REQUIREMENTS ELICITATION APPROACH TO SUPPORT E-LEARNING ACTIVITIES

[1]NOORIHAN ABDUL RAHMAN, [2]AHMAD RAZIF ABDUL RASHID, [3]FARHANG JARYANI

Computer Science Department, Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Kelantan Branch, Kelantan, Malaysia
Department of Commerce, Polytechnic of Tuanku Syed Sirajuddin, Perlis, Malaysia University of Applied Science and Technology, Tehran, Iran
E-mail: [1]noorihan@kelantan.uitm.edu.my, [2]ahmadrazif@ptss.edu.my, [3]fjaryani@yahoo.com

Abstract - E-learning is an application that can be used to obtain and share information via the Internet. By using E-learning, the learning process is more flexible than learning in a traditional classroom since learners are exposed with various kinds of platform and technology. Education can happen either in class, at home, in public anywhere and anytime. During learning process, knowledge can be reinforced, thus, contribute to another new theories or contributions. For higher education domain, E-learning has a very great value for students to learn by socially interact via online. Collaborative activities in E-learning help the instructors to produce knowledgeable graduates with various experience in gaining knowledge on respective subjects. This paper highlights on how requirements elicitation can support E-learning activities by using E-learning technology. This paper also reveals on requirements elicitation which is used to elicit important elements in E-learning to address social interaction during learning process. Lastly, this paper also seizes upon the opportunity to suggest possible requirements elicitation approach to extract learning elements and thus transform it into software requirements.

Index Terms - Collaborative activities, E-learning, learner, requirements elicitation.

I. INTRODUCTION

In giving best service to education, Electronic learning or E-learning takes part in disseminating and sharing knowledge for learners. E-learning is a way of learning in education industry which is supported by an integrated tool to fulfill learners need regardless of time, and place for their learning process[1][2][3]. It can be seen as a collaboration of entities which comprised of students, instructors, administrators, designers and developers of the application[1]–[4]. To serve virtual community in learning, efforts from content authors, instructional designers, multimedia technicians, teachers, trainers, database administrators, and people from various other areas of expertise counts in this case[5]–[7]. There are also other studies stated that E-learning is a Learning Management System (LMS) application that is used as a collaborative tool for knowledge sharing[8][9][10]. It is crucial to ensure that electronic learning technology is defined and consistently improved over time to cater demand from industry[11].

Software developers need to identify the right features to be gathered to address the issue of effective communication among learners while using E-learning. This paper begins with motivation (Section II) which elaborates the importance of clarifying requirements in E-learning by using the right requirements elicitation process. Analysis of literature (Section III) covers E-learning, Requirements Engineering and requirements elicitation. Next, Section IV explains the idea of gathering soft issues in requirements elicitation. Section V (Conclusion) summarizes this paper.

II. MOTIVATION

In implementing good quality of E-Learning, both user and developer need to have the same agreement upon E-learning implementation. Besides fulfilling technical requirements and business requirements for E-learning, developers need to understand how to ensure that they develop successful E-learning so that the application can be used as effective as possible among users[11]. They should discuss clearly for attaining the same goals in E-learning. The same goals will then lead to clarified requirements desired by both parties. The activity of communication in gathering requirements is associated with the process associated in requirements engineering (RE) concept. RE concept will be elaborated further in the literature review.
In using E-Learning, learners and instructors are the main entities communicate via online among them. Social interaction among people in the virtual communities determine the usability of E-learning. For distance learning like E-learning, it is related with a few factors like social presence, satisfaction and collaborative learning. These factors are socio-technical issue that are currently facing E-learning implementation. Interactions between learners or other E-learning users and also with the application play essential parts in determine the E-learning usability. They people involve needs to feel comfort and ease if they want to use the application[12]. A sense of connectedness during interaction among users might gauge users' encouragement to use e-learning. A study mentioned that interaction among individual in online learning is contributed by connectedness and collaboration[13]. According to So and Brush, connectedness and

closeness motivate to engage with group work. Scarce opportunities available to E-learning develop themselves in the environment leads to lack of sense of belonging within the group. With limited chances to do collaborative learning virtually, learners believe that online communication technology is not needed since they can meet face to face. Developer and user must be clear about elements that is to be included in e-learning and effective communication between user and developer can reduce the issue of socio-technical gap in E-learning implementation. The issue will also be discussed in the literature review. Section III will further elaborates on literature in order to support the motivation in this paper.

III. ANALYSIS OF LITERATURE

A. Overview of E-learning

E-learning is an application that can be used to obtain and share information via Internet[7], [9]–[11], [14]. E-learning's users can be students, teachers, employees in the organization, instructors at training centre or any individual or organization that uses the application. E-learning can be understood with various terms depend on its objectives and roles of the application. According to Nagy[15], "E-Learning is an umbrella term describing any type of learning that depends on or is enhanced by online communication using the latest information and communication technologies."

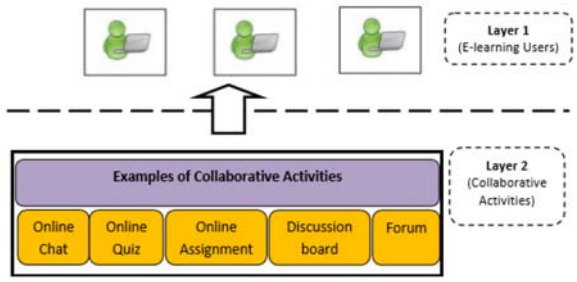


Figure 1 Collaborative activities in E-learning[8]

Figure 1 reveals collaborative activities which exist in E-learning namely online chat, online quiz, online assignment, discussion board and forum. The identification of collaborative activities (Layer 2) is able to help E-learning developer to elicit features needed upon the demand of the collaborative activities from the E-learning users. The knowledge area of requirements elicitation process can be extended to elicit requirements based on social interaction for a collaborative application, thus, enhancing the development of collaborative technologies. 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. The article elucidated that 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 per day and 7 days per week with an Internet connection.

E-learning situation and traditional classroom situation may differ in terms of having technology for E-learning. Its building block consists of content, application, infrastructure, portal and browser whereas traditional classroom comprised of content, teaching methods and classroom[15]. There is a study which reviewed two E-learning projects in the European Union stated that the usage of computer users among teachers via Internet has increasing by time and it is predicted to transform their teaching methods[15].

B. Challenges in E-learning

The challenge in establishing E-learning is how to disseminate information effectively. The designer should consider several factors when designing the application. The objective of having E-learning should be justified so that information can be conveyed clearly by the user. In addition, E-learning application must also be adaptive with different learning styles and different user profiles. A quality E-learning must follow the needs from its user in order to meet learning objective[14]. Another study highlighted that E-learning might face difficulties not only in terms of its high cost and quality of content but also concern about interaction among user in user-friendly manner. This facility can lead to higher cost since user-friendly facility must be made available 24 hours[14]. Figure 2 visualizes how E-learning plays as a knowledge management tool which is used as a sharing medium among users. In implementing knowledge management concept for E-learning environment, three components of social level that should be comprehend are individual level, task level and community level.

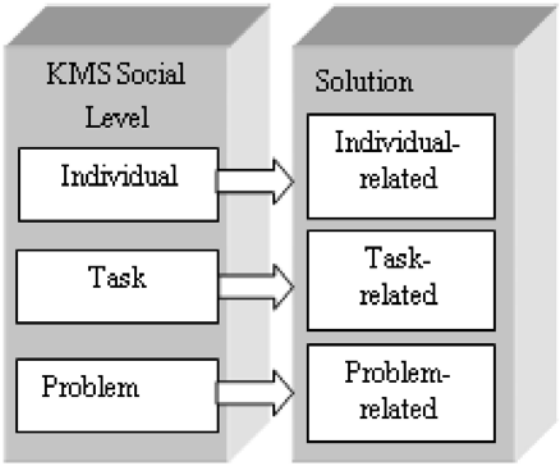


Figure 2 List of KMS Components and corresponds solution

Different social level represents different pattern of interaction in KMS and each social level can be solved independently. Some users find it discouraging to

learn new system for less or no benefit. Therefore, developer can help to ameliorate user's effort to use the system by designing easier task on the existing system with lots help and support from the developer's side. In giving and sharing knowledge, users need to perceptive upon knowledge management technology and let themselves anticipate with the tools and support. Therefore, based on Figure 2, those solutions can assist in providing helpful tool and support and also an environment that can give close feeling among community. Usability issue is the major concern in motivating and attracting users to use KMS because users need to feel comfortable using the system and also can experience their presence as in face-to-face interaction in seeking and sharing knowledge.

The concept of distance learning must be purified to let students learn online effectively which eventually encourage alternative learning access. There is a study in online engineering education which improved network communications and computer technologies to improve learning and teaching quality for engineering students (Bourne et al., 2005). The study found out that the students should be provided with sufficient laboratory facilities for online engineering education, cost reduction for online learning, mathematics and design capabilities for online learning and sufficient online technology to be virtually existed.

In implementing mobile learning, for instance, developer must examine whether users are ready and willing to use the application. There are also challenges in infrastructure, types of mobile devices if the user is using mobile learning, learning styles since different learning styles will produce different outcome for students. In designing web-based learning application, Activity Theory can aid the developer to identify learners factors in order to study users' interaction with E-learning systems [16]. The study revealed that factors like learner's active learning, multimedia instruction, problem-solving skills, teacher assisted as tutor contribute to e-learning systems success.

There is also a study depicts user behaviour and education practice in web-based learning environment which analyzed students in different semesters (Liu et al., 2003). The outcome shows that students' behaviour will change if instructor method of the teacher changed. Students think that web-based learning can give them more freedom, convenience where they can share ideas, innovation and activities. There are issues that can discourage them to use web-based learning such as problem in network, little communication between teachers and students where they cannot raise questions and get answer at instance. The courage in collaborating among leaners and instructor can motivate achievement of e-learning operation and this can be accomplished by having good surrounding in the e-learning community itself. Participants need to understand each other's work and help each other in dealing with problem solving. Instructor also helps in giving guidance to students in collaboration by coaching them on how to collaborate, setting up boundaries towards the given task and be a moderator to invite, support those students. Students' attitude is important in collaboration since it is the indication whether learning community is active and participates in sharing and learning knowledge. Palloff and Pratt[17] has justified the best characteristics in online course are openness, flexibility and humour, honesty and willingness to collaborate.

C. Overview of Requirements Engineering

Requirements engineering (RE) is a wide area of knowledge that is branched out from software engineering field. There is a few definitions that can express what RE is. "Requirements engineering (RE) is concerned with the identification of the goals to be achieved by the envisioned system, the operationalization of such goals into services and constraints, and the assignment of responsibilities for the resulting requirements to agents such as humans, devices, and software. The processes involved in RE include domain analysis, elicitation, specification, assessment, negotiation, documentation, and evolution"[18]. According to Lamsweerde, requirements engineering is not an easy task because the process deals with conflicting ideas of proposed system as well as vague requirements from the beginning of the system planning.

Another issue is difficulty in defining requirements because each requirement available need to be considered, selected, prioritized and finalize the by resolving requirements conflict and construct acceptance criteria. A set of complete requirements gives solution for software that is going to be designed and implemented. It is also difficult since requirements need to be understood by technical or non-technical stakeholders and the requirements establishment should be addressed its goals, functions and specifications of software behaviour and their evolution over time.

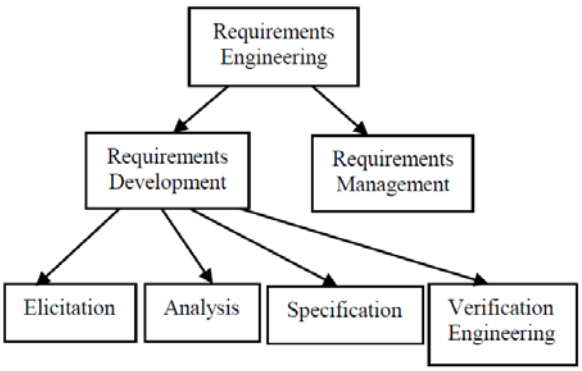


Figure 3 Subdisciplines of Requirements Engineering[19] [8]

Figure 3 reveals that requirements engineering has been divided into requirements development and

requirements management. Requirements development is further subdivided into elicitation, analysis, specification, and verification. Requirement development activity must result an agreement from project stakeholders upon product's capabilities. Whereas requirements management part will consist of activity that controls project changes in the requirements baseline and observes requirements implementation.

To elaborate, the four subdivisions of requirement development have their own target. For elicitation, it is considered as the first step in requirement development because product's business requirements, user involvement initiate the process to gain requirements. The project scope is defined and stakeholders need to justify why the project is needed. Then, each user will be assigned their tasks and quality attributes of the requirements will be defined to comprehend features to be put into the system.

D. Overview of Requirements Elicitation

"Requirements elicitation is the process of seeking, uncovering, acquiring, and elaborating requirements for computer based system." It is not just a gathering process but it is a process to understand the requirements that have been collected by going through activities with appropriate tools, techniques and approaches[20]. The requirements elicitation is essential to the success of software development projects[17].

Based on the analysis of literature that has been gathered, there are elements of 'soft issues'[21][8] that need to be identified during requirements engineering. These elements affect system development and also users that are going to use the application. The 'soft issues' are related with the social aspects elements that need to be taken into consideration in E-learning implementation. Previous case studies have been reviewed in order to get ideas on how to extract social aspects requirements in the case studies and what model can best-fit the elicitation process for a particular case study. The model must be analyzed in terms of the nature of E-learning as well as the characteristics of previous case studies. The previous case studies have no exact similarities with E-learning case study. However, there are elements like social interaction and requirements engineering activity that might match the process of developing all case studies. The previous case studies involved are considered based on social aspects elements that they can collect from the requirement engineering process. The case studies are multi agent system, development of Information System projects, system development in organization that have many stakeholders, computer game and three-stage model by identifying key users during the Web-based development process.

Section IV brings out soft issues during E-learning interaction and how requirements elicitation can help to improve E-learning usage.

IV. GATHERING SOFT ISSUES USING REQUIREMENTS ELICITATION

The authors believe that soft issues in E-learning deal with the ability to gather social interaction requirement among learners to ensure effective communication between users. Therefore, to strengthen the process of requirements elicitation, the E-learning scenario needs to be further investigated to elaborate more on the issue of collaborative activities among the learners. Soft issues can be seen as another requirement in E-learning to foster user participation and motivation by improving the sense of connectedness and interaction among the users. Interaction involves behaviour of each individual which can help the connection to be successful. Soft issues such as social interaction in collaborative activities help individuals to communicate and be comfortable with each other, thus allowing themselves to collaborate in the problem solving environment[8]. The element of user profiles is also important in collaborative activities. Same background and same interests can cultivate a mutual understanding and allow the users to share knowledge. In this case, the requirements of these social and technical aspects need to be identified in the early stage of the requirements engineering process to reduce the need to modify the application throughout the development. The identification requirements relate to soft issues has helped to reduce the ambiguity of the requirements required in collaborative applications. Another important thing is that other social aspects, such as motivation, connectedness, comfort, and mutual understanding in collaboration, et cetera must be elicited from the user requirements since social issues must be tackled early in the RE process. This is necessary to reduce the socio-technical gaps in E-learning and decrease errors during the implementation stage.

Quality E-learning has to be designed according to the user's requirements regardless of the evolving requirements of the stakeholders. Requirements are varied such as functional requirements, non-functional requirements, and domain requirements[22]. In developing Computer-Supported Cooperative Work (CSCW) application such as E-learning, the students' collaboration is one of the most important features that allow the students to communicate and share their knowledge virtually. In order to ensure effective student interaction, the developers are responsible for identifying the appropriate process in eliciting requirements for student interaction.

In E-learning, each learner may experience a feeling of connectedness, varying levels of perception, and reactions which exist when interacting with another person. The quality of the CMC environment must be

taken into consideration to allow successful communication[23]. Therefore, it is possible for social presence element to improve the learner's motivation by ensuring its usability and sociability become the basic needs in the online community like E-learning.

The theory of social presence can be linked with E-learning since social presence technology is believed to be an alternative to face-to-face interaction among individuals[24][25]. The theory is also related to other mediated-interaction technology, which mainly explains the different technological forms that can assist social interaction, which in turn encourages interaction of mind among individuals. Gefen et al.[26] describes social presence "the extent to which a medium allows users to experience others as being psychologically present"[26]. Whereas, Cheng and Atlee [27] has defined social presence as "the degree to which participants in computer-mediated communication feel affectively connected to one another, has been shown to be an important factor in student satisfaction and success in online courses"[27].

Hwang and Park[28] divided social presence into three concepts which are co-presence, mutual awareness, and connectedness. Social presence as a co-presence is the feeling of collaboration with other people as if they were in the same location, space, or room. Whereas, social presence as mutual awareness can be considered as the feeling of others' existence in a mediated environment and the connectedness reveals the meaning of having social exchanges and to become acquainted with each other.

A sense of social presence occurs when the user feels like he has access to another intelligence and its reaction to the user in any social interaction like the human-to-computer interaction. A sense of social presence which is one of soft issues in collaborative activities can be transformed into a set of requirements by using suitable requirements elicitation approach. In summary, a set of requirements can help software developers to identify suitable features for E-learning development.

CONCLUSION

In developing E-learning, developers should identify what are the features that can support collaborative activities and social interaction that involve among learners. During requirements elicitation approach, mutual understanding among stakeholders is a must in finalizing E-learning technology. Besides identifying E-learning technical requirements, stakeholders should be aware of soft issues that may occur in user interaction since soft issue may affect the effectiveness of the application usage. Requirements elicitation process must be carefully investigated to ensure appropriate solution has been implied to the right domain.

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