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Challenges in Requirements Engineering for E-learning Elicitation Process

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Abstract: Requirement Engineering (RE) is a crucial phase in software development process. It is a process to allow users and developers to elicit required information during requirements gathering before implementation starts. Collaborative application is an example of software that possesses knowledge sharing as the main component needed by users in using the application. RE supports software implementation by identifying requirements specification needed for supporting knowledge sharing. This paper gives an overview of requirements elicitation in collaborative application under the umbrella of RE. Thus, Electronic learning domain will be used as an example of collaborative application in order to give the idea of knowledge sharing among users. Electronic-learning can be seen as a collaboration of entities which comprises students, instructors, administrators, designers and developers of the application. Therefore, the challenges of E-learning are also highlighted in this paper in order to depict the importance of RE process for software development purpose.

Keywords: Collaborative application, e-learning, knowledge sharing, software development, requirements engineering, user

1 Introduction

At the present days, education offers great flexibility to learners in order to help them to succeed. Education can happen either in class, at home, in public anywhere and at anytime. Education helps to raise knowledge, and we can thus relate the knowledge with events in life. For higher education domain, learning greatly helps students to achieve their target in their study, and it is also vital for universities to give the best facility as much as they could to their customers. To relate this, higher education institution has to become very conscious about the importance of giving the best quality of technology learning to students. In giving the best service to education, Electronic learning or E-learning takes part in disseminating and sharing knowledge among learners[1]. 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. It can be seen as a collaboration of entities which comprises students, instructors, administrators, designers and developers of the application[2]. One study has stated that E-learning is a Learning Management System (LMS) application that is used as a collaborative tool for knowledge sharing. It is crucial to ensure that electronic learning technology is defined and consistently improved over time to cater demand from industry[3]. Guido also explained that electronic learning is so popular in giving academic resources to its users. They can review course activities online, submission of assignments, doing online quizzes, joining online forum and discussions. Therefore, it is crucial to ensure that electronic learning technology is defined and consistently improved over time to cater demand from industry. This paper elucidates the idea of initiating requirements elicitation process before implementing collaborative activities regardless of evolving requirements in system development process. This paper also classifies elements or subdisciplines as well techniques which exist in Requirements Engineering process.

2 Requirements Engineering: State of the Art

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 in expensive cost of production. Therefore, prevention of requirement error must be detected earlier to prevent from potential and critical risks in the future[4]. Figure 1 visualizes RE sub-disciplines. There are issues discussed related to online learning practice and its concern with collaborative[5]. 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.

Figure 1 elaborates the four subdivisions of requirement development in RE. Elicitation is considered as an initial step in requirement development since product's business requirements and user involvement initiates the process to gain requirements. The project scope is defined and stakeholders need to provide reasons why the project is needed. Then, each user will be assigned tasks and quality attributes of the requirements will be defined to comprehend features to be put into the system.

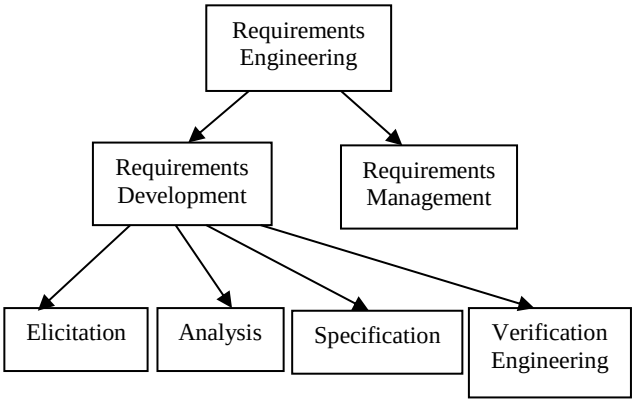

Figure 1: Subdisciplines of Requirements Engineering [6][11]

One other study has stated that RE consists of activities such as eliciting requirements, modeling and analyzing requirements, communicating requirements, agreeing requirements and evolving requirements[7]. The process consists of:-

- Eliciting requirements – this process is to gather requirements from stakeholder using some approaches to obtain product features from stakeholders.
- Modeling and analyzing requirements – the process of visualizing requirements into more understandable representation and usually can be depicted by diagrams or figures.
- Communicating requirements – during this stage, analyst is responsible to understand those requirements in depth and able to relate those requirements and thus, combine requirements into a sequence of processes that can best to picture the idea of business process for certain software development.
- Evolving requirements – the process needs the analyst and stakeholders to continuously clarify an agreement upon a set of requirements in order to mature requirements process in software development. The requirements might change or progress throughout the software production process.

A study also described RE in a number of activities which consist of[8]:

- Requirements elicitation or requirements discovery stage will allow the customers or users reveal their expectation and needs towards proposed system. The correct stakeholders need to be identified so that accurate requirements can be produced for the next stage of RE activity.

- Requirements analysis and reconciliation involve analyzing and interpreting the requirements into sensible requirements to the proposed system. These requirements come from the data which has been gathered from users input. Requirements engineer needs to understand that users can always give opinion regardless whether it is related to the proposed system or vice versa. Those collected requirements can be deficient whereby it will cause difficulty to requirements engineer to understand in order to ensure that it matches the main objective of the proposed system.
- Requirements representation or requirements modeling transform analyzed requirements in the previous stage to understandable and easy to be visualized by all the stakeholders. The visual representation is represented into some models such as using natural language, mathematics and visualizations.
- Requirements verification and validation is the process to determine whether specified requirements represent users' needs. Specified requirements can be validated using semi-formal and formal methods, text-based tools, visualizations, inspections and so on.
- Requirements management involves managing volatile requirements over time since users' might have some other expectations through the development and also changing of business process. Next section provides an overview of social interaction element as one of the requirements in E-learning.

From these conceptual theories of RE, the authors reckon there is a need in investigating the importance of requirements elicitation in RE since it is an initial process to manage a set of accurate requirements for developing software development.

3 Requirements Elicitation

Requirements elicitation engages in negotiation and collaboration activities with all stakeholders that will eventually result in 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[9]. Requirement elicitation is done to identify solution for designing and developing system based on certain scenarios which helps developer for implementation [10].

Elicitation techniques can be differentiated by a few classes which consist of [7][12-13]:

- 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 detailed understanding of needs. Examples are brainstorming, focus groups, RAD/JAD workshop.
- Prototyping – this technique is applicable to 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.

Having all these techniques, the challenges are still remain for the stakeholders in designing a platform for active collaboration platform due to issue in RE during software development process.

4 RE Challenges in Software Development

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. The existing challenge in RE is the difficulty in defining requirements because each requirement available needs to be considered, selected, prioritized and finalized 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 getting technical and non-technical stakeholders to understand the same thing and finally establish the same goals, functions and specifications of software behaviour and their evolution over time as long as demands are required. A proper requirements elicitation technique may contribute to accurate requirements before implementation starts. There are existing requirements elicitation techniques available to maintain requirements' consistency, accuracy as well as ambiguity [14-15]; however, existing methods are focusing on general problem domain and there is an opportunity to improve elicitation technique to support human activities in order to address problem specific domain [16]. The importance of social interaction motivates the improvement of requirements elicitation technique in capturing social presence which is possible to exist in collaborative application and thus, managing the requirements as social presence requirements for the collaborative application.

5 Component Classification in Implementing Collaborative Element in E-learning

The authors provide component classification in implementing E-learning application. According to Figure 2, in implementing E-learning domain, the stakeholders need to consider some conditions so that the requirements can be gathered successfully during requirement elicitation process.

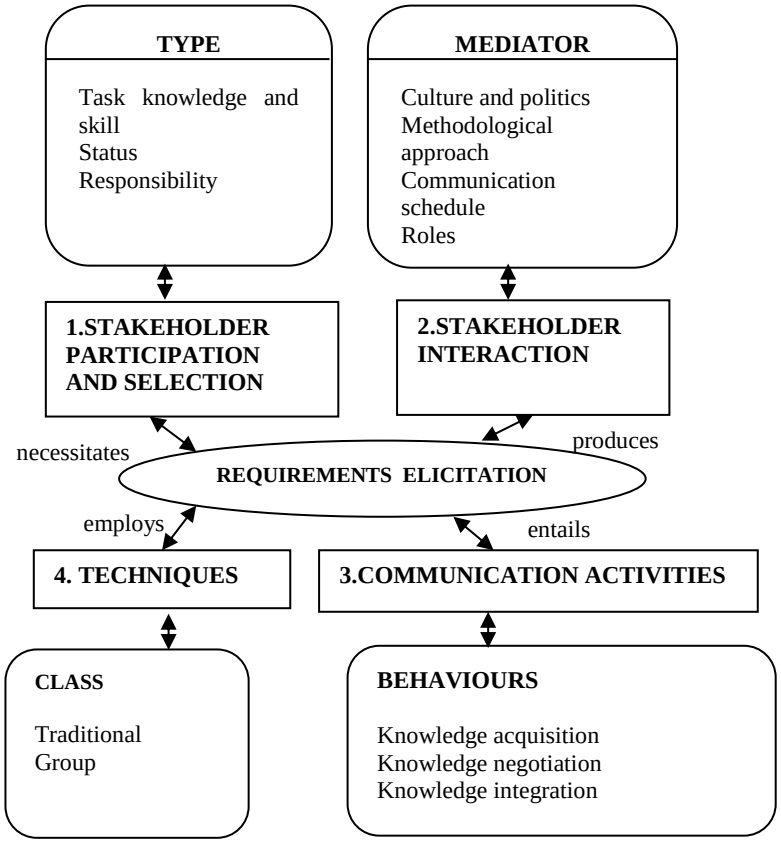

Figure 2: Component Classification in Implementing Collaborative Element

Four component classifications that involve in the process of implementing collaborative element are stakeholder participation and selection, stakeholder interaction, techniques and communication activities. According to Figure 2, whenever eliciting takes place, type of stakeholder is taken into consideration in order to identify and to profile each stakeholder according to his interest and skill in order to ease the process of understading his needs and interests in each collaborative activities. Meanwhile, for stakeholder interaction, these elements namely culture and politics, methodological approach, communication schedule and roles are important to be identified in order to comprehend the environment and school of thoughts which leads to stakeholder's understanding in a particular issue of requirements. The third component classification is type of techniques whereby different form of elicitation such as traditional and group can affect the requirements which are going to be elicited. Additionally, types of communication activities such as knowledge acquisition, knowledge negotiation and knowledge integration assist in understanding how information is disseminated and shared among stakeholders.

To summarise, stakeholders participation and selection needs to be conducted based on background of knowledge, skill, status as well as the responsibility that they possess. Types of medium of interaction must also be considered to ease the developer to understand how the learners communicate and also how to improvise the online communication effectively. Requirements elicitation technique must be selected appropriately to suit the elicited domain during software design process. The stakeholders should also investigate how the knowledge is received, sent or processed during online interaction.

6 Conclusion

This paper discussed state of the art of RE and the challenges in E-learning for learners. The challenge in effective interaction promotes developer to really understand social aspects of users' needs such as elements of effective collaboration, level of users using the application, identifying user behaviour in using E-learning and the importance of developing effective collaboration. Requirements elicitation models need to be compared to see the model variation in obtaining social aspect for E-learning. RE activity must be further studied to see the process that can be related to getting social aspects issues as well as collaboration issue in E-learning interaction.

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