

CHAPTER V

FINDINGS AND DISCUSSION

This chapter was discussing the major findings and implications of the survey results. Recommendation had also given at the end of the chapters.

THE OBJECTIVES OF THE STUDY

Main objective 1: To analyze factors affecting the design of virtual classroom environments for project-based learning in higher education.

Main objective 2: To design a virtual classroom environment for project-based learning in higher education.

For supporting two main objectives, the sub objectives need to identify. The sub objectives are as follows.

1.1 To identify factors affecting the design of virtual classroom environments for project-based learning in higher education.

1.2 To analyze factors affecting the design of virtual classroom environments for project-based learning in higher education.

2.1 To design a virtual classroom environment for project-based learning in higher education; and

2.2 To propose a virtual classroom environment model for project-based learning in higher education.

RESEARCH QUESTIONS

For objective 1, the research questions is what are the factors affecting the design of virtual classroom environments in higher education?

For objective 2, the research question is what are the factors affecting the design of virtual classroom environment for project-based learning in higher education?

RESEARCH METHODOLOGY

To answers the research question, this study was 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 the effective virtual classroom environment for project-based learning. The third phase is to propose the design of virtual classroom environment for project-based learning environment.

1. The first phase, data were collected from five experts with extensive online teaching experience. Twenty-three factors from expert review were categorized into four main grouped: learner factor, pedagogy and instructional factors, Environment of learner factors, group dynamic and peer impact factors.

2. The second phase, four factors from phase 1 has been adopted for the design of virtual classroom environment. 349 students enrolled in Information Literacy, Faculty of Humanities and Social Sciences, Khon Kaen University in academic year 2007, were selected to participate in this study by simple random sampling. A pre-test was conducted to identify the students' learning achievements and team learning skills before implementing the virtual classroom. The students were grouped into three group sizes : large, medium, and small. They were assigned to study under the project-based learning on the web for five weeks. In the sixth week, the students presented the projects and then, the post-test was conducted.

3. The third phase, a model of virtual classroom environment design was proposed. These have been approved by four experts.

FINDINGS

The findings has been summarized according to the research objectives as follows:

1. The first sub-objective is to identify factors affecting the design of virtual classroom environments for project-based learning in higher education. The research question is that what factors are affecting to the design of virtual classroom environments in higher education?

To answer this question, factors affecting the designs of virtual classroom environments from experts' review were categorized into four groups.

1. Learner factor concerning the characteristic of learners. The learner factor which approved by experts was self-directed learning.

2. Pedagogy and instructional design factors concerning pedagogy and instructional design to transfer knowledge to learners. It included interaction design,

interface design, content design, usability design, accessibility and responsiveness, feedback quality, instructor experience, assessment, and activity design.

3. Environment and community of learners factors concerning online learning environment and community of learner that allow learner to communicate with other learner, teacher, or peer etc. It included community tools, online student support, learning resource, availability of instructors, quality technology, orientation to course, accessibility to hardware and software, positive interaction between instructor and learner, scaffolding.

4. Group dynamic and peer impact factors concern the relationship between group members. It included group size, strengths of the team members, task clarity, and team leadership.

2. The second sub-objective is to analyze factors affecting the design of virtual classroom environments for project-based learning in higher education. The research question is that what factors are affecting the design of virtual classroom environment for project-based learning in higher education?

From the second sub-objective, the study of subject's opinions in factors affecting on learning achievement and team learning skills were conducted. Factor analysis was shown on factor loading of each factor to identify the factor relationship. The relationship between factor affecting virtual classroom environment designs categorized into four main factors were as follows.

1. Pedagogy and instructional design factors concerning the pedagogy and instructional design in virtual classroom environment. These are composed of the following nine sub-factors. The details are follows: 1) interface design, 2) content design, 3) usability design, 4) interaction design, 5) accessibility and responsiveness, 6) assessment, 7) feedback quality, 8) instructor experience, and 9) activity design.

2. Environment and community of learner factors concerning the environment and community of learner that allow learner interact with instructors, peer, learning resource, etc. in virtual classroom environment. These are composed of the following nine sub-factors. The details are as follows: 1) Orientation to course, 2) Positive interaction between instructor and learner, 3) Accessibility to hardware and software, 4) Social aspects -scaffolding, 5) quality technology 6) Availability of instructors, 7) Learning resource 8) Community tools, and 9) Online student support.

3. Group dynamic and peer impact factors concerning the relationship between learner and group members. These are composed of the following three sub-factors. The details are as follows: 1) strengths of the peer cooperation, 2) team leadership, and 3) task clarity.

3. Group size was emphasized only group size to make a project together.

To answer the second sub objective, a 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 environment. The results indicated that group dynamic and peer impact factors and group size were significantly positive correlated with the learning achievement and it can explain 50 percent of the variance in each factor for learning achievement. About team learning skills, the results indicated that only group size was significantly positive correlated with team learning skills and it can explain 88 percent of the variance in each factors for learning achievement.

Discussion

Discussion for the first sub objective

Several factors were likely influenced the design of virtual classroom environments. Learner factors were identified in the previous studies as an important factors influenced in online learning outcome (Lim, Morris & Yoon, 2006; Contreras, 2004; Monson, 2003). Learner factors are varied for example age, prior experience, learning style, or online experience. Lim, Morris & Yoon (2006) found that age was identified as an important mediating variable resulting in differences in course outcomes. Similarly, Vampola (2001) found the older trainees preferred private implementation activities such as individual learning time and did not prefer coactive analysis activities such as small group discussions. Simpson and Du (2004) reported that learning style was statistically significant to predict course satisfaction using the Kolb's Learning Style Inventory. In addition to Contreras' study (2004), the previous computer experiences and numbers of online courses taken were better predicted the student' confidences in using computer.

Only Self-directed learning was proved by experts that it is quite possible having impaction the learning outcome. Similarly, Su (2006) was proved that other learner characteristics such as gender, field of study, marriage status, etc. were not

significant to influence the learning outcome. She suggests that others variables are better predictors of online learner preferences for learning on online learning environment. For example, it is quite possible that online learners like to learn or interact with others more if they feel that they belong to the community and have a sense of ownership. Therefore other learner attributes have been laminated by the experts. The experts focused on other factors, such as pedagogy and instructional design, environment and instructional design, peer impact. However, self-directed learner was approved by the experts that it influenced the learning outcome in virtual classroom environment. In addition to Kim's research (2005), self-directed learning on e-learning is significantly correlated with learner intention to study on online learning.

Discussion for the second sub objective

1. This study found that vary factors help to create an effective virtual classroom environment for project-based learning in higher education. A systemic understanding of these factors can help instructional designers create the effective virtual classroom environment. Positive interaction between instructor and learner is one of the most important factors that contribute to learner outcome in virtual classroom environment. It was not surprising to find that positive interaction influenced to virtual classroom environment designs because it has proven to be an important strategy for online learning (Cohen, 2002; Schrum & Hong, 2002 ; Bonk & Reynolds, 1997 ; Harasim, Calvert, & Groeneboer, 1997). To achieve learning outcomes, learners need to construct their knowledge by acting, reformulating, interpreting, sharing, and building on ideas and concepts through the reactions and responses of their peers. Online education, with its computer mediated communications systems, offers a potentially rich social learning environment that can support and facilitate active learning collaboration (Brown, 1997). Heinemann (2003) has proven Interaction among students is a critical variable in learning and teacher-student interaction is an important factor in cognitive and affective learning too.

Additionally, Asynchronous and synchronous communication with instructors or peer were the last mean score of factor that learners think it influence learners to success in virtual classroom environment ($\bar{x} = 3.84$, $\bar{x} = 3.88$). The finding shows

that the frequency of interaction between instructors and students is less important than the quality of interaction between students and instructors such as positive between instructors and students. However, Instructors need to be available on virtual classroom because when students have some problems or questions, they assume that instructors can help or solve their problem immediately. Similarly Snell and Browder (2000) suggested that instructors are carefully to provide enough prompting to reduce errors and encourage successive approximations.

2. Self-directed learning was to discard by factor analysis. These results contrast with other previous researches. In the previous researches showed that self-directed learning influenced on success in learning achievement and team learning (Kim, 2005). However, Bonk & Graham (2006) suggested that self-directed online learning is particularly useful for adults who are busy with their jobs and may need classes related to the workplace (e.g. recertification or career advancement) or for personal development. Similarly, Hannum (2001) described the self-directed learning is often used for stand-alone instruction when an instructor is not available. In this study, learners are undergraduate students in general course, not for career advancement and learning activities. This course emphasize project-based learning, that allow learners to interact with learners or instructors in anytime they want. Instructors are always available for them. From the above reason, it is the cause to discard self-direct learning from the factors affecting the design of learning environment for project-based learning.

3. Pedagogy and instructional design failed to detect a significant difference in correlated with the learning achievement. The results are different from the other study. The previous studies showed that instructional design has proven to be an important factor for online learning success. (Lim, Morris, & Yoon, 2006 ; Lim & Yoon, 2006; Simpson & Du, 2004). In project-based learning contexts emphasized the learning activities that allow learner to find information or knowledge for supporting their own learning need, pedagogy and instructional design may be less affected than group dynamics and peer impact factors. Therefore the pedagogy and instructional design factors need to put into the factors affecting the design virtual classroom environment designs. From Lim, Morris, & Yoon (2006) findings the course outcomes were significantly influenced by online learners' learning motivation and

involvement. In order to provide greater learning engagement and promote learning motivation for online learners, Lim (2004) suggests several instructional strategies including: a) providing timely and frequent feedback to engage students in the learning process, b) facilitating direct communication experience among students and with instructors through alternative communication channels such as chat, threaded discussion, and audio/video conferencing, and c) embedding some rewarding mechanisms other than grades during online instruction such as checking students' learning progresses, sending frequent emails for feedback and encouragement, and sharing good examples of assignments accomplishments among peer learners. However, a different context and activities types may have had a different reaction to these factors. Because this study concentrated to project-based activities that allow learners work and learn together. Therefore group dynamic and peer impact is more relation to learning achievement and team learning skills.

4. Group size is an important element in the success of online learning teams. There was a significant difference in learning achievement across group size. The medium group size (6-8 members) was found having higher impact on learning achievement than the small group and the large group, at .05 significance level. On the other hand, there were no significant differences in team learning skills across group size. Differently from another research with learning in teams, it has indicated that three to five members is optimal (Lightner, Bober, & Willi, 2004; Learning Team Handbook, 2003). Unlike This research, it shows Thai learners in medium group size were higher achieved than small or large group size. A different student population type may have had a different reaction to these factors. Another reason, project-based learning in this study was assigned the project or activities that supported project every week. So, the over load of activities have an effect on learning achievement of the learners. Moreover Cosse, Ashworth, and Weisenberger (1999) suggest learner will learning teams work best when all the teams are of equal size.

3. The second main objective is to design and propose a virtual classroom environment model for project-based learning in higher education. The research question is which factors affecting to the design of virtual classroom environments for project-based learning in higher education?

Based on the result of factor analysis, it showed the relationships between members in groups are the critical factors affected learning achievement and team learning. To enhance learning achievement and team learning skills, the features should be designed to address critical issues of the virtual classroom environment.

3.1 The model of virtual classroom environment for project-based learning in higher education enhances learning achievement.

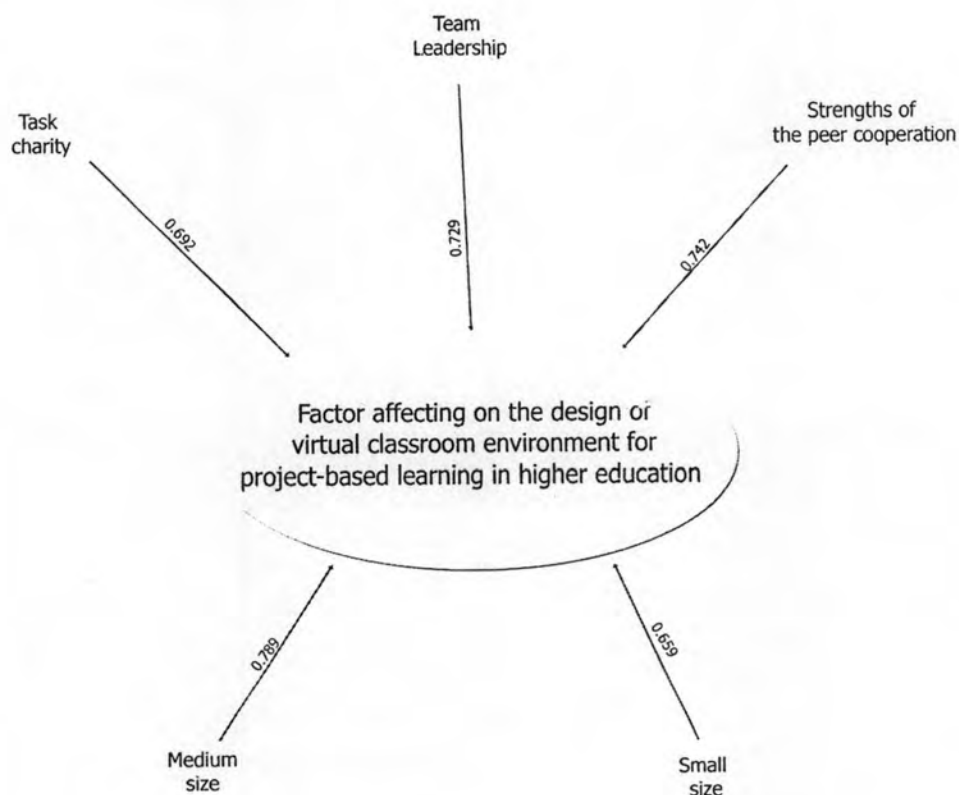


Figure 5: A model of virtual classroom environment designs for project-based learning in higher education on learning achievement.

Figure 5 showed how each factors affect on the design of virtual classroom environment on learning achievement using factor loading. If every factor is put in the virtual classroom environment, learning achievement is expected to improve about 50 percent of the variance in each factor. But the results of this multiple regression analysis indicated that group dynamic and peer impact factors and group size factors were indicating a large significantly effect of the learning achievement.

3.2 The model of virtual classroom environment for project-based learning in higher education enhances team learning skills.

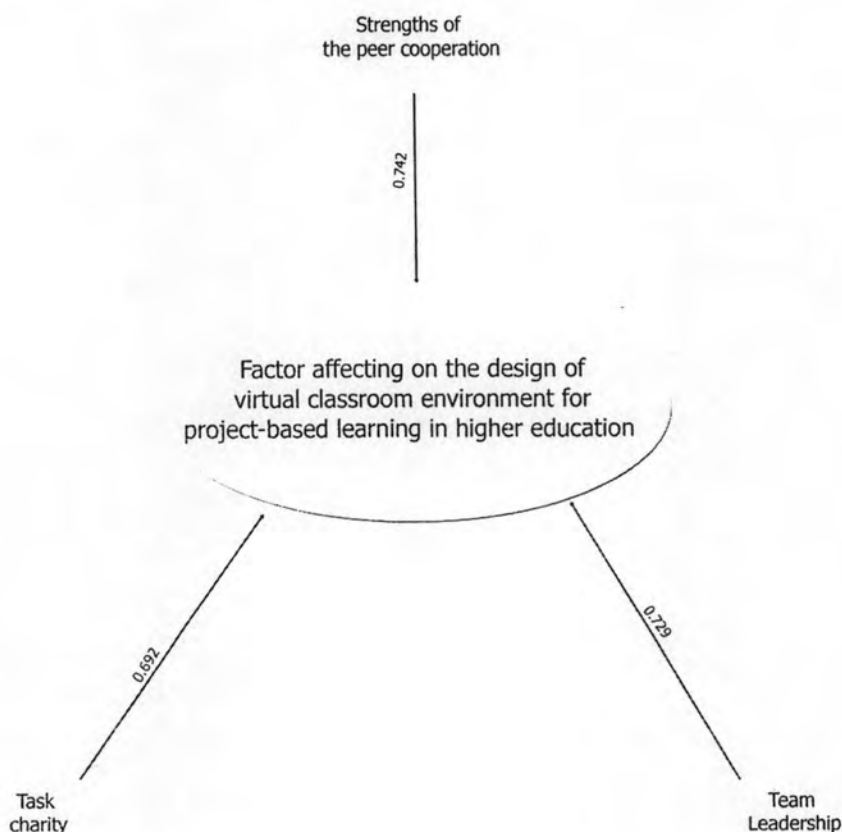


Figure 6: A model of virtual classroom environment designs for project-based learning in higher education on team learning skills.

Figure 6 showed how each factors affect on the design of virtual classroom environment on team learning skills using factor loading. If every factor is put in the virtual classroom environment, team learning skills are predicted to improve about 88 percent of the variance in each factor. But the results of this multiple regression analysis revealed that only group dynamic and peer impact factors was indicating a large significantly effect of team learning skills.

The result of this study indicated that instructor or instructional designer need to aware of factors affecting the design of virtual classroom environment. Especially group dynamic and peer impact factors are most important in learning achievement and team learning skills for project-based learning. This is the guideline for

instructors or instructional designers to create virtual classroom environment for project-based learning in higher education.

1. Group dynamic and peer impact factors. Instructors or instructional designers should be creating learning activities that allow members in each team learn and create their projects together. The types of assignment in virtual classroom environment should be clear objectives and tasks. Learners can choose their team by themselves and should be choosing one of them to take responsibility to be a leadership by themselves. It increases the strength of peer cooperation and the chances that they will actually work well.

2. Group size. The medium group size (6-8 members) was showed it is higher success in virtual classroom than small group and large group. So Instructors or tutors should to set group size about 6-8 members to make a project. However every team should be equal size.

Although other factors in this study proved not significant for learning achievement and team learning skills, instructional designers can not ignore them. All factors combine to create effective virtual classroom environment design, which will enhance learning achievement and team learning skills.

Recommendations

1. Recommendations for implementation.

1) While instructors or instructional designers design the virtual classroom environment. if they want learners get highly learning achievement, group dynamics and peer impact factors and groups size factors were watched to put in the virtual classroom environment. On the one hand, if instructors or instructional designers want learners get highly team learning skills, they should to give their attention to only group dynamics and peer impact factors.

2) Strength of peer cooperation was viewed as one of the important factor influenced learning achievement and team learning skill in virtual classroom. Therefore instructor should provide guidelines for collaboration to increase the opportunities for learners to actually work together.

3) The results of this study showed that the learners in a medium group size was found having higher achievements significant higher than those in a small group and a large group size. Therefore if instructors want to increase more learning achievement, the number of members in group should be about 6-8 members and all the team should be equal size.

2. Recommendations for further research

1) Learner characteristic in previous study about learning online and project-based learning showed that influential to success in virtual classroom. But in this research was emphasized only self-directed learning. Therefore factor research to study the other factors of learner characteristics may be worthwhile to investigate.

2) There are several frameworks for grouping factors. Grouping the factors that different from this study may give the different results. Further researches should be conducted.