

Supporting Collaborative Requirements Elicitation Using Focus Group Discussion Technique

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Abstract

Requirements elicitation is the important activity in requirements engineering process and it involves in discovering needs, capturing and gathering software requirements from the stakeholders. However, there are few problems faced by requirements engineer in order to carry out requirements elicitation process. The requirements elicitation is lacking in terms of various issues; stakeholders involvement, support tool and complete documentation so as to achieve on time delivery. This process becomes easier if the requirements engineer and the other stakeholders shared a preferred method even though they are in distributed places, geographically. In our case, the requirements engineer (courseware developer) and other stakeholders (schoolteachers) agreed to use Focus Group Discussion (FGD). Therefore, a prototype of Focus Group Discussion for requirements elicitation tool, FGD-RElicit is proposed to assist all stakeholders involved and aims to tackle some of the difficulties in conducting requirements elicitation process. FGD-RElicit is aimed to improve the requirements elicitation process, enhances the software requirements specification (SRS), and feasibly produce much better software. This paper presents the multi viewpoint approach adopted, FGD-RElicit details feature, evaluation and the results of its application in a case study.

Keywords: Focus Group Discussion, Requirements Elicitation Tool, Requirements Engineering, Collaborative Requirements Engineering

1. Introduction

Eliciting requirements should be carried out in a form, which encourages participation of all stakeholders involved. Currently, in a survey among courseware developers in Malaysia [1], it showed that not all stakeholders were given the opportunity to participate in the elicitation activity. As a result, many of them developed the application based on incomplete user requirements document (URD). This scenario will incur more difficulties when the project is completed or delivered, especially, the customer does not satisfy with the application and will not use the application.

To overcome these problems, a requirements engineer and other stakeholders must work together in discovering their needs to ensure on time delivery. To achieve this, requirements elicitation process needs to have a clear step-by-step activities to be followed by the stakeholders and using the shared elicitation technique. To support this, it is best to manipulate the Internet technology to facilitate the elicitation process. Even though, there are

available tools that support requirements elicitation process (or part of it), however, none of them emphasize on supporting shared elicitation technique.

This paper focuses on a prototype tool proposed to facilitate requirements engineer (courseware developer) in conducting a collaborative requirements elicitation process among a group of distributed stakeholders (schoolteachers). The tool is developed with an intention of encouraging more involvement from all stakeholders, using shared involvement technique and assessable from anywhere and at anytime. This tool eventually will produce a draft of requirements documents that are going to be used in the next stage of requirements engineering process, which is requirements analysis stage. The following section, presents the methods carried out. This is followed by discussions on subjects that were related for developing the prototype tool. The paper concludes with a discussion of the prototype tool and its further work.

2. Method

In order to construct a prototype of requirements elicitation tool using FGD, hereafter referred to as FGD-RElicit, three steps of process are involved which are: -

- i. Carrying out a study on requirements elicitation, including, requirements elicitation sources, techniques, tools and models. Prior to build a requirements elicitation tool, a process model and features need to be identified. Basically, the surveys that were conducted earlier and also the literature done were used as the basis of the formulation of the process model. The process model incorporates features to encourage more involvement from all stakeholders, use shared involvement technique and is able to be assessed from anywhere and at anytime or support collaborative work among a group of distributed users. While, the features incorporated in the requirements elicitation tool were mainly to support the model's requirements.
- ii. Develop the requirements elicitation tool prototype, FGD-RElicit, based on the process model and main features identified in step 1.
- iii. Evaluate the prototype, FGD-RElicit, as a proof-of concept

3. Background Study

3.1 Requirements Elicitation

The goal of requirements elicitation is to obtain as many user requirements as possible for an application, which is then documented in draft statement of requirements that serves as the basis of URD. It is documented using natural language, as it is customer-oriented document. Many techniques have been developed for requirements elicitation such as in [3, 4, 5, 6, 7, 8, 9, 10]. However, the work on requirements elicitation in educational software domain such as CSCL is still limited [4, 5]. Yet, there is no evidence on the suitability of these techniques for the use in CSCL domain. Here is a summarization of review of these techniques:

- i. Most of these techniques did not clearly emphasize on the documentation of user requirements. This documentation should be defined in a way that it can be easily used for the next phase in RE, i.e. requirement analysis.
- ii. Requirements elicitation is a collaborative work, and not all techniques emphasis the user involvement. Intrinsically, requirements elicitation insists on involvement of all stakeholders, consideration of multiple views and suitable environment to support the group-working situation.
- iii. Requirements elicitation is a difficult activity [22, 23], details of the tasks involved in requirements elicitation can be formulated in a form of guideline or step-by-step process. However, the literature review carried out shows that most of the techniques did not incorporated any guidelines in requirements elicitation tool. The incorporation of a guideline can improve the activity of requirements elicitation [11].

3.2 User Involvement

Requirements elicitation requires all stakeholders' involvement [5], as they are expert in their own domain. They come from different backgrounds - users are one of them. In a survey done previously, the courseware developers usually used FGD which is a facilitated brainstorming and discussion technique which is similar with the preferred technique by the schoolteachers. FGD which rooted in market research is a structured group process conducted for the purpose of obtaining detailed information about a particular topic, product, or issue [12]. The FGD technique is less formal compared to meeting. It is an ideal method for generating and exchanging ideas compared to interviews or surveys.

In the survey done, the users are not given high priority in requirements elicitation stage. Most of the courseware developers approached requirements engineer in eliciting requirements. One of the reasons is they have no time to consult all stakeholders. As such they seldom meet all of them in eliciting requirements.

A requirements elicitation tool that supports user involvement using any techniques including FGD is useful to encourage more involvement from all stakeholders including user. The collaborative and web-based environment allow stakeholders to access it from anywhere at any time.

4. Assessment of requirements elicitation tools

A review on fourteen requirements elicitation tools (RETs) indicates that RETs are developed to support the requirements elicitation technique [3, 4] for certain applications. The review has classified the RETs into group and non-group RETs [2]. Non-group RET is used by people involved to elicit user requirements within an environment that allows one person at a time and with no interaction with others. The individual involved identifies the application needs from similar system documentations, results of interview and hypertext retrieval. Among the non-group based RETs reviewed are AMORE [5], FAES [6], Requirements Editor [7], The Viewer [8] and CASE [9].

On the other hand, group-based RET shows involvement of several people working together in group session in eliciting user requirements. Several group session characteristics that may be seen in this group-based RETs are sharing of workspace, communication

between group members, sharing of information, coordination and control of shared objects, decision making, organization and common understanding of the work process and facilitation [10]. Several examples of group-based RETs [11] are Dynamic Design Specification with Chunking (DDSC) [12], Meeting Ware [13], Enterprise Analyzer [14], Group System (Group Outliner) [15], CREWSL'Ecritoire [16], gIBIS [17], Action editor [18], JPREview [19] and LiNC [20].

The review on currently available RETs has disclosed that requirements elicitation process consists of several components:

- It involves certain activities.
- It shows iterative characteristics.
- It shows user involvement.
- The output is added with graphics representation.

The trend shows that RETs are towards group-based rather than non-group based. This is suitable with the cooperative nature of requirements elicitation process [21]. The five important requirements elicitation activities are: identification, elaboration, integration, validation and evaluation [5, 6, 7, 12, 14, 15, 16, 17, 18, 21]. Identification discovers ideas, functions, objects, constraints, concerns and viewpoints. Elaboration activity describes or refines ideas, functions, objects, constraints, concerns and viewpoints. Integration combines all ideas elicited for the output of requirements elicitation activity. Validation examines consistency of ideas. Documentation or specification lists all ideas in certain form according to criteria, standard, or notation.

Issues of user involvement or user participation which have been discussed widely in information system development [22, 23, 24] are considered in some of the requirements elicitation tools. All group RETs and some of the nongroup based RETs take into consideration users opinions using several methods of involvement techniques. Among them are group meetings, group discussions and participatory design. These techniques are more active compared to the techniques in the non-group RETs whereby they merely fill viewpoint template, giving responses during interviews and forwarding artifacts. Most of the RETs use or to some extent show iterative step in its requirements elicitation process. Majority of the group-based RETs are either support iterative totally or support it to some extent. However, none of the non-group RETs shows full iterative processes. AMORE, The Viewer and gIBIS have included graphics output to represent user requirements other than text listing. AMORE and The Viewer use graphics editor and process modeler to present requirements in graphics form respectively. gIBIS shows the requirements in network structure through its Integral Browser.

5. FGD-RElicit Development

5.1 The process model

In the Malaysian context, especially, in the courseware development, the main problems in requirements elicitation are associated with the lack of user involvement, provide a suitable platform for stakeholders to specify their requirements aimed at producing complete URD.

5.1.1 Problem

A preferred or commonly used technique is important for the success of user involvement during requirements elicitation activity. The study showed that the user is not given priority and there are several common practices among courseware developers when they carry out requirements elicitation. Less attention, however, is given to current practices in requirements elicitation, and this leads to a number of problems, especially, resulting in incomplete URD. More user involvement leads all stakeholders to propose and rationalize their needs and wishes. Within the period specified, they feel comfortable to give feedback to others' ideas and opinions if a familiar technique is used.

5.1.2 Environment

Involvement from all stakeholders during the requirements elicitation activity will bring all of them together in one platform. Such a platform is suitable as requirements elicitation activity is cooperative in nature [2]. FGD is the technique that is used as it is familiar to teachers and courseware developers. Using a familiar technique makes people feel comfortable, and thus, they will act confidently. FGD has several advantages in a cooperative environment such as in requirements elicitation activity [25]. FGD's environment also permits an iterative way of eliciting needs and wishes or requirements. The iterative process is suitable to the elicitation task as it involves many stakeholders who keep changing their concerns and viewpoints. Therefore, the requirements elicitation process certainly needs to be repeated again and again until all involved agree on the requirements. As many stakeholders are involved, an approach that allows multi-viewpoints especially domain viewpoints, is adopted within the environment to elicit the requirements. This is the multi-viewpoint approach, which is adapted from multi-perspective viewpoints [19]. The high-level algorithm is outlined in Figure 1, below. However, unlike Sommerville's multi-perspective viewpoints, the algorithm shows that integration is included as part of the requirements elicitation activity. In our algorithm, it is essential that the requirements be identified and documented early to avoid or minimize problems of over-budget in the software development life cycle. Therefore, the integration phase is included in the requirements elicitation activities besides identification and elaboration. This is in line with the general requirements elicitation activities as outlined by Kotonya and Sommerville (1998).

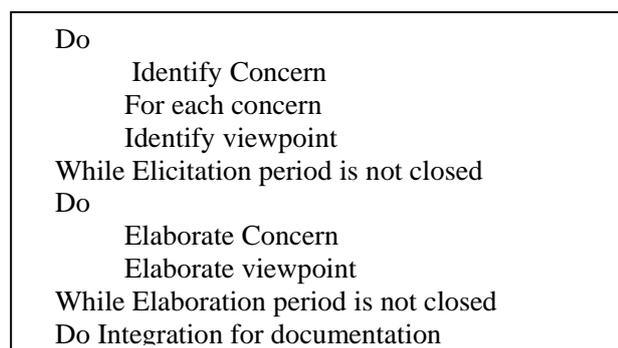


Figure 1. Multi-viewpoint Approach in FGD

5.1.3 Activity

Several common activities or steps have been identified to be very important in achieving the goal of requirements elicitation. Each requirement must go through the identification and elaboration stages, if agreed, it will be included for integration in URD. In requirements elicitation, the elicited user requirements could also be represented graphically using a concept map and an electronic mind map together with text, to give a clear understanding. The graphical representation helps to summarize the whole idea. Sometimes, it acts as a supplement for the text and helps in the elaborating the views and constraints. More importantly, it can be used by both expert and non-expert team members to express their understanding. In the discussion on the use of FGD technique, all stakeholders involved are assigned certain roles and are guided by a facilitator. In the courseware development context, the facilitator should be well acquainted with the CSCL issue to produce a productive outcome. The facilitator manages the users, specifically, to ensure that members of FGD communicate, and interact well with each other to ensure a fruitful discussion.

5.1.4 Support

An automated forum employing the FGD technique allows groups of stakeholders to participate in requirements elicitation. Following the three activities mentioned in the previous sub-section, the session is a guided discussion, with a facilitator, and all concerns or various topics of discussion are streamed according to the problem given. The final product of the requirements elicitation activity is a draft of the URD. This documentation will contain the raw definition of requirements which have been basically agreed upon by all those involved. The concept map facility helps to produce graphics supplementary to any requirements in the documentation for a better understanding or if the draft URD is to be presented visually. The purpose of making the document easy to understand is intended to ensure a smooth transition into the next phase and to assist in the iteration process. The documentation integrates gathered views and concerns all in one place, and this will make editing and amending easier. The process model is known as Focus Group Discussion for Requirements Elicitation (FGDRE).

Table 1. Summary of WRET functions throughout the elicitation process

Phase		Role (Facilitator/Participant)
Project commencement	Setting up project	Administrator
	Inviting members	Facilitator
Identification phase	Identify concern and viewpoints	Facilitator & Participants
	Sending and replying messages	Facilitator & Participants
Elaboration phase	Elaborate concern and viewpoints	Facilitator & Participants
	Elaborate concern and viewpoints using graphics	Participants
	Sending and replying messages	Facilitator & Participants
Integration phase	Integrating all concerns and viewpoints	Facilitator & Participants
	Polling	Participants
	Sending and replying messages	Facilitator & Participants

5.2 The features

Table 1 shows the summary of the FGD-RElicit functional requirements for each phase and role involved in the elicitation process.

6. Implementation

FGD-RElicit is based upon a multi-user web-enabled database and is developed using PHP open source development tool, MySQL database and run on IIS web server. The following are features implemented:

6.1 Setting up project

All projects in FGD-RElicit need to be activated by giving details start and end date for each phase. Each project will be assigned to one facilitator to in charge.

6.2 Focus Group Discussion

Participation in FGD-RElicit is carried out using FGD technique whereby 8 persons will be selected for each FGD. Participants are able to contribute ideas and responds to others ideas in the same workspace regardless their locations. In this session, the participant will go through three phases of requirements elicitation in the process of eliciting requirements for a system to be developed.

6.3 Identification of concern and viewpoints

The FGD session in FGD-RElicit is started with the Identification phase. In this phase, all participants are able to identify concern and viewpoints for the application to be developed. The concerns are general characteristic (non-functional requirements) to be imposed on the system to be developed. While, the viewpoints are more specific characteristics (functional requirements) which details up a particular concern. For a particular concern, FGD-RElicit allows participants to submit more than one viewpoint.

6.4 Sending and replying message

FGD-RElicit provides private message facility to be used by facilitator as well as participants to encourage others to be more active in the FGD.

6.5 Elaboration of concern and viewpoints

After the Identification phase ends, FGD-RElicit will bring all involved to the next stage which is the Elaboration phase. Any missing, unclear or inconsistent information can be added to elaborate further the viewpoints submitted earlier. Besides, text description, participants can also elaborate using graphics. FGD-RElicit provides facility to upload the graphics file created.

6.6 Integration of user requirements

All elaborated concerns and viewpoints will be integrated into a document called user requirements document (URD). FGD-RElicit uses simple structured representation in URD. Unclear viewpoints will be polled before integrating them into URD. The facilitator will decide to set to poll these sorts of viewpoints.

6.7 Polling

FGD-RElicit allows each participant to poll a particular viewpoint that is set to poll. As domain expert, they have right to be involved until the integration of all requirements.

Figure 2 show screen shots from FGD-RElicit.

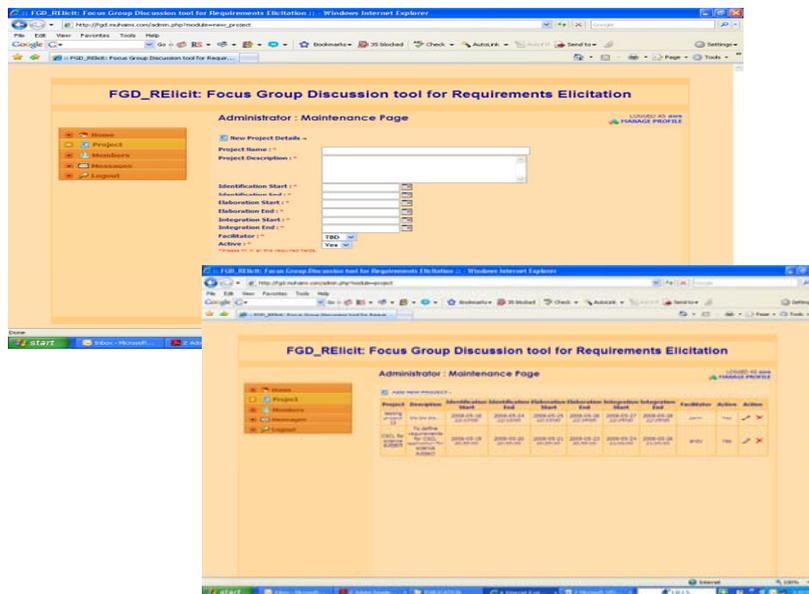


Figure 2. FGD-RElicit screen shots

7. Evaluation

The evaluation process involves in assessing features of FGD-RElicit was guided by Goal Question Metrics (GQM). The GQM approach [26] set some basis of evaluation (Goal), means (Questions) and measurement (Metrics). Based on this, two main goals of the evaluation are fulfillment of the development objectives and the usability and effectiveness of its component as a requirements elicitation tool. The experiment conducted includes quantitative and qualitative measurements.

7.1 Outline of evaluation

The pilot study was participated by a group of courseware developers, Postgraduate student and schoolteachers. This small group of people represents targeted test audiences that are comfortable with computer and familiar with Windows user interface, web browser and web application. The group consists of 26 people: 20 acted as participants and five acted as facilitator and one as the administrator. The administrator role was also an author to enable her or him to tackle any unexpected problems that might occur while using FGD-RElicit. All participants are familiar with web-based application however they have insufficient knowledge on requirements elicitation tool and its process. Most of the participants indicated that they were capable to use FGD-RElicit to carry out requirements elicitation process. Each participant was briefed on the elicitation process, the tool, the objectives, and the experiment material. Questionnaire was given to each participant during the evaluation. The questionnaire is organized to assess FGD-RElicit features, approach and objectives.

7.2 Results

In conjunction with the pilot study above, this section discusses the results that are achieved by using FGD-RElicit.

- i. Automate the process of requirements elicitation and moving from conventional techniques of requirements elicitation process to web-based tool that support shared involvement technique, which is FGD. The participants and the facilitator involved in this experiment were geographically distributed and they can perform elicitation process easily by using FGD-RElicit. Thus, it has been encouraged developers not to avoid the elicitation process and instead it promotes stakeholders involvement and fosters communication and understanding among them.
- ii. Ease the process of requirements elicitation. In the elicitation activities, FGD-RElicit provides flexibility in terms of time and place to ensure that the participants can contribute their ideas according to their preference.
- iii. FGD-RElicit provides registration facility for stakeholders in order to help the requirements engineer to identify suitable participants.
- iv. Since FGD-RElicit supports collaborative work, it is easy for requirements engineer to conduct requirements elicitation process, where:
 - All documents for Concerns, Viewpoints and the requirements documents draft have been put online. Participants shared these on-line documents and gave their suggestions towards the documents.
 - Each document created by participant can be monitored by facilitator and viewed by other participants.
- v. Requirements elicited were controlled by the facilitator to prevent any the requirements ambiguity. The facilitator will not include viewpoints that were not

relevant to the desired system. In addition, this also increased the correctness of the requirements.

- vi. The requirements document as the end product can be used in the next stage of requirements engineering process, where the participants had already agreed that the output satisfied the requirements for the desired system.
- vii. FGD-RElicit also provides,
 - The requirements that can be traced and managed easily as it is arranged using simple structured representation. Moreover, the graphics can enhance and bring to consistent understanding.
 - The requirements that become more understandable; where participants could navigate, verify and give feedback to those documents that they are not clear or need more explanation. There are not many feedbacks or comments given; this is revealed their understanding of the requirements discussed.
 - The requirements document is more complete, where FGD-RElicit has discovered both functional and non-functional requirements. At the end of the elicitation process, drafts of functional and nonfunctional requirements were created for the project.

In summary, the feedbacks from the survey are as follows:

- Generally, respondents were able to use the prototype with minimal difficulty.
- The prototype has an appropriate functional design that allows respondents to use the components efficiently when carrying out their tasks.
- The prototype has incorporated features and functionalities that effectively addressed the problems of user involvement, URD completeness, and providing a supportive environment for the requirements elicitation activity.

8. Conclusion and Further Works

There are still a number of FGD-RElicit features that needs to be enhanced in the future. Number of limitations of this tool are also identified, some of which may be addressed by future work in the area.

Currently, the facilitator's role in FGD-RElicit needs to be assessed further. Currently, the role is carried out by one of the participants or requirements engineers, which is influenced by biasness. The biasness can be removed by using facilitator agent to take over the human facilitator. Eventually, only relevant concerns and viewpoints would be included in the URD. This makes the process of moving or mapping from requirements elicitation phase to requirements analysis phase easier. In addition, the requirements resources must be collected and indexed for future references. As it is, the requirements document is able to include diagrams or notations that are related to the requirements by using other tool. Incorporating a graphics editor in FGD-RElicit make it a comprehensive requirements elicitation tool.

The requirements elicitation process is one of the most important activities in requirements engineering which is the first step in the software development. Requirements elicitation process should perform further research to discover its full potential and to encourage developers and users to perform this process.

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