The Role of Conducting Stakeholder Meetings in Requirements Engineering Training

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Abstract

One of the important challenges of Requirements Engineering education and training is how to prepare students for requirements elicitation activities with limited time and resources typically available in large undergraduate classes at tertiary institutions. In the last five years, we have been experimenting with variety of teaching and learning techniques to address this challenge. In this paper we describe our most recent effort in addressing this issue by redesigning our RE subject through a new format for elicitation and specification activities. Our findings suggest that the combination of role playing techniques and applying a systematic process for these activities are effective in achieving the expected learning outcomes.

1. Introduction

In recent years, there has been an increase emphasis in university curriculum on Requirements Engineering (RE) at the undergraduate and post-graduate level. Initial investigation of RE education issues and challenges was reported in RE’95 conference [16]. The real dilemma in RE education is to educate students with a balance between solid foundation of RE subject concepts as well as exposing students to complexity and uncertainties in various requirements engineering activities [7].

In typical software development projects, developers gather requirements by frequent face-to-face interactions or by arranging workshop session with stakeholders to leverage requirement clarification, elicitation [22][4], negotiation and communication [3]. It is evident from the literature that formal communication and interaction is important for routine coordination and discussion in software projects [14]. Most typical means of eliciting requirements are face-to-face discussions, formal meetings and inspecting documentation. An important part of holding meetings is structuring the minutes of the meeting, capturing and managing knowledge elicited and retrieving the meeting decisions in succeeding meetings [6]. These techniques assist in determining the consistency and accuracy of requirements information. Despite this, interviewing and oral communication techniques are typically addressed superficially in university education [13]. Traditional exercises for teaching requirement engineering typically train students to develop requirements models based on written sources of information rather than through oral communication and negotiation [12, 21].

In the past five years, at the University of Technology, Sydney (UTS), we have been teaching RE as a core second year subject in the BSc in Information Technology degree. The first time offering of this subject was reported in RE’03 [25]. Over the years, we have used a variety of feedback seeking techniques as well as self and peer assessment to refine and improve the way we teach RE.

In this paper, we focus on our revised process for teaching requirements elicitation through role-playing which led to a more rigorous process for documentation. The main aim of applying these approaches is to address some of the issues and challenges that we faced in previous offerings of the same subject as reported in [25] and [2]. We describe the revised RE subject we taught and the experiences and lessons we learnt from this exercise. In the next section, we begin with a brief coverage of role-playing. We then describe the design of the RE subject and then follow with a section on how we assessed the effectiveness of our approach and some lessons learnt. The concluding section describes ways in which the delivery of the subject can be improved.

2. Background

2.1. Role-Playing

Role-playing is a technique used to achieve better understanding of a situation by experiencing realistic simulations. Role-playing has been used in many different areas namely: health science [19], engineering
Role-playing is a vital technique in building an active and collaborative learning environment to promote requirement elicitation and improving requirement specification. During role-playing, students appreciate development of social skills, face-to-face interaction, positive interdependence, and learn how to handle conflicts [1]. Students gain an understanding of how to develop the requirements according to the stakeholder needs and expectations, by participating in different stakeholder meeting, actively communicating and understanding stakeholder’s conditions.

Meeting with the stakeholder is an important part of requirement engineering activities. The stakeholder may be real (a customer from industry or a domain expert) or simulation (someone that acts and simulate true interest of customer needs) [10]. There are significant issues associated with real customer in term of high cost, time and customer commitment. Consequently, students often have to play the role of the stakeholder.

As noted in literature, there are considerable issues also associated with student playing the stakeholder’s role. Firstly, it is difficult to create a balance between an experienced and non-experienced student to simulate a stakeholder’s meeting session. Students who are industry experienced play the role of the stakeholder more effectively. This is due to their experience working in the business environment which exposes them to the articulation of the business process, operations and workflows. It is important to note that most students do not have the relevant industry experience [7].

Secondly, there is an inconsistency in role-playing as the student get confused with being stakeholders and developers at the same time [25]. In a real-life scenario, the stakeholder has a clearer and persistent understanding of the product requirements, whereas the students do not have this understanding. Students may accurately play the role of developer as some of them have the experience of being a developer but they do not have the experience of being a customer. One way of resolving this is for an academic staff member to perform the role of the stakeholder [7].

Our approach is different from other RE education technique as our focus is on academic staff playing the role of the stakeholder and students playing the role of development team, thus incorporating collaborative oral elicitation [21] and negotiation techniques within stakeholder meetings process.. We believe that the setting where role playing augmented with active communication techniques will help students obtain a practical orientation of the industry environment setting, thereby maturing their communication, conflict resolution skills [2] as well as foster mutual development of requirements with stakeholders.

3. Subject Overview

Requirements Engineering was offered at UTS, Faculty of Information Technology as a core subject for an undergraduate degree within the Faculty of Information Technology. The purpose of the RE subject was to introduce students to the foundation of, methods, approaches, tool and techniques of RE. The main learning outcomes for this subject were a) interviewing and group work skills for requirement elicitation and validation b) analysis and modelling skills for problem solving, and c) writing skills for requirement specification. The subject components consisted of a two-hour lecture, a one-hour exercise tutorial and 15-minute stakeholder meetings for five designated weeks based on the underlying elicitation activities.

The major topics discussed during the lectures focused on various areas namely: foundation of RE, elicitation, modelling and analysis, negotiation and validation, specification and management of requirements. The purpose of the tutorials was to reinforce the material delivered in lectures and to ultimately establish a process (through stakeholder meetings) where students played the role of requirements engineers and an academic staff member played the role of a stakeholder. Most of the tutorial activities were conducted in teams.

Students were encouraged to actively participate in the discussion, clarification, elicitation of requirements as well as development of the solution. In this way, students experienced difficulties associated with the stakeholder meeting process (see section 4), and learn to refine the requirements iteratively. During the first tutorial session, each tutorial class was divided into 4-6 teams in a group of up to 6 students. Each team was asked to analyse the project brief for an assigned case study during the tutorial session. Each team had the following responsibilities:
• Elicit requirement from customer
• Analyse and model those requirements
• Specify and document the requirement
• Validate requirements, and
• Manage the artefacts and process of requirement engineering.

In order to create a more realistic setting, during the first tutorial session, students were also asked to choose individual roles. These roles included (1) a team leader to assign tasks to other team members, (2) an administrative assistant to be responsible for taking minutes during the meetings, (3) a domain expert to do research and become familiar with all aspects of the application domain, and (4) quality assurance person to act as a group’s inspection moderator.

In order to ensure that every student got the opportunity to play every role and get full exposure to the issues involved, students were advised to take turns in playing these roles. Tutors were asked to ensure that the roles were changed throughout the semester.

The final part of the subject was dedicated to requirements management and students were introduced to techniques and tools available for this task. In particular, the requirements management tool, Rational RequisitePRO™ was introduced to students and the last three weeks were dedicated to laboratory exercise sessions with this tool.

3.1 Assignment and Assessment details

The assessment component was used to enhance students’ cognitive abilities, thereby engaging students in different learning activities. There were three parts of assessment components: two major assignments, group tutorial exercise, and a final examination. In the two assignments, the stakeholder meetings process played a vital role. The first assignment was to develop a requirement model by using use case modelling technique, where students were given a case study description to analyse. Students were also given use case template [8] as a guide to develop their use case description for this assignment.

The second assignment consisted of SRS development, where a preliminary description of the system and initial customer needs and expectations were provided to the students. Depending upon the students’ understanding and elicitation of requirements from previous stakeholder meetings, students were asked to develop a first draft of the SRS using the IEEE template [13]. Students were also asked to revise the SRS in accordance with the feedback from stakeholder meetings. Throughout the SRS revision (i.e. requirement development process) students were instructed to manage requirement by means of a traceability matrix and to incorporate this matrix as part of their final SRS submission. In the second assignment, the grading criteria consisted of were completeness, correctness, consistency, clarity and traceability of the SRS based on well-accepted quality attributes for requirement specifications [9].

4. Structure of Stakeholder Meetings Process

The stakeholder meeting process was structured, communication rich, information centric and result oriented. It consisted of three stages namely (1) Pre-stakeholder meeting activities (2) Stakeholder meeting (3) Post-stakeholder meeting. An overview of the stakeholder meeting process is presented in Figure 1.

4.1 Pre-Stakeholder Meeting

During the first tutorial session, the tutor provided a project brief to the students and discussed the general requirement of the case study. It was important that each development team member had a thorough understanding of the case study in order to contribute effectively as a team member. The stakeholders also discussed the existing business artefacts (workflow, business flow, templates etc.) in subsequent meetings, to improve the students’ understanding of the current and proposed system. Consequently, with the subsequent interaction of stakeholders and development team, the students obtained a better understanding of the case study.

4.2 During Stakeholder Meeting

The development team was expected to be prepared for the stakeholder meeting. Before the meeting, the development team should have read the meeting agenda and have their questions ready. This is important to ensure that the meeting was conducted productively.

The role of a stakeholder on the other hand, was to provide all the relevant information about their needs to the development team. They also provided knowledge about the current system and information about the application domain. The development teams had the responsibility to document the minutes of the meeting and distribute them to the stakeholders within 48 hours after the meeting.
4.3 Post-stakeholder meeting

As shown in Figure 1, after each meeting session, the developers typed the minutes of their stakeholder meeting and emailed them to the stakeholder. The stakeholder then responded by either confirming that the minutes were accurate and a true record of the meeting that took place or indicated the possible mistakes and inconsistencies found in the minutes. The comments in the meeting minutes were then sent to the developers via email. In the following stakeholder meeting session, the development team would need to clarify the issues raised by the stakeholder.

5. The Case Study: Zaflin Warehouse Company

The case study selected for discussion in this paper is the WAS (Warehouse Subsystem) case study. The developers worked for a software development company (SoftSystems Pty. Ltd) which develops software for a diverse range of businesses. The developers are required to develop a web-based system called Direct Application Warehouse Connection (DAWC) for Zaflin Warehouse Company which consists of a chain of warehouses distributed over several continents. The main stakeholder at Zaflin provided the initial set of user needs.

5.1 Main features for Warehouse Sub-system (WAS)

The development teams were given a statement of main features specified by the stakeholders. These features were the basic functions that should facilitate the warehouse employees in their duties. These included entering the product characteristics into the system, to assign an unique product identification number to each product type, to input product delivery details, and to handle product returns due to damaged and discontinued products, etc.

5.2 Eliciting User Needs for WAS

The main features provided to the development team served as a starting point for further elicitations. These features were incomplete and the developers were asked to elicit and negotiate the user needs during the stakeholder meeting sessions. In preparation for the first stakeholder meeting, the developers prepared questionnaires which they used as a tool when asking questions pertaining to the features. The developers asked questions regarding Zaflin Warehouse Company’s business operations, the current system that was in place and questions to further clarify the features. Each session consisted of only 15 minutes. During the first three sessions, the developers elicited WAS’s functions, the users of WAS, the access levels of these users, the workflow, data flow and the business operations. In the last two sessions, developers asked more detailed questions about the functions, with emphasis on the software functional and non-functional requirements and system constraints.

5.2.1 Supporting documents

During the stakeholder meeting sessions, the stakeholder provided several supporting documents, such as screenshots of the perishable and non-perishable storage area, the warehouse storage form and the delivery form. In addition to these documents, the stakeholder also described the perishable and non-perishable products, the storage facility, operations, the location of the local and international warehouse offices, and the scenario that also described the workflow and operations. This information was not provided to the developers in hard copy as the developers needed to practice their elicitation, negotiation and communication skills during the stakeholder meetings.

5.3 Modelling and SRS development

The user needs and software requirements elicited from the stakeholder meetings were used in the development of the assignment. After the third stakeholder meeting session, the development team developed their first assignment, where the deliverables included the use case diagram; use case descriptions, the meeting minutes, which had been approved by the stakeholder, and all the group’s meeting minutes. The stakeholder then assess the deliverables and provided comments for
improvements. The development teams would then clarify those comments during the following stakeholder meeting sessions.

Based on the comments, clarified user needs, and software requirements, the development teams then prepared their second assignment, which was the SRS document. In the second assignment, the development teams needed to submit the deliverables, which included the SRS (including the revision history), a traceability matrix, revised use case diagram, and use case descriptions from Assignment 1 that clearly showed the changes made to address the comments made.

6. Research Methodology

The survey’s objective was to assess the effectiveness of the stakeholder meeting process in achieving the learning outcomes. A questionnaire consisting of closed and open-ended questions was used for the survey. For the closed-ended questions, the students were asked to rate their agreement with a statement provided, where the rating is as follows: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5).

The type of survey used for this study was an online questionnaire. The participants for the survey were students who played the role of developers. Twenty-five students from 11 development teams were contacted via electronic mail to participate in the survey and 10 students later participated.

The students were given an URL to submit their responses. The responses given were rich in information as students shared their experiences during the stakeholder meeting sessions. Some students also offered valuable suggestions to improve the stakeholders meeting process. Although there was a relatively small sample of 10 students that participated in this survey, the aim of the survey was to investigate the efficiency of the stakeholder meeting process rather than aiming to ensure statistically significant results.

7. Findings

To analyse and discuss the role that stakeholder meetings process played in the requirements engineering subject, questions from the survey questionnaire were extracted and the results analysed. We will discuss the participants’ comments and structure a pattern from these responses.

Firstly, we look at the requirements elicitation, negotiation and communication skills that students gained throughout the stakeholder meeting process. Secondly, we discuss how useful students found the above skills for their future profession. Thirdly, we discuss in what way the stakeholder’s meetings assisted in the development of the deliverables for assignments. Finally, the findings from the question about improvements for the stakeholder meeting process will be presented in the lessons learned section.

7.1 Skills students gained throughout the stakeholder meeting’s process

The students were asked to rate their agreement that the stakeholder meetings process improved their communication and negotiation skills. For both types of skills, the analysis results reported a mean rating of 4.1. From our scale of agreement of 1 to 5, this implied that the students agreed that the stakeholder meetings improved the students’ communication and negotiation skills. All the students indicated that they have developed elicitation skills by attending the stakeholder’s meetings. The students also reported on other skills such as negotiation and writing requirements. Several students also commented that their elicitation skills and techniques were improved throughout the meetings as they gained valuable experience during each meeting session with their stakeholder. Due to this, throughout the meetings, the students developed a clearer understanding of the requirements and how to write them coherently and specifically. One student made the following comment: “The most noticeable technique that I have developed is elicitation. Prior to this subject I had not had much practice nor opportunity to elicit anything from anyone”.

The students also reported on other skills, which they had gained, such as the leadership skills and requirements prioritization skills. The leadership skills were fostered after the students played the role of team leaders and had to plan, lead the meetings and ensure a productive use of meeting time with the stakeholder.

7.2 Usefulness of Skills in Future Profession

In terms of identifying the usefulness of the negotiation and elicitation skills in the student’s intended career, the students in general agreed (mean rating of 4.3) that both skills were useful in their intended career. The students were asked to describe how these skills would be utilized when preparing for working in the industry. The students indicated that the negotiation skills would help with communicating and providing business solutions for clients, while requirements elicitation and writing requirements
would help with efficiently and correctly identifying business solutions.

The students also indicated that during the meeting sessions, the students could deduce the client needs and requests. One student also commented that the negotiation, requirements elicitation and requirements writing skills would give them a higher level of confidence when presenting their requirements specifications and solutions to the client. The following comments were made:

“Communication is essential in the industry and is needed to gather and define the correct requirements and identify the correct questions to ask in order to find requirements.”

“…be much more objective in my thinking and the importance of ensuring that the whole team is at the same page for a certain issue. This is critical in the workforce as well”

7.3 Development of assignment deliverables

When developing the deliverables for both assignments 1 and 2, the students were asked to rate their agreement regarding the usefulness of the stakeholder’s feedback in clarifying the software requirements. The students’ responses reported a mean of 4.4, which indicated that the students agreed that their stakeholder’s feedback was helpful in clarifying software requirements. In terms of the supporting documents provided, the students agree (mean: 4) that the supporting documents increased the students understanding of the software requirements.

The students were also asked how the stakeholder’s meetings assisted in the development of the assignments. The students stated that the stakeholder’s feedback was critical as it led to the improvement of the use case modelling and requirements they were specifying. It also led to improvements in their requirements elicitation, where the students knew parts of the requirements that they needed to clarify with the stakeholder. The feedback provided by the stakeholder also better assisted the students in understanding the system requirements for both assignments better. The students commented that the stakeholder meetings gave them opportunity to probe further into details about the stakeholder needs and learn the type of questions they should ask and when to ask them. The questions that they asked were important when developing the assignments. The following comments were made:

“The feedback given by the stakeholder on the meeting minutes gave me a better understanding of what is required for the assignment because they [the stakeholder] would provide background and other relevant details about the system which were not stated on the assignment sheet”

“It provided the basis of what we needed to work on and what we needed to further develop on the assignment.”

Students indicated that the stakeholder meetings were important particularly for Assignment 1, as they needed to understand the current process and system, identify the main functions (and dependencies) and understand why the new system is needed and what it needs to achieve. The students also indicated that the stakeholder meetings promoted teamwork among team members and improved their skills with time management, negotiation, communication, prioritisation, and documentation, which were all very important when developing their assignments.

9. Lessons Learned

From the survey, the students were asked for potential improvements that they would suggest for the stakeholder meetings and the entire process of requirements elicitation for this subject. The students provided valuable comments, which are presented here as lessons learned.

Firstly, in terms of the assignments, the students suggested that the use cases should only be limited to five instead of the current eight use cases. Additionally, a process diagram for the current process and desired process be included as part of the deliverable. This would be more beneficial in ensuring that students understood the importance of comprehending the current system’s and business processes.

Secondly, in terms of the stakeholder meetings schedule, the students suggested that the initial meetings be extended to 30-minutes sessions (instead of the current 15-minutes sessions). This is so that the students could ask more questions that are useful in assisting them in developing their deliverables.

Thirdly, students indicated that the stakeholder needs to provide more relevant background information about Zaflin Warehouse Company before the initial meeting as it would allow them to understand the system and business better, hence be more prepared for their first meeting. This was a reasonable request however, one of the main objectives of the subject was to familiarise students with the requirements elicitation techniques and therefore students were meant to take the initiative in finding out some background information beforehand and to practice asking relevant questions.

Overall, students indicated that they enjoyed the subject, particularly participating in the stakeholder
meeting sessions. They found the practical aspect of the subject to be beneficial when developing their assignments which prepared them for their intended career as well. They also found working in groups to be an interesting and rewarding learning experience.

10. Conclusion

RE teaching and training presents many interesting challenges to those engaged in IT education. One of those challenges is preparing students for effective requirements elicitation, negotiation, and specifications. They need to develop specialised form of oral and written communication skills. We have used various forms of role playing over the last 5 years in teaching RE to undergraduate students and have found it to be effective. Furthermore, in the most recent offering of this subject we have enforced a certain degree of rigour in following a defined process in preparing for, conducting, and documenting the meeting with stakeholders. In this paper, we described our new approach and reported on our assessment of this new approach. The feedback received indicates that this revised approach has been effective.

The complete evaluation of our outcome could only be observed and measured when students graduate, enter the workforce and end up practicing requirements analysis. This form of evaluation, we fear is impossible to carry out at this stage, but what can be evaluated is observing the students in their future subjects that are project based where students are engaged in requirements analysis for a complete systems development project.

References


