DEVELOPMENT FOR AN INTRODUCTORY ACTIVE LEARNING PROGRAM: UTILIZE A SHORT-TERM DESIGN PROJECT

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Abstract

In this study, “a short-term introductory PBL education program” is developed for “learners before full-scale PBL practice,” which include “high school students who have not experienced PBL” and “college students who have little experience of PBL.” The purpose of this educational program is to enable learners to acquire (1) the ability to express their own opinions to others (communication skill), (2) the ability to tackle problems from the viewpoint of users (design thinking skill), and (3) the ability to work as planned (the skill to grasp the entire picture of each problem). Accordingly, we focused on a design project that allows learners to brush up these three skills and complete each assignment by themselves. This paper reports on the educational practice for a short-term design project targeted at high school students. Through a questionnaire survey conducted after this project, we received positive feedback from high school students who have taken this educational program.

1 INTRODUCTION

One of the effective educational methods for promoting active learning is project based learning (PBL) [1, 2]. In PBL, it is common to implement a project mainly based on group activities, and students can acquire necessary skills for working in society through this learning process. Therefore, many colleges in Japan have adopted PBL [3, 4].

A variety of PBL can be conducted according to the academic year of students, for example, by discussing “familiar problems” and “problems with local communities” and cooperating with enterprises. Taking advantage of this merit, we, too, adopted PBL in our classes. However, we cannot ignore the risk that learners who are not accustomed at active learning will hinder group activities in PBL. Such learners are considered to lack the capability of tackling problems. In this study, a short-term introductory PBL education program has been developed for learners before full-scale PBL practice. This paper reports on the implementation of an educational program we are developing for high school students.

2 SHORT-TERM INTRODUCTORY DESIGN PROJECT

So that learners can practice PBL smoothly through group activities, we will develop an educational program for conducting a three-day introductory design project. The subjects are “high school students who have not experienced PBL” and “college students who have little experience of PBL.” The purpose of this educational program is to enable learners to acquire (1) the ability to express their own opinions to others (communication skill), (2) the ability to tackle problems from the viewpoint of users (design thinking skill), and (3) the ability to work as planned (the skill to grasp the entire picture of each problem). For this paper, the project is a short-term design project; accordingly, we prioritize the improvement of communication and design thinking skills over the skill to grasp the entire picture of a project.

The project theme is “to design an easy-to-use cup for elderly people.” A team is formed by about 3 learners, and the project proceeds in accordance with the procedure shown in Fig. 1. (1) The learners research elderly people, who would become users; (2) discuss the potential needs for easy-to-hold cups from the viewpoint of elderly people; (3) come up with some ideas; (4) produce, examine, and improve a prototype, and determine a final design; and (5) place an order for the production of ceramic cups with the final design. Here, (1) and (2) correspond to the problem identification process, and (3) to (5) correspond to the problem-solving process. Especially, (5) is an option for making the project activities more practical.
3 IMPLEMENTATION OF A DESIGN PROJECT

This section explains the details of the design project conducted for 9 first-year students of Ishikawa Technical Senior High School at Building 26 (Challenge Lab) in Ougigaoka Campus of Kanazawa Institute of Technology for 3 days from July 30 to August 1, 2018 (3 hours in the morning and 3 hours in the afternoon each day).

3.1 Day 1

3.1.1 Morning of Day 1 (Stage 1)

The outline of the 3-day project was explained, and the 9 high school students were divided into 3 teams that were each composed of 3 members. Then, each team was provided with a suit for experiencing the physical abilities of seniors, and each student was instructed to put on that suit and walk around in a room, as the first group activity. The students realized “how much elderly people can exercise” (Fig. 2). The students were instructed to do the daily activities of seniors as much as possible inside the building, for example, by using the handrails of stairs, checking a bulletin board, and going to a restroom, so that they can understand how elderly people (assumed users) feel. The objective of this simulation is to make the students conjecture what kinds of cups would be easy to use for elderly people, and proceed to the next stage for stirring potential needs.

Figure 1. Flow of the design project.

Figure 2. Simulation with a suit for experiencing the physical activities of elderly people.
3.1.2 Afternoon of Day 1 (Stage 2)

We took the high school students to a facility for the elderly, and provided them with “an opportunity to communicate with seniors.” Before visiting the facility, the students had received a lesson about the paper-crafting technique, which would be used for communicating with seniors. We visited the facility named “Day Service Center—Ibis Yokogawa,” which cares for about 20 elderly people. On that day, a recreational event, in which high school students and elderly people would enjoy paper-crafting together, had been scheduled. The objective of this interaction is to foster the students’ sympathy with seniors just like that suit for simulation, and help them design a cup from the viewpoint of elderly people. The students can observe the movements of the hands of seniors during the paper-crafting (Fig. 3). After returning from the facility for the elderly, we instructed each team to summarize their ideas about cups that would urge seniors to use them (that is, their design concept). The primary feature of a cup is that “you can pour something to drink into it,” and each team’s design concept would be reflected in its auxiliary feature. When each team is instructed to determine a design concept, the high school students discuss how a cup should be designed so as to be easy to use for elderly people.

![Figure 3. Interaction with seniors through paper-crafting.](image)

3.2 Day 2

3.2.1 Morning of Day 2 (Stage 3)

At the end of Day 1, we instructed the students to present the outcomes of their discussions, including what they found about seniors and their design concepts reflecting what they found. Next, we encouraged the students to come up with some ideas based on each team’s design concept. Each of the students drew an idea on a design sheet, and explained it to other members while showing it. As they exchange opinions in each team, their ideas become more substantial.

3.2.2 Afternoon of Day 2 (Stage 4)

The students selected one from their designs, and proceeded to the production of a prototype based on the selected design (Fig. 4). The prototype is produced for the purpose of making the students understand that they can find problems that become apparent when the design drawn on the sheet is embodied.

3.3 Day 3

3.3.1 Morning of Day 3 (Stage 4)

The students put on the suit for experiencing the physical activities of elderly people and tested the usability of their prototype cups (Fig. 5). They received opinions about their prototype cups from other teams, and reflected them in improvement ideas. Then, they summarized the improvement points for the first prototype, and proceeded to the production of the second prototype.
3.3.2 Afternoon of Day 3 (Stage 4)

After the production of the second prototype, each of the students was instructed to prepare a manuscript for a presentation about the design developed in the 3-day project, and give the presentation.

3.3.3 Afternoon of Day 3 (Stage 5)

The outcomes of this 3-day project are the sheet on which a design was drawn, a prototype based on the design, and the manuscript for a presentation about the design. The processes so far constitute this educational program, but we were able to proceed to Stage 5, by enlisting cooperation from a local ceramic artist. In order to produce ceramic cups with the designs drawn by the students, they convey their designs to “the person who possesses pottery skills” by utilizing the above mentioned three outcomes. Here, we requested Ms. Tomomi Takeda, a Kutani ware artist, to meet the high school students and listen to what kinds of cups they want to produce. Kutani ware is a style of traditional Japanese porcelain in the region where our college is located. Through the meeting with the artist, the students would face difficulty in conveying their designs to others.

4 QUESTIONNAIRE SURVEY

Immediately after the design project, we conducted a questionnaire survey targeted at the 9 high school students, and obtained the results shown in Fig. 6.

Q1 to Q5 ask about the entire design project. It seems that Q1 was difficult for the students. However, they gave positive answers to Q1 to Q5. It can be concluded that the design project was good for them as a whole.

Q6 to Q11 ask about the contents of the lecture. The answers to Q7 indicate that half of the students were confused during the production of the first prototype. However, all of the students except one
gave positive answers to Q8, which asked about the production of the second prototype; accordingly, it can be considered that their confusion was relieved. This indicates that the students understood the importance of “pondering repeatedly.” They gave positive answers to the other questions, too. From these results, it was concluded that this educational program conveyed the importance of designing a product from the viewpoint of users to the students, as we aimed.

The questionnaires about the entire design project.
Q1: Have you understood the meaning of designing through the workshop?
Q2: Did you discover “the good side of yourself” that you did not know through the workshop?
Q3: Did you discover “something” that you felt short of yourself through the workshop?
Q4: Have you changed your way of thinking about your student life after the workshop?
Q5: Do you think that other college students should experience this workshop?

The questionnaires about the contents of the lecture.
Q6: Were you able to wear the suit for experiencing the conditions of an elderly person and understood the feelings of elderly people?
Q7: Do you think that you could design a cup that matches the design concept of the team in the first design?
Q8: In the second design, do you think that you could design a cup that satisfies the design concept of the team and that elderly people want to use?
Q9: Did creating a prototype (3D model) based on your own idea (what is drawn on the design sheet) led to the clarification of your idea (did your vague idea in your head form a clear shape)?
Q10: Did you understand the process of manufacturing (thinking through the user’s feelings, designing it, making it (prototype), improving it, and providing it to users)?
Q11: You explained to the potter to make a cup based on your design. From this experience, did you understand the need for communication skills to “tell” others what you designed?

Figure 6. Results of the questionnaire survey.

5 CONCLUSIONS
Through the educational practice in this study, the high school students engaged in the design project that emphasizes the sympathy with users. The purpose of this education program was to improve the
students’ (1) ability to express their own opinions to others (communication skill), (2) their ability to tackle problems from the viewpoint of users (design thinking skill), and (3) their ability to work as planned (the skill to grasp the entire picture of each problem), and the results of the questionnaire survey indicate that they brushed up (1) and (2). As for (3), there is a possibility that the ability was not developed enough because the project was short-term. To improve this ability, it is considered necessary to implement a longer project. As for “the effectiveness of PBL as an educational method for high school students in Japan,” the results of this study indicate that PBL is effective for high school students. From now on, we will apply this educational program to college students who have little experience of PBL, and discuss the difference from high school students’ attitude toward PBL.

ACKNOWLEDGEMENTS
We would like to thank Mr. Sumio Nakamura, Director, Advanced Design Research Institute, SDS, for advice on the writing of this study.

REFERENCES