Requirements Elicitation for Outdoor Learning

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Abstract— **The coming of the 21st century with changing drivers of requirement engineering forces to reconsider on requirement engineering and especially requirement elicitation. In Software Development Life Cycle (SDLC), faults could appear in every phase, and the significant cause of the almost every fault is in the initial phase. Therefore, to elicit the requirements for developing outdoor learning software should concern over not only the restrictions of the 21st century but also the viewpoint of outdoor learning. Thus, we proposed the tool for initial requirements elicitation of outdoor learning software development to gather the right requirements and enhance the requirement process concisely. This research followed the core basis activities of requirements elicitation merged with elicitation technique selection and questionnaire design. Besides, we also give the viewpoint of outdoor learning to be a guidance and suggest an initial set of suitable requirements elicitation techniques to elicit requirements of outdoor learning software development. Furthermore, the further research, the demonstration to apply this questionnaire with other requirement elicitation techniques to elicit requirements for outdoor learning software development.**

Keywords- requirement elicitation; requirement engineering; outdoor learning

I. INTRODUCTION

In Software Development Life Cycle (SDLC), before software development be started, the prevention of costly rework can be ensured by gathering the right requirements [1]. Requirements elicitation is as the quality process because its output affects to success or failure of software development [2]. Therefore, requirement elicitation is the significant process and needed to be concerned until no doubt on users' requirements.

The challenges of requirement engineering of the 21st century lead to reconsider about requirement engineering's role in software development. Many constraints are emerging, such as new approaches to software development and the quick response of the business to the new opportunities. Ian Sommerville defined four keys change drivers for reconsidering about requirement engineering in the 21st century: firstly, the new approaches for system development in particular. Secondly is the need of rapid software delivery. Third is the increasing rate of requirements change. The last key change is the need for improved ROI on software assets [3]. Perhaps, decreasing time of requirement processes and integrating the requirement processes and system implementation should be realized. Thus, the concise requirement process and be able to gather the right requirements is challenging.

While outdoor learning is learning with motivation approach and provides a real experience to students. To create the effective outdoor learning activities should consider the course objectives. However, new knowledge can change the context of subjects that affect to the requirements of outdoor learning software. Changing is a problem in every period. Furthermore, outdoor learning is still lacking on effective content presentation and experts of outdoor learning tool [4].

Therefore, four key change drivers and constraints of outdoor learning should be counted to consider when requirement elicitation for outdoor learning software development will be performed. The tool for requirement elicitation of outdoor learning software development is required to make the concise requirement process.

II. LITERATURE REVIEW

A. Requirements elicitation

Requirement engineering is activities from requirements discovering until providing a set of requirements document to the next stage. Requirement elicitation is one of the most recognized critical activities of software development [5]. Its process was divided under each model. Sommerville I. et al. divided into three activities under PREview model. PREview could be adapted to an existing or other requirements processes. It enhances the effective requirements specification by a framework of three activities and focuses on business concerns as a key of analysis [6]. Besides, Hickey and Davis divided to five activities. They also merge a model to the elicitation technique selection process to improve the quality of requirements elicitation process. This model points to the important of concerning to the problem, situation, project domain characteristics, and state of the requirements as well. Their model provides simply creations of a new elicitation methodologies by defining situational characteristics that increase the successful of software development [5, 7]. Although requirements process may consist of some activities depending on project characteristics, organization characteristics, etc. The fundamental activities of requirements

process are provided in [3]. "Table 1" shows the activities of PREview model that could be the core basis activities of requirements elicitation. This series of activities also appeared in fundamental activities of requirements process and a new unified model. Therefore, we followed the core basis activities with considered project constraints and integrated elicitation technique selection. Then we could create a suitable requirements process on a software project constraints.

TABLE I. THE COMPARISON OF REQUIREMENTS ACTIVITIES FOR CORE BASIS REQUIREMENTS ACTIVITIES EXTRACTION

Requirements elicitation models	Activities of models	Core basis activities
Fundamental activities of requirements process [3]	Elicitation, Analysis, Validation, Negotiation, Management, Document	Elicitation, Analysis, Negotiation/ Triage
A new unified model of requirements elicitation [5, 7]	Elicitation, Analysis, Triage, Specification, Verification and merged with Elicitation technique selection	
PREview model [6]	Elicitation, Analysis, Negotiation	

B. Outdoor learning

Could classroom teaching can achieve the understanding of student? To teach the students think or figure out, the teacher may need teaching experience or approach to support a study. There are many kinds of learning approach, such as classroom learning, fieldwork, outdoor educational visit [8], and game-based learning. Outdoor learning could be any learning that depends on what criterions are defined, such as place, time, environment, etc. For this research work, outdoor learning is the learning out of the classroom, and there are technologies and tools are components. An outdoor learning could enhance a learning environment. It provides a real experience and supports practical activities in the subject area. Moreover, "the Forest School approach" and "the development of school grounds" have shown outdoor learning can improve knowledge and skills through learner's experience [9]. In term of the attitude of a student, outdoor learning could increase the efficacy of learning, positive attitudes, and confidence [10, 11]. Student's positive attitude is contributed by willingness. Whenever, the student is willing to learn, think, analyze or solve the problem that is students' attitude is increased in the positive. Incidentally, game-based learning is the learning by playing. The learners are willing to face the conditions and the difficulties while they try to solve the problems in games. They are interested and enjoyed also they can control their learning time by themselves [12]. Thus, outdoor learning which is one kind of learning approach that has many advantages, for instance, providing immediate feedback or progress, motivating through rewards [13], and increasing positive attitude of learners.

Our suggestion about outdoor learning, we should adapt outdoor learning to some classroom learning in the proper subject areas. The adaptation can be done by creating activities matched with the course objectives and course context that may relevant to expected actions from the student, such as seeing, hearing, touching, scenting, thinking, analyzing, etc. Besides, designing conditions of activities relate to learning contents may solve the lacking of effective information presentation. Considering to both course objectives and course context will lead the creating of effective outdoor learning activities that could encourage the achievement of students' understanding. The learning on enjoyment helps the students decrease a boring in the abstract contents and complicated theory that leads the positive learning outcomes of the students

III. RESEARCH METHODOLOGY

The research methodology of requirements elicitation for outdoor learning consists of three steps which are defining, elicitation techniques selection, and questionnaire establishment. These steps are the activities in the elicitation phase integrate with questionnaire design. First, the very important activity should have done by fully concerning is to define every context of project and objectives. Next, consider a proper elicitation techniques to be used with the questionnaire for discovering of the need to know requirements. Then we should determine questionnaire layout, administration, and population in the questionnaire conduction step.

A. Defining

Defining is an activity of specification. Within this step we also provide a viewpoint of outdoor learning software on the context of the university. Defining seven lists of project situational characteristics [2] is to know about the context of a project, for instance, type of stakeholders and users, social environment, domain of a system, scope of a system, analyst's skill, and approach to be followed out. Next, course objectives are to know what should software support a course. Also, problem and solution domain, [5, 7] the analysts should define that problems and how they would solve if there are any. Then define known requirements to consider about what we need to know more. Lastly, check available elicitation techniques which should be experienced and suited. This step will encourage analysts to get initial information for continuing to the next step. The detail was shown in "Table 2".

For the development of outdoor learning software, there is the specific viewpoint as a business type. Thus, we gave the viewpoint of outdoor learning software for each concerned list to be a guidance in the case of the university.

TABLE II. VIEWPOINT OF OUTDOOR LEARNING SOFTWARE FOR DEFINING OF THE PROJECT CONTEXT LISTS

Defining lists	Viewpoint of outdoor learning software
Seven lists of project situational characteristics [2]	
1. Type of stakeholders	Almost stakeholder in the university is homogeneous because they are in the same domain of knowledge or the same field. Moreover, some of them are domain expert or decision maker if include an executive.
2. Social environment	The impact of social environment on requirement engineering process in the university. Software for outdoor learning that will be applied in some parts of the classroom could affect to course activities

Defining lists	Viewpoint of outdoor learning software
	and score of students.
3. Domain of the system being developed	Domain of the system could be both new system and existing system. It depends on a case of an educational organization.
4. Type of end users	End users of outdoor learning software in the university could be divided into two types: first is students and second is lecturers and/or teaching assistances. Definitely, the lecturers have knowledge about the domain and the students at least; they have the skill of using software and application especially through the internet.
5. Scope of system	The scope will specify the level of applying outdoor learning software. Each course be applied in the different level. Concerning a scope with a proper course context.
6. Analyst ability/skill	Analyst ability is specific of the personal analyst.
7. Approach to be followed out	According to five categories of elicitation techniques in [2], we can perform eliciting by using user's preference technique that proper to a project situational. To gather ease the requirements and information from users.
Course objectives	Course objectives could found in a teaching plan document and a course syllabus.
Problem and solution domains [7]	Problems and/or solutions may define if there are any.
Know requirements	Know requirements may found in the relevant documents of study course, such as teaching plan document, course syllabus, attendant documents, assignment documents, and score documents.
Available elicitation techniques	Five categories of elicitation techniques [2]

B. Elicitation techniques selection

To select elicitation techniques should consider about project situational characteristics, problem and solution domain, and available elicitation techniques then we will get a set of suitable techniques. To provide a general tool, we focus on fundamental techniques which are traditional, collaborative and cognitive techniques [2]. The questionnaire is the technique for eliciting requirement from a large population in lesser cost and time. Thus, we decided to conduct a questionnaire to be the tool for elicit requirement of outdoor learning software development.

Moreover, consider the information from a previous step we then suggest the initial set of techniques for outdoor learning software development as a following: traditional techniques; data gather from existing system, interview, and questionnaire, collaborative techniques; focus group and cognitive techniques; document analysis.

Normally study course, there are relevant documents and activities in the classroom that we can gather and analyze the initial information before eliciting the deeper information by other proper elicitation techniques. Thus, the qualitative technique is suited to elicit deep and intensive information that help the analysts to get a rich collection of information. As Davis et al. stated that interview appears to be one of the most effective elicitation techniques in a wide range of domains and situations [14].

C. Questionnaire establishment

Questionnaire establishment is the step of conduction a questionnaire from defining lists. Also, determine questionnaire layout to increase friendliness of questionnaire and accuracy of response. Next, determine questionnaire population and administration. The importance of this step is to decide how to administrate the questionnaire to be appropriate with a type of populations, and other constraints [15].

"Figure 1-3" show the hierarchical diagram of the questionnaire. There are nine questions, and each question composes of many lists which are the choice for yes or no question. It is for defining initial information and scoping the outdoor learning software development project. There are two parts: first is project overall, it guides to define and scope the characteristic of a software project. The questions of project overall are shown in "figure 1". Second is course information, to contribute the specific of course information for initialize requirements analyzing. Course specification questions for existing system are shown in "figure 2" and for the new system are shown in "figure 3". This questionnaire could be used with

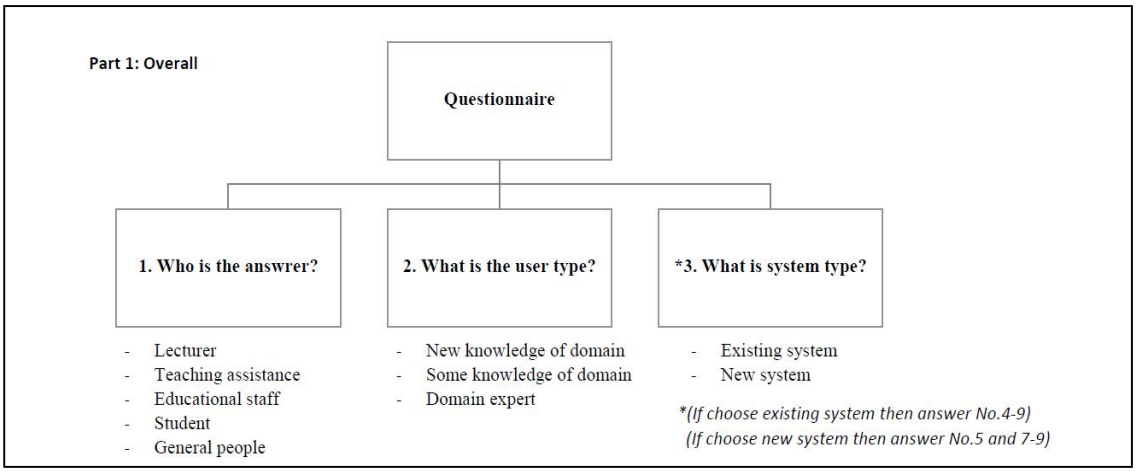

Figure 1. Hierarchical diagram of questionnaire part 1

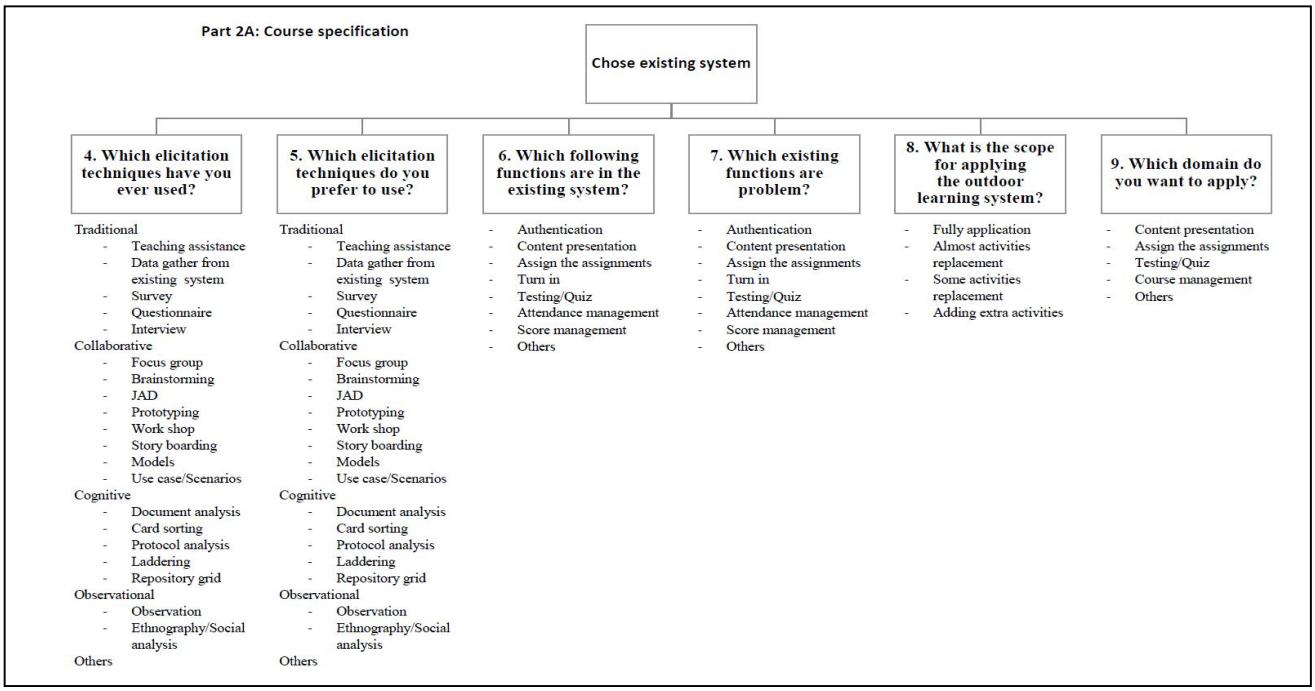

Figure 2. Hierarchical diagram of questionnaire part 2A

other requirement elicitation techniques for gather deeper information and requirements. Also, questionnaire optimization by adjustment or improvement in an appropriately to software project context can enhance an efficiency.

IV. CONCLUSION

To handle with requirement engineering in the coming of the 21st century, requirement process should be changed or modified by considering the context of project domain and four

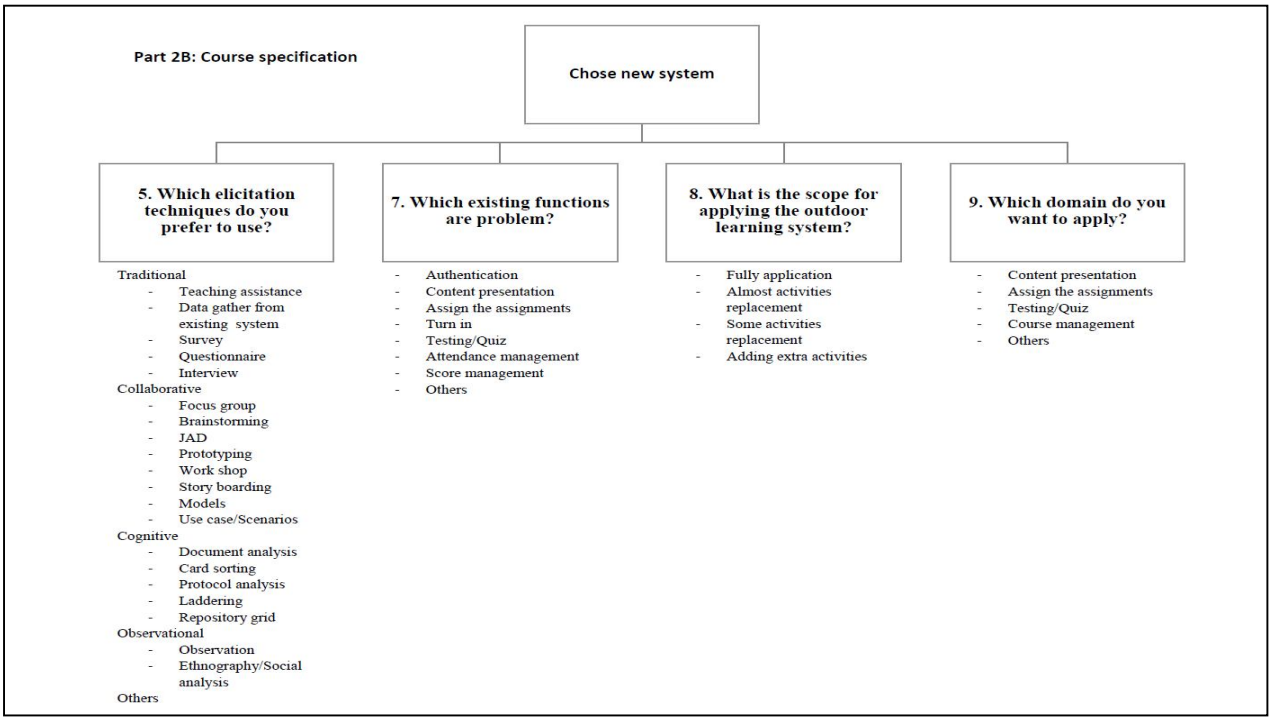

Figure 3. Hierarchical diagram of questionnaire part 2B

key change drivers of requirement engineering. Also, the effective software for outdoor learning has to support the learning of students. The successful of study is student can achieve the course objectives.

This article only focuses on the elicitation phase to conduct the questionnaire as a requirements elicitation tool of outdoor learning software development that suites to an educational environment: having a huge population and less time-consuming. This tool was developed by merging of requirement elicitation, elicitation techniques selection, and questionnaire design. The advantages of the questionnaire can enhance the requirement process concisely and could handle with restrictions of the 21st century. Besides, we gave the viewpoint of outdoor learning for determining the set of context project lists and suggest the set of suitable requirements elicitation techniques for outdoor learning software development. Moreover, to optimize the questionnaire by adjustment or improvement in an appropriately to software project context can enhance an efficiency of requirement elicitation. Furthermore, the further research will demonstrate the applying questionnaire with others requirement elicitation technique to elicit requirements for outdoor learning software development.

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