

## CHALLENGES IN E-LEARNING: FROM REQUIREMENTS ENGINEERING PERSPECTIVE

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**ABSTRACT.** Nowadays, education offers great flexibility to learners in order to help them to succeed. E-learning as knowledge management tool gives service to learners in disseminating and sharing information. Therefore, there is a lot of interaction from users in E-learning community that helps them to solve tasks in E-learning application. There are challenges to sustain E-learning service because users might get bored and infrequently use it. Requirements Engineering (RE) takes the opportunity to strengthen RE process by investigating how socio-technical requirements such as lack of social presence, feeling bored and lack of motivation can be transformed as socio-technical requirements and are available to be implemented by developers as agreed by users. Therefore, RE process should manage to capture socio-technical requirements in order to allow consistent motivation among learners. Requirements elicitation, as the initial stage in RE process, may improve its mechanism in eliciting socio-technical requirements for collaborative application such as E-learning. Hence, RE process and E-learning components must be carefully studied to ensure RE as in Software Engineering field can assist collaborative application to improve elicitation process and come out with a set of requirements before E-learning is implemented. This paper describes challenges in social interaction issue for E-learning environment and how RE sees these challenges.

**Keywords:** requirements engineering, E-learning, requirements elicitation, collaboration, social aspect, socio-technical requirements

### INTRODUCTION

Electronic learning (E-learning) is a Learning Management System (LMS) which is widely used by higher institution to provide learning facility for learners and instructors. It is used as a collaborative tool for knowledge sharing and gives support for its users by providing facilities such as review course activities online, assignment submission, online quizzes, online forum and discussion and other collaborative activities among users. This application is needed by learners to ease their learning activity regardless of time and place. Requirements Engineering (RE) is seen as one of the sub-disciplines in Software Engineering (SE) that involved with identifying accurate requirements according to users' demand. RE activities complement with E-learning environment since E-learning must be defined and improve consistently in order to fulfil request from users (Guido *et al.*, 2008). For achieving desirable outcome, RE activity is essential to ensure users and developers understand the same problem domain and hence attain improvised value of social interaction as one of E-learning features.

## MOTIVATION

This paper is produced to share some ideas on how RE process may fortify its process in establishing socio-technical requirements for collaborative application. E-learning has been selected as collaborative application in this paper to highlight the challenge of RE process. The process is essential in producing an accurate set of requirements which can support socio-technical requirements resides in online collaborative activities. Active collaboration among members during learning process helps them to learn mutually and actively participate in online activities (Alonso, López, Manrique, & Viñes, 2005). Distance learning is also related with social presence and user satisfaction while using the system. These factors play crucial parts in determine the E-learning usability. A study has pointed out that interaction among individual in online learning is contributed by social presence and collaboration (So & Brush, 2008). Hence, user and developer must understand these elements in order to influence interaction even though they are not having face to face interaction. These elements can be categorized as socio-technical requirements or social aspect which is considered as psychological aspects in developing information in order to create user's connectedness and bonding while involving with distance learning activities. There is another study stated that collaboration in E-learning is imperative since it creates social interaction to the group for knowledge sharing (Kreijns, Kirschner, & Jochems, 2003).

## LITERATURE REVIEW

This section covers topics regarding the overview of E-learning and what is the relation with collaboration activities. The literature review explains the relation of collaboration in social interaction and also why is it important in developing E-learning. This paper also identifies what is social aspect based on selected case studies and the relation with RE activity.

### Overview of E-learning and Collaboration Activity

A quality E-learning follows users' needs in order to meet its objective (Schewe et al., 2005). The system should be clearly presented in order to convey information to the user. In education, there are several collaboration categories like storytelling, open-ended discussion, focused discussion on certain topic or project work and also mentoring. Knowledge management technology allows learners to own knowledge from knowledge discovery and consequently create inventive finding throughout collection of knowledge that they have gained (Rongrong & Jun'e, 2008). The courage in collaborating among users can motivate achievement of E-learning operation and this can be accomplished by having good surrounding in the E-learning community itself. Instructor can help 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. A study has justified the best characteristics in online course are openness, flexibility and humour, honesty and willingness to collaborate (Palloff & Pratt, 2003) and online learning can give strength to collaborative activities among members. There is an issue regarding social interaction in E-learning which affects learners' motivation to work together with other members in online community. They feel less connected with online group which discourage them to involve actively with the task. Individual might differ with each other and this case different level of user acceptance towards the technology (Huang, Lin, & Chuang, 2007). Learners need interaction in the community so that they can learn new knowledge, experience new skill and attitudes towards the problem.

By improving social interaction in E-learning, user can improve satisfaction towards E-learning usage and this can only be done if users feel the connectedness or bonding among

members in the group. By increasing the level of connectedness, they can actually improve collaboration activities in E-learning. In this case, E-learning system must be carefully planned so that social interaction issue can be identified and thus can be solved by developer throughout implementation.

### Overview of Requirements Engineering (RE)

RE is a sub-discipline of SE. “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” (van Lamsweerde, 2000). According to Lamsweerde, RE 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. The existing challenge in RE is the 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. Then, all requirements that have been examined are transformed into a set of complete requirements that gives solution for software that is going to be designed and implemented. RE will be challenging in terms of making technical and non-technical stakeholders to understand the same issue and finally establish the same goals, functions and specifications of software behaviour and their evolution over time as long as demands are required.

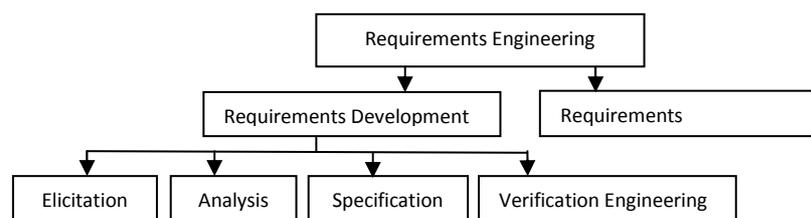


Figure 1. Subdisciplines of Requirements Engineering (Wiegiers, 2000)

Figure 1 reveals that RE 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 features. Whereas requirements management part consists of activity that controls project changes in the requirements baseline and observes requirements implementation. In this paper, the author explains about elicitation process in RE and relates with the importance of elicitation in complementing with social interaction issue in collaborative application.

To elaborate, the four subdivisions of requirement development have their own target. Elicitation is considered as the first step in requirement development whereby product’s business requirements along with user involvement initiate the process to gain requirements. Elicitation process follows by defining the project scope and justification of why the project is needed by the stakeholders. 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. At this point, elicitation during RE is a very important process to ensure all stakeholders have the same agreement upon their proposed system. Next section covers the overview of requirements elicitation and examples of requirements elicitation model that may support social aspects that exist in corresponding system for five selected case studies.

## 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 (Zowghi & Coulin, 2005). The requirements elicitation is essential to the success of software development projects (de Oliveira & Mesquita Spínola, 2007).

## Examples of Requirements Elicitation Model

There are elements in ‘soft issues’ that need to be identified during RE. These elements affect system development and also users that are going to use the application (Thew & Sutcliffe, 2008). The ‘soft issues’ are related with the social aspect elements that need to be taken into consideration into E-learning implementation. The study stated that sociability which is a desire to be part of a group is the value that exists in online community and RE should investigate how to analyze and come out with the requirements to add in this value. Five 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 collaborative activities. There are elements like social interaction and RE activity that might match the process of developing five case studies. Case studies involved are considered based on social aspects elements that they can collect from the requirement engineering process. Case study handled by Liang *et al.* used AT-AC tool to identify social aspects and manipulate Unified Modelling Language (UML) to visualize requirements from multi-agent system (Liang, Ruo, & Bai, 2009). By having Activity Theory as the supported element in the model, both developer and user not only can gather technical requirements but also can see how the social levels interlinked in the system itself. Second case study used goal-driven approach to investigate based on information that they have gathered from organizational (Kavakli & Loucopoulos, 2003). This approach focuses on understanding the need for change in current organizational situation and collected it as goals to be achieved by the organization. However, they did not specifically focus on social aspect of the system that is going to be built.

The third requirement elicitation model is called phenomenographic study (Zhang & Han, 2008). It is about acquiring requirements through conversation that has been done with stakeholders. This study analyzed behaviour and how learners deal with social relations and eventually will discover three kinds of social relationship which consists of learner-learner relationship, learner-tutor relationship and group tension among the community. Whereas, affective requirements are needed while eliciting requirements for game enjoyment (Bentley, Johnston, & von Baggo, 2002). Affective factors for user experience are subdivided into satisfaction, game efficiency, and game effectiveness. This study considered affective requirements to be established as emotion in game setting and these requirements are analyzed using RE process. The fifth model is about identifying key users in order to forecast what is the role of users in system development (Yang & Tang, 2003). This model can handle requirements from users albeit one user is replaced by another user. The relationship between users is analyzed using social network analysis (SNA). According to Yang and Tang, this method helps to measure relationships between people, group and also organization in the company.

## DISCUSSION OF LITERATURE

The first factor that motivates E-learning is collaboration issue. Collaboration allows users to involve in E-learning community and take part in a particular task based on roles that are given to them such as students, instructors or administrators. Collaboration allows active

cooperation among student in E-learning (Fetaji & Fetaji, 2007; Sun, Tsai, Finger, Chen, & Yeh, 2008). This highlights collaboration as social aspect requirement from stakeholders whereby stakeholders must clearly identify and they have to know things that they want in E-learning content. Requirements elicitation must be done not only to gather technical requirements but social aspect requirement in order to overcome collaboration issue and to encourage interaction issue in E-learning system. Collaboration is needed when users need to interact socially with others to unravel some tasks given by their instructors and the system has to help to improve social presence for E-learning community. Thus, requirement elicitation activity should play a role in uncovering what are the elements of collaboration needed in E-learning system. These elements might not obvious as functional requirements. Requirements elicitation activity must identify collaboration activities that are involved in E-learning.

The following challenge is interaction between user and E-learning application. Effective interaction is needed between user and the application to reduce time needed for user to understand user activity involved in the application. Thus, E-learning developer must produce accurate learner-centred design that suits learners since learners have various learning styles, behaviour and expectation towards the system. This can be achieved by having user support during interaction to maintain user activity. Requirements elicitation may help users in categorizing user's profiles in order to forecast level of users and this is important in determining user level of interest towards E-learning system. RE can adopt activity theory (AT) as suggested by Liang *et al.* in order to see social factors involve as well as components of tools, actors and sources needed for E-learning system. In a study done by Bentley *et al.*, user's motivation in game to increase game enjoyment has been gathered through affective requirements which concern emotions of user while playing computer games. The enjoyment is motivation for them to sustain themselves in the game and continue the excitement of playing games. In E-learning, the concept of motivation is one part of psychological aspects. Developer must take into account on how to develop E-learning system that can eventually endorse motivation to users.

## CONCLUSION AND SUGGESTED WORK

Social interaction issue in E-learning involve the improvement of collaborative activities. Effective social interaction can result from active collaboration among members. In order to ensure active participation, RE needs to gather information regarding effective content and also be able to capture social aspects in E-learning. Social aspects will be translated into RE as socio-technical requirements which may consists of soft issues such as motivation, connectedness, bonding. These requirements can therefore increase social interaction in E-learning. Social interaction can be improved by increasing social presence value in E-learning design which can be obtained by having desired requirements from users including requirement on how to have social presence element in E-learning. To conclude, content of E-learning and socio-technical requirements may help to increase social presence element of E-learning as a collaborative application. Currently, the author is doing the investigation on the appropriate requirements elicitation mechanism for capturing social aspects in collaborative application. According to the selected case studies, requirements elicitation process is used to capture social aspect by understanding stakeholders' roles, understanding learners' behaviour, identifying affective requirements and understanding the business process during system development. The appropriate requirements elicitation mechanism for collaborative application which is specifically for E-learning domain will be published on future papers.

Social presence has been identified as one of the elements to make user feels that they are welcomed in the group community. Existing requirements elicitation model can be investigated and analyzed in order to see whether those models considered social aspects as a set of

requirements as the outcome of requirements elicitation. Characteristics of social aspects should be further elaborated to give clear insight of what elements should be in E-learning. Collaboration features must also be identified in order to create effective collaborative activities in E-learning regardless of time and location. By having all these requirements, E-learning system is hoped to be supported by sufficient LMS infrastructure.

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