

# Collaboration in Problem-Based E-Learning: Requirements Engineering Activity

Noorihan Abdul Rahman<sup>1</sup>, Shamsul Sahibuddin<sup>2</sup>

<sup>1</sup>Faculty of Computer and Mathematical Sciences,  
Universiti Teknologi MARA (UiTM Malaysia),  
40450 Shah Alam,  
Selangor, MALAYSIA  
noorihan@kelantan.uitm.edu.my  
noorihan@gmail.com

<sup>2</sup>Faculty of Computer Science and Information Systems,  
Centre for Advanced Software Engineering,  
Universiti Teknologi Malaysia (UTM),  
International Campus, Jalan Semarak,  
54100 Kuala Lumpur, MALAYSIA  
shamsul@utm.my

## ABSTRACT

*Problem-based Learning (PBL) is a learning technique that is used for stimulating learners with problematic dilemma and encouraging the learners to solve the problem based on learner's capability. It is more to learner-centred approach whereby teacher or instructor plays role in guiding them to succeed. This paper enlightens on collaboration activities in e-learning and what element can be considered during requirements elicitation. This activity is essential to clarify the requirements needed in PBL-based E-learning application that is going to be used among learners especially for higher institution.*

### Keywords

*Problem-based Learning (PBL), learner, members, requirements elicitation, requirements*

## 1.0 INTRODUCTION

There is a study that shows that WWW application has received increasing demand among teachers whereby it influences the method that teachers will use for their teaching (Uzunboylu, 2006). By having WWW application as the teaching methods, learners are able to experience learning process through online application and E-Learning helps to realize virtual environment so that they are communicating in non-traditional classroom. E-learning can bring convenience to the community since it permits people to interact regardless of different geographical location and time with certain speed and performance. It also concerns with interaction among learners. E-learning must be supported by technology whereby it keeps up learners throughout their learning process. It varies with traditional classroom in a way that E-learning is available 24

hours-a-day and 7 days-a-week with an Internet connection (Hamid, 2001).

E-Learning as a tool for knowledge management introduces collaboration concept in the community. Therefore, it is very imperative to emphasize that knowledge management tools must come together with knowledge management techniques in order to achieve favourable learning environment and to allow learners get acquainted among themselves and thus stimulate matching understanding to users' knowledge (Ubon & Kimble, 2002). This paper contains Section 1.0 which is to give introduction about E-Learning demand among community members. Section 2.0 explains Problem-Based Learning technique as a teaching style for students and relates collaboration element in Problem-based E-Learning. Section 3.0 gives the idea of requirements gathering in designing Problem-based E-Learning and what are the challenges that might come during requirement engineering process. Section 4.0 wraps up the idea of the paper.

## 2.0 PROBLEM-BASED LEARNING

Problem-based Learning (PBL) is a technique that has been introduced over 30 years ago in North America from health science field and this technique started to being applied in other disciplines. PBL empowers learners to have self-learning activity by having own research, collaborate and apply knowledge in producing the best solution for defined problem (Savery, 2006). It is one of the important learning techniques that is rising in tertiary education which has evolved from traditional learning education (Yeo, 2005). PBL technique has contributed learning process via cooperation among students in order to come out with an agreement of understanding among them. Students hold the responsibility in learning whereas teacher gives guides and put in their expertise knowledge for

opinions. Students work together to find solution for related problem which will result to no particular right answer for the solution in PBL (Hmelo-Silver, 2004). Based on Hmelo-Silver, students normally will collaborate among themselves and adapt with self-learning to resolve problem. The teacher will aid them to seek for problem solving throughout the learning process. Learning process in PBL can be experienced by related issues from a real-life problem and solutions are produced from discussions that has been made upon the issue (Lahteenmaki, 2001).

A few components that engage in PBL include people, process, and purpose. People in PBL environment should contain effective groups of people in order to generate effective result from discussion session. There should be combination of group members that can discuss the solution that can best fit the problem domain plus helpful facilitators or instructors who can help them to guide and give the boundary for the problem that learners have to solve. Whereas process involve administrative plan in order to support PBL-oriented learning with the support of technical equipment such as lab setting. Purpose is another component that explains appropriate policy by policy developers and administrators. This policy help to strategize on how PBL is going to be implemented for learners and also to make sure community members are adaptive to PBL environment (Stonyer & Marshall, 2002).

#### **2.4 Collaboration in Problem-based E-learning Environment**

“Collaborative learning refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another’s learning as well as their own. Thus, the success of one student helps other students to be successful”(Gokhale, 1995). Collaboration supports communication among users and tools available are Google Groups collaborative space, virtual, and face to face meetings (Suddaby & Milne, 2008). There are several issues which can be related with e-learning implementation.

E-learning technology is used to cater sharing knowledge activity among learners and other activities via online. Therefore, collaboration element should be imposed in learning technology so that collaboration can be done in the e-learning milieu. The issue in collaborative learning is to have effective collaboration among group members. Effective collaboration will result the best outcome from the face to face discussion. There are elements like good preparation of software and other materials which can stimulate collaborative learning environment. Good atmosphere of collaborative learning experiences encouraging question-answer session among students and they can challenge each

other to answer questions in E-learning (Curtis & Lawson, 2001).

There are issues discussed related to online learning practice and its concern with collaborative (Bernard, de Rubalcava, & St-Pierre, 2000). Those issues are on the subject of course preparation, creating good environment among online community, instructor’s task, promoting collaboration method in online distance learning and technology effectiveness. Bernard also emphasized that learner’s instructional needs, motivational preparation for learners enable online distance learners to have information exchange and interactivity.

### **3.0 REQUIREMENTS ENGINEERING**

A requirement is a “function or characteristic of a system that is necessary...the quantifiable and verifiable behaviors that a system must possess and constraints that a system must work within to satisfy an organization’s objectives and solve a set of problems”(Christel & Kang, 1992). The technical report by Christel and Kang also provide another definitions for requirements like “(1) a condition or capability needed by a user to solve a problem or achieve an objective; (2) a condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents; (3) a documented representation of a condition or capability as in (1) or (2)”.

Requirements Engineering (RE) is an important process in software development since identification of right requirements can aid in reducing software cost. Requirements errors that are produced throughout the development process can result expensive cost of production. Therefore, prevention of requirement error must be detected earlier to prevent from potential and critical risks in the future (Zowghi, 2002).

#### **3.1 Collaboration Activities with RE Support**

“Collaborative learning refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another’s learning as well as their own. Thus, the success of one student helps other students to be successful” (Gokhale, 1995). Collaboration supports communication among users and tools available are Google Groups collaborative space, virtual, and face to face meetings (Suddaby & Milne, 2008). Collaboration activities in classrooms may exists through discussions among members to solve problem which involve an active work towards course material. These activities complement criteria of PBL technique whereby the technique is allowing

learner-centred approach and let learners be as contributors towards the problem solving activity.

Fulfilling user's requirements for Problem-based E-learning environment is not an easy task since all the stakeholders need to work together to come out with design specification for achieving PBL feature. The keyword 'collaborate' has revealed that interaction element among users in E-learning is very important to ensure users are comfortable and can use E-learning as a medium to communicate and share knowledge. Developers also need to investigate user's background and user's activity for E-learning user to match E-learning application with learner's ability. There is a study stated that different learning styles affect student achievement in Web-based courses (Hong, 2002) and that is why it is significant to identify learners' profile and hence design suitable application for them. Collaboration needs social interaction among members because they need to work together towards problem solving task. Good interaction can improve collaboration and it is influenced by social presence element during the communication. The definition of social presence will be elaborated further in this paper.

### 3.2 Definition of Social Presence

Social presence in a computer-mediated communication environment refers to the user's degree of feeling, perception, or reaction being connected to another intellectual entity, which involves a subjective quality of the communication medium related to the concepts of intimacy and immediacy (Short, Williams, & Christie, 1976). It is important since it can lessen socio-technical gap for a particular system development and therefore increase interaction and collaboration among users (Kreijns, Kirschner, & Jochems, 2003). Social presence can also be defined as "the degree of awareness of another person in an interaction and the consequent appreciation of an interpersonal" (Walther, 1992).

The theory of social presence is important since social presence technology is hoped to be an alternative to face to face interaction among individuals (Biocca & Harms, 2002). The theory also relates on mediated interaction technology which particularly explained different technological forms that can assist social interaction which encourage interaction of mind among individuals. It can also be described as "the extent to which a medium allows users to experience others as being psychologically present" (Gefen, Karahanna, & Straub, 2003). Social presence can also be defined as "the degree to which participants in computer-mediated communication feel affectively connected one to another, has been shown to be an important factor in student satisfaction and success in online courses" (Swan & Shih, 2005).

### 3.3 Requirements Elicitation for Problem-based Learning

Requirements elicitation engages with negotiation and collaboration activities with all stakeholders that will eventually result clear basis for a set of requirements that is going to be used for system development. This results from the frequent interaction and agreement among stakeholders in Requirements Engineering process (Coughlan, Lycett, & Macredie, 2003). Requirement elicitation is done to identify solution for designing and developing system based on certain scenario which helps developer for implementation (Gaydos & Smith, 2009).

Elicitation techniques can be differentiated by a few classes which consist of (Nuseibeh & Easterbrook, 2000):

- Traditional techniques – these techniques involve questionnaires and surveys, interviews, analysis of existing documentation such as organisational charts, process models or standards and existing system manuals.
- Group elicitation techniques – involve team collaboration to capture detail understanding of needs. Examples are brainstorming, focus groups, RAD/JAD workshop.
- Prototyping – this technique is applicable with huge deal of uncertainty requirements and developers need to get feedback from stakeholders to improve the product quality. This technique needs input and output throughout the discussion so that requirements can be taken out from the stakeholders.
- Model-driven techniques – requirements will be collected based on goal-based methods like KAOS, I\* and CREWS.
- Cognitive techniques – this class of techniques will use think aloud, protocol analysis, laddering, card sorting, repertory grids
- Contextual techniques – use ethnographic, ethnomethodology, conversation analysis.

There are some issues in gathering PBL element for E-learning. Firstly, stakeholders need to have same agreement upon E-learning scope for PBL. For example, learner and instructor have their own roles in the application. Therefore, designer has to identify who are the users for E-learning and categorize roles for each actor. Categorization for each role is needed to help developer defined function of the system. This can be done by having requirements elicitation technique which is to gather type of stakeholders, their responsibility, how do they involve in the community and also how do they share knowledge within community.

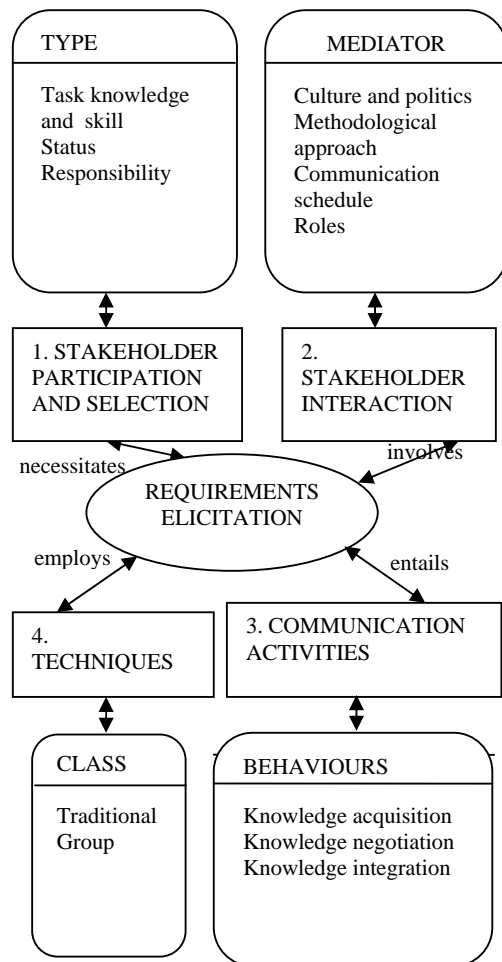


Figure 1: Four-dimensional view of RE (Coughlan et al., 2003)

Figure 1 shows a framework of four-dimensional view of RE which can help requirements elicitation during earlier stage of system development. It is divided into four components; stakeholder participation and selection, stakeholder interaction, techniques and communication activities. However, this framework did not mention regarding social presence element during system development.

Communication activities play part in requirement elicitation process to act as a channel for user participation during the development. Stakeholder acceptance involved combination of viewpoints from the stakeholders such as feedbacks, fear factor of losing jobs and resistance to change if new system is imposed. In this case, social presence element can be added in the requirement elicitation process to ease the communication among stakeholders. Users of the system can have lucid picture on why new system is going to be adopted in the organisation with minimum resistance from users. In this case, users can be motivated to use and collaborate in the system by injecting social presence feature in the system. Users might gain satisfaction from

development product by having social presence as a psychological involvement. There is a study stated user satisfaction of the development products influenced by behavioural participation and psychological involvement (Barki & Hartwick, 1989).

Therefore, social presence features can be considered in Problem-based E-learning since the application involves a lot of virtual communication and collaboration activities from learners and instructor. Social presence requirements can be elicited from requirements gathering process to help developer starts with 'clearer' picture to accommodate connectedness among members in the application. Additionally, emotional bonding is relevant in keeping users motivated to execute group work via the application (So & Brush, 2008). The challenge for developer is to ensure that they are building desired application with desirable functionalities for members. Beside technical aspect, both user and developer need to think on how to reduce socio-technical gap in the application because this is one of the reason of learner's motivation for using E-learning application.

#### 4.0 CONCLUSION

Problem-based e-learning provides collaboration activities among members and hence social interaction in e-learning must be taken into consideration to foster effective learning process virtually. In this case, the effectiveness of social interaction in e-learning must be studied in order to encourage motivation for members to actively join e-learning. A requirements elicitation framework can be studied to help introduce social interaction element like social presence during requirement engineering activity which will then allow requirement engineering process to contribute in reducing socio-technical gap for e-learning development.

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