Design and Practice of Social Implementation Education in Engineering Education

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Abstract

To educate engineers, we need a method of social implementation education. Therefore, in Japan, educational innovation including social cooperation has started. Under this program, students are asked to identify social issues and develop solutions. This paper describes the social implementation project implemented by Kanazawa International Technical College fourth grader.

Keywords: *Engineering Design; Active Learning, Project Based Learning*

1. Introduction

In recent years, as an example of introducing project-based learning (PBL) and active learning at higher education institutions, social implementation education [1, 2], which attempts to solve concrete problems in society, is being conducted. At International College of Technology, Kanazawa (ICT), engineering design education and learning have been actively carried out, mainly based on hands-on group projects. Studies have also been conducted that consider the effect of extracurricular activities on regular classes.

In social implementation education, cooperation with outside organizations, companies, and regions is indispensable. Even if students discover problems from a wide range of fields, it is difficult to find outside organizations that will cooperate in the solution process. Therefore, as an early stage of introducing social implementation education, we attempted implementation with a limited field. In this paper, we describe a project we practiced in cooperation with a local printing company.

2. Outline of educational practice

This education was attempted in the subject of Design and Drawing in the fourth year of the Department of Electrical and Electronic Engineering. This course has one 100-minute lesson each week for 30 weeks. Since the target students were unfamiliar with the project activities of the team, we lectured for the first 20 weeks to give students the skills necessary for team activities.

In the first 15 weeks, students were taught to use a freehand sketch technique called *communication drawing* [3, 4] to smooth out activities and to organize and summarize ideas; in the next 5 weeks, students were taught techniques for analyzing engineering design process and problems, idea generation, and organizing ideas. Actual project activities took place in the final ten weeks.

2.1 Engineering design process

The project was basically executed in the following engineering design process [5]: (1) discovering the problem, (2) clarifying the problem, (3) creating the idea, (4) evaluating/selecting the idea, and (5) realizing the idea. Therefore, before actual project activities, we taught students how to proceed with projects in team activities, methods for analyzing problems, and techniques for originating and organizing ideas.

2.2 Project activities

The local printing company Wellco Holdings Co. provided students with a theme. Therefore, (1) identifying the problem in the engineering design process was done by the company, and students started with the second step, (2) clarifying the problem. The theme provided by the company was "Proposal of toys with stickers that children can stuck or peeled off freely in casual restaurants [6]." This special sticker is called a magic sticker (MS), and MS has the following features; printable on both sides of sticker, printable on release paper and partial paste on back of sticker.

There are many visits by families with children in casual restaurants in Japan. Gifts for children tend to be simple toys, and children play with them on the wait for food to come out. The theme given by the company is to propose a toy using MS that can be enjoyed by children younger than primary school children.

3. Student project

3.1 Project procedures

The student project was carried out using the following procedures.

(1) Providing the theme from the company to students
At the beginning of the project, the engineers came from Wellco Holdings Co. and explained to students the features of the MS, problems, examples of its present use, and so on. (Fig.2)

Fig.2. Explanation of MS by the engineers of Wellco Holdings Co.

(2) Clarification of problems
After listening to the explanations, students were divided into 7 teams and started team activities. Each team had three or four members.Students extracted features of the MS and clarified the problem of this project.

(3) Creation of ideas
Students created meny ideas using the brainstorming method.

(4) Evaluation and selection of ideas
In this process, each student team initially set five idea evaluation criteria. According to the criteria, a number of ideas devised were scored and the best ideas of the team were selected.

(5) Implementation and improvement of ideas
A prototype will be produced at the end of the project activity, but in order to refine the team's ideas, the team will organize their ideas into B1 sized posters and present them to printing company engineers and all students. In this presentation, the students were able to get advice from others outside the team, and the ideas were improved. Figure 3 shows two posters created by the students before planning the final idea.

(6) Prototype production
Students made prototypes using simple materials such as printing paper, glue, tape, and colored pencils to confirm their ideas.

(7) Final presentation
The students made a slide presentation. Each team made presentations using slides and prototypes created by printing company engineers, and answered and answered various questions and opinions from the engineers. Figure 4 shows pictures of the final presentation.

3.2 Final idea by students

The students came up with ideas such as quizzes, board games, coloring books, paper crafts, and shogi. Among the many ideas, not only the printed stickers were used, but also the idea of the product that children could paint freely and use as paper crafts was highly evaluated by the engineers. This idea was further examined by the designers and engineers of the printing company, and became actual products as shown in Figure 5, and was used in casual restaurants in Japan.

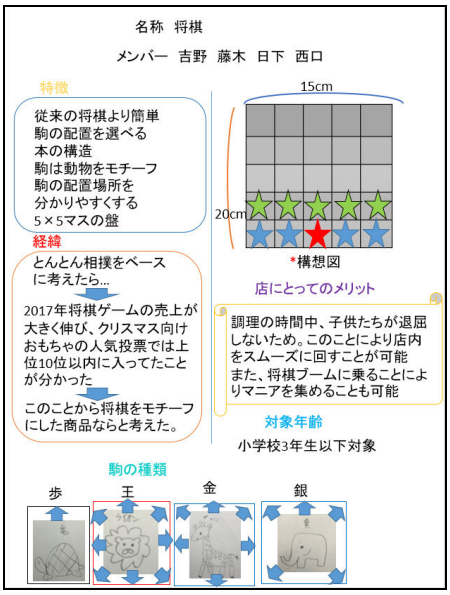

Fig.3. Posters produced by students.

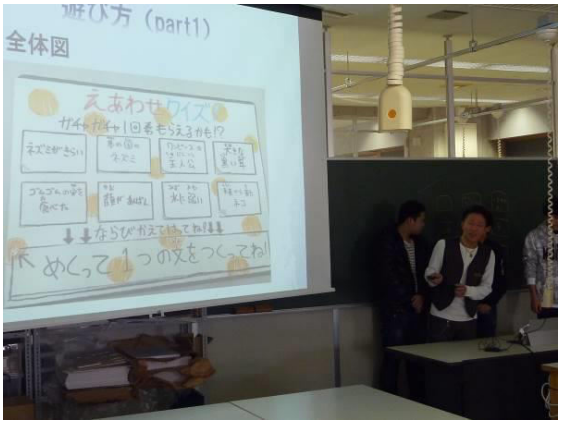

Fig.4. Final presentation by students.

Fig.5. Products realized from student ideas.

3.3 Questionnaire survey after project completion

After the project was finished, we administered a questionnaire survey. The survey target was 27 students who had taken the classes. Figure 6 shows the results of the survey.

Q1 Have you been able to improve your ability by being given a theme from a company?
Q2 Have you been able to improve your ability by receiving advice and comments from company engineers?
Q3 Have you been able to improve your ability by prototyping your idea?
Q4 Have you been able to work actively on this project?
Q5 Have you been satisfied with this class?

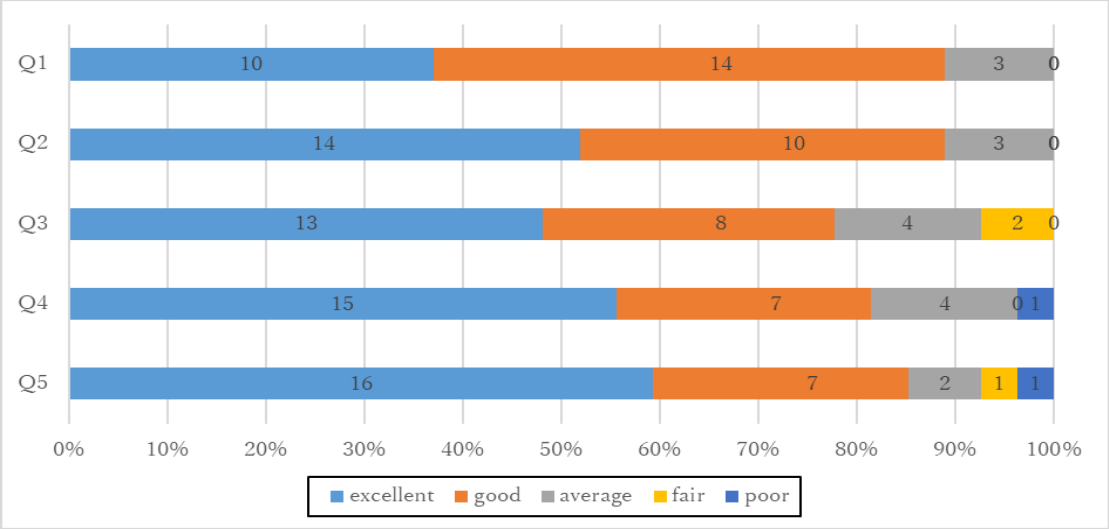

Fig.6. The results of the survey.

For every question, 78% to 88% of the students answered positively. Furthermore, the engineer's participation in the student's project succeeded in raising the student's project level significantly. Since students were able to come up with ideas that engineers did not think up to now, it can be judged that social implementation education is effective for engineering education.

4. Summary

In this paper, we described social implementation education practiced in cooperation with a local printing company. Some of the ideas proposed by students were of high quality that would lead to commercialization. The questionnaire results showed that many students had a positive opinion of this project activity.

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