

“YACON” PROJECT TO DESIGN PROMOTION OF REGIONAL SPECIALITIES COLLABORATING WITH THE LOCAL GOVERNMENT AND COMMUNITIES

Takao ITO¹, Mune-aki SAKAMOTO¹, Keiko MATSUMOTO¹, Jun-Ichi SAGARA¹, Ikuhiro TANIDA¹, Satoshi TAKEUCHI¹ and Miwa YASUKAWA²

¹Kanazawa Institute of Technology, Nonoichi, 921-8501, Japan

²Suisei High School, Hakusan, 924-0815, Japan

ABSTRACT

Project-Based Learning (PBL) is the backbone of Kanazawa Institute of Technology (KIT) in Japan. In its curriculum, Project Design Program is applied in 14 departments in four colleges. It also combines its curriculum with the extra-curriculum to obtain innovation skills. “YACON” project is an extracurricular design project at KIT collaborating with the local government and communities. Extra-curricular activities play an important part to enhance the cross-disciplinary activities using the design process to solve problems. “YACON” project started in 2013 in Project Design Program in which students tackled problems to promote regional specialties. Yacon (*Smallanthus sonchifolius*) is an edible tuber crop originating from South America. After the regular curriculum course was finished, students decided to continue the project as extracurricular and multi-disciplinary one. The project was conducted in collaboration with Nonoichi City government and agricultural cooperative groups. Through “YACON” project, students learn not only scientific knowledge of Yacon, but also marketing skills. They make plans of promoting Yacon usage, design promotion tools for Yacon products, and sell them in stores to get feedback from customers. Finally they made prototype products. Through the project, progress in students’ presentation skills and communication skills was observed.

Keywords: PBL, extra-curricular program, product design, Yacon, collaboration, COC.

1 INTRODUCTION

The effectiveness of problem-based learning and project-based learning (both abbreviated to PBL) has been accepted widely. Aalborg University in Denmark implements PBL as the basic educational methodology throughout its engineering program [1]. Worcester Polytechnic Institute in USA put project courses in curriculum [2]. Kanazawa Institute of Technology (KIT) sets PBL as the backbone of the curriculum and names it Project Design Program, which is consisted of 5 compulsory courses in 14 departments in all four colleges [3-4].

In order to raise an education effect of PBL, extracurricular activities not only beyond regular curriculum classes but disciplines are desired. A regular class is organized based on its discipline and class hours are not enough to accomplish an authentic project. Cooperation with the district or a corporation is also desired, which is hard to do in a regular class.

In 2013, Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan released the Second Basic Plan for the Promotion of Education. It announced that Universities that serve as the base for intellectual creative activities should be the Centre of Community (COC), and the government would aim to strengthen the function of COCs, which have the trust of the community, and enhance mutual exchanges with the community through students’ participation in the resolution of challenging issues [5]. KIT was adopted by the COC program. “YACON” project was selected as one of the COC programs of KIT.

To implement the project, five professors from three departments and a staff of KIT made up the faculty team. They are from Practical Engineering Education Program, Department of Applied Chemistry, Department of Applied Bioscience, and Department for Promotion of Collaboration. The project members are the students from six departments: Department of Mechanical Engineering,

Electrical and Electronic Engineering, Media Informatics, Architectural Design, Civil and Environmental Engineering, and Applied Bioscience.

The following parts of this paper are organized as follows: Section 2 will describe the pedagogical system combining curricula for grades and extracurricular activities. Some of the extracurricular activities will be shown. In Section 3, “Yacon” project will be explained: project objectives, curriculum activities, extracurricular activities and collaboration with the local government and communities. Pedagogical evaluation results will be discussed in Section 4. Section 5 will discuss the conclusion of the paper.

2 EXTRA-CURRICULAR PROGRAM IN KIT PEDAGOGICAL SYSTEM

The KIT pedagogical system consists of curricula for grades and extracurricular activities [6]. Project Design Program which is based on PBL is the backbone of KIT’s curricula. Centred on Project Design Program, the new KIT president sets co-creation education that spans generations, disciplines and cultures to realize education capable of producing innovative design [7]. Co-creation education gives emphasis to engineers’ activities in cooperation with various generations to gain deep knowledge and to increase their communication and innovative creation skills. It also combines the regular curriculum and multi-discipline extracurricular projects. More than a hundred extracurricular activities are supported to combine the formal curricula with further training and experience.

Normal curricular classes are in session only 160 days (16 weeks per semester) a year. Most of classes are carried out in the same grade of the same discipline. They are designed to realize practical education. However they are not enough to tackle the real-life problems. The expert performance is closely related to the assessed amount of deliberate practice [8]. KIT develops extracurricular activities to have its students spend not only after class hours but also remaining 205 days to experience interdisciplinary projects.

There are many extracurricular projects: YUMEKOB O Projects, Department/ Lab-related Projects, Collaboration with Industry and Community Projects, Educational Support Centre Projects, On-campus Internship Programs, and Students Union Programs. For example, there are 16 YUMEKOB O Projects (YUMEKOB O is a Japanese term which refers to the Factory for Dreams and Ideas) in 2016, which are self-directed projects to develop students’ technical competence through planning, designing, fabrication, analyzing and evaluation[9-10]. Robocon is one of the YUMEKOB O Projects, which aims to win first prize in ABU Asia-Pacific Robot Contest. The team won the first prize at Vietnam in 2013 [11].

COC projects are categorized as Collaboration with Industry and Community Projects and there were 14 projects in 2016. COC projects in KIT are requested to combine extracurricular activities with curricula, and are asked for more than three faculty members’ participation in a project.

3 “YACON” PROJECT

Yacon (*Smallanthus sonchifolius*) is shown in Figure 1. It is an edible tuber crop originating from South America, rich in fructo-oligosaccharides [12] and considered as a useful food material for health promotion [13]. It is cultivated in many places in Japan; Japan Yacon Association holds a seminar about it every year.

Through “YACON” project, the following education effects are expected by cooperation with the district including the value chain from a production site to a table: 1) students are expected to learn the marketing skills including the process of planning and developing products, 2) they will learn engineering process and analytical method with cooking and processing methods, 3) they will study the methods of literature search and patent search through review activities of scientific knowledge of Yacon. They make plans of promoting Yacon usage, design promotion tools and packaging of Yacon products, and sell them in stores to get feedback from customers.



Figure 1. Yacon

3.1 Yacon project from the Project Design Program to an extracurricular project

“YACON” project started in 2013 from Project Design Program. In Project Design 2 (PD2) course for sophomore, some issues were brought up as main topics from Nonoichi City other than discipline-related main topics. One of them was to promote regional specialties and some project teams tackled the issue to promote Yacon, which is one of Nonoichi specialties. After the regular curriculum course was finished, four students decided to continue the project as extracurricular and multi-disciplinary one. The project was conducted in collaboration with Nonoichi City government and agricultural cooperative groups. It has been recognized as one of the COC projects since 2015.

It was adopted as one of cooperation projects of Nonoichi City in 2016. The project has cooperated with Suisei-Factory, a virtual food company of Suisei High School which is the only agricultural high school in Ishikawa prefecture. The form of Yacon project is shown in Figure 2.

The project members increase to twenty students from six departments: Department of Mechanical Engineering, Electrical and Electronic Engineering, Media Informatics, Architectural Design, Civil and Environmental Engineering, and Applied Bioscience. Five professors from three departments and a staff of KIT constructed the faculty team for guidance of the project. In the project, students were divided into three activities: developing Yacon products, preparing Yacon booklet, and collaborating activities with local communities. Each team worked as a weekly project as extracurricular activities beyond discipline. Sometimes they jointly worked during weekends.



Figure 2. Form of Yacon project

3.2 Marketing activities

Students got experience to sell the existing Yacon products at the local special product sales corner of the department store for a week. All the members worked by daily shift operations. Yacon products were supplied by Nonoichi Agricultural Group. It was just like internship experience.

They learned AIDMA model which explains the psychological process of consumers' purchasing activities as Attention, Interest, Desire, Memorization and Action (purchase) [14]. To get Attention and Interest of the product, package design is important. To be Desired and Memorized, the product

quality is important. Students observed products similar at the department store, and got the opportunity to recognize the importance of developing new products and promotion tools.

To develop new products and the booklet, students investigated the strong points and the weak points of Yacon. The strong points are as follows: it is rich in polyphenol, a dietary fibre, beta carotene, vitamin C, or a fructo-oligosaccharide, it has good texture and table sugar can be lessened if used for cooking. The weak points are as follows: Yacon is not so popular, the period which can sell Yacon in the raw is only five months from November through March, and it will brown shortly after peeling.

Based on the survey, research-based activities, collaboration activities and developing activities were done.

3.3 Research-based project activities

Two kinds of research-based activities were performed: investigation on confirming nutrients, and research on preventing brown discoloration.

Students of Yacon project analyzed the vitamin C of Yacon leaves and compared the results with that of a cabbage. The analysis is not what a teacher told them to do like an experiment class. Students found the necessity of the analysis by themselves to explain the nutrients in the collaborating activities with the communities. They found there is more vitamin C of Yacon leaves in upper position than that of a cabbage. Study of the prevention from browning was made in a laboratory of Department of Applied Chemistry as the thesis of senior students. Both results were announced at the public lecture meeting of Yacon project.

3.4 Collaboration activities

The project held several events in cooperation with the local government and communities for the improvement in familiarity of Yacon. Students opened the booth at the campus festival and at the community festival, they gave a lecture at the local elementary school, and they held the cooking classes in the public halls.

For each activity, students made a plan and prepared presentation materials. They considered of what kind of age people would participate in each activity and what would be attractive for these participants. They targeted the young participant in ten to twenties at the campus festival, while they assumed the seniors as participants of cooking classes. In each case, they considered that the consciousness to health vegetables improved, one of which is Yacon, and participants could enjoy the event. They devised many cooking recipes for Yacon.

Through collaboration activities, students have found that they could learn a lot of things from participants. They were impressed by the schoolchild's politeness and the seniors' skill of cooking.

3.5 New Yacon products

Through the activities, they designed and printed Yacon booklet which contains cooking recipe and Yacon products so that it might be distributed at collaborating activities. It is shown in Figure 3. They designed the front page using the picture of Yacon tuber and flowers. They also designed the project logo and put it on the left upper position.



Figure 3. Yacon booklet

Also they planned and developed new Yacon products. They had meetings with the local food company for trial production. The new products are Yacon chips, Yacon pickles, Yacon jelly and Yacon Taiyaki (fish-shaped cake filled with Yacon paste). They are shown in Figure 4.

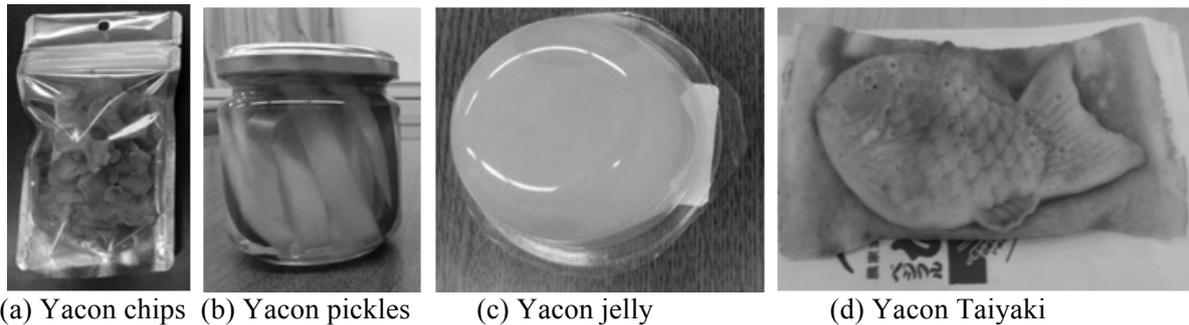


Figure 4. Yacon products

- Yacon chips: They are preserved food which can be eaten besides a season of harvest. Sliced Yacon is dried for 24 hours in 40 degree Celsius, without using oil. Fructo-oligosaccharide is condensed and chips taste sweet. A weak point is browning of chips.
- Yacon pickles: By pickling in vinegar, browning can be suppressed. Texture is also maintainable. In order to attach colouring, carrot and paprika are added. They can be eaten beyond a season of harvest.
- Yacon jelly: Yacon is decocted and filtered. Sugar and lemon juice are added and hardened. It can be offered as a dessert.
- Yacon Taiyaki: A fish-shaped pancake stuffed with sweet bean paste is a popular snack in Japan. Instead of bean paste, Yacon paste is used and sugar is suppressed.

With product development, package design is also important. There are various designs in the existing Yacon products. However there is no decorum in them. Some products use the city character of Nonoichi and others use the design of their original character. Students explored several design ideas but could not select the best one yet.

Even for professional designers, product design and package design are very hard. Students have learned that designing a product is not an easy task.

4 PEDAGOGICAL EFFECTS

During the project, only a few lectures were given from professors. They were about short introduction of marketing theory, guidance of Yacon features, methods of patent survey and product developing process. Many of activities were left to students' independency.

It is difficult to measure the pedagogical effects of extracurricular activities. There is neither a final examination nor a scholastic evaluation. However they learned a lot through the activities shown in Section 3.

Students did self-valuation of the growth of their capability and wrote reports about their growth through the project. All the members felt improvement in communications skills and presentation skills. Their communications skills improved through discussion with project members, and through activities with local communities. Some of them appeared on the radio program and introduced the project. They also worked hard to prepare presentation materials for collaboration activities, discussion with the local food company and lecture meeting open to public. They thought out in order to give explanation easy to understand.

In the project, junior students guided sophomores and freshmen. Juniors commented they could improve leadership. Sophomores who worked in the product developing activities mentioned they learned product planning from the meeting with the company which cannot be learned in a class.

5 CONCLUSIONS

The activities of "YACON" project were introduced. The project started in the curriculum of Project Design of KIT and was continued as the extracurricular and multi-disciplinary project. It was recognized as one of the COC projects of KIT, and was conducted in collaboration with Nonoichi City

government and agricultural cooperative groups. The project also cooperated with the virtual food company of Suisei High School in Ishikawa prefecture.

Through the project activities, students have acquired interdisciplinary knowledge and have experienced employment of the knowledge. The project activities include marketing activities, research-based activities, collaboration activities and developing new products. Through the marketing activities, students have learned the model of consumers' purchasing activities. They have also learned scientific analysis of nutrients. Presentation and communication skills have been improved through collaboration activities. They have experienced planning new products and designing promotion tools. They announced the activities at "Yacon Summit" conference open to public and acquired favourable comments.

Pedagogical effects were confirmed by students' self-valuation of the growth of their capability. Improvement in communication skill and presentation skill was recognized. Professors also observed improvement in a student's leadership.

This is one of good examples of co-creation education that spans generations, disciplines and cultures to realize education capable of producing innovative design, which is the new target of KIT education.

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REFERENCES

- [1] Fink, F. K., Integration of engineering practice into curriculum - 25 years of experience with problem based learning, *Proc. of the 29th ASEE/IEEE Frontiers in Education Conference*, 1999.
- [2] Tohoku University, *International Symposium on Project/Problem Based Learning: Reality or Myth?* Available: http://www.eng.tohoku.ac.jp/media/files/_u/topic/file1/2cmgppqeer.pdf [Accessed on 2017, 18 January].
- [3] Ito T., Shin M., Miyazaki K., Iwata S. and Sentoku E. The Effects of Spiral Educational Method through PBL: KIT Project Design Program, *Proc. of the 43rd Annual SEFI Conference*, 2015.
- [4] Ito T., Shin M., Miyazaki K., Iwata S. and Sentoku E. The Project Design Education Collaborating with City Governments and Communities, *Proc. of the 18th International Conference on Engineering & Product Design Education*, 2016
- [5] MEXT, *1.Measures based on the Four Basic Policy Directions*, Available: <http://www.mext.go.jp/en/policy/education/lawandplan/title01/detail01/1373796.htm> [Accessed on 2017, 1 March], (2013) 14 June.
- [6] KIT, *KIT's innovation education system*, Available: <http://www.kanazawa-it.ac.jp/innovation/index.html> [Accessed on 2017, 28 February].
- [7] KIT, *Message from the President*, Available: <http://www.kanazawa-it.ac.jp/ekit/about/strategy/index.html> [Accessed on 2017, 28 February].
- [8] K. A. Ericsson, R. T. Krampe , C. Tesch-Romer, The Role of Deliberate Practice in the Acquisition of Expert Performance, *Psychological Review*, Vol. 100, No. 3, pp. 363-406, 1993.
- [9] Matsuishi. M. The Factory for Dreams and Ideas: Students' Projects to Enhance Professional Technical Competence, *Proceedings of the 41st Annual SEFI Conference*, 2013.
- [10] KIT, *YUMEKOBO (Factory for Dreams and Ideas)*, Available: <http://www.kanazawa-it.ac.jp/ekit/about/campus-facilities.html> [Accessed on 2017, 28 February].
- [11] KIT, ABU Robocon2013, Available: http://kitnet.jp/ss/robocon/index.html?_ga=2.43891621.1858916390.1494916572-80200079.1459898191 [Accessed on 2017, 16 May].
- [12] Hermann, M. and Heller, J. *Andean Roots and Tubers: Ahipa, Arracacha, Maca and Yacon*, 1997 (Rome, Italy: International Plant Genetics Research Institute).
- [13] Murasawa, H. and Innami, S. A discussion on a significance of Yacon application for an improvement of health and nutritional conditions in the people of Nagano Prefecture, *J. of Nagano Prefectural College*, Vol. 65, 2010, pp. 61-73.
- [14] Hall S. R. and Richard M. B. *Retail advertising and selling*; 1924(New York: McGraw-Hill Book Company, Inc.).