# CHAPTER III

# RESEARCH METHODOLOGY

The objectives of this study were to identify factors that affect the design of virtual classroom environments for project-based learning in higher education and create a guideline for design the virtual classroom environment for project-based learning based on these factors. Thus both qualitative and quantitative research methodologies were adopted.

This chapter explains the procedures used in this study, which are divided into three phases. The first phase is to analyze the many factors related to designing virtual classroom environments for project-based learning in higher education, the second phase is to design a virtual classroom environment for project-based learning, and the third phase is to propose a model for this type of virtual classroom environments design using the factors as determined by the study.

## PHASE 1: ANALYSIS OF FACTORS RELATED TO VIRTUAL CLASSROOM ENVIRONMENT DESIGN FOR PROJECT-BASED LEARNING IN HIGHER EDUCATION.

In this phase, all factors affected on online learning and project-based learning were analyzed by content analysis and surveys of the experts opinion. The details are as follows:

### 1. Subjects

Online learning experts who were selected from instructor or in higher education who have thoroughly experiences in online learning in class for at least 5 years. Five experts from UK and US accepted to participate in reviewing factor affecting in a virtual classroom environment (Name list in Appendix A).

### 2. Research instruments

Two online questionnaires were designed and developed based on a theoretical framework that was developed from the review literature. The list of factors affecting virtual classroom environment was evaluated and approved by

online learning experts using the survey method. The first round online questionnaire had four open-ended check list questions (See Appendix B). The second round online questionnaire was designed by using the review of the experts from the first questionnaire. The second questionnaire was rating questions (See Appendix C).

**2. Research methodology**

2.1 The fundamental data from documents and literature was analyzed and synthesized in the following manner.

2.1.1 Used the literature to review factors affecting virtual classroom environment design.

2.1.2 Studied and analyzed data on project-based learning and team learning to find components, learning steps, activities, concepts, and theories. Used this data to design project-based learning activities for virtual classroom environments.

2.2 The factors affecting virtual classroom environment design were identified and classified by this researcher. Five online learning experts evaluated factors that affect in virtual classroom environments. The finally factors are categorized into four factors. The factors in this study were shown in table 4.

Table 4 The finally expectant factors in this study

| List of factors |
|---|
| **Learner factors** |
| 1. Self-directed learning |
| **Pedagogy and instructional design factors** |
| 2. Interactive design |
| 3. Interface design |
| 4. Content design |
| 5. Usability design |
| 6. Accessibility and responsiveness |
| 7. Feedback quality |
| 8. Instructor experience |
| 9. Assessment |
| 10. Activity design |

Table 4 (Continue)

| List of factors |
| --- |
| **Environment and community of learners factors** |
| 11. Community tools |
| 12. Online student support |
| 13. Learning resource |
| 14. Availability of instructors |
| 15. Quality technology |
| 16. Orientation to course |
| 17. Accessibility to hardware and software |
| 18. Positive interaction between instructor and learner |
| 19. Scaffolding |
| **Group dynamic and peer impact** |
| 20. Team leadership |
| 21. Task clarity |
| 22. Strengths of the peer cooperation |
| 23. Size of group |

### 3. Data analysis

About the first online questionnaire, frequency was used to describe the opinion of the expert. And the second online questionnaire, mean and standard deviation were used to describe the opinion of the experts.

## PHASE 2: DESIGNING OF AN ONLINE PROJECT-BASED LEARNING FOR VIRTUAL CLASSROOM ENVIRONMENT BY ADOPTING THE IDENTIFIED FACTORS FROM PHASE I

The second phase of research methodology was experimental approach. All factors from the result of Phase 1 were the factors affected the online learning environment design. But in project-based learning, team learning skills are essential. Therefore identifying factor related for virtual classroom environment for project-based learning has to be considered both of learning achievement and team learning skills. In phase two, these four factors has been design in virtual classroom learning.

For student who registered to Information Literacy at Khon Kaen University, Second semester academic year 2007.

**1. Subjects**

The subject in this study were 392 students who had been simple random sampling from student enrolled in Information Literacy, Faculty of Humanities and Social Sciences, Khon Kaen University in academic year 2007, but there were only 349 subjects from seven faculty completed the research procedure. Therefore, only 349 subjects were used in the experiment. The details of results were showed in table 5.

Table 5 Percentage of the area of study of subjects

| Items | Frequency | Percentage |
|---|---|---|
| Sciences | 109 | 31.2 |
| Humanities and Social Sciences | 88 | 25.2 |
| Management Sciences | 68 | 19.5 |
| Law | 39 | 11.2 |
| Fishery | 33 | 9.5 |
| Engineering | 11 | 3.1 |
| Agriculture | 1 | 0.3 |
| Total | 349 | 100.0 |

Table 3 showed that the students from seven diverse faculty responded to the questionnaire. The results show that thirty-one point two percent of the subjects were Faculty of Sciences students while only one student from Faculty of Agriculture were responded.

**2. Research instruments**

Research instruments of data were comprised of three tools.

2.1 A virtual classroom environment.

The virtual classroom environment design for project-based learning was developed by following the factors from experts review. The steps for development of virtual classroom were

2.1.1 Characteristics of the factors were analyzed based on the literature review. Then the virtual classroom environment for project-based learning was design following the factors from experts review. The results of analysis are following.

Table 6 The features or characteristics of factors

| **Factors** | **Feature or activities that set into virtual classroom** |
|---|---|
| Self-directed learning | The learners who are able to control themselves to join with learning activities or able to analysis a learning need by themselves. Therefore self-directed learner should be study in higher education level or upper |
| Interactive design | - The interactive lesson that encourage learners interact with the content<br>- Communication tools allow learner interact with instructors or peer |
| Interface design | Screen is designing that follow the interface design theory such as clearly of screen function, user simple, consistency of text, color, navigator etc. |
| Content design | Content is designing that follow the suitable amount of content, user simple, language, well- constructed, etc. |
| Usability design | Web design has link validity and ability to connect to virtual classroom anytime and anywhere |
| Accessibility and responsiveness | Virtual classroom has rapid respond time and accessibility to people with special needs |
| Feedback quality | Instructor will give immediate and adequate feedback to learners as soon as possible |
| Instructor experience | Instructor and tutors who have experiences in online learning |

Table 6 (Continue)

| Factors | Feature or activities that set into virtual classroom |
|---|---|
| Assessment | Instructor will show the assessment method to learner before class getting start |
| Activity design | Class activities that assign learner work on their project with team members to encourage self-study |
| Community tools | - Chat room,<br>- Web-board,<br>- Electronics mail |
| Online student support | - FAQ function,<br>- When learner need help, Virtual classroom will have instructor or tutor who are available almost 24 hours or help function. |
| Learning resources | Validity link to learning resources |
| Available of instructors | Clearly time schedule of instructors |
| Quality technology | Khon Kean University have 1 GB of speed internet and wireless for supporting learning activities |
| Orientation to course | Learners is knowing about how to learn in virtual classroom, competency or prerequisite skill before the class getting start |
| Accessibility to hardware and software | Computer laboratory room for supporting learning activities |
| Positive interaction between instructor and learner | Instructor or tutor will talk with learner in informal communication and make learner confident to learn in virtual classroom |

Table 6 (Continue)

| Factors | Feature or activities that set into virtual classroom |
|---|---|
| Scaffolding | Clearly menu structure to protect learner to lost the way. If learner lost the way, virtual classroom will have help function to solve their problem. |
| Team leadership | Learning activities that encourage all learner to work as team leader. Instructor will guide learner to know how to be a good leader or leader duties. |
| Task clarity | Instructors establish clear objectives and project assignment. If learner need more suggested, Instructor will be open to interaction |
| Strength of peer cooperation | Instructors provide guideline for work with the team member. Then Learning activities was assigned to team projects. Instructor will show learner how to measure their project, not only the result of project but the collaboration with the team member too. Moreover learner able to choose team member by themselves |
| Group size | Learners were groups into 5 learner in group, 6-7 learner in group and more than 8 learners in group. |

2.1.2 The virtual classroom environment was designed and developed by using Koobi, Javascript and PHP. The virtual classroom environment was evaluated and approved by three experts who had at least five year experience in online learning environments (Name list in Appendix A).

2.1.3 The virtual classroom environments were tried out with students individually and in a small group for one week. After revision the virtual classroom environments were published through the internet network at http://202.28.117.40/lms

2.2 Questionnaire about the factors affecting the design of virtual classroom environments for project-based learning (See Appendix D). There were three parts:

a) The subjects' general information. There were six checklist questions.

b) In part two is rating scale related to factor affecting in online learning. There were 78 questions cover in four factors.

c) Open question end related to the opinion on factors affecting learning achievement.

The questionnaire was designed to help reduce the subjects' boredom from reading lengthy texts on the computer screen. It was divided into five pages to make the length of the pages short. This was expected to help alleviate the respondents' fatigue, which may cause a low response rate (Monson, 2003 cited in Kim, 2005). The questionnaire has been validated by three experts who had at least five year experience in online learning environments and measurement (See Appendix A). The experts' primary comments were:

2.2.1 Some questions were difficult to understand.

2.2.2 Some question is not necessary such as the virtual classroom environment design should to follow the W3C standard.

The questionnaire was revised following the experts' comments and advice for improving the quality of the instrument.

A pilot test was conducted with 40 students to examine the questionnaire's internal reliability; it was calculated by using Cronbach's alpha coefficient and the questionnaire was revised again. The summary of the internal reliability of each scale is reported in Table 7.

Table 7 Cronbach's alpha coefficient of the questionnaire

| Scale | Cronbach's Alpha |
|---|---|
| 1. Learner factors | 0.78 |
| 2. Pedagogy and instructional design factors | 0.96 |
| 3. Environment and community of learner factors | 0.94 |
| 4. Group dynamic and peer impact factors | 0.90 |
| Total | 0.97 |

2.3 Learning achievement test

The 20 multiple choices questionnaire measured subject's knowledge and competency in the subjects matter before and after learning. The content validity were validated by three experts in information literacy (See Appendix A). The test had been try out with 40 students. The KR20 coefficient number of the instrument was 0.807 (See Appendix E).

2.4 Test of team learning skills

The thirty items rating scale was developed based on team learning theory (Senge, 1994; Sirilak Jijareon, 2545 ; Vorawan Vanichjareonchai, 2549). The three experts in project-based learning and team learning evaluated the validity of the test's content . The test has been tryout to 40 subjects. The cronbach's alpha coefficient was 0.8933.

2.5 Lesson plans

A lesson plan for teaching was used as an instructional activity to transfer knowledge and learning contents to the learners, which developed following project-based learning theory. The steps for development of lesson plans were

2.5.1 The analysis of content and instructional objectives was selected and outlined form the course contents of Information Literacy. The content and instructional objectives were based on the course description of Information Literacy that emphasis in Information retrieval; evaluation, analysis, and synthesis of the information; and report and citation.

2.5.2 The lesson plan were design and written. The lesson plan was following project-based learning activities based on the web project learning model (Jung, Jun, & Gruenwald, (n.d.). The details of each step were

a. Getting ready. Instructor assigned a project outline in the virtual classroom. The outline's purpose was to provide the information necessary for learners to envision their project.

b. Deciding topics. Members in team read the project outline. Their recalled their past experiences related to the project assignment, and shared their idea or information. In this step, each group decides subtopics of the project for themselves.

c. Planning activities. Learners worked on their projects. They determined the activities and event that take place at each stage of their topics, specific roles and responsibilities, plan appropriate timelines and post in virtual classroom.

d. Investigating and representation. Members in groups worked on their roles and responsibilities to do their projects. Investigation includes information retrieval on information searching tools, interviewing experts, or observation. Representations were including texts, map, figures, diagram, and so on.

e. Finishing. Each group produced reports and presentation as a result of the activities, share their end products on the web. Instructors allow all of students to comment on the projects, or share their knowledge.

f. Evaluating. Teachers evaluated the whole process of the project based on participation and product.

2.5.3 The lesson plans were evaluated and approved by three information literacy experts. The experts were university instructors who teach about information literacy and have at least five years experiences using project-based learning in their classes.

2.5.4 The lesson plans were developed and adopted in virtual classroom.

**3. Research methodology**

3.1 Pretest on learning achievement and team learning skills have been given.

3.2 Three hundred forty nine subjects were grouping three group sizes: large, medium, and small, by they were nine to ten members in large group, six to eight members in medium group, and three to five members in small group.

3.3 The subjects were assigned to project-based learning on online learning for five weeks following the lesson plan. The sixth week, the subjects presented the project and the posttest has been conducted.

3.4 The questionnaire related to factors was published on the web and allow the subject to reply within two weeks. But it had low respond rate, the paper questionnaire was develop for collected data. The final responded rate was 89.03%.

**3. Data analysis**

Several statistical techniques were employed to analyze data for this study. This section describes the procedures used for the quantitative analysis in this study.

3.1 Descriptive statistics (such as percentage, means, and standard deviations) were used to explain the learners' general information and subjects' opinion in online learning and project-based learning

3.2 t-test was performed to evaluate learner achievement and team learning skills. A t-test probability of .05 was used to determine the statistical significance.

3.3 Exploratory factor analysis was conducted of the Likert-scale items to analyze the learning achievement and team learning skill factors in the virtual classroom environment. A factor analysis reduced the number of variables by grouping those that are moderately of highly correlated with one another into a factor, thereby allowing the researcher to describe variables by a few factors (Franenkel & Wallen, 2000 cited in Kim, 2005). Thus, a factor analysis was employed in the present study to reduce the number of variables for learning achievement and team learning skill factors in the virtual classroom environment to a few underlying factors.

3.4 Multiple regression analysis was performed to determine the factors that were associated with learning achievement and team learning skills change during

learning in virtual classroom. The results of multiple regressions, exploratory factor analyses shed light on which factors significantly influenced the learning achievement and team learning. A statistical significance of the regression was determined at the .05 significant level.

## PHASE 3: PROPOSING OF A MODEL OF VIRTUAL CLASSROOM ENVIRONMENT DESIGN FOR PROJECT-BASED LEARNING IN HIGHER EDUCATION

In this phase, a model of virtual classroom environment design was proposed based on the result from the second phase. The details are as follows:

1. The model of virtual classroom environment for project-based learning in higher education was developed.
2. The model of virtual classroom environment for project-based learning has been validated by the consensus of four experts.
3. Present the conclusion of virtual classroom environment for project-based learning in higher education.