empowered through training of PBL facilitation skills in the subsequent year with the knowledge and experience gained through this study.

Keywords: Problem-based learning (PBL); Facilitating PBL; Role of facilitator; Constructivism; Real world learning

Introduction

Background, Rationale and Objectives

Problem-based Learning (PBL) is a pedagogical approach that begins with a real-world scenario or a 'problematic case' such as pollution, disaster, and so forth to be solved using scientific and mathematical knowledge/skills. PBL encourages research and information-gathering, reasoning and problem-solving skills, collaboration and interpersonal skills, besides the acquisition of subject matter knowledge such as science and mathematics related studies. Barrows (1992) provided a PBL model of five major steps: problem presentation, discussion in collaborative team, solution, reflection, and outcome. In PBL, the teacher is a facilitator to guide the learning process through questioning and coaching, rather than to provide a ready answer.

PBL was first introduced in the medical school of McMaster University in 1969. PBL is more than “problem solving”. The problem is used to help students identify their own learning needs as they attempt to understand the problem, to collaborate in groups, to research and find information, synthesize and apply the information found by the group to solve the problem. Hence learning from group members besides from tutors who facilitated the training, in the process of solving the problem and gaining knowledge is an important feature of PBL that has now been internationally adopted throughout various disciplines of higher education. PBL was introduced into schools (K-12) in 1993 in USA (Barrows & Kelson, 1993) for various subjects, and is now practised for students of various ages in schools worldwide (Hung, Jonassen, & Liu, 2008).

PBL is practised in some Malaysian universities including Universiti Malaya (UM), Universiti Sains Malaysia (USM), and Universiti Putra Malaysia (UPM), especially in medical and engineering studies, but it is still rarely seen in Malaysian secondary schools. The majority of Malaysian secondary school students as well as teachers have not encountered PBL approach at schools (Faaizah & Halimah, 2007). Even in secondary science classrooms where students should be prepared with higher order thinking skills to solve contemporary challenges, PBL is not a common instruction strategy (Tan & Arshad, 2014) though this study showed that PBL promoted student questioning, active thinking and learning.

In the Malaysian education context, PBL is not commonly practised in secondary schools where the respondents of this study teach (Tan & Arshad, 2014). As a result of the usual Teaching and Learning (T&L) methods of teachers to emphasize on students’ ability to memorise and recall to obtain marks in exams, many Malaysian students lack thinking skills (Yeoh, Cazan, Ierardi & Jacic, 2017). These students may also be unable to compete in this globalized era where problem solving, collaboration and communication skills are essential (Yeoh, 2017a). The lack of ability of Malaysian students to perform in the international assessments that emphasize problem solving, critical thinking and transversal competencies confirm that our T&L methods need a change, and one of the changes that the author recommends is the use of PBL in schools. In fact all the abovementioned studies provide reasons why Southeast Asia Ministers’ of Education Organisation, Regional Centre for Education in Science and Mathematics (SEAMEO RECSAM) conducts PBL courses on a regular basis, to introduce teachers to PBL.

This study will investigate if the respondents are encouraged to be more willing and more confident to practise PBL after the experiences provided by the activities that are carried out within this course. The respondents of the study were from a large group of 500 teachers who attended the Science, Technology, Engineering, & Mathematics (STEM) Workshops for Teacher Education Division (BPG), at SEAMEO RECSAM over a period from 5 September through 8 November, 2017, in 5 batches with each batch with 100 teachers. The course title was “Enhancing STEM learning in Secondary Science/Math Classrooms”. The facilitators were specialists of SEAMEO RECSAM.

Review of Related Literature

Problem-based learning (PBL) places responsibility upon the students to take ownership of their learning, and thus, the teacher’s role is to facilitate the learning, based on constructivist principles. The basic concept of constructivism (or constructivist propositions on how we gain understanding) is that understanding is in our interactions with the environment, and what a learner understands has a relation to how it is learned. Our understandings are based on our

goals, our activity, the context and the content that is presented in our learning environment. The second point is that our goal for learning stimulates us to learn, and it decides what we pay attention to, and what existing experiences we bring in to construct new knowledge/ understandings, and what is finally constructed. Hence the goal determines the learning obtained. The third point is that knowledge evolves through social negotiations, and this indicates the great value of other people who possess alternative views to challenge our current schema, and act as stimuli for new learning (Savery & Duffy, 1995). The three propositions lead to several instructional principles that guided the teaching, and how the author designed the learning environment to engage the participants' problem solving behaviour, based on the eight principles that are realized in the PBL model of Barrows (1986, 1992):

1. All the learning activities must be tied to a larger purpose that is perceived by learners as relevant;
2. The learner is supported to develop ownership for the task,
3. An authentic task is designed;
4. The task and the learning environment reflect the complexity of the environment in which the learner should be able to function;
5. Learner must have ownership of the process used to develop a solution;
6. Support the learner to think and work in the learning environment. The teacher as facilitator provides scaffolding to help learners achieve what they cannot on their own (Vygotsky, 1978);
7. Learners test ideas against alternative ideas, just as knowledge is socially negotiated;
8. The teacher as facilitator provides opportunity for reflection on the learning process, the strategies and the content learned.

Haith-Cooper (2003) stated that a PBL facilitator should facilitate PBL in a manner what is conducive to student learning. Pourshafie and Murray-Harvey (2013) reported a study involving 63 teacher education students, that the respondents identified distinct facilitation in 'attitudes, skills and knowledge'. Effective facilitators possessed both content and pedagogical knowledge. Such facilitators conveyed belief in the self-efficacy of students who possessed a humble attitude and did not consider self as all-knowledgeable. These facilitators created learning environments that allowed collaborative participation, scaffolding and support. The respondents indicated that they were in favour of PBL elements for their future practice (Pourshafie & Murray-Harvey, 2013).

Murray-Harvey, Curtis, Cattley and Slee (2005) revealed that students attending in-service training teacher education had provided self-ratings that over a semester, they had substantial gains in four generic skills: problem-solving, knowledge building, personal/ interpersonal development and communication skills. In that study, PBL had provided the opportunities to develop collaboration skills through student engagement in researching authentic, relevant and meaningful school issues. Besides acquiring knowledge, PBL had allowed students to develop problem-solving, collaboration and communication skills. They concluded that the study reassured them that PBL was effective to motivate and engage students as well as to develop problem-solving and communication skills (Murray-Harvey et al, 2005). Problem-solving requires critical and creative thinking, collaboration, communication that are transversal skills (Yeoh, 2017a) that hopefully could be achieved by the respondents of this study.

Furthermore, research showed that the advantages of PBL come with a price. PBL requires resources and tutor facilitation (Wood, 2003) that may not be always available, although the resources are available at SEAMEO RECSAM. Wood (2003) also reported that some

educators find PBL facilitation difficult and frustrating, which is a reason why this author will be reporting first-hand experience about facilitating and evaluating a PBL course.

Statement of Problem and Research Questions

The review of literature reveals that PBL is not a common feature in Malaysian secondary schools, hence it is necessary to facilitate in-service training session on PBL for our teachers so that they gain expertise and experience with PBL. The respondents also had not used PBL in their teaching; they did not emphasize problem solving, collaboration and communication but they preferred the traditional approach where teachers speak and students listen passively (Tan & Arshad, 2014; Yeoh et al., 2017). Although they were already trained teachers, the respondents would benefit from the in-service training on PBL facilitation. The author hoped that the session would convince them of the benefits of PBL. The respondents could be viewed as within Vygotsky's 'Zone of Proximal Development' (ZPD) where with some facilitation, they could be able to perform a task with guidance given (Harland, 2010; Vygotsky, 1978). Thus Vygotsky's ZPD provides a framework for this study.

The first issue that was pondered by the author is: 'Can the facilitation of this in-service training on PBL facilitation skills expose the respondents to PBL so that they gain confidence to conduct PBL?' For the respondents to be comfortable and gain confidence, they need to feel that the PBL session was appropriately conducted, and hence the author asked several questions on this matter.

The second issue arises from the fact that the respondents were usually taught using traditional methods of teaching and learning (T&L) as described in the earlier paragraph. Since the respondents were teachers who had rarely encountered PBL processes, it was necessary to examine if they were aware that the roles of teachers and students have shifted in PBL.

The third issue was related to the literature review that stated that PBL requires more resources and this requirement poses challenges to facilitators. This research will answer the question: 'How can a facilitator handle the challenges of a PBL class?' Wood (2003) had reported that some educators find PBL facilitation difficult and frustrating, which is a reason why the author who was the facilitator is reporting first-hand experience about facilitating a PBL course.

Based on the problem statement, the following are research questions to be answered:

1. Did the respondents consider that parts of the PBL lesson were appropriately conducted?
2. Were respondents aware that the role of the teacher in a PBL class has shifted?
3. Were respondents aware of the roles of students in a PBL class have shifted?
4. Would the respondents be willing to use PBL in some of their own school lessons?
5. Were the respondents confident of their own ability to conduct a PBL class?
6. What were the experiences of the facilitator with regard to the challenges of conducting PBL, including the use of resources?

Methodology and Implementation

Evaluative research involving systematic collection of data about the organisation (Powell, 2006) of an in-service training session is the research methodology of this study. This section describes the methodology for data collection and analysis of this study.

Development of the Questionnaire

Based on the past experiences and the review of literature, the author prepared a questionnaire to obtain info from respondents that would answer the research questions (as listed in Table 1). Respondents were instructed to tick the box of their choice where ‘SD’ meant ‘Strongly Disagree’; ‘D’ if they ‘Disagree’; ‘A’ if they ‘Agree’; and ‘SA’ if they ‘Strongly Agree’. Later these descriptors were coded in the Likert scale of 1, 2, 3 and 4 respectively. The author did not provide a category for ‘Undecided’, but the respondents were told that they could write that, if they chose to. However none of the respondents needed that option.

The following is the Instruction given to the Questionnaire (Table 1) administered to elicit responses from in-service trainees on their perceptions towards the requirements for facilitating PBL activities.

Direction:

Please tick (√) each of the boxes which corresponds to your views/perceptions expressed in each statement by referring to the following Likert Scale:

1-Strongly Disagree; 2-Disagree; 3-Agree; and 4-Strongly Agree.

Table 1
The Questionnaire Administered to Elicit Responses

| | 1 (SD) | 2 (D) | 3 (A) | 4 (SA) |
|---|-----------|----------|----------|-----------|
| 1. The Introduction was appropriate. | | | | |
| 2. The grouping procedures were appropriate | | | | |
| 3. The use of abbreviated names was appropriate. | | | | |
| 4. The ice-breaking was appropriate. | | | | |
| 5. Discussion of “STEM-student-PBL” Project was appropriate. | | | | |
| 6. Discussion of “PBL on Transversal competencies” project was appropriate. | | | | |
| 7. Role/s of teacher has shifted to facilitate PBL. Design the Problem/s Anticipates T&L Gathers resources Does research Facilitates learning Helps students to overcome difficulties | | | | |
| 8. Role/s of student in PBL has/have shifted. Confront the problem Define the problem Design plan to solve the Problem | | | | |

| |
|---|
| Gather information |
| Construct potential solution/s |
| Select and present the best or <i>desirable fit</i> |
| 9. I will try to teach certain subtopics using PBL in school. |
| 10. I am confident that I can use PBL effectively |
| Other views/ descriptions.... |
| Suggestions for improvements |

Since the PBL lesson could be conducted in various ways, the author decided that “appropriateness” would be a desirable term used in the Introduction, Grouping Procedures, Ice-breaking, and the Discussions. The quality of ‘appropriateness’ was at times based on cultural norms, as this is carried out in a community where brief names or nick names were frequent and prevalent. The first six questions focused on the appropriateness of each part of the lesson. The questionnaire also spelled out about the roles of the Teacher/ Facilitator as having shifted to include the following: Design the Problem/s; Anticipates T&L; Gathers resources; Does research; Facilitates and Helps students to overcome difficulties. The roles of the Student were also spelled out as the following: Confront the problem; Define the problem; Design plan to solve the problem; Gather information; Construct potential solution/s; and Select and present the best or desirable fit.

The last two questions of the questionnaire asked for information on the respondents’ willingness to try PBL in some of their lessons, and if they were confident that they would be able to use PBL with their own students. They were also asked for their views and other general suggestions.

Respondents

The 32 respondents were selected as convenient sample of whom the author directly facilitated. They were grouped into teams consist of four or five members in each team. Since they were adults and preferred to keep to their original seating positions, the author agreed that their grouping would be based on their seating positions. The ice-breaking activity was simple: each participant introduced him/herself, and wrote their preferred brief name on the white board, in columns that had been defined by group numbers.

Each group elected a leader and a scribe who prepared the PowerPoint (PPT) to present their answers. They were told to use only two computers per group, and they could use their mobile phones to search for information. The author reminded the participants that while some schools may not have as many as 30 computers in a lab as reported in studies e.g. by Wood (2003) that it was more proper for students have access to mobile devices.

The Implementation of PBL Lesson

Before conducting the problem-based learning (PBL) class, the author had researched, and reflected on past experiences in facilitating PBL, while lecturing at a matriculation college. After some reflection on what objectives could be achieved within the available time of two slots of two hours each, the author decided to carry out two projects. Based on the ample total amount of time allotted of four hours for the entire training session, the researcher decided to carry out a student STEM PBL project (so that the respondents could emulate and implement

with their own students in schools), followed by a teacher education PBL project on 21st century skills. Both projects required online search. Each group would use two computers, and participants could also use their mobiles for searching info.

To facilitate the preparation of suitable content for introduction, the author had searched online for pictures, figures, videos and prepared a PowerPoint presentation, adapted from one that was provided by a colleague, who had also conducted PBL for a previous batch of Malaysian teachers. These teachers were sent to RECSAM for training by the Teacher Education Division of the Malaysian Ministry of Education. The issues related to STEM included global warming, using non-sustainable energy source, genetically modified food, and deforestation. Two online videos were selected. One was on PBL at Maastricht University, and the other was on PBL in a secondary school in Maine, USA. It was hoped that the videos would be able to help the participating in-service teachers to understand the benefits of PBL. The titles of videos used were ‘Maine School Engages Kids With Problem-Solving Challenges.mp4’ and ‘Problem-Based Learning at Maastricht University (1).mp4’ (Yeoh, 2017a).

First hands-on session on “STEM-student-PBL” project

The first project was on STEM education that respondents could carry out with their own students, and was adapted in the “STEM-student-PBL” project with reference to a module prepared by Mangao, Hazura, Foo and Devadason (2014). The following scenario was adapted by the author with tasks assigned to the groups during the PBL training session.

Scenario:

In view of the tsunami and earthquake tragedy in Japan, you are to research and do a presentation on the methods of heat transfer and factors that affect heat transfer.

Task 1: You have to propose effective materials to construct a thermos-container that can keep food warm for a long time.

Task 2: You are to design and create a prototype of a thermos-container that is suitable to provide hot drinks to the victims of the tragedy.

Task 3: You are to develop simple and practical way of keeping the drinks hot in the thermo-container. Propose an efficient way of reheating the drinks.

The “STEM-student-PBL” Project was implemented based on the following rationale. In this present century, innovations in science and technology in a knowledge-based society have become increasingly important. Innovation is the key to economic growth and continue to be expected to improve human’s life. STEM education is the driver of innovation’ and STEM emphasizes activities that allow students to engage in real-world problems and experiences through problem-based, project-based, and inquiry-based learning activities. These activities utilize and improve higher order thinking in problem solving. Hence the manner in which science is taught should be revamped to reflect advances in science education and make science more appealing to all (National Academies Press, 2016).

To better facilitate PBL anchored on the “STEM-student-PBL” Project, each group of respondents had to provide answers for all 3 abovementioned PBL tasks, and were encouraged to search for answers online. Each group comprised of 4 or 5 teachers. After about 10 minutes,

the facilitator observed that some respondents were not aware that the material should be food-grade quality, and so provided the info that respondents should search for this. From then, respondents were able to find high density polyethylene (HDPE), poly propylene (PP), and images of food-grade plastics that were familiar to them. For this problem, respondents had about seventy five minutes that was left after the ice-breaking and introduction activities. They were asked to search information from the internet, but most of the groups looked for insulator substances, without specifying that they should be food-grade. Hence the facilitator had to assist them, and after that the participants were able to provide solutions for all the cases. They were asked to prepare a PowerPoint presentation using 3-6 slides (as suggested by facilitator), and present their answers in 5 minutes per group. However some groups were not able to complete the task on time. To overcome this issue, they were asked to email their PowerPoint file to the author, and re-visit it after the second PBL assignment on Transversal competencies (Yeoh, 2017a).

Second hands-on session on ‘PBL on Transversal competencies’ project

At the second slot, the facilitator discussed with the respondents a change of plan that would save time. They discussed the ‘PBL on Transversal competencies’ project, went through a similar process of searching for answers, and then presented the answers raised in the ‘PBL on Transversal competencies’ project. The reason for adding this second project was to provide the respondents with more exposure to the common issues relevant to 21st century education (Yeoh, 2017b).

The author introduced the broad problem: “How can we provide 21st century education for our students, given the present curriculum?” The author then provided an example of how it could be better defined with limitations as “How can we facilitate the development of an entrepreneurial mind-set and entrepreneurship skills in our students within our science and math classes? The diagram from Care and Luo (2016) was used (Figure 1) to illustrate transversal competencies or 21st century skills.

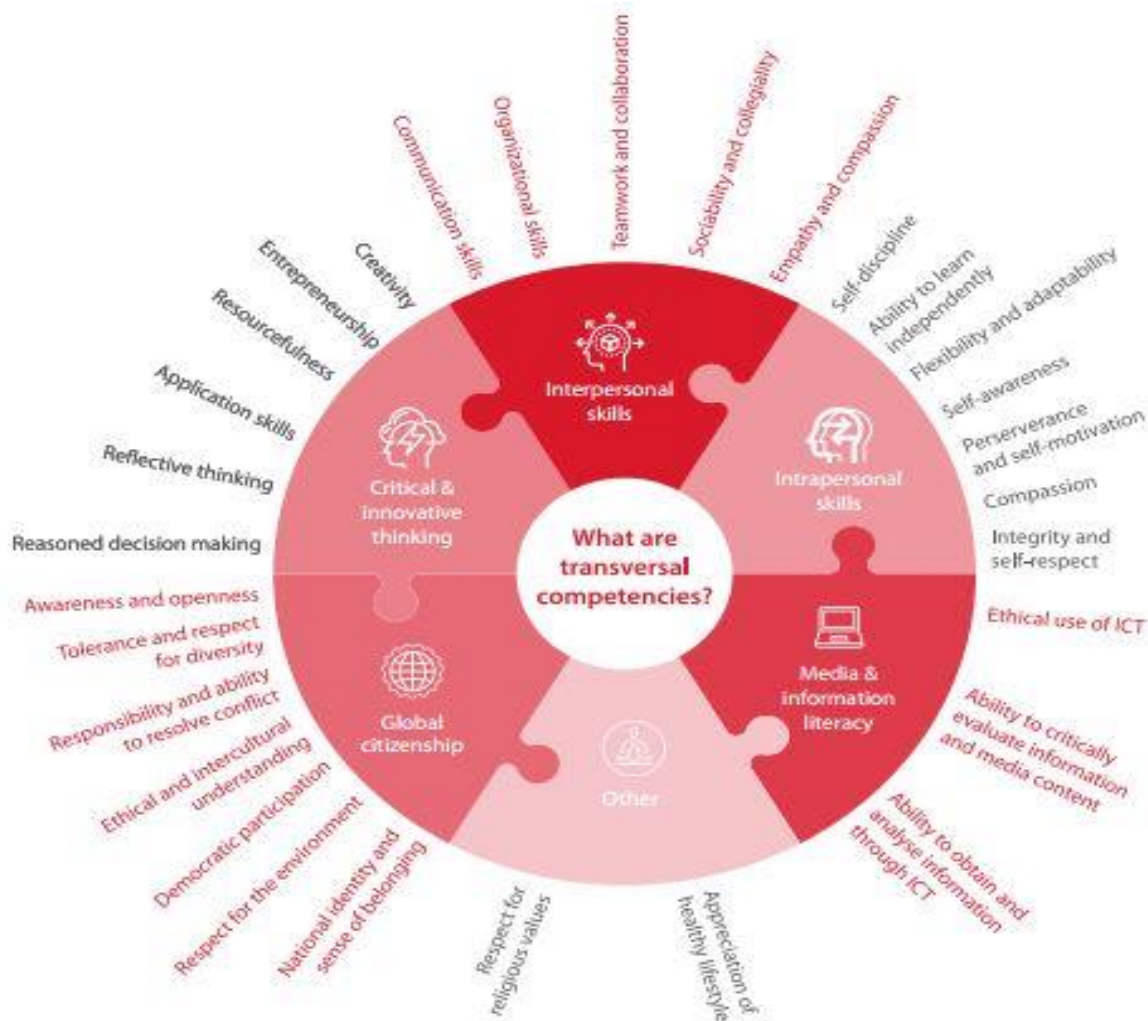


Figure 1. What are transversal competencies or 21st century skills?
(Care & Luo, 2016)

Each group had to come up with a problem statement, and search for information. The facilitator suggested the participants to brainstorm and then look into Google Scholar for research papers that provided answers, and synthesize the answers, citing the authors of previous research. Each group referred to at least three research papers. This time, all the groups found something which they wanted for their research problem that focused on one arm of Figure 1, for example “How can we facilitate our students in developing critical thinking?” They had to search info from three research papers (a suggested number) and prepare their presentation using PowerPoint within about 50 minutes, leaving 70 minutes for presentations, because there were 7 groups. The second project on Transversal competencies was included because the author had recently conducted a seminar on the subject that included heads of schools, and a workshop that involved teachers on this subject. They had found that there was a need for exposure of teachers to transversal competencies (Yeoh, 2017a; 2017b).

The groups took turns to present their findings. Each group could choose to present either their answers to the first STEM project, or the second project on Transversal competencies. The respondents were much more interested in 21st century education as they have searched and found information to satisfy their need to know more about it. Entrepreneurship, Creativity, Communication Skills, and Ethical use of ICT were the topics that the participants favoured.

Only two groups chose to present their findings for the first STEM-student-PBL project. Generally, the presentations were met with favourable comments from the facilitator and other groups. At the end of the workshop, the respondents provided the ratings on the questionnaire. Content validity was agreed upon by three specialists of SEAMEO RECSAM, and the reliability of the questionnaire was 0.908.

Data Analysis and Discussions of Findings

This section discusses the answers in response to the following research questions:

1. Did the respondents consider that the parts of the PBL lesson were appropriately conducted?
2. Were the respondents aware that the role(s) of the teacher in a PBL class has/have shifted?
3. Were the respondents aware of the roles of students in a PBL class have shifted?
4. Would the respondents be willing to use PBL in some of their own school lessons?
5. Were the respondents confident of their own ability to conduct a PBL class?
6. What were the experiences of the facilitator with regard to the challenges of conducting PBL, including the use of resources?

First, we note that the average mean responses to the questionnaire items exceeded the minimum value of 3.00; meaning that most of the respondents agreed to the statements on the questionnaire. The mean values ranged from 3.03 to 3.25 (Table 2).

Table 2
Analysis of Data Extracted from the Responses (N=32) in Questionnaire

| | Max | Min | Mean | Std Dev |
|--|-----|-----|------|---------|
| 1. The Introduction was appropriate. | 4 | 3 | 3.13 | 0.336 |
| 2. The grouping procedures were appropriate. | 4 | 3 | 3.19 | 0.397 |
| 3. The use of short names was appropriate. | 4 | 3 | 3.22 | 0.420 |
| 4. The ice-breaking was appropriate. | 4 | 3 | 3.16 | 0.369 |
| 5. Discussion of 'STEM-student-PBL' Project was appropriate. | 4 | 3 | 3.25 | 0.440 |
| 6. Discussion of 'PBL on Transversal competencies' project was appropriate. | 4 | 3 | 3.19 | 0.397 |
| 7. The following role/s of teacher has/have shifted: Design the Problem/s Anticipates T&L Gathers resources Does research/ Facilitates | 4 | 3 | 3.25 | 0.440 |
| 8. The following role/s of student in PBL has/have shifted: Confront the problem Define the problem Design plan to solve the Problem Gather info Construct potential solution/s Select and present the best or desirable fit | 4 | 3 | 3.25 | 0.440 |
| 9. I will try to teach certain subtopics using PBL in school. | 4 | 2 | 3.09 | 0.390 |
| 10. I am confident that I can use PBL effectively | 4 | 2 | 3.03 | 0.309 |

Other views/ descriptions....

2 Requests for PBL on Math (because they were math teachers)

Suggestions for improvements

None

The following are discussions based on the data presented in Table 2.

In response to the first research question, most of the respondents considered that the parts of the lesson were appropriately conducted. The Introduction was appropriate (mean response is 3.13); the grouping procedures were appropriate or acceptable to them (mean=3.19); the use of short names was appropriate (mean=3.22); the ice-breaking was appropriate (mean=3.16); Discussion of 'STEM-student-PBL' Project was appropriate (mean=3.25); and Discussion of 'PBL on Transversal competencies' project was appropriate (mean=3.19). As discussed earlier, there is no fixed manner of carrying out a PBL class, but what is important is that it is appropriate as perceived by respondents and conducive to benefit the respondents (Barrows, 1986; Haith-Cooper, 2003).

Concerning the second research question on whether respondents were aware that the role of the teacher in a PBL class has shifted, the mean was 3.25 (the highest value obtained in the survey). The roles were listed as 'Design the Problem/s', 'Anticipates T&L', 'Gathers resources' and 'Does research/ Facilitates'. The respondents had perceived that the facilitator had carried out those roles as well as provided support and scaffolding, thus enabling them to gain the confidence to practise PBL so as to enhance their professional practice and improve their own teaching, through the hands-on activities (Harland, 2010; Vygotsky, 1978). Perhaps the author may consider future research to elicit response for ratings for each of the roles and duties of the facilitator, rather than just lump the many duties together as was done in this study.

In response to the third research question on whether respondents were aware that the role of the students in a PBL class as having shifted, the mean was also 3.25, the highest value obtained. The shifted roles were also listed including 'Confront the problem', 'Define the problem', 'Design plan to solve the Problem', 'Gather info', 'Construct potential solution/s', and 'Select and present the best or desirable fit'. The respondents had seen themselves carrying out those duties as defined by their roles and agreed that their roles had shifted from being an inactive, 'empty vessel' waiting to be filled with knowledge, to become active constructor of knowledge through their interactions with others in the environment (Savery & Duffy, 1995). Again, further research may include ratings to be elicited for each of the roles and duties carried out by the student, rather than just lump the many duties together as was done in this study.

Concerning the fourth research question on whether respondents would be willing to use PBL in some of their own school lessons, the mean was 3.09. This implies that most of them agreed that they would try to use PBL approach for some lessons at least. The author hopes that the respondents truly do that because if they do not change their T&L methods, the whole exercise of sending 500 teachers for such courses at SEAMEO RECSAM would not be profitable to the students, and to the community. Some of the teachers had asked for the email and phone number of the author, and so far the author has only been in touch with two of them. However the minimum value was 2, meaning that at least one respondent did not agree.

In response to the fifth research question if the respondents were confident of their own ability to conduct a PBL class, the mean was 3.03. This implies that generally most of them agreed. However this was the lowest mean, and besides that, the minimum value was 2 (from one

respondent), meaning that one out of 32 respondent did not agree. Only the fourth and fifth research questions had a minimum value of 2, showing one respondent was not willing to try PBL in his/her class. It could imply that four hours of exposure to PBL was not sufficient to empower one of the 32 respondents to be willing and confident to practise PBL in their own schools. Perhaps in future the duration of courses may be modified accordingly. This is the advantage of carrying out such a study with the author as facilitator as well as the one doing the research to inform practice and/or even policy.

Concerning the sixth (the last) research question on the experiences of the facilitator with regard to the challenges of conducting PBL, including the wise use of resources, there are several issues to discuss. Although there were 30 computers in the room, only 14 were used. There was no need to waste resources. The respondents used their mobiles to search for info and this is practical and right. It would mean that the respondents could carry out PBL in schools since most schools have more than 14 computers. As compared to the study by Wood (2003) who had reported that educators felt that facilitating PBL was frustrating, it was not that frustrating for this study. This was because the author found that although it was challenging to see to the needs of 32 individuals (in 7 groups) with just one lab assistant, certain educators adapt more easily than others to being a facilitator of PBL, just as it was more difficult to convince that one out of 32 respondents to be willing and confident to use PBL in school.

Conclusions

In this study, we considered that PBL is not a common feature in Malaysian secondary schools, and hence it is necessary to facilitate PBL classes for our teachers at RECSAM so that they gain expertise and experience with PBL. The 32 respondents were trained teachers who did not carry out PBL. They were used to the traditional teaching and learning approach, and they may be viewed as within the Zone of Proximal Development, and likely to be able to carry out PBL in their own schools, if provided with some guidance on facilitation skills.

We discussed six research questions that were derived from the problem statement. Briefly, the respondents considered that the various parts of the PBL session were conducted appropriately. The respondents agreed that they were aware that the roles of teachers and students have shifted in PBL. Most of the respondents felt that the facilitation of this PBL class exposed the respondents to PBL so that they were mostly willing to carry out PBL in their own classes. Most of the respondents had gained some confidence to conduct PBL, but there was one of the 32 who did not gain this confidence, and hence was not willing to try PBL. Perhaps that one individual needed more time and more encouragement. However, at RECSAM, our aim is to empower our teachers, and hopefully even more teachers will be empowered to facilitate PBL in their schools in the future.

The other issue was related to the fact that PBL requires more resources and poses challenges to facilitators (Wood, 2003). In this research the author had successfully limited the number of computers and encouraged respondents to use their mobile devices. Furthermore, with the assistance of one lab assistant, the author was able to facilitate the PBL class for 32 respondents placed in seven groups, and the class was over four hours. PBL facilitation was energy-consuming. But it was not very difficult nor was it frustrating. This implies that certain educators adapt more easily than others to being a facilitator of PBL. Educators who are willing to be a guide at the side of participants and empathize with them may adapt more easily to the role of a PBL facilitator.

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