Improving Collaborative Activities in E-learning using Social Presence Requirement Elicitation Process

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ABSTRACT

In developing learning application, a social presence requirement is needed to gain a sense of connectedness albeit through user interface. Social presence is important in order to increase interaction and collaboration between users. In motivating students to actively use E-learning, the requirements elicitation process plays an important role. Multiphase mixed method design is used in this study to evaluate the usability of requirements elicitation product that can be used to extract social presence requirements. There are three artefacts namely *Technical Guide to Requirements Elicitation for Social Presence Support, Social Presence Requirements Template and Social Presence Requirements for E-learning* that are produced in this study to demonstrate their role in supporting E-learning environment.

Keywords: Artefact, collaborative application, E-learning, Requirements elicitation process, requirements, social presence requirements, users

INTRODUCTION

Requirements elicitation is an initial process in Requirements Engineering (RE) to gather stakeholders' ideas before software development begins. The malfunction of requirements elicitation process may lead to project failure during software development (Kausar, Tariq, Riaz, & Khanum, 2010). The challenge to elicit requirements can be seen in developing collaborative application (Murray-Rust, Scekic, Truong, Robertson, & Dustdar, 2014;Pedreira, García, Brisaboa, & Piattini, 2015; Rahman & Sahibuddin, 2010). Obtaining user requirements from human activities such as exchanging information, discussions, problem solving,

resolving conflicts or disagreements is a challenge because it is generated by humans (Fournier, Kop, & Durand, 2014). Therefore, besides having technical solutions for developing collaborative applications, stakeholders should consider requirements from the human perspective (Hayat et al., 2010).

A proper requirements elicitation technique may encourage the stakeholders to obtain more accurate requirements (Dalpiaz, Giorgini, & Mylopoulos, 2013; Dzung & Ohnishi, 2009; Farfeleder et al., 2011; Kaiya & Saeki, 2006; Kitamura, Hasegawa, Kaiya, & Saeki, 2008; Konaté, Sahraoui, & Kolfschoten, 2013; Liaskos, McIlraith, Sohrabi, & Mylopoulos, 2011; Raspotnig, Karpati, & Katta, 2012; Shibaoka, Kaiya, & Saeki, 2007; Thurimella & Maalej, 2013) of social presence in E-learning. To address RE issues in collaborative application, the authors have related to social presence to promote interaction in a collaborative application or face-to-face interaction. Figure 1 illustrates how social requirements and social presence may be understood in the RE field and clarify the need for social presence as a social presence requirement.
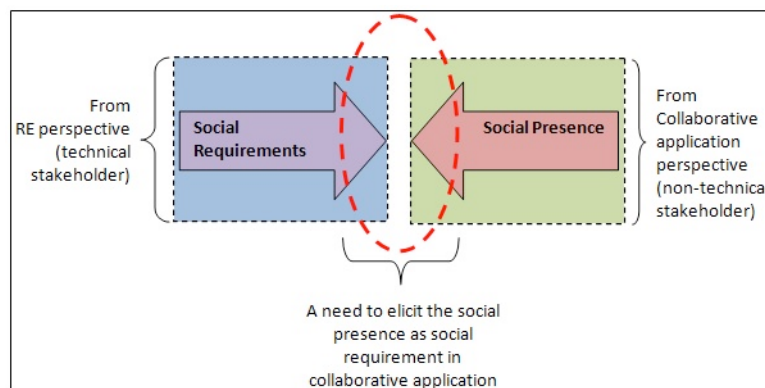

Figure 1. The Relationship between Social Presence and Social Requirements

There is a need to prepare an accurate set of requirements specification to better understand the users' needs in E-learning. In this research, the requirements elicitation process reveals an accurate set of social presence requirements. The goal for having requirements elicitation process in this study is to ensure that users are satisfied with the product. Effective usage of E-learning is essential to motivate the students to learn and use the application actively. In developing E-learning as a collaborative application, the stakeholders should gather the requirements needed by students to ensure that they can interact and share knowledge actively in the E-learning community. Therefore, by using a suitable requirements elicitation process, stakeholders will be able to successfully capture the right criteria based on users' interests and minimize requirement errors

(Azadegan, Cheng, Niederman, & Yin, 2013; Islam & Houmb, 2010; Vale, Albuquerque, & Beserra, 2010).

This paper envisions the opportunity to the RE field to investigate the knowledge of requirements elicitation process in E-learning whereby the E-learning is an example of application that is demonstrating the ability of collaborative activities. This paper highlights the importance of eliciting social presence via learning technology by using social presence requirements elicitation process. It will evaluate the usability of requirements elicitation product for supporting social presence requirements three artefacts known as *Technical Guide to Requirements Elicitation for Social Presence Support, Social Presence Requirements Template and Social Presence Requirements for E-learning*. The purpose of these artefacts is to allow developers or requirements engineers to extract information related to social presence and that of E-learning users. The artefacts can also be supporting documents to elicit social presence elements for other collaborative applications besides E-learning.

METHODS

In this work, the multiphase mixed method design is used as a guide as shown in Figure 2. The author has chosen this design method in order to elaborate findings of social presence requirements and address the contribution with the Requirements Engineering (RE) body of knowledge.
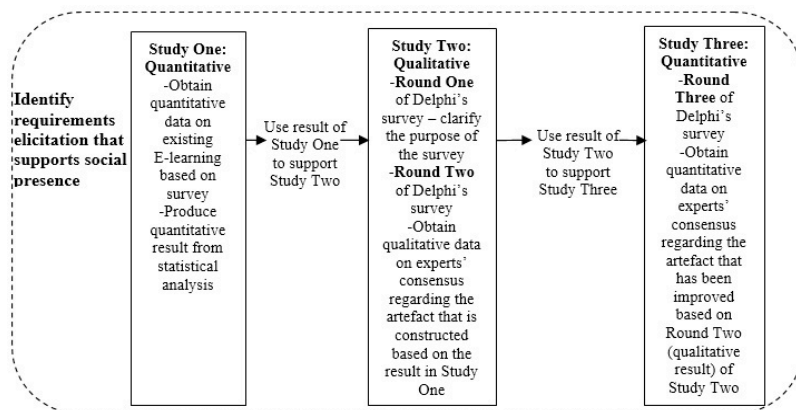

Figure 2. Multiphase mixed method design

Study One in the multiphase design was conducted to investigate the existing requirements elicitation processes for supporting social presence in a collaborative application. It aims to identify the social presence factors of the E-learning domain, and to design a new requirements elicitation process flow. The author simplifies the research activities and outcomes for each study in the multiphase by specifying the research questions, phase, and analysis as well as reporting each study in the

multiphase design. A detailed description on Study One has been revealed by Rahman and Sahibuddin (2016).

Next, the initial artefact produced in Study One was used in Study Two to demonstrate the second part in the multiphase method design. The objective of Study Two was to demonstrate the usability of social presence requirements in a collaborative application. The initial artefact was used as an initial document to develop a 'Technical Guide to Requirements Elicitation for Social Presence Support'. In this research, a three-round Delphi survey was used to seek consensus from experts regarding the developed artefact. A Delphi survey was carried out to evaluate the usability of social presence requirement in supporting a collaborative application. The evaluation of the artefact, which has the support of social presence requirements, was initiated to the E-learning domain. Round One and Round Two of the Delphi were carried in Study Two. Meanwhile, Round Three of the Delphi was carried out in Study Three of the multiphase method design.

Study Three, which consists of Round Three of the Delphi's survey, was conducted quantitatively to evaluate the artefacts produced from the experts' consensus in Round Two of the Delphi. The objective of Study Three was to evaluate the usability of the produced artefacts. Box plots are used to portray the results after conducting usability evaluation for the produced artefacts.

RESULTS AND DISCUSSION

This section elaborates on the usability evaluation after completing requirements elicitation process using box plot analyses. The box plot was used to visualize the concentration of the data in the respondents' answers (Dean & Illowsky, 2013) as well as to explain the findings (Uusimaki, 2004). The purpose of presenting the box plot in the Delphi results was to help understand how the artefacts are related, such as to forecast feedback from the experts regarding the quality of the document structure for each artefact, the quality of the content for each artefact, and regarding the use of the social presence factors presented in the artefacts. The feedback obtained was analysed to obtain the experts' opinions on Artefact One, Artefact Two, and Artefact Three. Examples survey instruments for the artefacts can be seen in Appendices section.

Figure 3 shows the E-learning and software documentation experts' response to the structure of Artefact One. The overall results revealed that the artefact is well-structured, whereby the experts' responses reached a median value of 4 and 5. As can be seen in Figure 3, the eleven experts expressed their responses equal to or more than 3 of the 5-point Likert scale values which indicated positive responses towards the structure of Artefact One.

As can be seen in Figure 4, a twenty-fifth percentile of the experts responded that the attributes of Artefact One, such as
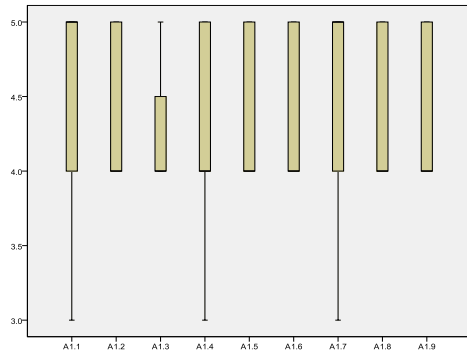
Figure 3. Box plot on the responses from four of the E-learning experts regarding the requirements elicitation contribution of social presence support
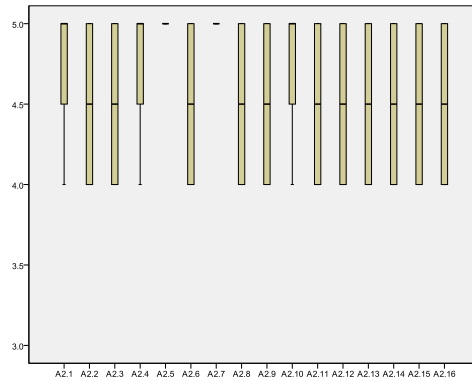

Figure 4. The E-learning experts' responses towards the document attributes (Artefact One)

the clarity of figures and tables, relevance of content, documentation preciseness, documentation readability, documentation completeness, documentation accuracy, documentation consistency, being up-to-date and use examples in document were either 4, 4.5 or 5. The median results from the documentation experts were also 4.5 and 5. The median for the E-learning experts' response towards document attributes was 4 and 5 for Artefact One. A similar response was also achieved from software documentation experts. Overall, the feedback of all experts was consistent regardless of their background. Therefore, it could be concluded that the results from the two groups are not extreme. The author also believed that the responses given by the experts contributed a positive respond, thus the artefact could be recommended for social presence requirements implementation for E-learning.

Next finding reveals the result for Artefact Two which consists of the analysis of Social Presence Requirements Template. Figure 5 depicts the box plot of the experts' feedback for Social Presence Requirements Template. The response of the eleven experts showed a positive response, whereby the seventy-fifth percentile is 5, which is the highest degree in the 5-point Likert scale. Additionally, it also indicated that the use of the MoSCoW prioritization method introduced in this template was acceptable to software documentations' experts and E-learning experts. The questions from B2.10 to B2.13, which asked the experts' their opinions whether the template was able to give instructions on writing 'Must Have', 'Should Have', 'Could Have' and 'Won't Have' requirements, achieved a median with a value of 5. This showed that the experts agreed on the use of MoSCoW prioritization method for classifying social presence elements as proposed earlier in the SEM analysis. In general, the experts agreed with the social presence requirements template which was represented by Artefact Two.

The authors also provide an analysis of the experts' feedback on social presence requirements quality in E-learning using Artefact Three. Figure 6 depicts a box plot for analysing the quality of social presence requirements for the E-learning domain in Artefact Three. The quality was measured using the questions' list from C2.1 to C2.14. Overall, the experts agreed that Artefact Three was acceptable since the documentation for social presence requirements for the E-learning domain was in the twenty-fifth percentile for all questions which were at 4 and 4.5. Question C2.9 also explained the experts' positive opinions with twenty-fifth percentile at 4 which revealed the experts' feedback on the ability of factors such as Perceived Satisfaction (PS), Perceived Relevancy (PR), Perceived Confidence (PC), and Perceived Attention (PA) to be justified as social presence requirements in E-learning. The median reported in Figure 6 were 4 and 5 which infers that the experts gave high marks for accepting social requirements
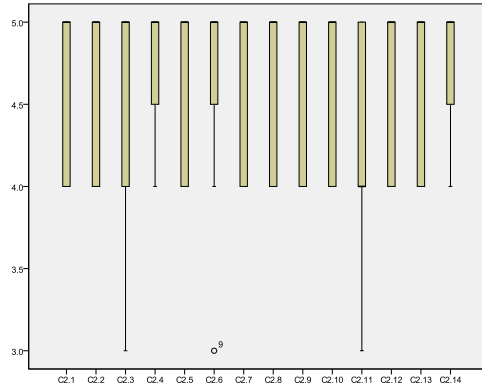

Figure 6. The experts' feedback on Social Presence Requirements for the E-learning domain (Artefact Three)

documented for the E-learning applications in Artefact Three.

All three artefacts can be used as guide and reference in capturing social presence requirements in the E-learning domain. The features of E-learning described in the artefacts may differ from the features of social presence described in other collaborative applications. The usability evaluation performed by Delphi's survey showed Artefact One, Artefact Two, and Artefact Three, was able to elicit the following elements: Perceived Satisfaction, Perceived Relevancy, Perceived Confidence, and Perceived Attention.

CONCLUSION

There is a potential to improve the elicitation process of capturing social presence requirements in E-learning. Requirements engineers and related stakeholders may face some difficulties in obtaining requirements related to human experience and feelings.
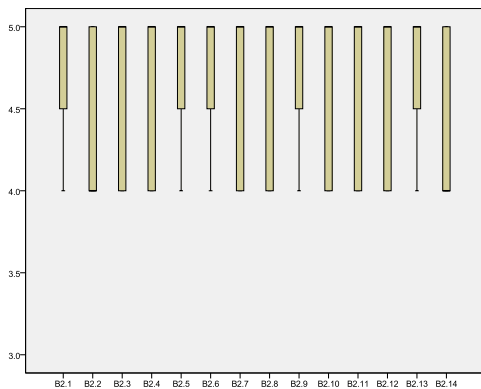

Figure 5. The experts' responses towards Social Presence Requirements Template (Artefact Two)

Therefore, requirements elicitation products such as *Technical Guide to Requirements Elicitation for Social Presence Support, Social Presence Requirements Template and Social Presence Requirements for E-learning* are used. This research is able to expand the knowledge of RE whereby it has produced requirements elicitation products for developing requirements in collaborative application.

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APPENDICES

Examples of evaluation instruments for the artefacts

A1.1	Section '1. Introduction' is well-structured
A1.2	Section '2. Overall Description' is well-structured
A1.3	Section '3. An Overview of Social Presence' is well-structured
A1.4	Section '4. Social Presence in E-learning' is well-structured
A1.5	Section '5. Adapting Technical Guideline to E-learning Domain' is well-structured
A1.6	Section '6. Social Presence Requirements Element' is well-structured
A1.7	Section '7. Prioritization Matrix for Social Presence Requirements' is well-structured
A1.8	The document refers to related standards to come up with its own content
A1.9	The stakeholders find it easy to follow structure and content of the document
A2.1	Clarity of figures and tables
A2.2	Relevance of content
A2.3	Documentation preciseness
A2.4	Documentation readability
A2.5	Documentation completeness
A2.6	Documentation accuracy
A2.7	Documentation consistency
A2.8	Being up-to-date
A2.9	Use of examples in document
A2.10	Explanation is not redundant
A2.11	Achievable
A2.12	Concise
A2.13	Sections are cross-referenced
A2.14	Prototypable / Implementable
A2.15	Reusable
A2.16	The requirement specified is testable whereby it is able to generate test case from this document.
B2.1	The template clearly mention a sequence of steps to be carried out
B2.2	The template explains how to classify and describe elicited social presence element for Perceived Satisfaction, Perceived Relevancy, Perceived Confidence and Perceived Attention
B2.3	This template shows on how to write down requirements identifier
B2.4	This template shows on how to write down element of social presence using the Technical Guide given
B2.5	This template shows on how to write down description of social presence using the Technical Guide given
B2.6	This template shows on how to write down familiar statement of social presence using the Technical Guide given
B2.7	This template provides complete guide to do elicitation based on requirements elicitation process flow in section '5. Adapting Technical Guideline to E-learning Domain'
B2.8	This template states clearly the use of prioritization method in requirements elicitation

APPENDICES *(continue)*

B2.9	This template tells what is MoSCoW prioritization method before giving instruction to prioritize elicited requirements
B2.10	This template gives instruction on writing 'Must Have' requirements
B2.11	This template gives instruction on writing 'Should Have' requirements
B2.12	This template gives instruction on writing 'Could Have' requirements
B2.13	This template gives instruction on writing 'Won't Have' requirements
B2.14	This template gives instruction to make a clear statement for each requirements description that need to be fulfilled
C1.1	The document manages to be a supporting document for E-learning development
C1.2	The document describes E-learning owner and related E-learning description
C1.3	The description of E-learning user is clear
C1.4	The document states clearly requirements for PS
C1.5	The document states clearly requirements for PR
C1.6	The document states clearly requirements for PC
C1.7	The document states clearly requirements for PA
C1.8	The document gives understanding on social presence in E-learning
C1.9	This document identifies each requirement by using prioritization method
C1.10	The document helps stakeholders to specify social presence requirements in ranking order
C1.11	The document is able to be used as a reference to other related collaborative application, such as E-mail application, document sharing application and other collaborative application
C2.1	This document gives clear instruction to write down requirements element for PS, PR, PC and PA
Q2	This document organizes requirements element appropriately
Q3	This document describes related content on social presence in E-learning
Q4	This document describes each section precisely
Q5	This document can be understood by the reader to explain social presence feature
Q6	This document meets the criteria to support social presence in E-learning
Q7	This document presents another aspect of requirements specification whereby it emphasizes on social presence for collaborative application
Q8	This document gives sufficient examples by using 'Familiar Statement' for each requirements element in component PS, PR, PC and PA
Q9	The requirements element for each component (PS, PR, PC and PA) are achievable to be implemented in E-learning
Q10	The explanation for each 'Element', 'Description' and 'Familiar Statement' are concise
Q11	Each section in this document is inter-related to represent social presence requirements
Q12	The requirements element in this document is possible to be implemented
Q13	The requirement specified is testable whereby it is able to generate test case from this document
Q14	This document can be used as a reference to extract social presence for other collaborative application