

# Preliminary Analysis of Problem Solving Method in Online PBL (Case Study in It Security Subject at UTEM)

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## ABSTRACT

The rapid development of information and communication technology nowadays indirectly affected the development of education in Malaysia. Conventionally, the teaching and learning session is teacher-centred style, but gradually change to student-centred style. Case study of this project is Information Technology Security (IT Security) subject for third year students in Universiti Teknikal Malaysia Melaka. The problem solving first part of this paper will discuss about method, problem statement and objective of the research. This paper also will explain the research framework and research question. Finally, this paper will discuss the testing plan implementation for this research.

## Keywords

Problem Based Learning, Problem Solving Methods, Project Framework.

## 1.0 INTRODUCTION

The workplace of the 21<sup>st</sup> century requires professionals who not only have an extensive of knowledge, but also know how to keep that knowledge up-to-date, applying it to solve problem, and function as part of team (Salimah and Zaitun, 2004). This explains that rapid progressions of technology development lately somewhat design the world community that is more developed and developing. So, this situation has formed the new recruitment pattern in this century. Current professions require professionals who not only have a huge knowledge, but also know how to keep it up-to-date, apply that knowledge to solve problems and can cooperate smoothly in teamwork. As the Information Technology rapidly growth, emerge new ideas to combine the methods or characteristics of PBL with other subjects and learning platforms. PBL method, which was originally designed for medical schools, has now spread to other disciplines and is being used in Dentistry, Law, Education, Engineering, Architecture, and others as an instructional method to enhance the teaching and learning

process (Neo & Neo, 2005). PBL is an educational tool used in classrooms around the world, from grade schools through professional institutions (Faaizah and Halimah, 2006).

Table 1: Problem Based Learning at Overseas (Faaizah and Halimah, 2006)

Institution	Field
Hawaii, McMaster, Linkoping, Glasgow	Medical
Ohio, Maastricht, Breda, Plymouth	Business and Management
Monash, Conventry, Stanford, Manchester	Engineering
Sidney, Maastricht	Law
Manchester	English
Melbourne, East London	Architecture

Table 2: Problem Based Learning Examples in Malaysia (Faaizah and Halimah, 2006)

Local Institution	Field
Universiti Islam Malaysia	Environmental law
Universiti Malaysia Sarawak	Medical
Universiti Kebangsaan Malaysia	Medical
Universiti Sains Malaysia	Physic
Universiti Malaya	Information Technology
Universiti Teknologi Malaysia	Information Technology

PBL is used widely to all level of students around the world. Further research has suggested that to produce an e-learning of technical subject which implement PBL environments that have specific problem solving method.

By implementing this method, hopefully it could improve the comprehension of students in the subject matter. Both current learning method and PBL method have the same purpose. It is to deliver the knowledge or information to students, at the same time, to ensure that students understand the content of delivered knowledge. But, both methods have their own style and learning approach.

PBL should begin with an authentic problem, which is genuinely problematic for the learner and representative of

problems found in professional practice (Bridges, 1992; Charlin, Mann, & Hansen, 1998). Effective PBL begin with problems that can sustain students' interest as they attempt to reach a viable solution and motivate them to probe for deeper understanding of the concept being studied (Chun, & Wong, 2000). Research shows that when problem are engaging, it is more likely for higher levels comprehension and skill development to occur (Albanese & Mitchell, 1993).

By giving the real problems that related with the subject matter, students can open their mind and realised about not only what question of the knowledge, but also the why question. So, they will know why they need to absorb and understand the knowledge. Why I need to learn this topic? This is the question that is trying to be put in students mind when they learned using PBL. The other purpose of this project is to change the way of learning. Normally, students will just listened to the lecturers and taking notes" (Leite, 2005). So, this project is trying to attract students for learning by doing. By using PBL methods, the learning materials can encourage self-evaluation. This is supported by Albion, 2000.

This project also to find out whether the PBL method is suitable or not to be implemented for technical subject such as IT Security. In the e-learning of IT Security that will be developed later on, students will view the related problems that are displayed at the early of the e-learning; they will try to find out the solution of the problems. In the process of solving the problems, student hopefully will acquire all learning objectives of the topics. So, this will show how important the problem solving methods for this project. This study is trying to find out the suitable problem solving methods for learning IT Security course. In order to find the problem solving method, the measurement of student's ability to solve the problems in each steps of the problem solving methods will be prepared. Problem solving method is one of the important PBL features. It will be discussed further on the next topics.

According to Liu (2005), PBL is a learning process where students are presented with a problem and are asked to apply reasoning, questioning, researching, and critical thinking techniques to find a solution to the problem (Faaizah & Halimah, 2006). Therefore, the important characteristics of PBL include student-centred learning, problems that are authentic, self-directed learning, learning in small groups and teacher as facilitators. This is supported by Faaizah and Halimah (2006).

PBL groups have been shown to effect learning through activation and elaboration of knowledge, and by stimulating conceptual change through cognitive dissonance (De Grave et al., 1996; Schdmit & Moust, 1998). PBL also encourage a group study in which students solve the given problem in a group. How to produce a team of students to study the problem meanwhile they are using online courseware? By referring to a project been conducted by Neo and Neo (2001), for online

communication between students and lecturer, they used Yahoo Messenger. It provided convenience way for the students as the lecturer could not provide answer and guidance over the Net very easily at anytime (Neo & Neo, 2001). So for this project, research suggested to embed an online communication features. Forum has been selected for student's online platform.

PBL involve students actively in learning and solving a problem, focuses on the learners and offers more flexibility for learners to enhance their creative and critical thinking skills and problem based learning ability (Tan, 2000). The problem based learning environment has many elements of the constructivist learning model, as it also requires that the students to become active participants in both learning content and the learning process (Savery & Duffy, 1995). When learning in PBL environment, students need to take responsibility on their own learning. This is because there is no lecturer that will lecture the subject matter. So, by hook or by crook, they need to cover that topic themselves by using the e-learning that is prepared.

## 2.0 PROBLEM SOLVING METHOD

Problem is defined as a horrible situation that is tricky to deal with or understand. But for education, problem is a question that rose for inquiry, consideration, or clarification in more common meaning. In design, a problem is any situation where people have an opportunity to make a difference, to make things better. Whenever people are thinking creatively and critically about ways to increase the quality of life or to avoid a decrease in quality, they are actively involved in problem solving (Rusbult, 2001).

Students worked in groups, solving the problem using the multimedia development process (MDP), which was utilised to design the multimedia application. According to Neo and Neo (2005), they have used MDP as the solving methods for students in their PBL project.

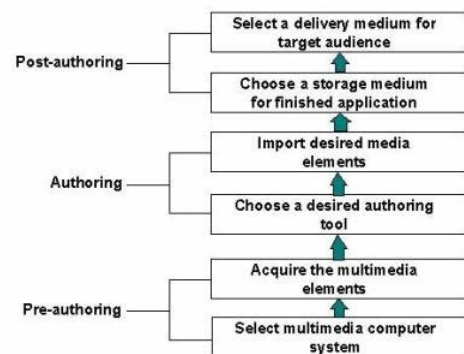


Figure 1: The Multimedia Development Process (Neo & Neo, 2005)

For C<sup>2</sup>HADAM project, it has FILAS as its problem solving method. By using FILAS, students can improve their problem solving skills using an inquiry technique. FILAS also enables the teacher to see the level of understanding

that the students attain, and to provide additional guidance on how to improve their levels of understanding of the nutrition topic (Faaizah & Halimah, 2006).

Table 3: *FILAS Table (Faaizah & Halimah, 2006)*

Step	Instruction
Facts	Identify facts from problem scenario.
Idea	List out possibilities that related with scenario.
Learning issues	Identify learning issues from scenario problems.
Actions	Identify action from scenario problem, prepare to-do list in order to do the problem
Solution	Identify solutions to solve the problem scenario.

There are eight problem solving steps in PBL methods which cover these steps:

- Read and analyze the scenario situation.
- List out the hypothesis, ideas, or hunches.
- List what is known from the prior knowledge.
- List what is unknown.
- List what is needed to be done which cover the actions to solve the problems.
- Develop problem statements which cover the idea that clearly identifies what is tried to be solved.
- Gather information, organize, analyze, and interpret info from multiple choices.
- Present findings such as report; make recommendations, predictions, and inferences. Students can be prepared with templates of presentations to guide their presentations of foundation.

Based on problem solving methods of Neo and Neo (2005), Faaizah and Halimah (2006), and Ohio State (2004), the study has come out with five general steps in problem solving method:

- Problem definition – students are guided to define the displayed problem. Write down your understanding about problem.
- Fact finding and analysis – students will analyse the problem and find for the fact of the problem. They have to write down their prior knowledge about the problem given.
- Action listing – students will write down list of action needed in order to solve the problem. The action such as ask experts, do research on library, searches for internet resource.
- Ideation and solution finding – students will make a list of all finding information from the action above.

- Solution evaluation and implementation – students have to prepare the reports for the finding information that they have completed.

### 3.0 PROBLEM STATEMENT

In lecture atmosphere, students will just listening to the lecturers and taking notes (Leite, 2005). The first problem is about the active learning. No active learning occurs in current learning styles. Normal scenario in UTeM, students should print out the lecture notes that have been uploaded by lecturer from portal. Students just jog down point and only hear to the lecturer. At the end of the class, the input is not as much as expected by lecturer. This learning style is not involved students in the learning process. Using the e-learning in problem based learning environment, students will learn the subject matter themselves. With the scaffolding given like lecturer's notes, internet resources, expert video, forum and glossary, it will help students in their learning process and attract them to learn more.

Second problem here is about relationship. In current learning style, student will learn the topic linearly. So, they do not know the relationship between the topics with the real life situation. They do not know why they need to study these topics, and what the relationship with their future job is. Learning using problem based learning methods; student will be triggered for learning by using the related problems. These problems with specific characteristics will be enlightening students about the relationship that embedded in that topic. They will realize on what situation the knowledge that they gathered will be used latter on.

The third problem is problem solving method. There are no problems solving skill in current learning style. So, students are not guided with right steps to solve their learning problems. This project is focused on one part of problem based learning characteristics that is problem solving methods. Problem solving methods is one of important part in problems based learning that will guide students to solve problem step by step. At the end of the learning session, students should get all learning contents and objectives by using the steps provided.

### 4.0 OBJECTIVE OF THE RESEARCH

Overall, this study will produce these contributions:

- To integrate problem based learning methods in learning IT Security subject.
- To provide an e-learning in problem based learning environment that able the students to study on their own by thinking and exploring the resources.
- To provide specific problem solving methods related with the subject matter that suitable with problem based learning approach.

## 5.0 RESEARCH FRAMEWORK

A theoretical framework is a treatise that interrelate the theories involved in the question. The development of e-learning needs a suitable framework in order to ensure the flow of the project work properly. Normally, a flow of the project is divided to three stages. First stage is called as Research and Analysis. In Research and Analysis stage, project team members will do some study that relate with the project main objectives. It will cover the related previous study of the project which is important to support the project development. The second stage is about the Software Development Life Cycle or SDLC. The SDLC is relates to process of developing systems which normally loaded into chapter of methodology. The SDLC also is the entire process of formal, logical steps taken to develop a software product. The phases of SDLC can vary somewhat but generally include the conceptualization, requirements and cost or benefits analysis, detailed specification of the software requirements, software design, programming, testing, user and technical training, and maintenance (MKS.com, 2009).

There are several models that can be used to guide the software development lifecycle. Some of these include waterfall model which is the original SDLC method, ADDIE model, ASSURE model, rapid application development (RAD), joint application development (JAD), the prototyping model, the spiral model, and many more. ADDIE is stand for Analysis, Design, Develop, Implementation and Evaluation. While ASSURE is stand for Analyze learners, State objectives, Select instructional methods, media and materials, Utilize media and materials, Require learner participation, and Evaluate and revise. The SDLC model that will be adapted with this PBL project is ADDIE.

Why ADDIE? The ADDIE model is a generic, systematic approach to the instructional design process, which provides instructional designers with a framework in order to ensure that their instructional products are effective and that their processes of product are as efficient as they can possibly be. The ADDIE instructional design model is a basic model that holds true for any type of learning, including web-based (College Station, 2001). The phrase show that in developing instructional software project, ADDIE is the most suitable model can be for the flow of the project.

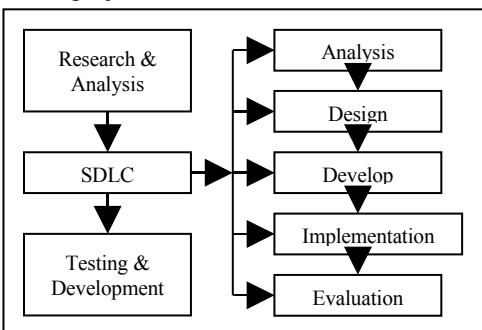


Figure 1.0: Research Framework

The last part is Testing and Development. This final stage cover testing methods which than will prove the effectiveness of the project. A few tests will be conducted in this part. There will be assessment process of the project based on test result and data that is gained from the test or questionnaire to show either the project conducted is efficient or not.

### 6.1 Theoretical Framework in SDLC

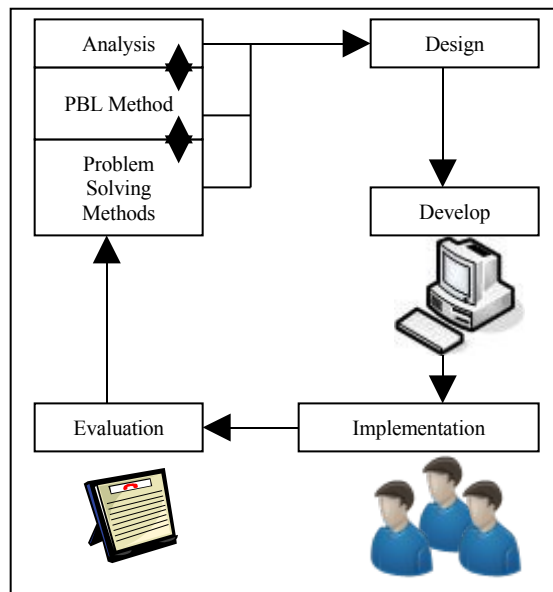


Figure 2.0: Theoretical Framework

Based on the figure above, the process is started with analysis. In this part, review about literature of problem based learning and problem solving method is carried out. Other data about project is identified such as selecting instructional methods, learners' profile and also objective of the project. The next flow is design. In design part, developer will design the storyboard and layout of the prototype. Media and materials that will be used in the project are selected. After that, the project will continue with the development phase. This phase will refer to the design phase for develop the project in multimedia tools chosen. The selected media and materials in the previous part are utilized. In implementation part, it requires learner participation. The prototype will be distributed to target users to check out any flaws or bugs existed. The final part is evaluation. In evaluation stage, the evaluation on prototype performance is conducted by using functionality testing. This functionality testing is to test either the prototype functions properly or not. This testing also will evaluate the prototype whether it is catered to the features of problem based learning or not.

### 6.0 RESEARCH QUESTION

Some of the research questions to be answered in this project are below:

- i. Why problem based learning is suitable in learning IT Security subject?
- ii. What are the differences between problems based learning and current learning methods in FTMK?
  - The differences between the problems based learning courseware compare to current methods in terms of students and lecturer behavior reaction.
  - The differences between online problems based learning courseware compare to current methods in terms of the effectiveness aspect.
  - The differences in terms of students' performance after undergo problem based learning methods compare to current methods.
- iii. What is the effect of applying PBL methods in IT Security subject?
  - The result of the students before using the prototype?
  - The result of the students after using the prototype?
    - a) Is there any different in terms of result between students that using prototype compared to students that using convention learning method?
    - b) Is there any different in terms of students result before and after using the prototype?

## 7.0 TESTING PLAN IMPLEMENTATION

### 7.1 Preliminary Analysis

Based on the discussion with the subject expert in IT Security course, they have suggested Authentication and Basic Cryptography. The questionnaire will be distributed to the students at the end of this semester when they have complete studying all chapters. This questionnaire will measure the difficulties of the chapters. These questionnaires are aimed to select the hardest topic in IT Security course.

A test will be distributed to students at the end of this semester. In the test, student will answer about 20 questions which are two questions for each subtopic. This test is to find out which topic is the most hard for students to understand.

### 7.2 Research Testing

In the preliminary analysis, a few interviews of lecturer of subject matter are implemented. This interview is to view lecturers' opinion and suggestion and to choose the right topic from IT Security subject. After that, questionnaires are

distributed to students. The aim of these questionnaires is to view students' opinions and suggestion and to pick topic based on the target user site. Data of past three previous semester exam will be collected to find out previous students performance in IT Security subject. At the same time, data of result for this semester also collected. Data that is collected such as quizzes, midterm exam and final exam. From data collected, topic is chosen. The chosen topic for this project is Network Security.

Under analysis, students are interviewed at the end of this semester to confirm the topic chosen. Currently, the chosen topic is Network Security based on the early preliminary analysis that has been done. In the next semester, pretest of Network Security will be done to identify the prior knowledge of students in Network Security. Students are divided into two. Group one will learn the Network Security in conventional method. While group two will learn Network Security in PBL environment by using the e-learning. Second questionnaire will be spread to students of group two. This questionnaire is to view students' opinion on project based on their acceptance, usability of e-learning and also the problem solving method provided.

For final analysis, student will be given post test to check out their understanding on the subject matter. The result of the post test will show whether PBL method or conventional method that is better.

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