

The effects of project-based learning in “systems analysis & design subject on communication competence of university students in Korea

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Keywords

Project-based Learning, Communication Competence, Women’s University Students, Nonequivalent Control Group Pretest-Posttest Design

Abstract

This study aims to examine whether an improvement effect appears in communication competence of university students when applying the project-based learning to “Systems Analysis & Design” subject. The study conducted the analysis on the lowest communication competence of job-seeking students among various areas of basic occupation skills while thought to be the most important in the industry.

From the study results, the project-based learning was shown to be generally effective in improving the communication competence of the university students. Through this study, it was identified that the project-based learning is a useful teaching-learning method in improving the basic vocational skills of university students; however, there is a need for new studies in order to improve some abilities belonging to the sub-areas of communication.

1. Introduction

University education of Korea has been focused on cultivating student's personality and knowledge for a long time. But, the college education focusing on personality cultivation was faced with limitations in the situation that job-seeking is becoming difficult and students should explore their careers by themselves. According to the March 2015 Employment Trends published by the Korea National Statistical Office, the unemployment rate of 20s was 10.7%, which was shown to be at least two times higher (Statistics Korea, 2015). The importance of basic vocational skills has been emerged for college students in the situation of the times that it is difficult to get jobs. The basic job skills are the yardstick for gauging whether university students are equipped with the capacity needed to adapt proactively to changes in society. Education at university should also be interested in the improvement of basic vocational skills in addition to the knowledge and humanity development.

It is difficult to set up separate subjects for cultivating the basic vocational skills in the current university education. It is not easy to establish separate classes for extra basic vocational skills additionally under the circumstances that it is lack of time for the mandatory courses required by the Ministry of Education in Korea. In addition, communication skills, problem solving skills, interpersonal skills, and other skills belonging to the vocational basic skills consist of different knowledge, skills, and attitudes. It is not easy to enhance the whole skills in a short period of time. And there are limitations in improving the basic vocational skills of the students attending universities to the level desired by societies and companies through non-formal education programs and lectures. Therefore, it is necessary to explore the realistic education plan for continuously improving the basic vocational skills of university students through the reconstruction of educational contents and methods in the majors.

In this regards, the project-based learning can be a useful teaching-learning method for improving the basic vocational skills. It is possible to improve the ability to communicate with colleagues, interpersonal skills, collaboration skills, procedural knowledge and skills in addition to the acquisition of major knowledge when applying the project-based learning to the majors (Markham et al., 2003; Stanley, 2011). Considering these points, this study designed classes utilizing

the project-based learning for improving the basic vocational skills and examined what effects it has on the improvement of the communication skills among the basic vocational skills. This study designed a teaching method in which students perform projects by teams in the "Systems Analysis & Design" subject which is a class using the project-based learning.

2. Theoretical Background

2.1 Effects of the project-based learning

The project-based learning is a teaching method in which instructors set up meaningful tasks in the classroom and students cooperates with fellow students while executing the tasks. The project-based learning can be the subject of interests in a situation where employment is becoming harder in that it enables the self-directed learning, and be able to improve the basic occupation skills such as communication skills and interpersonal skills. In the class using the project-based learning, learners organize teams and design projects for solving the practical problems. The project is designed for the learner to endeavor to extract performances according to the output format given by the teacher in advance. In the process, collaboration and communication between members of project team formed by learners and communication with instructors are made. Learner can learn the knowledge and skills as well.

In project-based learning, learners go through the formal procedures for deriving a clear and specific performances for the final products; and instructors carry out expert guidance and instructions for solving problems that the learners encountered in the project implementation process (Rhyu, 2015). Problem-based learning deals with complex and unstructured problems as the main target; it differs from the project-based learning in that learners look for alternatives and solutions by themselves and instructors perform the role of helpers (Savery, 2006).

The project-based learning sets meaningful issues or tasks specifically and can take advantage of instructors as experts in the process of solving them. And learners can cultivate skills and attitudes while learning about guides on the execution method of the projects and on how to create a form, etc. from instructors for deriving the results of project performance.

The project-based learning is a learning that is made focusing on the significant tasks integrating topics and concepts of learning in various areas for a relatively long period (Blumenfeld et al., 1991); the "System Analysis & Design" is a proper course to be designed using the project-based learning in the course characteristics. The project-based learning infer problem, exchange ideas, and go through a process of discussion in the project execution process (Laffey et al., 1998), in which collaboration skills, communication skills, and teamwork skills are important. (Krajcik et al., 1999) emphasize the importance of knowing how to work with people with different backgrounds for students to succeed in the real world.

During this ongoing collaborative learning among team members, learners can contact experts and experience actual research methods of researchers (Diehl et al., 1999); instructors should be able to perform the role of experts in the class.

The National Foundation for the Improvement of Education (NFIE) created by the American National Education Association (NEA) presents the following points for the advantage of the learning using the project-based learning (NCTM, 2000).

First, motivation will be increased. Students make efforts voluntarily to complete projects.

Second, problem-solving skills are increasing. Learners will have the ability to solve complex problems in a more active and successful manner.

Third, research capacity will be improved. Most projects require utilizing a variety of materials, which encourage students to be independent researchers.

Fourth, cooperative learning will be increased. Through a cooperative project, students will have the opportunity to gather the experiences of colleagues, evaluate the work of others, share information, and learn cooperatively.

Fifth, the data operational capacity is getting higher. Students will have the responsibility to perform complex tasks; and have a capability of utilizing time, equipments, and other various resources.

Educational effectiveness of the project-based learning is appropriate in cultivating basic occupation skills in that it can induce active participation of learners by addressing tasks of activities that can excite interests of learners and emphasizes the practical experience that learners plan and execute on their own as the subjects of the activities.

2.2 Basic vocational skills

Basic vocational skills are the abilities required for all workers working in the society, which is the abilities needed to be continuously cultivated in accordance with the variation in the promotion and performing duties in the workplace. (Trilling &Fadel, 2009) conceptualize it, in more comprehensive perspective, as a lifetime skill necessary for humans to live their lives for a lifetime and a competency required for future talents. The basic vocational skills go through the process of being acquired, developed, sustained, and lost during the entire period of life; though it is difficult to stipulate simply (Park, 2006), the abilities need to be cultivated from schools. The studies on the basic vocational skills have been continuously conducted in Korea since the mid-1990; in the earlier stage, there were studies on establishing concepts and areas and the studies have been performed to develop standards later. And ways to utilize the basic vocational skills, program developments, and curriculum reforms have been continuously carried out in educational institutions. Recently, studies on the evaluation of the basic vocational skills have been actively underway focusing on the high schools and universities.

The basic vocational skills are dealt with under the name of core skills, employability skills, or essential skills. The term of key competency is used in companies as well. It is necessary to examine the areas to know more specifically about the basic vocational skills. Details on the areas and sub-factors of the basic vocational skills have been presented in a variety of ways depending on the states and scholars.

SCANS (Secretary's Commission on Achieving Necessary Skills) under the US Department of Labor created a scenario for the duties of workers in 5 industries (manufacturing, health services, retail, food and hospitality, public services) to derive the skills required for effective job performance and derived basic vocational skills under the name of 'Workplace Know-How' through interviews with workers in various fields and positions. The Workplace Know-How is the ability to be applied commonly to all positions; and means the basic technologies and competency for productive and satisfactory life. The basic vocational skills of SCANS, that is, the Workplace Know-How consists of 3 fundamental skills and 5 workplace competencies; there is mutual correlation between each area and the areas are also used at the same time. SCANS of USA classified the basic vocational skills into 5 levels ((Level 1-5) consisting of preparatory, work-ready, intermediate, advanced, and specialist level.

EFF (Equipped for the Future) of USA developed EFF Content Standards presenting the skills and qualifications needed for adults. EFF Content Standards classified adults into families, citizens and workers. In addition, NWRC (National Work Readiness Council) of USA derived the concept of NWR(National Work Readiness) by deriving the skills for students to have before employment based on the EFF Content Standards.NWR means the relevance as a role of an adult and a subset of the big picture of life-long career path, which is being utilized as a framework of qualifications referred to as National Work Readiness Credential.

The basic vocational skills of Korea are defined in the national competency standards (NCS) which was proclaimed as a standard in 2014, which is classified into 10 basic vocational skills (communication skills, numeracy skills, problem solving skills, self-management skills, resource management skills, interpersonal skills, information skills, technical skills, organizational-understanding skills, work ethic). The basic vocational skills are meaningful as requirements that

job-seeking students should be equipped with in accordance with the needs of the industry. In the paper (Yang&Jeong, 2015) studying on the case that the levels of actual job-seeking students are less satisfactory than the level considered to be important in the industry, the Engineering Department showed the highest figure in the communication competence when comparing the difference between the degree of importance and the degree of satisfaction (the degree of importance -the degree of satisfaction). That is, the basic vocational skill showing the largest difference in the capacity level of students compared to the requirements of the industry is the communication competence. From the result of the study by (Yang &Jeong, 2015) problem solving skill (1.04) and interpersonal skill (0.96) are next to the communication skill in the difference between degree of importance and degree of satisfaction.

2.3 Communication skills

The communication skills refer to the knowledge that people have relating to the social properties of communication (Lee et al., 2003; Rubin, 1982; Spitzberg&Cupach, 1989). The definition that is commonly accepted regarding communication is that the senders and recipients send and receive information by utilizing a certain channel. Many communications occur in the industry performing jobs or in the classrooms of schools where classes are conducted. Especially, the communication skills in the workplaces are directly related to the productivity (Kim& Lee, 2014). However, it is not easy to verify whether the senders and receivers perform effective communication with each other and whose communication skills contain problems in the case of poor communication.

(McKay et al., 1995) classified the communication skills necessary for improving interpersonal relationship and enhancing the effectiveness of communication in schools or workplaces or general societies into basic skill and advanced skill; and presented 3 skills of listening, self-revealing, self-expressing skill for the basic skill. Especially, listening is being emphasized in the industry in terms of communication activation and productivity improvement. Effective ways of listening proposed commonly in the literature are summarized as neutral response, interpretation of meanings of the other party's statements by putting them another way, additional questions, outlining the contents heard, checking with feeling of the other party (Bolton, 1979).

(Trenholm& Jensen, 2000) defined the communication competence as a capacity to communicate in the personally-effective and socially-appropriate way, and are focused on the capacity to be involved in the cognitive process of the senders and receivers who perform the communication. The sub skills of the communication competence presented by them are: 1) the skill to give meanings to the environment surrounding the involved in communications; 2) the skills to establish the communication goals strategically; 3) the skills to properly perform the social roles); 4) the skills to expose a visible image of their value; 5) the skills to create intelligent messages containing verbal and nonverbal communication and desirable relationship, etc. (Trenholm, Jensen, 2000).

This study set the sub areas of the communication competence as information collection, listening, overcoming the fixed mindsets, open communication, self-revealing, proactive communication, and understanding others' perspectives (Lee et al., 2003); and measured the communication competence through questionnaires.

3. Methods

3.1 Research overview

This study was conducted on the students of 2nd grade taking the "System Analysis & Design" course in the IT-related department of engineering college of A Women's University. Before proceeding with the project-based learning in earnest, the objectives and procedures of the study was explained for the students who participated in the study. Then, the questionnaire method for measuring the communication competence was explained and pre-diagnostic tests were performed.

The project-based learning activities were conducted up to 12th week; and the post-diagnostic tests were conducted to see about improvement in communication competence in 13 ~ 14th weeks.

3.2 Research procedures

This study reconstructed classes to be in line with the research goal for pre-post study design of the same group. The class operation processes were structured for students to identify and solve topics and issues for analysis by referring to the prior studies relating to the project-based learning (Lee, 2013). First, the students were let to form teams and to analyze the company's website under the analysis and to design a new system regarding improvements. The objects under the system design are database, process and user interface; the problem situation of the projects that the students perform are set as the process of selecting, analyzing, and designing the company's website under the analysis in teams. Through this course, students will be able to recognize the overall situation of the organization and plan the specific system analysis and design direction to implement a system for the organization in the field since employment.

Stage	Instructor	Learner
Preparation stage (1st~3rd week)	Guide on the purpose for implementing the project-based learning Guide on the whole process of the projects Guide on the team organizing Guide on the pre-tests for communication skills Guide on the topics of the projects Guide on the project planning	Understanding the whole process of the projects Organizing teams and introducing team members with each other Ice breaking Understanding key learning concepts (personal learning) Conducting the pre-tests for communication skills
Planning stage (4~7th week)	Providing the related learning resources and information Guide on the team discussion Explaining the key learning contents and concepts Guide on how to perform projects	Collecting the related learning resources and information Team discussions for deriving the solutions Create the plans to perform projects Understanding key learning concepts (personal and team learning)
Analysis and design stage (8~12th week)	Guide on how to create outputs from the performed projects Explaining the key learning contents and concepts Guide on how to perform projects	Collecting, exploring, analyzing the learning resources and information Team discussions for deriving the solutions Creating the drafts of outputs and revising for complement Understanding key learning concepts (personal and team learning)
Evaluation stage (13~14th week)	Outlining the entire learning contents Evaluation and overall general comments Guide on the post tests for basic vocational skill	Announcing project results by team Reflecting Post tests for basic vocational skills

Table 1: project-based learning process

The process of the project-based learning structured in the study is as in <Table 1>. The first stage is the preparation stage for projects, which is configured by the orientation explaining the purposes for applying the project-based learning to classes and the educational meanings. The second stage is the project planning stage; students selected the website of the company considered to be of high interests and value by teams and collected the related information. The theories

techniques for the analysis and design were conducted in lectures and practices for understanding the key concepts that instructors describe. The third stage is the analysis and design stage; the contents learned or collected information to date and work situations were reviewed and solutions for the tasks were derived through consultation with team members. The last stage is the evaluation stage; while comparing their presented solutions with ideas of others mutually, all teams had a time for reflecting on the project activities that performed to date.

3.3 Measurement tools and analysis

For communication skill measurement tools, the measurement tools developed by Lee et al. (2003) to measure on the students and adults of Korea were used. Lee et al. (2003) developed the tools for measuring the communication skills, problem solving skills, and self-directed learning skills in order to measure the core capacities required over each life stage on the national level in terms of the Korea Education Development. The measurement tools for communication competence are configured to fill in the scores that the students perceive themselves considering the level of the actions that occur frequently to them, for 7 questions to which scores of Likert 5-point scale are granted for a total of 7 sub-areas.

Pre- post tests were conducted on the students who participated before and after experiencing the project-based learning to examine the level changes in communication skills depending on the time of diagnosis. The mean and standard deviation were computed on the data collected in this study and the paired sample t-test was conducted on the test results.

3.4 Study results

From the results of the paired sample t-test for the pre-post diagnosing tests, the difference in communication competence (entire) was shown to be statistically significant as in <Table 2>. The t-value of the entire communication competence was shown to be -2.810 with 0.006 in the significance probability, showing the significant difference. It tells that the communication competence of the students was improved after the project-based learning. It can be interpreted that the project-based learning has a positive impact on the communication competence of students.

	N	Mean	SD	t	Significance probability (Both sides)
Pretest	105	3.4059	.29021	-2.810	.006**
Post-test		3.5269	.34063		

Table 2: t-test on communication skills (entire)

Analyzing the results of the pre-post diagnosing tests for each sub-areas of the communication competence

The paired sample t-test was conducted for each area to identify the difference for each of the individual variables; the results as in <Table 3> were obtained. The information collection skills, skills of overcoming the fixed mindsets, self-revealing skills were shown to be statistically insignificant; the skills are interpreted to have not improved by the project-based learning. However, listening skills and proactive communication skills were shown to be significant at the significance level of $p < 0.01$; the open communication skills and skills of understanding others' perspectives were shown to be significant at the significance level of $p < 0.05$.

3.4.1 Information collection skills

From the result of measuring the information collection skills, which are the skills to grasp whether or not to be able to collect the inductive information collection based on the fact after identifying the dialogue contents and intentions of the other party in the communication process, the skills were shown to be insignificant. That is, the effects of improvement in the information collection

skills thanks to the project-based learning showed a small upward change in the comparison of mean values; however, it is interpreted that the change is not significant enough to conclude that the information collection skills were improved.

Significant at the level of * $p < 0.05$, ** $p < 0.01$

Variables		N	Mean	SD	t	Significance probability (Both sides)
Information collection skills	Pre-test	105	3.9078	.42895	-1.898	.060
	Post-test		4.0190	.46769		
Listening skills	Pre-test	105	3.4525	.43438	-2.684	.008**
	Post-test		3.6245	.44227		
Skills for overcoming the fixed mindsets	Pre-test	105	3.6328	.54273	.610	.543
	Post-test		3.5824	.60735		
Open communication skills	Pre-test	105	2.9840	.37561	-2.044	.043*
	Post-test		3.0832	.36307		
Self-revealing skills	Pre-test	105	3.5001	.61020	-1.042	.300
	Post-test		3.5834	.59986		
Proactive communication skills	Pre-test	105	2.9903	.64886	-2.951	.004**
	Post-test		3.2636	.61954		
Skills for understanding others' perspectives	Pre-test	105	3.3754	.55704	-2.050	.043*
	Post-test		3.5335	.56733		

Table 3: t-test on individual variables of the communication skills

Information collection skills are highly likely to vary depending on who is the communication party. It seems not easy to improve the differences in opinions and grasping intentions between classmates in acquaintance for two years since the college enrollment by the project-based learning. However, in case of organizing a team with strange people in the real industry and performing works with them, it is possible to guess that this would show different measurement results. Or there is also a possibility that changes to a relaxed manner at the communication occurred as familiarity increased with projects in progress between learners who were sensitive to the information they collect. These cases are different issues separate from the presence or absence of improvement in the information collection skills. In addition, for the information collection skills, there is a possibility that collection is made more sensitively based on intentions and facts in the absence of sufficient sharing of emotion with the other party. There is a need for studying by forming a project team in members who had never met each other in order to identify it.

3.4.2 Listening skills

Unlike the information collection skills, the listening skills are the skills to understand and identify the intentions of the other party accurately and feedback them repeatedly sometimes. The effects of improvement by the project-based learning were shown to be significant at t-value of -2.684 and at the significance probability of 0.008.

Since the project-based learning requires students to form teams by themselves and derive the final outputs for performances, it is impossible to derive the target result without accurate communication. Many discussions and opinion coordination are necessary in the process of project execution. It is considered that the improvement in listening skills could be achieved in the process.

3.4.3 Skills for overcoming the fixed mindsets

Improvements in skills of overcoming the fixed mindsets were shown not to be improved by the project-based learning. The fixed mindsets mean that it is not possible to communicate

objectively because of depending on the gender, area or appearance of the communication party. This study set the experiment environments to be the situation that makes it impossible to include a variety of communication parties into the project members. There is a limit of not providing an environment to improve the skills of overcoming the fixed mindsets due to the communication relationships with team members organized within a fairly homogeneous group such as classmates of the same school or same class. There is a need for conducting studies in the environments in which it will be possible to measure the presence or absence of the improvements in the skills of overcoming the fixed mindsets by constructing teams in members with a variety of areas, ages, and gender in the future.

3.4.4 Open communication skills

It is the open communication skills to understand a variety of viewpoints and have the attitude of listening to the opinions different from mine. From the measurement results, it was shown to be significant at t-value of -2.044, with the significance probability of 0.043. Open communication enables to raise the attitude of respecting the opinions of the other party, which can be seen to be improved as very meaningful skills through the project-based learning.

It is presumed that there was a need for listening to the opinions of classmates, with open attitude, who have the opinions different from the learner himself or herself in the team project execution process. It is necessary to exchange opinions candidly with each other to solve problems or derive a new solution through team work between learners. It is because it is impossible to reach the mutual coordination or agreement without open communication.

3.4.5 Self-revealing skills

In the social and cultural aspects, Korea has a culture very lacking in self-revealing skills. It requires quite a long companionship and time to expose oneself to the other. Especially, in Korea with customs in which it is not easy to reveal herself even among close friends for women, self-revealing is a kind of courage and ability.

From the result of the project-based learning, no significant effect was shown in the improvement in self-revealing skills. It is interpreted that the project-based learning showed a sufficient effect enough to overcome the cultural customs. Other learning methods may be necessary for improvement of self-revealing skills or it may not be the problem to be overcome by learning. And it is thought that it may be the area requiring longer-term training and learning than thought.

3.4.6 Proactive communication skills

This study showed that the biggest effects of the project-based learning were found in the improvements of the proactive communication skills. It was shown that there is the biggest effect among 7 sub factors with t-value of -2.951, and significance probability of 0.004. The proactive communication skill refers to the skill to clearly express one's opinions in an organized way and actively raise questions about what he or she wants to know about. It can be interpreted that students cultivated a fairly active attitudes and became to be able to communicate proactively as a result of this project-based learning.

The proactive communication skill means using expression or gesture as well as words actively. For Korea female students, it may not be easy to express themselves positively and proactively in the past, traditional culture. However, team construction and project performing only by female students could make them fairly free from these cultural constraints. Regarding this point, there is a need for further analysis through additional studies on whether female students can improve their skills for proactive communication in the case of co-ed as well.

3.4.7 Skills for understanding others' perspectives

The project-based learning also showed the significance in improvement of the skills for understanding others' perspectives with t-value of -2.050, and significance probability of

0.043. Understanding others' perspectives means the improvement in the attitude to consider other's position and identify difference from mine and try to find rooms for possible coordination.

This is the skill to be necessary by all means for cooperation and coordination in the implementation process of projects. It was confirmed that it was improved by the effect of the project-based learning.

4. Discussion and Conclusion

This study was conducted for the purposes of knowing about what impacts the project-based learning has on the communication skills, which is a kind of basic vocational skills of university students. From the result of pre-post diagnosing tests that were conducted in the "System Analysis & Design" class using the project-based learning, the related skills were shown to be improved in 4 areas (listening skills, open communication skills, proactive communication skills, skills for understanding others' perspectives) among 7 sub areas of the communication competence. However, the effects were not shown in the other 3 sub areas (information collection skills, skills for overcoming the fixed mindsets, self-revealing skills), which implies that further studies are necessary for a new learning design for the project-based learning to be utilized.

Limitations of the study are that the study objects are limited, above all. This study is the study targeting on the students enrolled in a particular course in a particular college so it is rather hard to generalize the results of the study. In addition, there is a room to be thought about the feasibility that the study intended initially since the size of sample was small because the subjects were limited only on the students enrolled in a certain course in the judgment that it was reasonable to complete the study within a course under the study design. In this regards, it seems to be necessary to synthesize the research results with the need for the further studies conducted pursuing the diversity of courses as well as expansion in number and expansion of the research subjects in the future.

However, this study is meaningful in that it attempted to exhibit the effect of improving the basic vocational skills by applying the project-based learning to a required course. The study also is meaningful in that it requires further verification through a variety of the additional studies in the future. Especially, the study elucidated the presence of specific improvement in learning effects before and after performing the project-based learning by each sub area of communication competence.

From the study results, it can be said that the application of the project-based learning to "System Analysis & Design" subject has a positive impact on improvement of essential capacities that the professionals leading the changing era should possess.

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