ESTABLISH THE CUSTOM OF STUDY BY THEMSELVES FOR FRESHMEN AT SCHOOL DORMITORY

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Abstract

Freshmen are required to live in a school dormitory in the Kagoshima National College of Technology. National Colleges accept students who have just finished secondary school in Japan. Therefore, they have to be trained to prepare well for their careers as engineers. Every year, between 10% and 20% of students cannot graduate from the Kagoshima National College of Technology because they cannot take enough credits to meet the graduating requirement. Some of the students studied at cram school for the entrance examination for national college admission when they were students of secondary school. It seems that while they learned the way to score well in examination, they did not learn the proper way to study at the cram school. Though they were excellent in secondary schools, they cannot cope with their studies in National Colleges. Furthermore, there are very few cram schools for National Colleges because the percentage of students at National Colleges to that of the same generation, is very small. Therefore, the custom of self-study has to be established for students at the dormitory.

In this report, the effort for freshmen to establish the custom of self-study in Kagoshima National College of Technology is described. There are five classes at every grade in this college. Only for freshmen, all members of each class are assembled and required to study by themselves, under the supervision of a professor on-duty at night. Because of the capacity, this study is held four times for each class for the module. They have to spend 80 minutes for every study session. In this study, the students are not allowed to whisper. To establish the custom of self-study, this initiative is carried out before the mid-term examinations in the first semester. Through this study, it seems that the custom of self-study has been established.

Keywords: *introduction for engineering education, dormitory, extracurricular activities, studying by themselves, training for freshmen*

Introduction

Teachers have to spend a lot of their effort for students' bullying (called as 'Ijime' in Japanese) or behavioral problems in secondary schools. And most teachers spend long time to Extra-Curricular Activities, such as baseball, soccer, judo, so on, after school and on holidays. Teachers of secondary school don't have enough time to prepare their classes. Furthermore, Ministry of Education, Culture and Technology (MEXT) were received with reduced school hours and the number of hours devoted to academic subjects like mathematics or physics. Therefore, many students attend to private cram school.

In Japan, elementary schools and secondary schools are compulsory. However, students have to take the entrance examination for high school admission. The aim of cram school is to help their students for passing the high school admission test. Students have to devote most of their time repeating different exercises prepared by cram school. However, in cram, school the students have not practiced the usual way of studying like of that in regular school. There are less cram schools established for National colleges since the population of the National colleges are relatively small thus, resulted to poor performance of the students despite excellent scores in the entrance examination. Therefore, it is the important for freshmen at National College to practice the usual way of studying.

In Kagoshima National College of Technology, only for freshmen, all members of each class are assembled and forced to be studied by themselves under supervision at dormitory. This project is introduced in this report.

Background

Kagoshima National College of Technology was established in 1963. It is located in Kirishima City, the southern part of Kyushu Island. Kagoshima National College of Technology offers regular and advanced courses. Regular course is completed in five year and has five departments, namely Mechanical, Electric and Electronic, Electronic Control, Information Technology

and Urban Environmental Design and Engineering which was derived from Civil Engineering in 2009. Each department consists 40 students in each grade. After graduation, they are given associate degree. Advanced course accepts the students who graduated from regular course. It is two-year course of Mechanical and Electronic Control Systems engineering, Electrical and Information Systems Engineering and Civil Engineering. Its capacity is 20 students in each grade but twice number of capacity is usually accepted. After graduation, almost of them are given bachelor's degree.

At Kagoshima National college of Technology, 10% to 20% of third grade students have to remain in same grade for another year because they cannot take enough credits for their requirement. Considering their excellent scores in the entrance examination, the reason seems being not of their ability but of their quantity of study before or after school.

All National Colleges (KOSEN) in Japan have own dormitories. Two or three professors have to be on duty at night. In Kagoshima National College of Technology, near the six hundred students stay at the dormitory and freshmen are compelled to live at a school dormitory for a year. This is one of the largest number in Japan. Table 1 shows the number of students at dormitory of Kagoshima National College of Technology in the first term of 2013.

Table 1 Number of student in dormitory

	Male	Female	Total
1st grade	181	18	199
2nd grade	130	17	147
3rd grade	108	9	117
4th grade	75	1	76
5th grade	34	3	37
Advance	1	0	1
total	529	48	577

A capacity of the room for a freshman is two persons and a freshman lives with a second or third grade student in the first semester. In the second semester, two freshmen live in same room together. Table 2 shows the daily schedule from Sunday to Thursday in the dormitory of Kagoshima National College of Technology. Obeying to the daily schedule, students have to study for two hours and forty minutes a day at least. Professors on duty visit students' room at random and watch their study. On this time, students don't allowed to visit other rooms, sleep, listen to the music, read Manga. If professors find these action, students are penalized. However, students are not watched whole time of self-guided study by professors. Therefore, some student seem to pretend to study when professors visit their rooms.

Table 2 Daily schedule of dormitory

Get up	7.00
Assembly and Execercise	7.00-7.20
Breakfast	7.20-8.20
School day begin S	8.30
Lunch	11.55-12.55
School day ends	15.00
Bath time	16.30-19.50
Dinner	17.30-19.00
Evening Assembly	19.55
Self-guided study	20.00-23.00 (Except 21.20-22.00)
Final Assembly	23.00
Light out	24.00

Project for freshmen

In 2013, the dean of dormitory affairs together with five assistant deans has established a self-study practice for the incoming freshmen. In the said project, the students of each department assemble in a multi-purpose hall which capacity covers around sixty students. Moreover, the utilization of the multi-purpose hall is limited to one class only. There is a corresponding schedule for each department on when they can use the hall for that particular week as shown in Table 3.

Table 3 Schedule of this project

	Mon	Tue	Wed	Thu
4/15-4/18	Mech	Elec	Cont	
4/22-4/25	Info	Urbn	Mech	Elec
4/29-5/ 3		Cont	Info	
5/ 6-5/ 9		Urbn	Mech	Elec
5/13-5/16	Cont	Info	Urbn	Mech
5/20-5/23	Elec	Cont	Info	Urbn

This project is carried out from Monday at the third week of April to the day before the midterm examination of the first semester except Friday, Saturday, Sunday and the day befor holiday. Eighty minutes from 8 PM are allocated for this project. Two professors who are duty to supervise them on two shifts. In this project, any guaidances on study are not required for professors because that is out of the contract between professors and colleges. However, auaidances is not permit to professors.

Results and discussions

Some views in the daily recoads of the dormitory by professors who are on-duty at night are shown below.

Some students ask me many questions about Mathematics. I was worried if I can answer their questions because I'm not good at Mathematics. (24th April)

Some students didn't want to study. I forced them to study. (25th April)

There was a student who will try to take a certification examination in Mathematics (Suken). For this purpose, he was studying about differential and integral calculus though he is a freshman. I helped him study the way to differentiate the product of two equations. (1st May)

Some students did nothing on that time. I forced them to study. (7th May)

Some students seemd to be tired at 8.50 pm. I told them that they had to make an effort to establish their own concentration. (7th May)

All students were studying hard except one who was almost sleeping. However, they looked being only forced to study. (8th May)

Most students lose their focus on their study at 9.00 pm. I force them feel refresh staying on their seats. (13th May)

All students were studying hard without chatting. (15th May)

Students seem to start the preparation for the midterm examination in Mathematics. (18th May)

All students studied hard. One student asked me about Mathematics. I was able to answer him but it took a few minutes. I believe that the purpose of our school dormitory is to offer the oppotunity of education for students. (20th May)

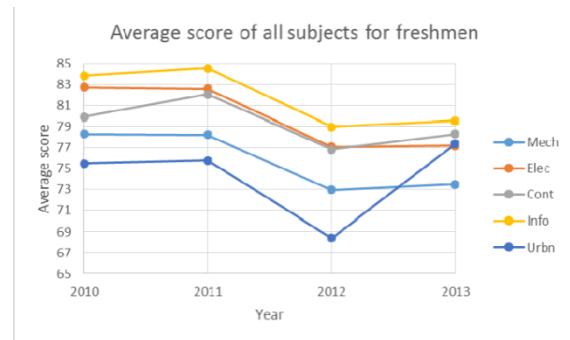Figure 1 studying students at school dormitory
(22nd May)

Figure 2 Average score at midterm examination of all subjects for freshmen

Figure 2 shows the average score of every department of the first midterm examination of all subjects for freshmen from 2010 to 2013. From 2012 to 2013, the average score of all department have increased. For the past four years, students have to take the same subjects. However, sometimes professors of certain subjects change as well, and the abilities of students vary each year they enter even at the same department. Furthermore, the average score seems to be influenced by the effort of the class teacher. Therefore, it is difficult to evaluate this project through this figure given the various factors.

Conclusions

Members of each freshmen class in Kagoshima National College of Technology are assembled and forced to study by themselves under the supervision of the professors on-duty at night. The effect of this project was not determined by their scores. However, the professors supported the students.

These professors does not need to teach students at the dormitory because the allowance for this duty is not included for teaching. It is proposed to secure some instructors, for example retired professors or students of advanced course as teaching assistant, for this project to be improved.

Acknowledgements

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Homepage of Ministry of Education, Culture, Sports, Science and Technology-Japan, http://www.mext.go.jp/english/

APPROACH OF EXPERIMENTAL PROGRAM OF ELECTRICAL ENGINEERING FOR K-12 STUDENTS

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Abstract

This paper was discussed an experimental program approach to educate about electrical circuits for K-12 students for technical training at the Okinawa National College of Technology (ONCT). The challenge of this program is to design and fabricate "a functional object" by using electric circuits through project based learning (PBL). The aims of this challenge program are to give some interests about electrical engineering and to foster communication skills through group-work. The electric circuit kits, such as object position detector and light-active digital recorder were used for project tools of their object challenge. In final class of this program, presentation was carried out to encourage their challenge for their idea and creative approach, In presentation, students show each role, such as a leader, designer, and constructor, in the group. To clear their roles and responsibilities is to motivate what they do in group-work program. In this paper, we present the effective of our program approach. Control program teaching fundamental methods and technical skills are mandatory for electric engineering. "Creative Challenge" based on PBL leads students to think application fields.

Keywords: *Electric circuits, design, presentation, group-work, K-12 students, electrical engineering, experiment program*

Introduction

The main aims of engineering education are for students to develop and integrate engineering knowledge, skills, understanding, and experience but it is difficult to educate them in technical skills through classroom lectures. Course curricula in engineering have generally been based on lectures and experiments on subjects to overcome these difficulties. Many universities have tried various approaches to manage their students in their curricula and to train them in technical skills. R. V. Aroca, *et al* (2013) proposed low-cast educational robot system to increase students interests. I. G. Guardiola, *et al* (2013) reported funded research project to teach system design. H. Alrakharian (2014) presented that implementation of a project-based

telecommunication to require a combination of technical and soft skills. P. D. Cristforis, *et al* (2013) suggested behaviour based approach for programming robot and the design to enrolment in robotics program. J. Ressitein, *et al* (2013) reported using circuits kits for K-12 student education. They also suggested applying circuits kits for elementary school students was attractive to enhance electrical engineering.

Therefore, our experiment program for regular course 1st students whose age are 15-16 years old was designed to focus on connection knowledge, understanding and practical training means of teaching electrical circuits. Furthermore, to enhance their motivation against electrical engineering, instructors provide a project about fabricating "a functional object by using learned circuits".

This report presents that our trial of experiment subject is to carry out as one of effective approach to connect fundamental knowledge and practical training of formation electrical circuits for K-12 students. In this paper, it is suggested how to approach of our experiment program to take into engineering design using circuit kits. This study indicated that it is effective and attractive for K-12 students to give some opportunities to practical trainings, such as concrete electrical circuits, design object under some restrictions, presentation, and group-work.

Program Design

The subject of experiment for electric engineering for 1st grade students of ONCT is 4 units and the class is doing 4 hours in a week for 15 weeks. The contents of our experiment program for regular course 1st were summarized in Table 1. Our program provides three class-styles, such as lecture for fundamental understanding, practice for training technical skills, and presentation. One of new approaches in this experiment program is to create "something of functional object" by using learned circuits based on PBL methods.

The program approaches of the subject of this experiment are as follows,
- ✓ How to teach fundamental methods of electrical engineering to give knowledge,
- ✓ How to connect methods and technical skills for electric circuits,

Table 1 Contents of experiment for electrical engineering.

Contents	Hours
Lecture:	
SI unit & Symbols	4
Universal Standard	4
Ohm's law & Kirchhoff's laws	4
Practical Training:	
Ohm's law & Kirchhoff's laws	4
Analog Multimeter	8
Objective Detector	12
Digital Recorder	12
Creative Challenge:	
Working	8
Presentation	4

✓ How to increase "interesting" about electrical engineering.

To achieve these elements, the lecture in class connected with practical training. In the lecture, students learn fundamental methods, such as Ohm's law and Kirchhoff's law. As following the lecture, students are trained how to form electric circuits by using breadboards and to confirm and understand these circuits law. After practical training, the session of "creative challenge" was carried out to enhance student's motivation and to think application of their learning. The project is to create "something of functional object" by using commercial used circuit kits as group-work. The aim of this project is to train creativity and communication skills. The details of this program are described in below.

Lecture: The aim of this session is to learn fundamental elementse of electrical engineering for students. Instructors teach basic topics which are required for electrical engineering, such as the International System of Units (SI units), Universal Standard, Ohm's law, and Kirchhoff's circuit laws. In the lectures of SI units and universal standard, students were checked their understanding by short test and group discussion. In the lectures of Ohm's law and Kirchhoff's law, class-style was combined between lecture and practical training. After theoretical understanding by lecture, students checked their learning by taking short test and fabricating electrical circuits.

Practical Training: The aim of this session is to confirm their learning and to train technical skills for electrical engineering, such as fabricating circuits and operating measurement systems. At the beginning, to motivate interesting to electric circuits, each student fabricated an analog multi-meter. The ways of seeing circuit diagrams and soldering technique were taught by fabricating multi-meter. Since a multi-meter can be a hand-held device and useful for basic fault finding of electric circuits, the fabricated multi-meter was used for next stage training, such as checking Ohm's law and Kirchhoff's' law. Also, one of the key factors to
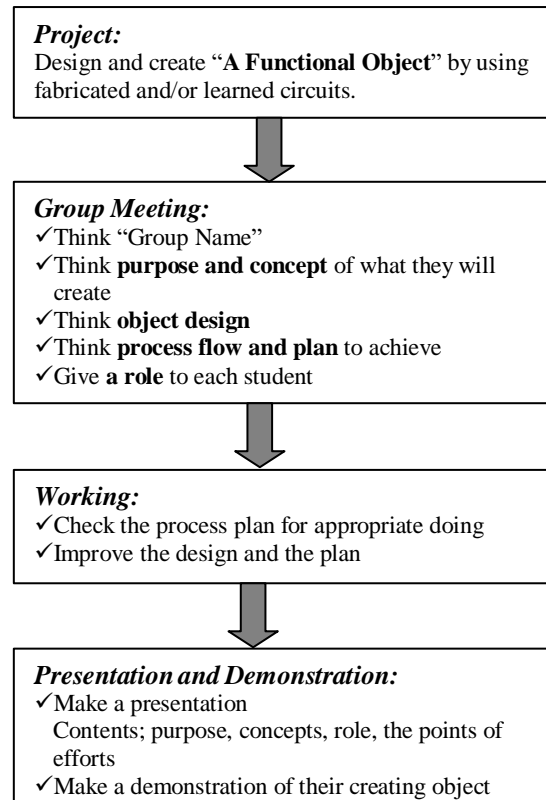

Figure 1 Flow chart of "Creative Challenge" session.

practical training is to know functions of circuits components, such as resistor, capacitor, diode, and so on. Another key factor is to design and create their original object by using fabricated circuits.

Creative Challenge: The aim of this session is to design and to fabricate functional object as well as making a presentation through project based learning (PBL) and team-work. The required achievements are four elements as bellow;
(1) To have discussion and meeting of the project,
(2) To perform each role of the team of the project,
(3) To plan their work in appropriate,
(4) To present their work, such as concept, plan, role, efforts, and demonstration.

Practical Training and Creative Challenge for Obtaining Engineering Skills

Figure 1 shows a process flow chart of this creative challenge session. At the beginning, instructors provide a topic of the project, as "Create functional object by using learned circuits". The explanation of the project was carried out several times in the class-room to give enough time thinking for students. After practical training, the groups which consist of 4 or 5 persons have a discussion and meeting for their project. In this step, the key factor to achieve is to decide concept and each student's role.

Figure 2 A Planning and Design sheet for "Creative Challenge".

Figure 2 shows the sheet for discussion. Students wrote, 1) purpose and concepts, 2) functionality of the object 3) Use application, 4) Elaboration and 5) design and plan in this sheet. This sheet helps students to confirm their plan and working.

Next step, students worked and did for achievement of their projects. In this step, the key factor is to change or improve their plan to achieve their purpose.

Final step is to make a presentation and demonstration that they did the project. Students scored each other in the presentation.

Results and Discussion

Students proposed many ideas and objects which were summarized in Table 2 for example.

Group A proposed "5 coded organ" whose concept is to play the organ for refresh. Their idea and elaboration was to use "object position detector" as dummy keyboard. Group B made "Security Alarm" which was used for secure households. It is only one way object position detector could use their inventiveness to sense motion things. Group C created "Shooting Game". A shooter emitted infrared light for shoot, and then a target received infrared light and activated light LED and sound alarm. Group D fabricated "Music Box" which consists of light activate recorder. When person opens a box, recorded music is sounding.

To achieve their goal of this, students can improve their idea and plan. Figure 3 shows the plan and design

Figure 3 Plan and design sheet after group meeting. (a) Cover sheet for creative challenge. The contents are "object tittle", purpose, and functionality. (b) Design sheet for creative challenge.

sheet based on a sheet as shown in Fig.2. This plan and

Table 2 Summary of examples of student's ideas and creative object.

Group No.	Object Tittle	Purpose, Concepts, Functionality	Elaboration
A	5 Codes Organ	To play a organ for refresh Player control object detector as a key board switch When sensing players motion, sound code.	Use **Object Position Detector** for dummy keyboard Use **Light Activate Digital-Recorder** for music codes
B	Security Alarm	To secure households When object detector is sensed motion thing, the alarm is sounded.	Use **Object Position Detector** for sensing target Use **Light Activate Digital-Recorder** for alarm
C	Shooting Game	To take a refresh Shooter emits infrared light for shoot, Target receives infrared light and light LED and sound alarm	Use **Object Position Detector** for target Use **Light Activate Digital-Recorder** for pointing
D	Box with Sound System (Music Box)	To take a fun for storing When person opens a box, music is sounding	Use **Light Activate Digital-Recorder** for sound music
Etc.	Etc.	Etc.	Etc.

design sheet helps students that they can confirm to change plan and/or design to improve for appropriate. The key factor of this was that students understood the improvement and their efforts what they were doing.

Finally, presentation and demonstration was carried out to show their project achievement as shown in Figure 4. Through this experimental program, students could have some motivations for electrical engineering.

Conclusions

We reported that implementation of creative design as a experiment topic which is effective and attractive for K-12 students to enhance interesting about electrical engineering. The project of creative challenge was carried out to give a project which was performed to create a functionl object by using learned electric ciruits kits. The obtained achievements of our approach are follow;
(1) It is important to teach fundamental methods of electrical engineering as well as practical training for creativity.
(2) It is attractive for K-12 students to fabricate circuits with functional elements rather than basic circuits of series and parallel circuits.
(3) It is effective for students to give a project which are required to make a plan, role, design for a goal.
(4) The plan and design sheet helps students to improve their first idea.

Acknowledgements

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(a) Group working

(b) Presentation and demonstration.

Figure 4 Photos for "Creative Challenge" session. (a) team work, and (b) presentation and demonstration.

REPORT ON THE INTERNATIONAL EXCHANGE PROGRAM WITH MODEL PLANE CONTEST AS TECHNICAL CHALLENGE THEME

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Abstract

Currently, the development of global human resources is of great importance in Japan. The Ministries of Education, Culture, Sports, Science and Technology aim to overcome the Japanese younger generation's "inward tendency". How can we develop human resources that can cope with global issues? We conclude that hands-on experience is important and effective. International exchange program for the National Institute of Technology in Japan is important, that students tackle technical challenges in the program. Kitakyushu NIT has been carrying out international exchange programs with VTC in Hong Kong. The technical challenge theme of international exchange programs with Hong Kong VTC IVE, carried out in Kitakyushu NCT, is the making of the model plane.

In this report, we describe points for the effective implementation of international exchange program with technical challenge. We had set up several groups formed by Japanese and Hong Kong students to promote communication by speaking English. Each student proposed his or her opinions during a discussion and aggregates these opinions before getting into production, to achieve the objectives. The teacher is required to facilitate the work among the students. In addition to tackling technical issues, the implementation of the cultural exchange or orientation was also important. Friendly flight competitions and presentations of group activities were conducted on the final day. We confirm the effectiveness of the program by the questionnaire intended for students.

Keywords: *International Exchange, Collaborative Learning, Active Learning, Facilitation, PBL*

Introduction

International student exchange program between National Institute of Technology (NIT), Kitakyushu College and Hong Kong Vocational Training Council (VTC) has passed 3 years. International exchange program organized by VTC side is carried out in every August and program organized by Kitakyushu side is carried out every March.

There is a consensus in implementing the program. The technical challenge theme is selected from the engineering field. The technical challenge theme does not has clear answer, creativity and design capacity is required for problem solving. Tutor explains the outline only of technical problems, it is necessary to think or students themselves or find more information. Groups of 4-6 members are made up of Hong Kong students and Japanese students. These points are set with the aim of educational effects, respectively.

Problem-solving skills (the skill to approach from various angles find a more optimal solution to solve the problem that does not has clear answer), skills to combine multiple technologies, teamwork and collaboration skills and global skills are required for engineering education in the future. It is best to solve the problem by a team from students majoring in various fields with communicating in English. To appeal to their own opinion, to listen to others ideas, these are required when working in a team. With the globalization of the industry, base of production activities is shifting to an advantageous country at a cost of personnel expenses. These skills are required for modern engineers. Engineers will have to adapt to the environment multicultural, multi-religious, multi-lingual.

We were looking for effective global engineers education program a long time. However, introduction of the global education into the regular curriculum is difficult, after all, it is the most effective education method that students experience international exchange program to be implemented in spring or summer vacation actually. Table 1 shows International Exchange Program that carried out between Kitakyushu college and VTC so far.

Table 1. Past International Exchange Program carried out between Kitakyushu and VTC

Period	Place	Theme
March, 2012	Kitakyushu	Robocode
August, 2012	VTC	Control of Solar Panel
March, 2013	Kitakyushu	Robocode
August, 2013	VTC	Bridge Contest
March, 2014	Kitakyushu	Model Plane Contest

Kitakyushu has been set technical challenge themes that are intended to be cooperative work of software engineers up to now. We set the technical challenge theme of international exchange program held on March 2014 was the original model plane competiton in cooperation with the teacher who belong to the department of mechanical engineering.

Light Plane Competition

We explain model plane competition in the order of "Purpose", "Lecturing", "Design and Making" and "Competition". We also introduce impression of students and future works. Since it is a lightweight model aircraft, we use the word "light plane" hereinafter.

1. Purpose

The main purpose of the light plane competition is to obtain a better understanding of flight principles through the lecturing, the design, and making of the light planes. These light planes can be made from styrene papers, balsa woods, and plastic films, and can be controlled by radio communications.

2. Lecturing

The lecture of the flight principles and making of the light plane was given by students in the advanced course of Kitakyushu college.

Figure 1 shows the main parts of the light plane which consist of a propeller, wings, and flames. Lift force is generated by the main wing as shown in Figure 2. If the angle of attack which is the angle between a reference line on a body and the chord line of the airfoil or the driving force by the propeller increase, then the lift force increase. Figure 3 is the relationship between lift and gravity. When the lift force is equal to the weight force, the light plane is in a state of equilibrium.
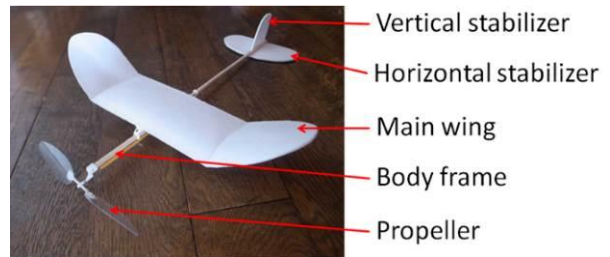
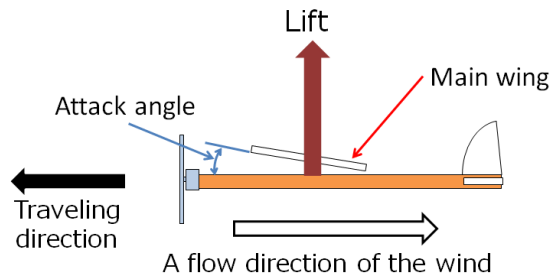
Figure 1 Light plane parts

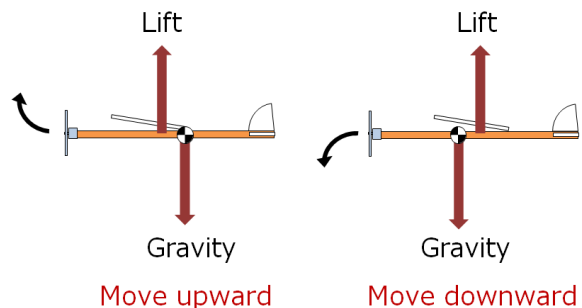Figure 2 Lift of the plane

Figure 3 Relation between the lift and the center of gravity

Figure 4, 5, and 6 show the functions of the main parts of the light plane. Dihedral angle is the upward angle from horizontal of the wings. When the body leans to one side, the plane returns to normal condition. The horizontal and vertical stabilizers provide longitudinal (pitch) and/or directional (yaw) stability and control.
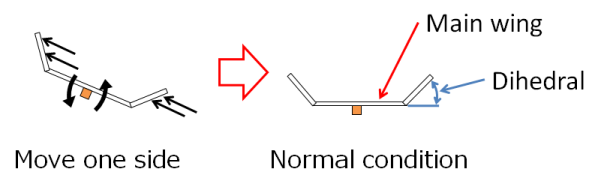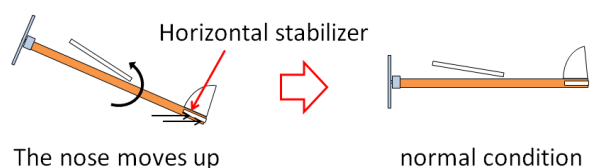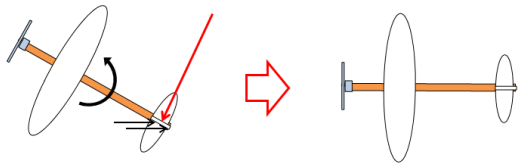

Figure 4 Wing dihedral angle

Figure 5 Horizontal stabilizer

The nose moves right   normal condition
Fig. 6 Vertical stabilizer

3. Design and Making

Design and making of light plane processes are as follows.

(1) Team Forming

Firstly, we have built the four teams by grouping one team contains three Kitakyushu college students and two VTC students. Team forming is decided by a drawing. Moreover, we decided a making leader and a presentation leader in each team.

(2) Discussion and Design

In each team, we have performed discussions to decide a concept and to design the light plane. By using the paper, students draw the concept sketch and the prototype design shown in Figure 7.

(3) Prototype

By using the concept design, the prototype of the light plane (without the propeller and servo motors) is developed. The prototype is made of the styrene paper (Figure 8), and is thrown for the test flight (Figure 9).

(4) Making

Next, we make the light plane for the competition which is controlled by the radio transmitter. The light plane is made of styrene papers, balsa woods, plastic films, etc. For the prototype and/or the redesigned plane, we have attach motors, a propeller, a battery, and a receiver (Figure 10). Then, we can remotely operate the light plane.
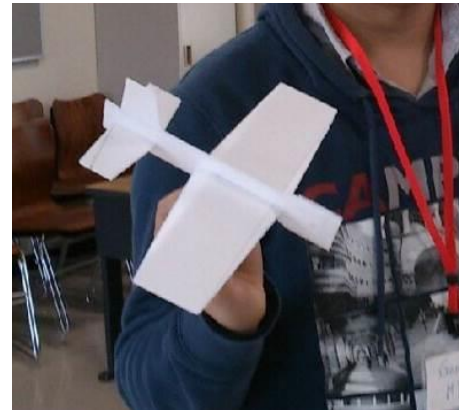

Figure 7 Discussion and design

Figure 8 Prototype

Figure 9 Test flight of the prototype

Figure 10 Parts of the radio-controlled plane

(5) Test flight and improvement

The developed light plane was tested by remote operations in a gym. Then, we adjust the plane, the wing, the thrust force, and motors for maneuverability and stability. Moreover, if improvement is necessary, it is redesigned and remade.

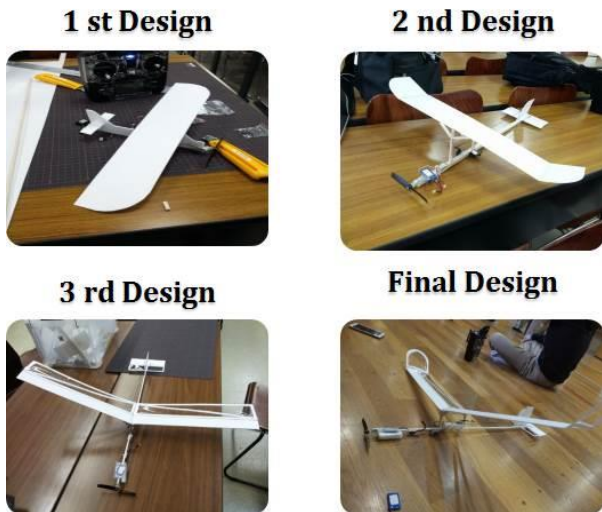Fig. 11 Test flight of the radio-controlled plane

Figure 12 Improvement of light plane

4. Competition

On the final day, the light plane competition was held for the four sections, appeal, speed, technical, and endurance.

(1) Appeal section
- Time limit : 3 minutes
- Scoring the another team's planes about each element: visual effects, performance of the plane, and pilot skills.

(2) Speed section
- Compete with arrival time to the aim spot

(3) Technical section
- Time limit : 3 minutes
- Horizontal turn : 1 point
- Cutting a figure of eight : 2 points

(4) Endurance section
- Compete with the flight time using one battery

In the 1st, 2nd, and 3rd place team gets 3, 2 points, and 1 point respectively in each section (Table 2). The results of the competition is shown in Table 3.

Table 2 Points of the competition in each section point

	point
1st place	3
2nd place	2
3rd place	1

Table 3 The score of the competition

Team	A	B	C	D
Appeal section	3	2	1	0
Speed section	1	3	2	0
Technical section	3	2	1	0
Endurance section	3	1	2	0
Total Score	10	8	6	0

5. Impression and Future Works

The following are the student's impressions.

(Student A)

I felt a lack of my English. But I thought the production of light plane went well. And I want to go to Hong Kong this summer as much as possible. I want to wear the English conversation ability.

(Student B)

I was really able to have a great time with students in Hong Kong. We did a production of the light plane. I wanted to be able to speak English through the Hong Kong international exchange. I also want to speak English more by then if there is a Hong Kong international exchange.

(Student C)

We interacted actively each other. For example, going to dinner, playing basketball and baseball and so on. Thanks to these actions, we could have meaningful time.

The future works are as follows. Since progression of the competition was not smooth, we need to improve the description of the competition. Moreover, since the plane by the team D cannot fly, we should consider a variety of alternative solutions in this case.

Presentation Section

To report the activities of the team in English is one of the important educational purposes of this international exchange program. Japanese students are not good at speaking English and shy. It is apparent that Japanese students seek support to Hong Kong students. That forge close ties with the preparation of presentation is one of our aims. It is not good to focus on only own team presentation. It is also important to hear other team's presentation. Therefore we adopted the peer review system, including students in the evaluation of oral presentations. Figure 13 shows oral presentation evaluation form.

Figure 13 Oral Presentation Evaluation Form

The review was carried out by two teachers and 22 students. Endpoints are five and evaluation is a 5-point scale respectively. Table 14 shows five endpoints of evaluation. Table 15 show the average score of the oral presentation evaluation.

Table 14 Five Endpoints of evaluation

1	Effective use of visual aids
2	Clarity of voice and Pronunciation
3	Preparation
4	Information
5	Cooperativeness (Kitakyushu and VTC)

Table 15 The average score of oral presentation evaluation

Team	A	B	C	D
Endpoint 1	3.00	3.00	3.21	2.68
Endpoint 2	2.95	3.37	3.63	3.05
Endpoint 3	3.21	3.42	3.42	2.79
Endpoint 4	3.32	2.95	3.11	2.53
Endpoint 5	3.26	3.37	3.11	2.74
Total Score	3.15	3.22	3.29	2.76

Figure 14 shows a part of the slide of the team C presentation They presented the improvement of the light plane with a lot of information. The overall evaluation scores were also appropriate.

Figure 14 A part of the slide of the Team C presentation

We also found that both light plane competition and oral presentation competition are also effective to raise up their motivation. It seems that bonds of team members are strengthened by two competitions.

Program Schedule

In this section, we introduce the program schedule and illustrate a key point for the international exchange program implementation. From past experience, we are confident that the important point that the success of the international exchange program is to solve the tension of students. Also, it is not only to challenge the technical issues, to know culture, economy and social of the area is also important. We were planning the program in mind the thing above.

Day 1 - "Welcome to Kitakyushu"
We went to Fukuoka International airport to pick up VTC members and guide the hotel by rented bus. We also introduced the Tanga market of Kokura district this day (Figure 15).

Figure 15 Walking Tanga market

Day 2 - "Welcome to Our college"
Opening Address, Campus Introduction and Self-Introduction were performed in opening session (Figure 15). Japanese students are shy and not good at speaking English in particular, facilitator must support them and create a fun atmosphere.

Figure 15 Campus introduction, Self-introduction and Orientation

We conducted a basketball game in the competition format of Hong Kong team and Japanese team. After easing their tension we conducted an orientation. They went to shopping with two students from Japan and Hong Kong and reported on what was purchased. This is also the practice of presentation (Figure 15). In order to address technical challenge by team unit, it is important to relax students' tension or to promote their exchanges.

Day 5 - "Factory Tour and Museum Visit"

Day 6 - "Japanese culture experience"

There are several worldwide companies in Kitakyushu. Automotive industry is one of them.

Figure 15 Factory visit, Museum visits and Japanese culture experience

We visited the Nissan Motor Kyushu and learned about the characteristics of the automotive industry. We also visited museums (Day 5, Figure 15). We have also experienced Japanese cultures such as the tea ceremony and cherry-blossom viewing. Cultural experience is also important in the international exchange program for mutual understanding.

Conclusions

We carried out international exchange programs. We have adopted a PBL approach and the technical challenge theme of this program is to make light plane. We have kept in mind that the students themselves to learn proactively in this program. The advanced course students gave the lecture of the flight principles of the light plane as tutor. We adopted a peer review system to evaluate the presentation. We have an interest in these educational methods such as Active Learning and Collaborative Learning. We continue efforts to support the proactive learning of students in the future.

We carried out a questionnaire survey in the 5-point scale for each item in the program. Generally good results were obtained. However, some items were found to be improved. It is necessary to further improve the English ability of the Japanese side.

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ON THE DEVELOPMENT OF PROFESSION'S BASIC ABILITIES STUDIED BY USING THE PBL EDUCATIONAL METHOD

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Abstract

This paper focuses on the second year project to revitalize t h e city centre through cooperation among industry, government, academia, and local community. In Kanazawa City, the price of land in the city centre has been rising lately, particularly as a result of the operation of a new Shinkansen line in 2015. Following a plan of the Sinkansen project, "Marche" started as a practical response to the complexities of city revitalization. The project which we carried out last year was to create the Branding Scheme, to create a sense of unity, and make effective use of a space called "Seseragi-Street" in the centre of Kanazawa City. We organized "Marche" and i t w a s held on September 30, 2012. The project promoted mutual interaction between students and citizens and let students commit m o r e deeply to the aim of making society better.

Since the results of the questionnaire surveys c o n d u c t e d last year w e r e encouraging, we tried to improve "Marche" by increasing i t s f r e q u e n c y and the scale, this year. To carry them out, we added and planed many activities and formed many groups regardless of age or gender, to energize the area. We won the competition of the municipal budget again which made it possible for us to continue the project in 2013. This is a practice using Project Based Learning scheme, to enhance students' twelve abilities classified into three categories: action, thinking, and teamwork.

The scheme is an evaluation method for what the society fundamentally requests. In addition, our questionnaire survey f o r stores and visitors was a l s o done successfully. The results showed that visitor numbers increased each time, meaning m a n y recognized "Marche" as a regularly-held event. We also created a questionnaire survey for students, asking them about their improved abilities. The self-evaluation caused one of the educational effects and its results notifies the students of their specialties. In addition, we won the first prize i n t h e Design Competition 2013 in Yonago on November 14, 2013. Its proper evaluation would continue t o

f u n c t i o n as a driving force and keep up students' motivation. It can be said that the project is surely guaranteed in that it is socially awarded every year.

Keywords: *Revitalization of City Centres, Continuity, Collaboration, Action, Thinking, Teamwork, CDIO*

Figure 1, Seseragi Marche in 2013

Introduction

The so-called hollowing out of economy in city centre is now a major problem in many local cities. To deal with the difficult situation, in Kanazawa City, redevelopment projects have undertaken and also town centre managements have emerged as practical responses to the complexities of city revitalization. Faced with the operation of a new Shinkansen line in 2014, the revitalization has been achieved so that the price of land in the city centre has been rising lately. Following the trend, we planned and carried out the project of **"Seseragi Marrche"** last year, which makes the street called Seseragi Street well-known.

This paper describes the project planned and carried out through cooperation among industry, government, academia, and local community. This project brought out the synergistic effects of collaborative learning among different groups. Students' supports to revitalize city centre and the project's activities deepened the relationship between the students and the citizen.

The aim of the project in 2013 was to make "Seseragi Marche" a regular event. In the second year of the project, we tried to hold Marche four times. In addition, we planned new programs in which children, women and also elderly people could be involved. We

hope that they made the street much livelier. And also, Nishimoto Lab. in INCT joined us as a partner and gave us a big help this year.

Materials and Methods or Pedagogy

Location and Problem

Seseragi-Street is located in a commercial district in Kanazawa City centre where old and new stores uniquely co-exist. The length of the street is approximately 1km along an irrigation canal. Despite that the street has a lot of traffic and also unique feature, it is hardly considered to be a well-known street. In order to establish the sense of unity and community, we started Marche last year.

Organizing a Project Partner

Human resource and budget are necessary to implement the project. Therefore, last year, we firstly formed a project partner to work on the project. The project partner consisted of three groups: Dochi Lab. in INCT, Machizukuri Study Group belonged to Toyo Planning CO., LTD, and Seseragi-Street Promotion Association. In addition, Nishimoto Lab. in INCT joined us as a partner in 2013. Then, sixteen students including 8 fourth grade students and 8 fifth grade students got involved this year. The project was a part of an activity in laboratories and a class in college. The groups cooperated, taking advantage of their specialties. Dochi Lab. and Nishimoto Lab. in INCT were in charge of branding scheme: spatial structure design and decoration along the street, public relations, planning and promotion and also research in the project. Machizukuri Study Grope belonged to Toyo Planning CO., LTD arranged with each group and the related people and also advised for plan and project. Seseragi-Street Promotion Association supervised Marche and was in charge of the choice of the store at Marche.

Table 1, The correlation diagram of project partner and their roles

Budget: Cooperative challenge project for town management.

Secondly, to implement the project, we tried to prepare a budget. In 2013, we gained two public funds. One was the Cooperative Challenge Project for Town Management that we obtained last year, too. It was a cooperative project of both citizens and the administration. Kanazawa City provides a budget to invite public participation. The purpose of this project is to call for ideas of revitalization in regional areas or challenge to the new field to solve various administrative problems. Many original plans were proposed from the citizens or groups in 2013 too. 57 groups applied and 44 passed the application competition. 28 out of 44 groups were selected at the final presentation competition. And the other was Revitalization Project for Regional Shopping Area. Seseragi-Street Promotion Association applied it and got passed. With the budget, we made an original tent and a sign board which were designed for easy and speedy set up.
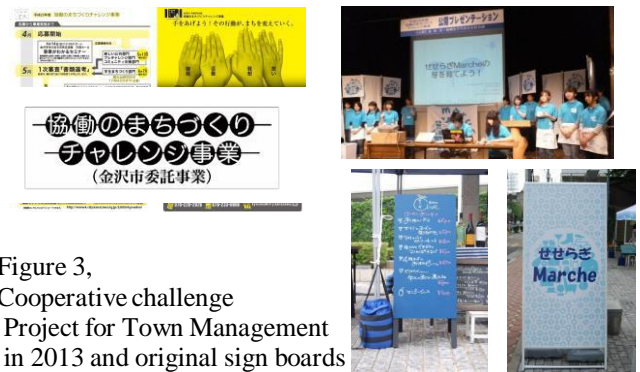

Figure 3,
Cooperative challenge
Project for Town Management
in 2013 and original sign boards

The Projects

1. July 6, 2013 Seseragi Marche on the Star Festival

The first Marche was held on July 6, on the Star Festival. 8 stores were open at open-space on the street called Korinbo-Hiroba. We made advertisements and planned space design and stage events. The staffs and visitors wore a cotton summer kimono with summer features to make the street much livelier and more attractive.
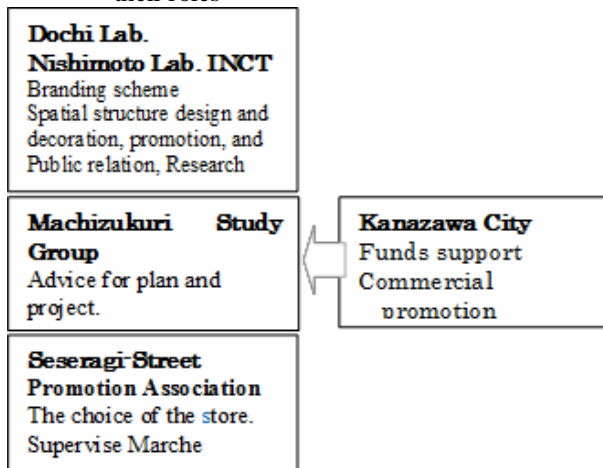

Figure 4, Poster and Article from Hokkoku Shinbun. July 7, 2013

Figure 5, Korinbo-Hiroba July 7, 2013

2. September 8, 2013 Seseragi Marche in twilight

The Second Marche was held on September 8. 13 stores were open at Korinbo-Hiroba, We made advertisements and planned space design and stage events. A part of sales was donated to Tohoku for the Great East Japan Earthquake.

Marche in the evening was our first attempt. According to our research, approximately 1,000 visitors came during 4 hours. The Mayor came to see how crowded the place was.

Figure 6, Poster and Article from Hokkoku Shinbun September 7, 2013

Figure 7, Korinbo-Hiroba September 7, 2013

Figure 8, Greetings from the Mayor and donated a fund to Tohoku

3. October 6, 2013 Seseragi Marche

Since the festival called Seseragi-Matsuri takes place once a year in autumn, we decided to hold Marche and the festival on the same day so that the street became livelier and more attractive. We made advertisements and planned space design and stage events as we did last year. At the festival, the street was closed to vehicles and 46 stores were open at Korinbo-Hiroba. As new events, work-shop and art exhibition for children were implemented. Also joined Marche was a fresh-market organised by a group of neighbours.

Figure 9, Poster and Article from Hokkoku Shinbun. October 7, 2013

Figure 10, Work-Shop and Art-Exhibition for children

4. November 4, 2013 Seseragi Marche

The last Marche in 2013 was held on November 4. 12 stores were open at Korinbo-Hiroba, We made advertisements and planned space design and stage events. A new work-shop for children was carried out.

Figure 11, Poster and Article from Hokkoku Shinbun November 5, 2013

Figure12, Korinbo-Hiroba Work-Shop for children November 4, 2013

Results and Discussion

1.   Evaluation

We had two evaluation methods through counting the number of visitors and a questionnaire survey about the project to visitors and stores every time. In addition, we also asked students which profession's basic abilities they improved through the project.

1.1 The number of visitors

The success of outside event mostly ascribes to the weather. In fact, in Marche on November 4, it was already cold. However, according to our research, the number increased comparing to the number on July 6. On September 8, 2013, the visitor was approximately 1,000. The Figure 13 shows that it is a quite successful result. It can be said that Marche had the ability to attract more customers each time.
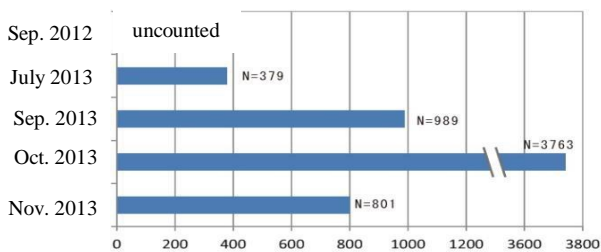

Figure 13, The number of visitors

1.2. Questionnaire survey about Marche

We made questionnaire survey to both visitors and stores. There were ten questions in total. We will show some results below.

To visitors

The questionnaire survey to visitors was conducted in an interview-style, asking five questions.

2.
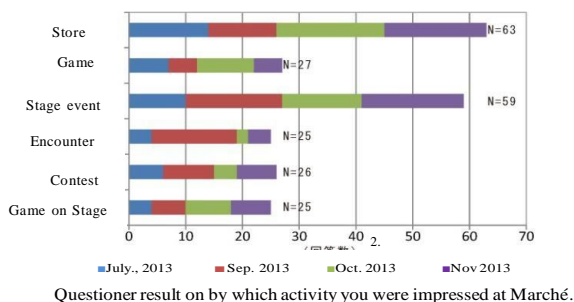Questioner result on by which activity you were impressed at Marché.

Figure 14, Questioner result on by which activity you were impressed at Marche
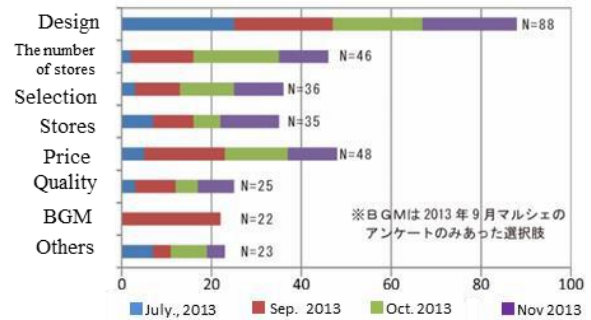

Figure 15, Questioner result on by which you liked at Marche

The first question asked by which activity you were impressed at Marche. The answers in Figure 14 shows that store and stage left a strong impression and the same as last year.

The Second question asked by which you liked at Marche. The result in Figure 15 tells us that design received remarkably high evaluation. The logo mark with branding was accepted widely.

To stores

We provided five questions and all stores filled in the form. We collected all answers and some comments.
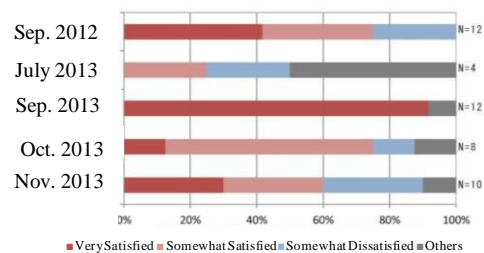

Figure 16, Questioner result on over view of Marche
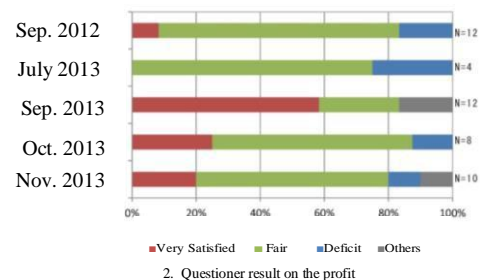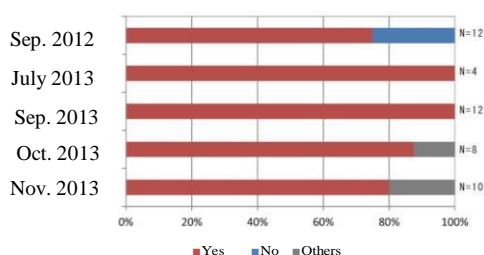

2. Questioner result on the profit

Figure 17, Questioner result on the profit

3. Questioner result on you intends to open your store if Marche is held regularly

Figure 18, Quest _____ en your store if Marche is held regularly

As for an overview of Marche in Figure 16, it received quite high evaluation except the one on July, 2013. Marche on July 6 was the first Marche in 2013. The number of visitors was low in Figure 13. And also they were not satisfied with the profit as in Figure 17. However, after that, the result on profit and the over view of Marche reached satisfaction level due to increase in number of visors. Moreover, the result in Figure 18 shows strong intention of the stores to open regularly at Marche.

1.3 Questionnaire survey about Student abilities

One of the aims of the project is practical education to enhance students' twelve abilities classified into three categories. Students are required to develop the ability of basic scholarship and special knowledge. Additionally, they need the twelve abilities as well as the society fundamentally requests them. The Ministry of Economy, Trade and Industry has advocated the twelve abilities in Table 2 as an educational evaluation since 2006. It is because they think it necessary for student to improve the abilities to work with various people at work and in community.

Table 2, Required Twelve Abilities

1	Action,	Independence, Approach, Action
2	Thinking	Finding, Planning, Creativity
3	Teamwork.	Presentation, Attention, Flexibility, Understanding, Discipline, Stress control

Source From: Ministry of Economy, Trade and Industry

As main staffs, 21 Students from Dochi Lab. and Nishimoto Lab. in INCT have been involved in Marche since last year. We asked all members and collected 18 out of 21 answers. A method was called Comparing the Points before –and-after by and also called Five-grade Evaluation.

All ability increased about 1 point in Figure 19. However, presentation ability was quite low. This response may be due to the fact that they realized difficulties of the presentation in public from their experiences. One student commented that preparation in advance was a key to success.
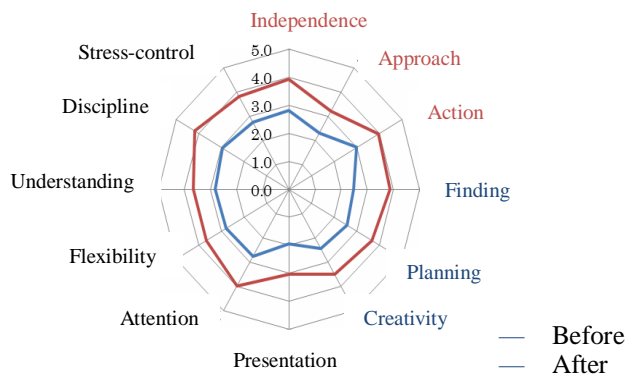

Figure 19, Before-and-after about the point of average of Students' Twelve Abilities

While students seem to have no confidence of their presentation, each item in Figure 20 shows that the students gave more points not only to independence, finding, and attention, but also to presentation. For the presentation, they took care of how it could be successfully shown in public. And also, presentation was a good opportunity to receive various and valuable comments. However, they sometimes faced the stark reality by those comments. In fact, the experiences surly improved presentation technique and moreover it made the project better.
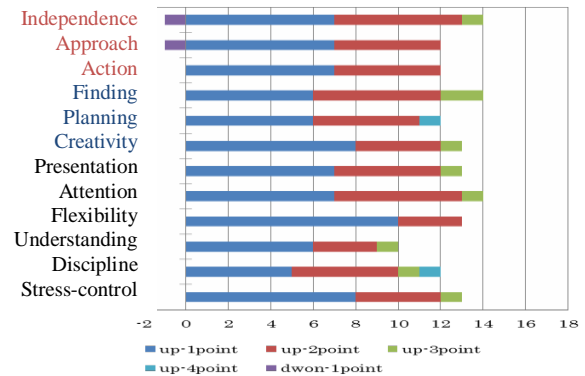

Figure 20, The range of the increased point

2. Achievements and additional effects

2.1 Projects

Marche was held four times to revitalize the city centre in 2013. Moreover, some additional effects of Marche in concert with other groups in surrounding areas were found;

1. Sweets de Marche promoted Seseragi-Street Promotion Association with other University and collage on November 3rd ;

2. re-opened Fresh-Market with our help and they joined Marche on October 6th ;

3. Event for children: Work-shop, art exhibition October, 6 and November 4th ;

4. donated fund to Tohoku for The Great East Japan Earthquake on September.

Figure 21, Fresh-Market joined Marche October 6, 2013, Sweets de Marche on November 3. 2013, Event for children and report to the Mayor about the donation

2.2 Students

The students achieved to publish four News Latters. They visited shops and gathered news materials on their own. Then, they designed and handed them out on the Marche each time.

Figure 22, The first issue of News Letter on July 6

Some students have been involved in the project for two years. Since they made an official presentation many times, their presentation ability including drawing and speech skills had been remarkably trained. Consequently, we won the first prize in Design Competition 2013 in Yonago on November 14, 2013. The Design competition was organised by National College of Technology. 115 plans from 55 colleges applied. The theme of the competition was "Merchant's House in the city in the future". We chose Seseragi-Street as its site and designed the street with its feature of irrigation canal and vertical interval. Since we visited the site weekly for two years, we had an opportunity to find what their advantages were.

Figure 23, visited and reported to the Mayor in article from Hokuriku Chunichi Shinbun on Desember18, 2013 and gained the first prize of Design Competition 2013 in Yonago.

Conclusions

Through the project, it can be concluded into two points as follows:

1. What was achieved in the project?

The purpose of the project was to continue the Seseragi Marche. We tried to improve Marche by increasing the number of times and the scale this year. Since Marche was held four times as we planned, it was carried out so. We tried and planned many activities and made many groups regardless of age or gender to energize the area. Because of that, some additional effects and achievements were found. During Marche, we could see a sense of unity and community through Marche's design works and people's functions. The space and street which we designed were effectively active and livelier comparing to last year. By increasing the number of times and scale, the number of visitors got increased. It is clear that we carried out and prevailed the image of Marche.

2. What did the student achieve?

As in the last year, the student gained five abilities: time management, deadline awareness, communication, budget control, presentation, and design. And also, it was found that Profession's Basic Abilities were also improved through the project according to students' self-evaluation. As a result, we have been achieved meaningful goals and achieved social evaluations for two years.

The project was surely guaranteed by the awards and a praiseworthy educational methods.

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PRACTICAL EDUCATION BASED ON THE NEEDS OF THE COMMUNITY

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Abstract

The system of Preservation Districts for Groups of Traditional Buildings was established by the national government in 1975 in order to protect historic districts in Japan. Many selected districts in rural areas have been struggling with the following problems: aging, marginal settlements, run-down industry, and depopulation. As a consequence of the designation, the rise in the number of tourists is anticipated in those districts. However, they are not ready to accept the tourists and prompt action is required. Thus, they outsourced human resource and ideas for town management. Eight districts out of 106 in December, 2013, the largest number in Japan, are located in Ishikawa Prefecture. Hence, we formed a project partner called Support Team for Town Management to work on preservation activities requested by the local authorities with financial support from the University Consortium of Ishikawa. The project partner consists of three academic laboratories from different colleges.

This paper focuses on Higashidani Village in Kaga City and describes the students' impact on the local community as a good stimulus. We tried to give ideas that would promote the district's appeal to the world, to the town management. The first step was for students to conduct field surveys. Then, during workshops, we discussed and decided what should be designed from the outcomes. As a result of the discussions, we made a Landscape Resource Map for tourism, published by the "Higashidani Conservation Society" in 2013. For a Community Café run by the society, we planned and beautified a back yard to make it look more attractive. In addition, we also carried out more activities with the branding scheme.

This is a practice using the Project Based Learning scheme that encourages students' interest in regional issues. The goal was to enhance the students' abilities as in the following: a volunteering spirit, regional contribution, a strong sense of social responsibility, engineering ethics and cooperation to solve a problem. Another goal was to change people's way of thinking through the students' activities. A questionnaire survey and interviews with the local community clarified the effect of the students' activities. Meanwhile, the result also indicated what people need and gave directions for sustainable town management.

Keywords: *Sustainable Community, Succession, Collaboration, Regional Contribution, Social Responsibility, Volunteerism, CDIO,*

Introduction

The Agency for Cultural Affairs provides public funds for Preservation District for Groups of Historic Buildings. It is because these districts are valued as cultural asset.

Human support is also necessary for the maintenance. However, Japan has problems with the declining birth rate and aging population. This tendency is particularly notable in rural community. Therefore, they outsource human resource and ideas for town management.

This paper describes the synergistic effects of collaborative leaning among different groups. This project was planned and carried out by a local community, local authority, and three academic laboratories: Ishikawa National college of Technology, Kanazawa Institute of Technology, and Kanazawa Collage of Art. This is a good opportunity so that they participate in society through collaboration with local community. The students' supports to energize local community and the project's activities have deepened the relationship between the students and the village people.

The Project: Pedagogy and Method

Location and Problem

Many selected Preservation Districts for Groups of Traditional Buildings have poor transportation network. That is because they are located in such as mountains and islands. Therefore, it can be said that the characteristic features are well maintained. To put it in other words, those areas are left behind in isolation in terms of development.

Landscapes formed by peoples' lives or jobs in the given regions are indispensable to understand the livelihood and jobs of the people. However, fifty percent of the population has reached to or exceeded the age of sixty-five because of depopulation so-called "marginal settlements", which means that people living there can hardly maintain the village on their own. After their designations, it is easy to predict that they will face the following issues: increase in number of visitors, inconvenience of transportation, and probably trash problem. Since they may result in negative factors for inhabitants, prompt action is needed to solve them.

106 districts are classified as important Preservation Districts for Groups of Traditional Buildings and Ishikawa Prefecture has eight such districts, which is the largest number in Japan. Support Team for Town Management deals with two villages called Higashidani and Hashidate in Kaga City. This paper focuses on the village, where our questionnaire survey to inhabitants had successfully done.

Figure 1, Traditional building in Higashidani Village

Higashidani is a mountainous village consisted of four areas: Aratani, Imadachi, Ohzuchi and Suginomizu. The village once prospered from the charcoal industry. It is in heavy snowfall area. In the middle of winter, snow reaches two meter height. Traditional buildings were built from the Meiji period to around 1960. These highly valued traditional architectures are well preserved and merge harmoniously with the surrounding environment to form a scene of historical beauty. Typical architectures have two stories, red clay tile roofing, and monitor roof. In 2011, the entire village was designated as Preservation District for Groups of Historic Buildings by the Agency for Cultural Affairs. The agency provides financial support to municipal projects such as restoration, façade enhancement, and disaster prevention for Preservation Districts for Groups of Traditional Buildings, as well as provide the necessary guidance and advice for the sake of municipal efforts.

However, Higashidani Village now faces many ploblems: ageing, marginal settlements, run-down industry, depopulation, bus route abolition, fire precautions, snow precautions, housing vacancies and preparations to accept visitors.

The population in the early Meiji period in Higashidani was approximately 1700. Since then, the population has started to decrease. In the era of high economic growth, inhabitants moved to city because of modernization. Severe climate and inconvenience are also reason for their moving. In 2014, population is only 49. More than 70 percent of the population has reached to or exceeded the age of sixty-five.

In such a situation, village people established the Higashidani Conservation Society in 2008 in order to preserve the village and promote town management. The number of its member is 80 but 65 members live in surrounding area.
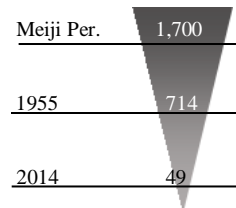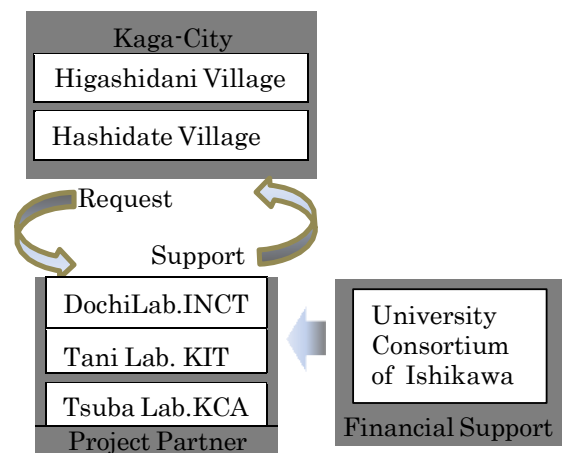

Figure 2,
Changes in population

Figure 3,
Meeting with project partners

Organizing project partners

We already started some activities in 2011. In 2013, we officially formed a group of project partners named Support Team for Town Management to Work on the Preservation Activity. The project partners consist of three academic laboratories: Ishikawa National College of Technology, Kanazawa Institute of Technology, and Kanazawa Collage of Art. In addition, 20 students got involved in this project as it was carried out as a part of activity in laboratories and a class in colleges. The project was requested by the local authority, Kaga city, and carried out with financial support by University Consortium of Ishikawa.

Table1, The correlation of project partners

Projects: Landscape Designs and Branding

First step was to gather information. Students conducted field survey at the four sites to figure out what advantage and disadvantage were. From the outcomes, we decided how the village should be designed.
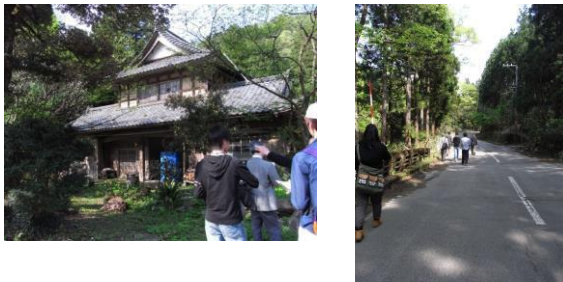

Figure 4, Field survey at the site

After the field survey, we held workshops in which three laboratories, Kaga city, and the local community cooperate together to offer suggestions for improvement. All outcomes from field survey were divided into three categories: advantage, disadvantage, and ideas for improvement. We plotted each point on the map with different colour and discussed how each area should be.

Figure 5, Outcome from the field survey at Aratani and Imadachi

Figure 6, Co-operation work shop

Branding scheme and design

To enhance the site image, branding scheme was carried out as bellow.

1. Preservation for the birthplace: Shinbo-no-Ike

There is a pond called Shinnbo-no-Ike and it is believed to be the birthplace of the village. However, as it is difficult to access there, there is a request from the local community to clean up and maintain the pond. We planned to create a space where people could gather and have a rest. For its effective use, we designed a foot path and set benches around the pond. Next year, we are going to set about the land improvement.
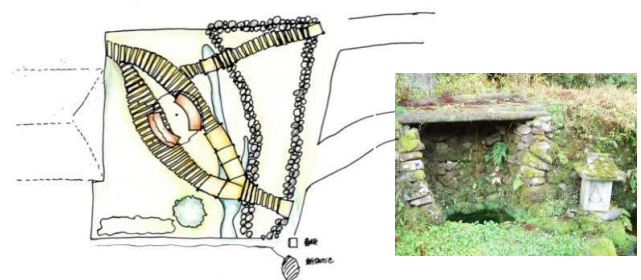

Figure 7, A plan for Shinnbo-no-Ike

2. Gardenizing community café and foot-path

For a community café run by Society, we planned and gardenized back yard to make it look more attractive. It was Higashidani Conservation Society that refurbished approximately ninety years old traditional building and converted it into community café called Wild Flower Café in 2010. The cafe opens every Sunday from spring to autumn and provides local specialties. It is now a good place to introduce local products. It also provides a space to relax not only for village people but for visitors. Moreover we have suggested an idea on the interior and garden at the back yard since 2011. While the garden is still under-construction, we covered garden with turf and brick and comfortably layout some benches in this open cafe terrace.

Figure 8, Wild Flower Café and maintenance of the back yard

Figure 9, A plan for Wild Flower Café

3. Landscape Resource Map

We designed a Landscape Resource Map for tourism using the outcome from the field survey. It was published by the Higashidani Conservation Society in 2013. Therefore, we cleaned foot-path to make it easier for tourists to walk with the map. The map is available at a tourist information office.
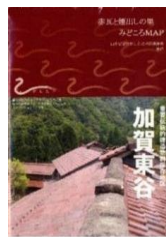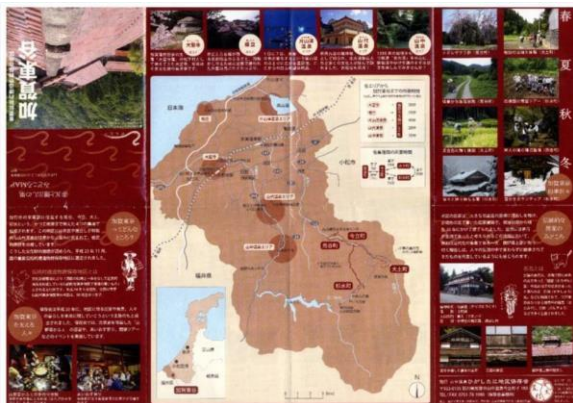

Figure 10, Landscape Resource Map

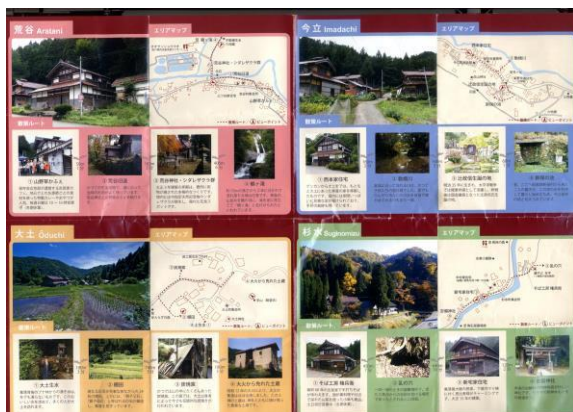Figure 11, The front side of Landscape Resource Map

Figure 12, The back side of Landscape Resource Map

4. Collaboration Event

Figure 13, Poster of the collaboration event on 12 October 2013

As Support Team for Town Management deals with two villages in Kaga City, the city has organised collaboration events and workshops to illuminate the villagers' mind since 2011. We have discussed how the village can be appealed.

The latest event was held in Hashidate Village on 12 October 2013. The students from different schools have been giving presentations about the two villages since 2011. It is a good exchange program in that they get to know each other well.

We also had a logo mark competition in the event. The students from three laboratories proposed their ideas. Among 14 ideas for Hashidate Village and 11 ideas for Higashidani Village, the best ideas were chosen by people in the village, professors and officers in Kaga City. We attempted to promote branding with logo marks.

Figure 8,
The best idea of Higashidani Village by student in INCT

The best idea of Hashidate Village by student in KCA

Results and Discussion

Evaluations

We had two evaluation methods through the questionnaire survey and interviews to Higashidani Conservation Society about activities for town management and the effect of the students' activities on December 2013. And also the purpose of the evaluations was to evaluate, activate, or investigate directions for sustainable town management.

"Higashidani Conservation Society" consists of 80 members. Since 65 people have moved to city area, only 15 members now live in Higashidani. We collected 37 answers and also some comments.

The result in figure 15 indicates age range in "Higashidani Conservation Society". Approximately 80% of the answers were 60 years old and above. It means that the society also accelerates aging. It is difficult to continue itself.
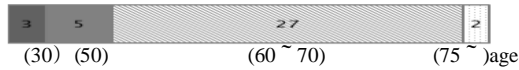

(30) (50) (60～70) (75～)age

Figure 15,   age range in "Higashidani Conservation Society"

■Everyday, ■ 2～3 in a week, ■ once a week,
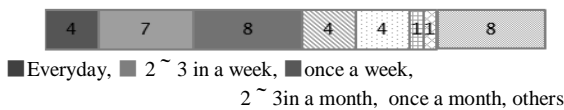2～3in a month, once a month, others

Figure 16, Questioner result on the number of travel to Higashidani
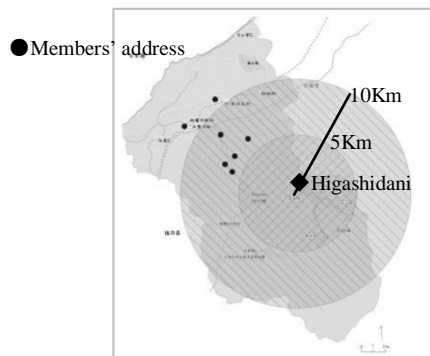

●Members' address

Figure 17, Distance from Higashidai to 65 members' addresses

The question asks how many times you have travelled to Higashidani. The result in figure 16 shows a half of answers marked more than once a week. According to their addresses in figure 17, most of the members live within 10km area from Higashidani.
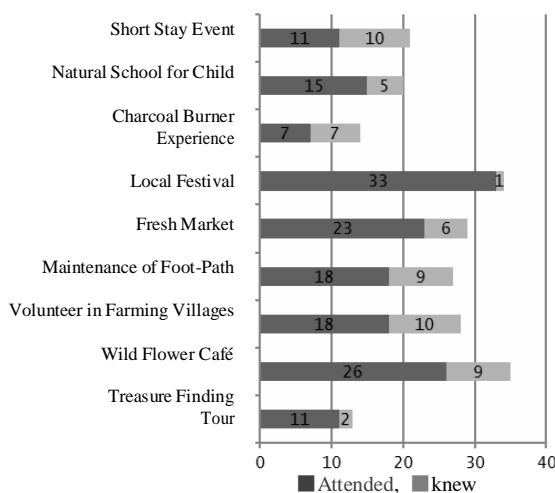
Figure 18, Questioner result on which activity you attended or knew.

Question asks by which activity you attended or knew. Figure 19 shows that most of the members got involved in Wild Flower Café and also the local festival. While the local community hold events such as Short Stay Event, Natural School for Child, Charcoal Burner Experience, and Treasure Finding Tour aiming at attracting tourists, they are not widely known.

■Positive, No preference, ■Negative,
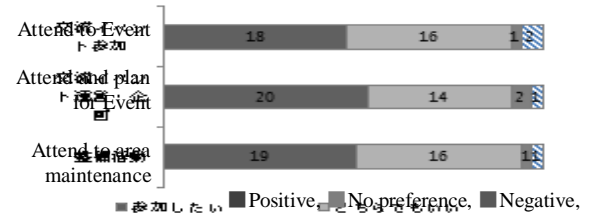
Figure 19, Questioner result on which activity you intended to continue.

The question asks by which public relation you want to use. In figure 20, the half of answers is positive about the public relations. However, the half of answers is "no preference". It indicates that an advanced age prevented people from attending activities.

■Positive, ■No preference, ■Negative,
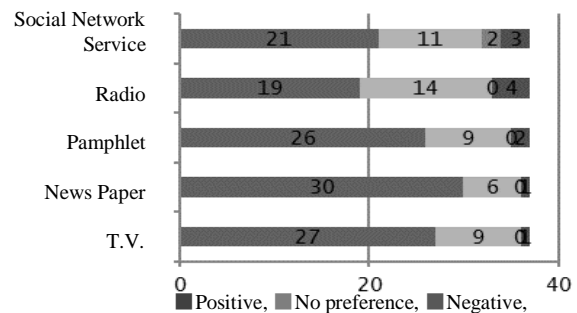
Figure 20, Questioner result on which public relation you want to use

In figure 20, positive answers occupies rather large proportion. Surprisingly, people seem to use S.N.S. We expected that S.N.S has not yet been popular among the village people. The result tells us that approximately 60% of answers are positive about S.N.S. However, there is a comment that they need a technical support for S.N.S.

Figure 21,   Produced sample of local products in 2012

We talked about local products as a souvenir at workshop in 2012. We made samples in figure 21 and discussed which discussed which goods to produce.
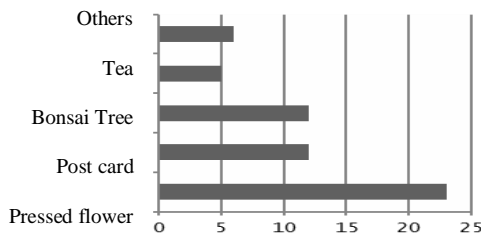
Figure 22, Questioner result on which local specialty you intended to produce

However, the result of the survey in previous year is not still satisfactory. According to the questionnaire survey of this year, as in figure 22, we will see that the pressed flower with wild flowers is in big demand. Following image strategy, the wild flower may function as a branding scheme. We should increase the number of items using wild flowers like post card, tea and lump shade.

Conclusion

We gained some comments on achievements and future works for students' activities from village people and Local authority as in the followings:

1. Achievements

The increase in awareness of town management ascribes to the students' activities and progressing maintenance of Wild Flower Café. The students found advantages of the village and promoted landscapes well. People recognized attractive aspects of the village through the students' activities. Moreover, it was a good chance that the projects were carried out by academic advices. The students gave a big confidence to ages and energized the village. As for Students, the project was a good opportunity to participate in society with a strong sense of social responsibility and volunteerism. To continue the project, new students have to take over for predecessors properly every year.

2. Future work

In this study, we found the village people lack communication. We must reconsider to establish network-system between partners. Therefore, we realize meeting and workshop are very important for co-operative project.

As mentioned in figure 20, the village people are capable of using S.N.S as public relations and communication tools. This ability makes it possible for villagers to communicate with project partners. It may also be a good idea to provide S.N.S for the aged people who had few experience of such communicative tools so that they are encouraged to participate in communication. The communication method is a key issue for sustainable town management.

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TEACHING MATERIAL DEVELOPMENT TO CULTIVATE MATHEMATICAL ABILITIES
- FOCUSING ON EFFECTS OF SOLVING PROBLEMS INVOLVING ORDINARY DIFFERENTIAL EQUATIONS-

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Abstract

In this paper, we propose a new mathematical teaching material with respect to ordinary differential equations. The aims of its introduction are to evoke the interest in mathematics and to acquire mathematical abilities. Nowadays, it seems that national colleges of technology face one problem. Many students do not study eagerly in these schools. Not only are students doing poorly in their studies, but those who are doing well, seem to attend lectures passively. They also adopt the same tendency for mathematics. Traditionally, mathematics has been taught in ways such as applying formulae to solve problems and various calculus questions.

It is clear that such instructions are not suitable for the current students. In order to overcome such a situation, various trials were taken in the national colleges of technology and those results have been reported. This formed the background of this paper. In past two years, the author also continued mathematical trials to attract students to see the beauty and experience the joy of mathematics. To realize this philosophy, ordinary differential equations were taken as teaching materials. In a trial conducted in 2013, he made his students generalize a formula for the general solution of linear ordinary differential equations of second order with constant coefficients. It was expected that study of this problem caused some educational effects on mathematical knowledge and mathematical thinking abilities. Checking the process of the solution of this problem, we argued these educational effects precisely. Finally we verified the achievements. After the trial, students' opinions were sought through a questionnaire. It showed the following results: More than 50 % students admitted that joy of mathematics had been evoked. All of them also did not deny the improvement of their proof abilities. In particular, our material influenced advanced students more effectively. Other outcomes were also mentioned.

Keywords: *Teaching Material Development, Linear Ordinary Differential Equations, Generalization of Proof, Cultivation of the Proof Ability, Evocation of Joy of Mathematics*

Introduction

Mathematics plays important roles in engineering. It does not only offer a useful language to describe mechanisms of phenomena but also discipline students' mathematical abilities. In this paper, let the word "mathematical abilities" mean both of the mathematical knowledge and mathematical thinking ability. In Umeno (2006) , it was pointed out that mathematical abilities are required to realize creativities in engineering. The studies and practices about mathematical abilities has been done in many schools (see Katagiri 1 and 2 (1988), Nakajima (1986), Ouchi & Marushima (2001) and Umeno (2008)). The challenges to foster mathematical abilities were also tried in national colleges of technology. Mathematics usually has been taught in ways such as applying formulae to solve problems and solving various calculus questions. Some students have the mistaken idea that to study mathematics is to memorize formulae. In such an attitude, it is difficult to obtain even acquisition of mathematical foundation. In order to acquire mathematical abilities, it is necessary to motivate students and to make them study spontaneously. Some attempts to improve such situations were done in national colleges of technology. Actually, we found them in *Journal of Education in the Colleges of Technology*. Such attempts are roughly classified as the following three types:

1. Lectures by using calculators - Seitoh (2003)
2. Lectures in which teachers emphasized the applications for engineering- Fukao (2008), Fukao (2009)
3. Revision of curricula-Tagami et al. (2008), Tagami et al. (2009)

The author also has been trying to design lectures to improve such situations in 2012 and 2013. His philosophy is to attract students by feeling the beauty and joy of mathematics. To realize this philosophy, he made his students solve mathematical problems whose solutions are not in their textbook. Namely, appealing to students' curiosity, he tried to motivate students. The rials were designed for third graders in Tsuyama National College of Technology. The result of first trial done in 2012 was reported in Watari (2013). In this

paper, we verify the educational effects of a teaching material used in his second trial in 2013.

A proof problem for linear ordinary differential equations

In the author's trials, the following educational aims were always intended:

Aims
1. Evocation of the interest in mathematics
2. Acquisition of the mathematical abilities and their improvements

To achieve these, we took account of the following four points of view in our teaching materials used in the trials:

- Problems should be challenging for students.
- Problems should not be able to solve by ad hoc ways (i.e. their solutions are not obvious for students).
- Problems should be understandable within students' knowledge.
- The solutions for problems can be constructed by the knowledge which has been learned by students

Table 1 below shows the curriculum of mathematics in Tsuyama National College of Technology.

Table 1. Curriculum up to third graders in Tsuyama National College of Technology

Grade	Subject
First grader	· Fundamental Mathematics I
	· Fundamental Mathematics II
Second grader	· Differential and Integral I
	· Fundamental Linear Algebra
Third grader	· Differential and Integral II
	· Linear Mathematics (Differential Equations)
	· Engineering Mathematics Practice

The author chose problems with respect to differential equations as teaching materials. Because they are not only important for engineering but also are characterized as applications of differential, integral and linear algebra. Differential equations allow us to make reasonable problems which satisfy the four points of view above. We treated a classification problem of ordinary differential equations of first order in the first trial. In the second trial, we consider the following theorem:

<u>Theorem A</u>   Consider a linear ordinary differential equation of second order with constant coefficients

$$y''+ay'+by=Q(x). \cdots (*)$$

Let

$$y''+ay'+by=0 \cdots (**)$$

be the homogeneous equation corresponding to (*). For the general solution of (**)

$$y = C_1 y_1(x) + C_2 y_2(x),$$

that of (*) is given by

$$y = \{C_1 + u(x)\} y_1(x) + \{C_2 + v(x)\} y_2(x)$$

where

$$u(x) = \int \frac{- y_2 Q(x)}{W(y_1, y_2)} dx, v(x) = \int \frac{y_1 Q(x)}{W(y_1, y_2)} dx.$$

The notation $W(y_1, y_2)$ expresses the Wronskian for y_1 and y_2.

<u>Proof of Theorem A</u> Replacing the coefficients C_1 and C_2 in the general solution of the homogeneous equation (**) by functions u and v, we have

$$y = uy_1 + vy_2. \cdots (1)$$

We will determine u and v to satisfy (*).
Differentiating the both hand sides of (1) with respect to x, we obtain

$$y' = u' y_1 + v' y_2 + uy_1' + vy_2'. \cdots (2)$$

Here we only consider the functions u and v which satisfy

$$u' y_1 + v' y_2 = 0. \cdots (3)$$

Furthermore, differentiating the both hand sides of (2), we have

$$y'' = u' y_1' + uy_1'' + v' y_2' + vy_2''. \cdots (4)$$

Substituting (1), (2) and (4) to (*), we get

$$u' y_1' + v' y_2' = Q(x). \quad (5)$$

Consider the system of linear equations (3) and (5)

$$\begin{pmatrix} y_1 & y_2 \\ y_1' & y_2' \end{pmatrix} \begin{pmatrix} u' \\ v' \end{pmatrix} = \begin{pmatrix} 0 \\ Q(x) \end{pmatrix}. \cdots (6)$$

Multiplying (6) by the inverse of the coefficient matrix, we have

$$\begin{pmatrix} u' \\ v' \end{pmatrix} = \begin{pmatrix} y_1 & y_2 \\ y_1' & y_2' \end{pmatrix}^{-1} \begin{pmatrix} 0 \\ Q(x) \end{pmatrix} \cdots (7)$$

$$= \frac{1}{W(y_1, y_2)} \begin{pmatrix} y_2' & - y_2 \\ - y_1' & y_1 \end{pmatrix} \begin{pmatrix} 0 \\ Q(x) \end{pmatrix}$$

Namely,

$$u' = \frac{- y_2 Q(x)}{W(y_1, y_2)}, v' = \frac{y_1 Q(x)}{W(y_1, y_2)}.$$

It follows that

$$u = \int \frac{- y_2 Q(x)}{W(y_1, y_2)} dx, v = \int \frac{y_1 Q(x)}{W(y_1, y_2)} dx.$$

Q.E.D

We cannot find this theorem in standard text books for colleges of technology (see Arai et al. (2006) for example). It is in higher level text book of analysis (e.g. Apostol (1967)). Since the required mathematical

knowledge is within that of third graders in colleges of technology, it is meaningful to study this theorem. However, we did not study it but also tried to generalize it.

Problem B Generalize Theorem A to the case of linear ordinary differential equation of order n with constant coefficients.

The challenge for Problem B consists of two stages.
Stage 1: To understand the proof of Theorem A
Stage 2: Generalization of the proof of Theorem A
Through both stages, it is expected that students will deepen their understanding about the following mathematical knowledge.

Table 2. The knowledge expected to be deepened

- Differential
- Integral
- Solutions of linear ordinary differential equations of second order with constant coefficients
- Determinants
- Solutions for a system of linear equations by using the inverse of the coefficient matrix of the system
- Adjoints of square matrices
- Inverses of matrices given by their adjoints
- Wronskians

Similarly, two positive effects on mathematical thinking abilities are expected.

Table 3. Expected effects on mathematical thinking abilities

- Cultivation of the proof ability
- Acquisition of mathematical awareness

We add some comments on the notion "awareness". It was introduced in Umeno (2006). Umeno insisted that the exertion of creativity in engineering arises from the awareness. It was also mentioned that the realization of the awareness requires not only foundations of engineering but also mathematical thinking abilities. We intended to raise the mathematical awareness by solving Problem B.
Here we analyze Stage 1 and 2 separately

Stage 1
Students already have studied the contents in Table 2 in their regular lectures. So Stage 1 is characterized as reviews of what they have already learned. Note that all matrices appeared in this stage are squares of order 2. The process of proof is given in Table 4. The most technical point in the proof of Teorem A is the addition

of an extra equation (3) (It is the gray part in the proof). After this operation, we have two equation with respect to two indeterminantes u' and v'. This fact allows us to determine u' and v' uniquely.

Table 4. Proof process for Theorem A

	What to do	Knowledge required	Technical point
Step 1	Let $y = (C_1 + u)y_1$ $+ (C_2 + v)y_2$ be the general solution of (*)	·Solutions of linear ordinary differential equations of second order with constant coefficients	·Application of Variation of constants
Step 2	Determination of u' and v'	·Differential ·Determinants ·Solutions for a system of linear equations by using the inverse of the coefficient matrix of the system ·Adjoints of square matrices ·Inverses of matrices given by their adjoints ·Wronskians	·Construction of a system of linear equations w.r.t. u' and v' by adding an extra equation (3) ·Solution for the system of linear equations obtained above
Step 3	Determination of u and v	·Integral	·Determination u and v by the integration of u' and v'

Stage 2
Here we describe the generarization of Theorem A as the answer of Problem B.

The generarization of Theorem A   Consider a linear ordinary differential equation of order n with constant coefficients

$$y^{(n)} + a_{n-1}y^{(n-1)} + \cdots + a_1 y' + a_0 y = Q(x) \cdots (*)$$

Let

$$y^{(n)} + a_{n-1}y^{(n-1)} + \cdots + a_1 y' + a_0 y = 0 \cdots (**)$$

be the homogeneous equation corresponding to (*). For the general solution of (**)

$$y = C_1 y_1(x) + \cdots + C_n y_n(x),$$

That of (*) is given by

$$y = \sum_{i=1}^{n} \{C_i + u_i(x)\} y_i(x)$$

where

$$u_i = \int \frac{\tilde{a}_{n,i} Q(x)}{W(y_1, \cdots, y_n)} dx.$$

The notation $\tilde{a}_{n,i}$ expresses the (n, i)-cofactor of A where

$$A = \begin{pmatrix} y_1 & y_2 & \cdots & y_n \\ y_1' & y_2' & \cdots & y_n' \\ \vdots & \vdots & \ddots & \vdots \\ y_1^{(n-1)} & y_2^{(n-1)} & \cdots & y_n^{(n-1)} \end{pmatrix}$$

and $W(y_1, \cdots, y_n)$ is the Wronskian for $y_1, \cdots, y_n$.
Note that $W(y_1, \cdots, y_n) = |A|$.

The difference between Stage 1 and 2 is the size of matrices. Though the proof of Problem B proceeds in a simmlar manner for that of Theorem A, we must treat squares of order n in this stage. So it becomes much more abstract. Before the challenge for Problem B, the author gave a lecture about general linear algebra (i.e linear algebra wihch was not taught in colleges of technology). The key points to succeed in the generalization are to be aware of the followings:

- Similar to the proof of Theorem A, add extra linear equations with respect to $u_1, \cdots, u_n$ to determine $u_1, \cdots, u_n$.

- u_i is discribed by the (n, i) -cofactor of the cofficient matrix A and the Wronskian $W(y_1, \cdots, y_n)$.

Practice

The trial in 2013 was held as a part of "Challenge Seminar which is a special lecture in Tsuyama National College of Technology. Teachers can determine the theme and freely arrange the contents in this lecture. About Challenge Seminar, refer to Konishi et al. (2011). In this year, 15 students took the author's Challenge Seminar. They ranged in their mathematical levels from poor to excellent. However, since they chose mathematics by themselves, the author guess they were motivated enough. The trial was practiced as in Table 5.

Table 5. Frame of the trial in 2013

	Step 1	Step 2	Step 3
Contents	·Theorem A ·Advanced linear algebra	·Generalization of Theorem A to the case of third order	·Generalization of Theorem A to the case of order n (Problem B)
Learning style	Lecture	Active learning approach	Active learning approach
Time	2h	2h	2h
Role of teacher	A messenger of information	Supporter	Supporter
Attitude for study	Passive	Active	Active

The author first taught advanced linear algebra which was needed to solve Problem B and explained Theorem A as Step 1. After Step 1, students discussed the generalization of Theorem A to the case of third order (Step 2). They proceeded the discussion by themselves. Finally, they tried to solve Problem B (Step 3). Students were grouped by their own departments for discussions. In these two steps, the author devoted himself to their supporter. He sometimes helped them with advices but never taught answers.

Results and Discussion

The survey was conducted upon the completion of trial. After the trial, students gave their opinions for questionnaire in Table 6.

Table 6. Questionnaire

Q1	I felt that mathematics is interesting through this trial.
Q2	I was active in the disucussions.
Q3	My idea contributed to the solution of Problem B.
Q4	My mathematical knowlege was deepened through this trial.
Q5	My proof ability was improved by this trial.
Q6	I enjoyed this trial.
Q7	Write your comment about this trial freely.

The responce rate is 87% (13 out of a total of 15 students) and the results of the questionnaire are shown in Figure 1. From Figure 1, 60% of students admited that their interests for mathematics were evoked by this trial. More than 50% of students thought that they argued eagerly but only 30% students did not affirmed their contributions for the proof. It was the lower score. It also seems that students' mathematical knowledge did not deepend enoguh. In contrast, there were no negative answer for Q5 and Q6.

Some students did not have enough mathematical foundation to join the discussions. So it seems that about 50% of studens could not understand the meaning of Theorem A. By this trial, the importance of foundamental was shown.
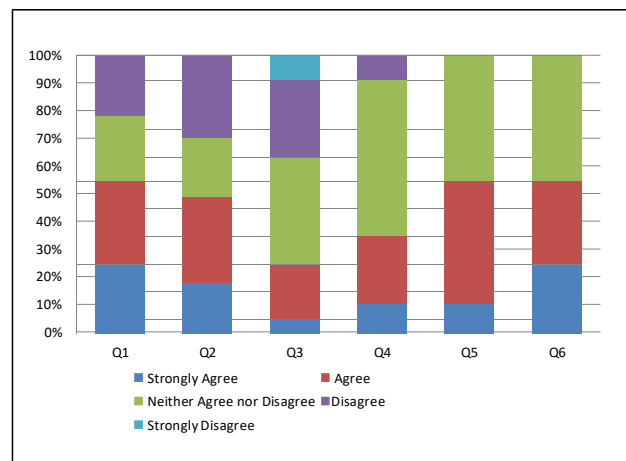

Figure 1. Results of Questionnaire

Conclusion

The author proposed a new teaching material with respect to ordinary differential equations in order to evoke the interest in mathematics and to acquire the mathematical abilities. This trial succeeded in acquisition of the proof ability. It was also attracted students. However, it was not effective for some

students who did not have enough mathematical foundations. A reason for this failure may be shortage of time. We should plan the next trial taking account of this point. On the other hand, it turned out that our teaching material was effective for advanced students. If students attained enough levels, then our teaching material is effective to make them acquire mathematical abilities and evoke of joy of mathematics. Our teaching material also provided an opportunity to study advanced linear algebra. This suits students who wish to enter universities as third grader after the graduation from national colleges of technology.

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PRESENT CIRCUMSTANCES AND PROBLEMS OF PRACTICAL HUMAN RESOURCES DEVELOPMENT AT INDUSTRIAL UNIVERSITY IN VIETNAM

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Abstract

In Vietnam, the JICA (Japan International Cooperation Agency) project aimed at the development of human resources for the industrial sector, is in progress at the IUH (Industrial University of Ho Chi Minh City) with the support of Japanese KOSEN from November 2013. In the project, teachers of IUH Thanh Hoa campus and KOSEN teachers have been jointly developing a human resource development model which provides practical and creative engineers for the promotion of Vietnam's heavy-chemical industry. In this presentation, we will provide an overview of the project and how participants obtained an understanding through project activities. Five working groups have been established to discuss issues like how to safety education, upgrade the teaching method, improve the experimental training for students, advance the problem-solved capacity of students through the research, and promote the collaboration linkage with local industries and local communities. As one of the project activities, we have formulated a new curriculum, a subject flow diagram and a format of a syllabus.

Although the project has just started, we found that it is important to ensure international standards of professional education, and to respond to various needs of local communities and companies in accelerating human resources development.

Keywords: *Human Resources Development (HRD), Technical Transfer, Curriculum, Syllabus, Subject flow diagram*

Introduction

The Government of Vietnam is trying to promote a new Human Resources Development (HRD) model which provides practical and creative engineers for the objective of becoming an industrialized country by 2020. In this context, the Government of Vietnam requested the Government of Japan to carry out Technical Cooperation Project for HRD for Heavy-chemical Industry, especially refinery industry. Following the request, Japanese Technical Cooperation Project (The Project for Human Resources Development for Heavy-Chemical Industry at Industrial University of Ho Chi Minh City) was started by JICA (Japan International Cooperation Agency) referring to the KOSEN system in Japan.

Project outline

Since Nov. 2013, our 3 years project has been implementing pilot activities at an existing local educational institution namely 'Industrial University of Ho Chi Minh City Thanh Hoa campus (IUH TH) and Main campus (IUH MC)' for identifying the most suitable KOSEN model for Vietnamese industrialization, in collaboration with its governing agency of Ministry of Industry and Trade (MOIT), as well as National Institute of Technology in Japan (KOSEN KIKOU). It was known that KOSEN has the reputation for engineering education. N. Mizutani (2007) has pointed out the educational power as one of the characteristics of KOSEN. In particular, He noted that the continuous education from young age, teachers' enthusiasm, and close linkage with enterprises are the fountain of educational power.

On the other hand, the current education in IUH TH is not well organized and arranged systematically. Individual lectures and practiced under courses are not linked each other. Also there are no close linkage with local industries and local communities in order to reflect a needs of industrial sector to education. Therefore It's difficult for students to understand comprehensive purpose/direction of the study.

In this situation, one of the authors was dispatched to IUH TH as a JICA expert from National Institute of Technology, Akita College (Akita KOSEN) for one year from Apr. 2014. The project has introduced Japanese Kosen as a Japanese educational institution for fostering creative and practical engineers to the persons related to the project and other educational stakeholders in Vietnam.
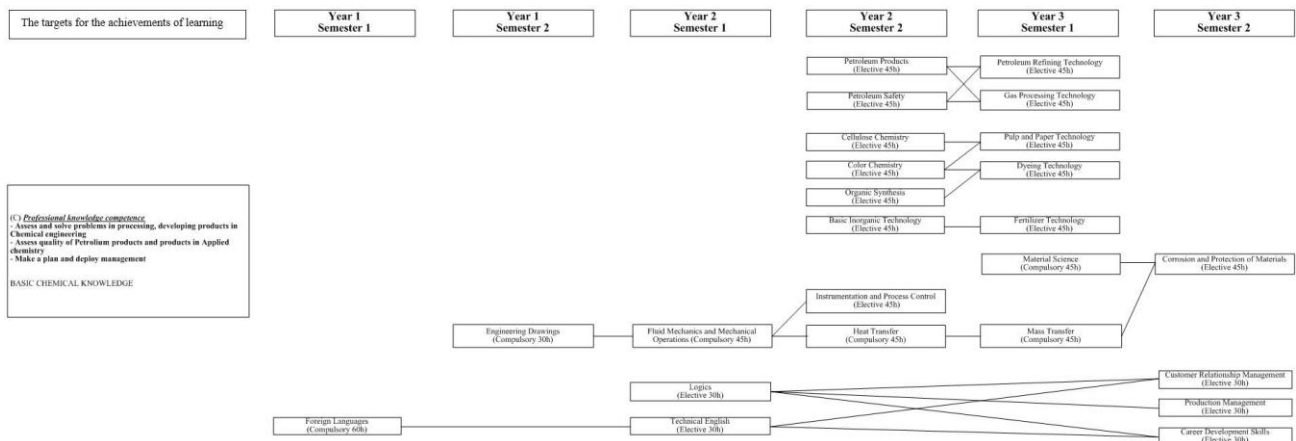
Figure 1 Sample of subject flow diagram.

Figure 2 Sample of format of syllabus.

Contents of activities

The project has just started, so the project has mainly put its effort to promote the mutual understanding between Vietnamese side and Japanese side in terms of policies, principles, daily operations, way of thinking. In the meantime, the project carried out a training course and a business trip in Japan to identify differences between IUH and Kosen.

As a result, IUH leaders decided to prepare the implementation plan of high quality college program (HQCP, Kosen-based model) which is aiming at establishing special courses in IUH TH and IUH MC, in the field of Chemical and Mechanical from the academic year 2014 - 2015. Some characteristics of the HQCP is as below: 1) three years education for students graduating from 18-year old (Five years consistent engineering education from 15-year old in Kosen), 2)

small-group instruction, 3) Assuring 100% graduates get jobs fitting their capability as well as employers' needs (100% job matching for graduates in Kosen), 4) Ratio of theory/practice: at least 30% of the Curriculum emphasizing on scientific experiments and practical training as well as basic academic knowledge in Kosen.

Regarding the preparation of HQCP, the Project has formulated a new curriculum, a subject flow diagram and a format of syllabus. We could create a consistent curriculum in each special field because we arrange the subject while checking the relationship of each subject using the subject flow diagram. A part of new subject flow diagram in field of Chemical is portrayed in Figure 1. Also, we could create more effective format of a syllabus by adding the outcomes that should be accomplished in order to check their level of understanding. A part of new format of syllabus is portrayed in Figure 2. Moreover, we reached the recognition of the importance of each lecturer's ownership for making syllabus for more responsible and fruitful education.

Conclusion

We would like to show a new HRD model collectively having good points in Vietnamese and Japanese educational model. We will continue to contribute our efforts to the promotion of the HRD.

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MULTISTAGE-EXPERIENCE EDUCATIONAL PROGRAM FOR ENGINEERING EDUCATION USING LEGO MINDSTORMS
~ THE ACHIEVEMENTS, CHALLENGES, AND FUTURE DEVELOPMENT IN THE SECOND YEAR OF PROGRAM INTRODUCTION~

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Abstract

In this paper, we report on the achievements, challenges, and future development in the second year of the multi-stage-experience educational program for a total of four years using the autonomous mobile robot. In order to cultivate students' system-design and system-development capabilities through the development of the autonomous mobile robots based on the general-purpose or their own program, electric circuits, and mechanical mechanism, we have introduced the multi-stage-experience program into engineering experiments between the first and third grade since 2012.

In the first year (2012) that we introduced the educational program, in the "basic experiments in control engineering" of the first grade, the robot development and competition for bringing back specified LEGO blocks after line trace and colour identification, were carried out with the LEGO bricks, sensor, and GUI (graphical user interface)–based programming. Also students have prepared and turned in their experimental report with the conscious of a PDCA (Plan, Do, Check, and Action) cycle after each experiment.

As the introduction of the multi-stage-experience educational program in the second year (2013), the program has carried out not only "basic experiments in control engineering" of the first grade but also "experiments in electrical engineering" of the second grade. In the "experiments in electrical engineering", approximately 40 students in the second grade class were divided into eight teams that consisted of five or six members, and carried out the robot development for the competition with the CUI (character user interface)–based programming and the conscious of the PDCA cycle. The theme of the robot competition was a flag-catching race that two robots competed for the best time to take the flag. Also each member of the teams wrote weekly report after each the experiment. The report was reviewed by the teachers and corporate technical experts, and returned to the students. Through these experiences, students' system-design and system-development capabilities have developed. By introducing the multi-stage-experience educational program into engineering experiments between the first and third grade, it will be possible to teach mechanical, electrical, and programming knowledge systematically, and stepwise from the first grade, and be possible to further develop students' system-design and system-development capabilities.
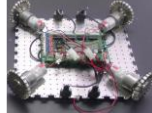
Keywords: *autonomous mobile robot, system design, multi-stage development, PDCA, engineering experiment, PBL (Problem Based Learning), LEGO Mindstorms*

Introduction

In the department of control engineering in Nara national college of technology, the PBL (Project Based Learning) education by the development of students' own autonomous mobile robots and competition using the developed robots has been carried out in "practical system design" of the 4th grade for 25 years since the establishment of the department. In recent years, however, students who find it difficult to develop the autonomous mobile robots have increased because there are no subjects to build a real system with practical and basic knowledge and skills about mechanism, electric and electronic circuit, program, and so on until the 4th grade in our department, and theme of robot competition is becoming more difficult. Thus, through the "practical system design", students can experience the robot development. However, through only one subject of "practical system design", the impro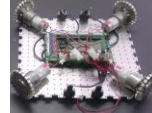vement of students' system-design and system-development capability is not nearly good enough because the teaching time for the capabilities is insufficiency.

In order to improve the students' system-

Table 1 The multi-stage-experience educational program with hands-on and problem-solving theme using LEGO Mindstorms.

Grades	1st	2nd	3rd	4th
Subject names	Basic experiments in control engineering	Experiments in electrical engineering	Experiments in control engineering I	Practical system design
The number of teaching hours	3 periods (1 period: 45 minutes) × 10 weeks	2 periods × 7 weeks	3 periods × 6 weeks	2 periods × 30 weeks
Base robots	LEGO Mindstorms	LEGO Mindstorms	Original Robots	Original Robots
Targets	☐ Learning about the machine mechanism ☐ GUI programming ☐ Understanding of PDCA cycle	☐ Introduction of opposing-type (parallel) task ☐ CUI programming ☐ Acquirement of knowledge about PDCA cycle	Planning on carrying out the program from this year (fiscal 2014) ☐ Control of original robots ☐ Design and manufacturing of their own parts (in part) (Utilization of 3D (dimensional) printer)	☐ Control of original robots ☐ Development of robot system using their own parts

design and system-development capability without changing the educational curriculum in our department, we have been introduced the multi-stage-experience

educational program with hands-on and problem-solving theme for engineering education using LEGO Mindstorms into engineering experiments between the 1st and 3rd grade since fiscal 2012. In other words, for the four years between "basic experiments in control engineering" in the first year of enrolment and "practical system design" in the 4th grade, the multi-stage-experience educational program that student can build the real system (their own autonomous mobile robots) with fostering of their qualities and abilities about the system development in a step-by-step manner through the robot system development using from off-the-shelf parts to their own parts has been carried out (Table 1).

In this paper, we report on the achievements, challenges, and future development in the second year of the multi-stage-experience educational program for total 4 years using the autonomous mobile robot.

The problem-solving theme in basic engineering experiment of the 1st grade

As the first step of the multi-stage-experience educational program, we introduced the educational program into the "basic experiments in control engineering" of the 1st grade in fiscal 2012. As shown in Table 2, the implementation period is 10 weeks between 21 November and 15 February next year.

Table 2 Implementation schedule in hands-on and problem-solving theme.

Week	Contents in the hands-on and problem-solving theme
1	Robot assembly (in base parts) and line trace (basic programming training with NXT-SW software)
2	Basic training of mechanism
3	Development of mechanism and program 1
4	Development of mechanism and program 2
5	Development of mechanism and program 3
6	Robot contest #1
7	Improvement of robot system 1
8	Improvement of robot system 2
9	Improvement of robot system 3
10	Robot contest #2

In this hands-on and problem-solving theme, approximately 40 students in the 1st grade class divided into 8 teams that consist of 5 or 6 members, and carried out the robot development using LEGO Mindstorms and robot competition in the class with the developed robots. The theme of the robot competition was to bring back the specified LEGO block from 4 different-colour blocks after line trace and colour identification. Figure 1 shows the field for the robot competition.

With regard to the development of autonomous robots, in the first week, we put on the basic programming training with NXT-SW software, because

in the class there are experienced and inexperienced students about the robot development using LEGO Mindstorms before school enrolment. Also, in the second week, with the cooperation of technical support section in Nara national college of technology, we put on the basic training of mechanism such as parallel linkage and crank-slider mechanism using LEGO bricks in the basic kit of LEGO Mindstorms. Based on the basic knowledge and skills for the program and mechanism learned through the trainings, students have developed autonomous robots for the three weeks after trainings. Figure 2 shows an example of the robot student developed.
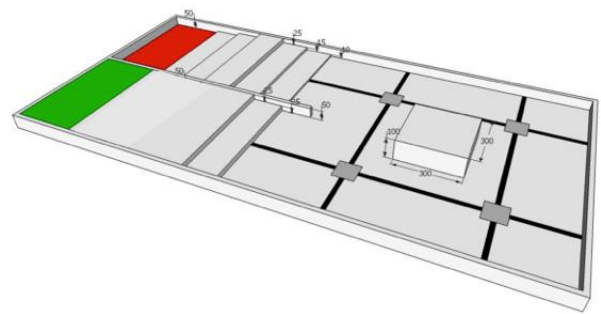
In addition, in this hands-on problem-solving theme, we made students self-conscious strongly about PDCA (Plan, Do, Check, and Action) cycle during the development of the robot system. Specifically each member and team wrote weekly report (PDCA check sheet) after each experiment, and submitted the report to the folder in the server for the report submission. The teachers and corporate technical experts of more than one reviewed the reports weekly from the point of view of the problem and its improvement plan in the mechanism and/or program and the writing skills with quantitative and specific form using the function of the tracked changes and comments in the Microsoft Word. By putting the reviewed reports on the server, we returned the file we returned the reports to the students. Figure 3 shows an example of reviewed report.

As a result of the multi-stage-experience educational program that was introduced the first year to "basic engineering experiment", there are some comments such as "I really enjoyed the experience about robot development". Therefore students could derive satisfaction such as "they could realize what they expected in our department", and increase students'

Fig. 1 Field for the robot competition.

Fig. 2 Example of the robot that student developed.

Fig. 3 Example of reviewed report.

Fig. 4 The field for the robot competition.

desire to study each specialized subject for development of the robot system. Also, there are some results: (1) by the division of roles such as program and mechanism, and sharing each member and/or team report among the team, students could develop their own autonomous mobile robots with checking respective progresses. (2) In order to perform the tasks with a conscious of PDCA cycle it was possible for students to carry out a meeting before and after work, and to understand the planning, execution, evaluation, and improvement process. (3) Through the robot development, group work became active such as the increase of opportunities for communication with students that would not usually talk.

However from the students who dealt with the LEGO Mindstorms in the first time, there is also the opinion such as "I could not participate voluntarily". Therefore the grouping is an issue in this hands-on problem-solving theme.

For this reason, in the "basic engineering experiment" of fiscal 2013 that is the second year of introduction of the multi-stage-experience educational program, approximately 40 students in the 2nd grade class divided into 8 teams such as groups consisting of only inexperienced students, only the experienced students, and inexperienced and experienced students in the development of LEGO Mindstorms. The implementation period is 10 weeks between 12 July and 12 November next year. The theme of the robot competition was directly applied the theme for the WRO (World Robot Olympiad) 2013 for junior high students. Specifically the robot starts from the starting area (green area in Fig. 4), detected a black block among the four different-colour blocks placed at four locations painted in dark gray, and brings the black block to the goal area (red area in Fig. 4).
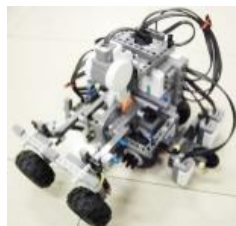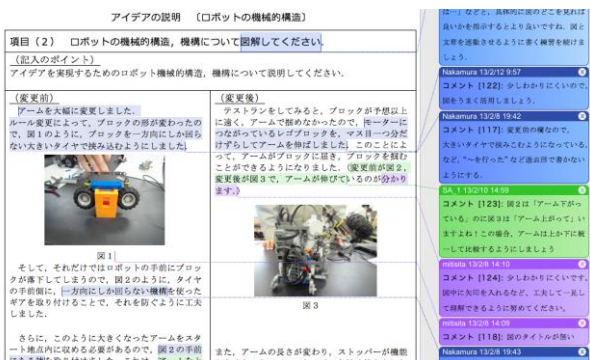
Major difference between the themes in fiscal 2012 and 2013 is the filed for the robot competition. That is, the field in fiscal 2013 is not a plane, and exists the steps zone after the start area and before the goal zone. Therefore the difficulty rapidly increased for the robot competition, and no team could goal. The difficulty for the theme of robot competition is major issue.

The problem-solving theme in "experiments in electrical engineering" of the 2nd grade

In the second grade of our department, students learn the programming and electrical circuit in classroom lectures. Therefore in the problem-solving theme in experiments in electrical engineering, it was initially planning the design and manufacture of robot system with a task of robot control by an external interrupt using students' own electronic circuit. However, since the number of teaching hours that could be used for the problem-solving theme was small, we devised the theme of the robot competition with the external interrupt by NXC (Not

Fig. 5 Field for the robot competition.

Fig. 6 Example of the robot that student developed.

eXactly C) software in CUI (Character User Interface) format. Specifically the theme of the robot competition was a flag-catching race that two robots compete the time until taking the flag. The time limit of the robot competition was 2 minutes. Also the restriction was the robot could not contact with the opposing team robot and "jammer" that moves randomly in the field for the robot competition. Therefore it's necessary to implement the interrupt (parallel) processing because the robots always detect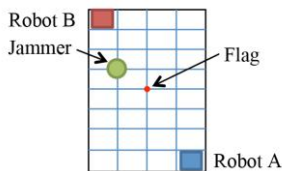 the opposing team robot and "jammer". As for the mechanism of base robots it was impossible to change and improvement for the mechanism because the robot development time was very short (8 hours in real terms). Note that the changes of sensor type, number of sensors, the position of the sensor, and the shape of the arm tip were allowed. In addition, in this theme, each team consisted a few students because all the students participate voluntarily. Figure 5 shows the field for the robot competition. Figure6 shows an example of the robot that student developed.

As a result of the problem-solving theme in "experiments in electrical engineering" of the 2nd grade, in the questionnaire after the theme, the proportion of students who have increased the interest in the robot system development was approximately 85%. Also, as compared with the robot development in the first grade, the proportion of students who felt the improvement on the robot production skill and technology was approximately 75%. From these results, students got conscious about their own growth.

Conclusions

In this paper, we have been reported on the achievements, challenges, and future development in the second year of the multi-stage-experience educational program for total 4 years using the autonomous mobile robot.

In fiscal 2014 that will be the third year of introduction of the multi-stage-experience educational program, the educational program will be introduced into the "experiments in control engineering I" of the 3rd grade. Because original robots are used in "Practical system design", it is necessary to devise a bridge smoothly to the original robots from the LEGO Mindstorms.

Acknowledgements

A LEARNING METHOD OF GLOBAL CAREER EDUCATION THROUGH A SERIES OF INTERACTIVE LECTURES

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Abstract

This program (Coming, Seeing, Listening, and Trying to Open the Door to the World) consisted of a series of lectures, encouraging the students to knock the door to the global world. We intentionally invited global leaders from Europe, USA and Asia who are working for international companies, such as Yoplait (France), FrieslandCampina (Netherlands), Bio-Rad (USA) and Sanyo Electric (Japan), for asking lectures to introduce their real stories of global career development with the following information: 1. Tell us your global career development history, 2. What were their key things when they took a career among several options, 3. What does "Global" mean for you, 4. Encourage students who want to work abroad. A total of 285 students participated in this series of lectures in 2012 and 481 students joined in 2013. We asked the students to answer a questionnaire to evaluate impacts of this program and we successfully received 205 (72 %) out of 285 participants in 2012 and 392 (81 %) responses out of 481 participants in 2013. More than 70 % of the participants showed a wish to "try to open the door to the world" after the lectures. There was a trend that higher-grade students showed higher interests in their future tracks, including global options. From the results of evaluation, we could therefore conclude that interactive face-to-face lectures given by current and active global leaders with a lot of real experiences on global career development have a direct power to motivate many students for opening their eyes to the world. It should also be suggested that other programs, especially for lower-grade students, could be necessary to initiate global sense.

Keywords: *global, career, education, lecture, interactive, learning, method*

Introduction

Japanese government today has continuously addressed that a strong Japanese society for future generation can be constructed by global and innovative young leaders (Prime Minister of Japan and His Cabinet, 2011). There is, therefore, an expectation from Japanese society that the National Colleges of Technology could take a key role to educate the next generation of leaders with full of global minds.

Based on these circumstances, we have launched in 2012 a global career education program for the local students in Okinawa, where locates halfway between Japan and south-eastern Asia, to open their eyes not only to Japan but to Asia and the rest of the world.

Pedagogy

Lecture Program

The lecture program (Coming, Seeing, Listening, and Trying to Open the Door to the World) was consisted of several interactive lectures, prepared and performed by several global leaders. There were 6 lectures performed in 2012 and 4 lectures were run in 2013.

Titles and speakers of the lectures were listed below.

Titles and speakers in 2012
1. Let's expand your world.
    Lectured in English, French and Japanese by Kaori Murakami, MBA, from France.
2. Following career in an international context.
    Lectured in English and Dutch by Gerard Robijn, PhD, from the Netherlands.
3. Coming, Seeing, Listening, and Trying to Open the Door to the World.
    Lectured in English by Junji Matsue, PhD, from Japan.
4. My globalization --- through US experience ---
    Lectured in English by Chinami Kaneshiro, PhD, from Japan.
5. Why and how did I open the door to the world?
    Lectured in English and other Asian languages by Suriyon Tansuriyavong, PhD, from Thailand.
6. Episode and massages.
    Lectured in English and Chinese by Kazuhide Sugimoto, PhD, from Japan.
    Lectures 3 to 6 were hold as a conference on the same day.

Titles and speakers in 2013
1. Making your dream come true.
   Lectured in Japanese by Motoyuki Sato, used to be a business person working in USA and Europe, from USA
2. Coming, Seeing, Listening, and Trying to Open the Door to the World.
   Lectured in English and Japanese by William S. Saito, used to be a CEO of US-based IT-venture company, from Japan
3. Coming, Seeing, Listening, and Trying to Open the Door to the World.
   Lectured in Japanese by Masanori Kurita, who is an executive breeding staff of penguins in Japan.
4. Coming, Seeing, Listening, and Trying to Open the Door to the World.
   Lectured in Japanese by Yasuyo Iga, MBA, who is a career consultant, from Japan.

Lecture style

Typical lecture was started with self-introduction session of a speaker, followed by a main talk on real-life career development stories of the speaker. We were always asking a speaker to include the following topics to achieve the goal, opening students' eyes not only to Japan but to Asia and the rest of the world.

1. Tell us your global career development history
2. What were their key things when they took a career among several options
3. What does "Global" mean for you
4. Encourage students who want to work abroad

Duration of each lecture was ranged from 20 to 60 min, followed by an interactive question-and-answer session for 10 to 30 min. This session was very important for us to encourage the students to open their eyes to global world.

Questionnaires

Before and after each lecture, we performed a questionnaire for students who participated in the lectures. We collected 205 answers out of 285 participants in 2012 and got 392 feedbacks out of 481 participants in 2013.

The following questions were typically used for evaluation of this program.

Q1: Are you interested in your career development?
Q2: Do you want to open the door to the world?
Q3: To what extent could you understand English?
Q4: Could this lecture be useful for your career plan?

Results and Discussion

Interactive Lectures by Global Leaders

We have in net 285 participants for a series of lectures in 2012 and in net 481 students in 2013. In this paper, we focus on results obtained from lectures performed in 2012.

Table 1 Summary of the lectures performed in 2012

Speakers	Murakami	Robijn	Others
Participants in lectures	130	85	70
Participants in questionnaires	94	57	54
Questionnaire participation rate	72%	67%	77%
Questionnaire participants			
1st grade	26	20	7
2nd grade	14	8	3
3rd grade	23	11	13
4th grade	18	7	22
5th grade	10	9	5
others	3	2	4

Table 1 shows summary of questionnaires in 2012. Each lecture collected more than 70 students, which was almost 10 % of total college students, and around 70 % to 80 % of the total participants made their feedback via questionnaires. These results suggested that students participating in each lecture have basically some interests in their future career plan. This could also be important not only for the participants but for the entire college students because the participants could have positive and interactive impacts to other students who had no lecture.

Summary of Questionnaires

Q1: Are you interested in your career development?

Figure 1 and Fig. 2 shows the answers of Q1 surveyed before and after the lecture made by Dr G. Robijn from the Netherlands. We had positive feedbacks from the students as followed.
1. After the lecture 75 % of the participants replied VERY HIGH or HIGH (Fig. 2) instead of 48 % of the participants replied VERY HIGH or HIGH before the lecture (Fig. 1).
2. After the lecture, the 3rd grade students (89 %) and the 4th grade students (86 %) showed higher degree of interest compared with other grades (Fig. 1).
3. The biggest increase of number of students, before and after the lecture, who replied VERY HIGH or HIGH was obtained in the 1st grade students (Fig. 1, Fig. 2).
From these observations, we could see the following trends.
1. The lecture could strongly motivate the students to enhance their interests to the global world.
2. Higher grade students have higher interests to the world.
3. 1st grade students could have higher sensitivity to the lecture than other higher grade students
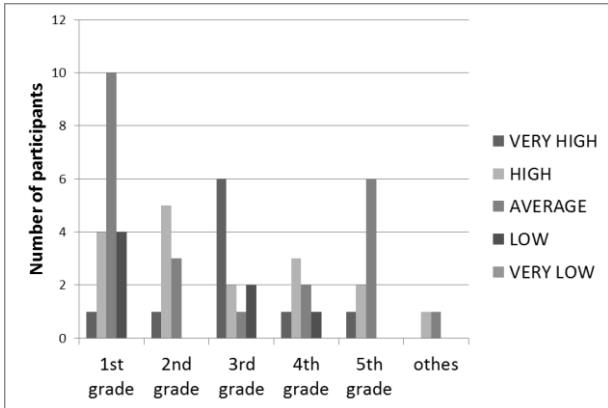
Fig. 1 Are you interested in your career development? (participants answered before the lecture)
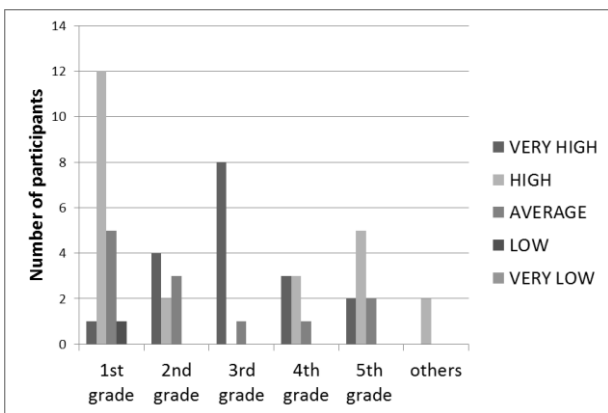

Fig. 2 Are you interested in your career development? (participants answered after the lecture)

Q2: Do you want to open the door to the world?

Figure 3 showed the replies of Q2 surveyed before and after the lecture made by Dr G. Robijn. There were also very positive feedbacks from the participants.
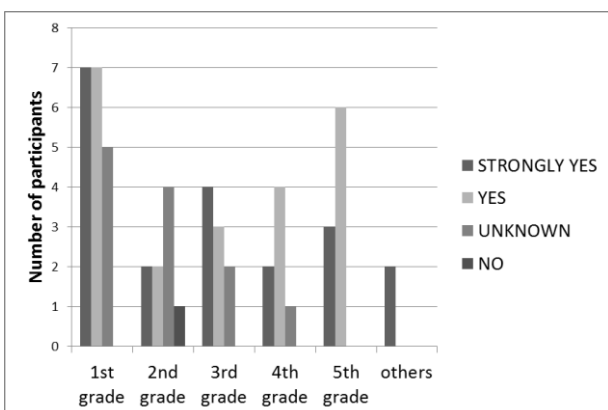
Fig. 3   Do you want to open the door to the world? (participants answered after the lecture)

1.   More than 70 % of the student in the 3rd, 4th and 5th grade said STRONGLY YES or YES.

2.   Percentage of participants who replied STRONGLY YES or YES was higher in upper grades than lower grades.
3.   Proportions of STRONGLY YES to YES were higher (more than 70 %) in upper grades than lower grades (40 to 60 %).

Q3: To what extent could you understand English?

Figure 4 showed the replies of Q3 surveyed after the lecture made by Dr G. Robijn
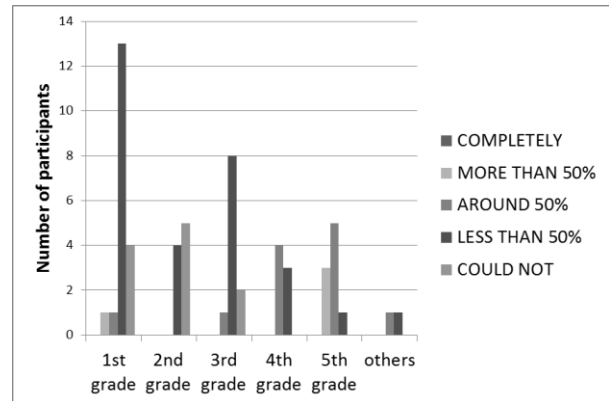
Fig. 4 To what extent could you understand English?

1.   89 % of the 5th grade students replied MORE THAN 50 % or AROUND 50 %.
2.   Less than 10 % of the participants in the 1st, 2nd and 3rd grade answered MORE THAN 50 % or AROUND 50 %.
3.   There was a tendency that higher English skill in higher grades.
4.   It is possible to conclude that duration of English study at the college may have positive educational effects in English listening skills.

It is quite obvious that many of the college students, especially in lower grades, do not have enough English skill to follow lectures in English. Educational programs for increasing their English communication skills could bring a synergetic effect on global career education if it is combined with the learning method reported in this paper.

Q4: Could this lecture be useful for your career plan?

Figure 5 showed the replies of Q4 surveyed after the lecture made by Dr G. Robijn. We obtained very positive responses from the students in all grades.
1.   Among all of the students who participants in the lecture, 83 % of them answered YES.
2.   85 of the students wanted to take a chance to join in another lectures on career development.
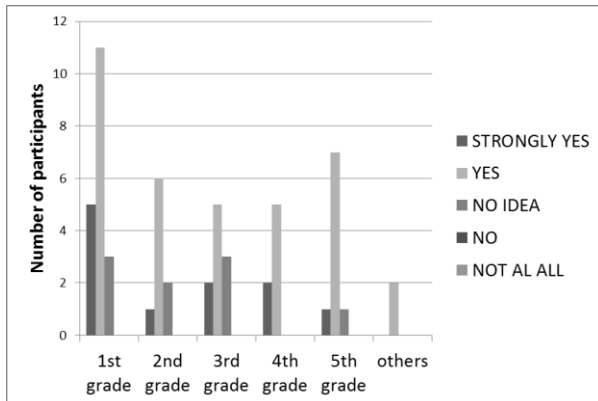
Fig. 5 Could this lecture be useful for your career plan?

Conclusions

Based on positive feedbacks from the participants, we could conclude that this series of interactive lectures on career development can provide certain number of participants with a motivation to knock or open the door to global world. We also confirmed that students at the Okinawa National college of Technology, located in the middle of Asia, tended to show high interests to play an active role in Asian society. We therefore proposed that global career education program through a series of interactive lectures could be a simple and quite direct tool for college students to open their eyes to the world. This program needs global leaders but does not require any special materials, meaning it can be planed and performed anywhere and anytime in the world. It could also be possible to hold an international conference on career education with multi-national leaders and students by using English as a communication language.

On the other hands, there is a challenge for us how to increase number of program participants. It is easy to imagine that students who actively participated in the program tend to have higher interests to the global world. We could just provide them with an environment to be encouraged by themselves. However, we need to consider how to interact students who have not been motivated by global world. There could be an option to utilize highly motivated students, who can be educated by this program, to interact with the low motivated students, letting them to "wake up". A simple and direct learning method of global career education, introduced in this paper, should have a significant value from this perspective.

It is also necessary to prepare specified, doable methods/tools for educated and motivated students to approach global world. Global internship programs and overseas student exchange programs would be options for these. We can now combine the learning method reported in this paper with other options to educate students more efficiently and more extensively.

Acknowledgements

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A PROJECT-BASED LEARNING AND BLENDED LEARNING ON KNOWLEDGE INFORMATION PROCESSING

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Abstract

This paper presents a challenge of dealing with student experiment and technical aspects of a PBL approach. The necessity of creative education has been increasing in national college of technology. The PBL education is the most suitable to foster the creativity. The students acquire communication skill and leadership through such the PBL learning processes as the problem-solving, collaborating activities, knowledge and skill acquirement stages.

In this paper, we apply the the subject of knowledge information processing using PBL to students of the advanced course in kitakyushu national college of technology. We expain the our PBL process to develop a windows 8 application. We plan the details of seven stages according to PBL process. We show the experimental system by student who struggled for the work using windows 8. Finally we will discuss the PBL program and state conclusion and future works.

We strongly assert that our PBL program is effective to make the students acquire the skill of problem solving, especially for those who have insufficient experience and communication skill.

Keywords: *Problem Based Learning, Logic Theory, Knowledge System, Windows8 Application*

I.   INTRODUCTION

It has been emphasized the necessity of creative education in japan. Especially, the necessity from social industry has been increasing in national college of technology which foster the industrial engineers. In fact, we are expected to grow the engineers in middle term goal of the national college of technology[1]. The most important thing for our teachers is to have definite consolidation and attitude. The creativity is based on the fundamental education. It is the problem-based learning (abbreviation as PBL) education that is the most suitable to foster the creativity.

One of the aims of today's education is to grow the students with both technological skill and practical one. To achieve this aim, we think the method of PBL is the most efficient. We studied the course proposal: Problem-Based Learning foundation programme [2]. By this experience, we execute the PBL during our second semester subject of knowledge information processing in kitakyushu national college of technology for advanced course of the students.

Section 2 states outline of Blended Learning. Section3 states our Blended Learning. Section4 states the subject on knowledge information processing using PBL. Section 5 explains the our experimental system using PBL process. Section 6 states the results and discussion. Finally, the conclusion and some problems yet unsolved are stated in section 7.

II.   BLENDED LEARNING

Blended Learning (abbreviated as BL.) is learning based on various combinations of classical face-to-face lectures, learning over the Internet and learning supported by other technologies that aimed at creating the most efficient learning environment.

Blended learning also incorporates other elements such as online and traditional learning environments, technology and media for learning content delivery, different teaching and learning methods (both online and traditional), group and individual learning activities and synchronous and asynchronous interactions.

The aim is to choose a mixture that will highly motivate the students, and assist them in successfully mastering the course.

Ⅱ.1 CREATIVITY

A Creativity is concerning to resolve the problems with many different answers and is important for PBL education to raise the original idea of thinking. The creativity is the potential power of creating new ideas under the unknown situation. The student must study the experimental problem and related knowledge in the process of PBL. The students acquire communication skill and leadership through such learning processes as the problem-solving, collaborating activities, knowledge and skill acquirement stages.

Ⅱ.2 **SUBJECT OF A KNOWLEDGE INFORMATION PROCESSING USING PBL**

We apply the subject of knowledge information processing to the students of advanced course of control engineering in Kitakyushu National College of Technology [3]. They study a basic logical theory and technique about knowledge representation by the subject above. They understand proposition theory and first predicate logic and then make program using prolog based on the logic. The goal of the subject is to understand the logic and the program algorithm. The students learn the programming with knowledge representation and inference based on the knowledge information processing.

We lecture the subject for 15 weeks and the time of lecture takes 100 minutes for a week and the number of credits is 1 unit. We give them a lecture about the fundamental first-order predicate logic for the first 5 weeks. Then in next weeks, we explain the basic programming. The last five weeks we give them a training of PBL with personal computer. If the students have some questions, we give them the answer anytime.

Ⅱ.3 **THE LECTURE OF E-LEARNING USING WEBCLASS**

For the purpose of advancing self-learning, it is necessary for teachers to encourage the student and aid them in learning the skill. It is important for students to build up the system so that they can tackle and achieve the goal of this subject.

If students can easily understand the lecture, they tackle the lecture eagerly even if there are some difficulties in the contents of the lecture.

We change the lecture style using PBL, we make new system that students can have objective to cultivate the learning ability and support studying attitude. The aim is to improve educational effect with the system.

We have been advancing e-Learning system through webclass in our subject for supporting the student. Now we are making the teaching materials for self-learning using webclass in the subject of knowledge information processing. We can use OHP content, backup and so on through WWW-brouser by the Internet in the webclass system. If we access the webclass server on the Internet, we can make teaching materials and students can upload the output at home and on our laboratory.

Ⅱ.4 **E-LEARNING**

The e-Learning system is to educate the students with the personal computer by the Internet. It has been increasing that educational services are being provided to companies, universities, and research facilities using the Internet.

As the system is working for 24 hours, every student can read lecture content and educational one at any time. The system is meaningful because the students can learn by themselves through preparation and review that teacher cannot explain during the lecture time of 15 times for one semester and they study the lessons according to their skill level. The e-Learning system includes meaningful assisted lecture materials. Its another meaning is to improve the quality of self-education based on independence and interest of the students by using exercise programs, photos, movies, sounds and so on

III. Our BL System

Ⅲ.1 **Education effects of BL**
There are two major problems between teachers and students in a face-to-face classroom.
(1) Preventing the complete understanding of the contents by the rapid pace built into learning structure
(2) Passive learning attitude
There are results of insufficient learning opportunities from the limitation of time and space. Faculty members in many face-to-face classes often have a psychological burden to achieve pre-designed learning outcomes, so they tend to offer students fewer actual learning opportunities.
BL is a solution that incorporates the benefits of both online and offline education. The key to BL is to select the right combination of media by lower cost.

BL can be divided into two types, each of which focuses on online or offline education and partially substitutes other types of education.
(Type 1) Mainly online education and complementary face-to-face instruction
(Type 2) Mainly face-to-face instruction and complementary online education

Ⅲ.2 **Teaching and Learning Activities in BL**
(1) Task submission and feedback
The teacher encouraged students to their report online. For feedback, the student and teacher met face-to-face.
(2) Q&A and teaching materials
Question &Answers focused on face-to-face meetings. Lectures were done by online.
(3) Interactive testing system
After lectures, we conducted online test about the content of lectures.
(4) Online supplementary lectures
If a student was absent for the lecture, we could watch a supplementary lecture online.

Ⅲ.3 **BL Process**
The BL learning process consists of a 15-week course executed on the subject of knowledge information processing as follows.
1) The course begins with a 1-week face-to-face session where the students have the chance to meet the teacher. The teacher explain about the syllabus. The teacher presents the learning objectives, discusses the most significant knowledge and tasks to be learned, and describes computer-mediated

interaction Learnig system WebClass (e-mail, lecture documents, test and forums.)

2) There is a 2 hours face-to-face session where students ask the teacher questions about the contents they have studied and discuss problems that they have encountered and possible solutions. The teacher presents the most important contents to be studied over the following week, stressing the concepts that are most important or harder to learn.

3) Face-to-face support is available to students at 2-hours lecture time for a week. Students can meet the teacher either individually to clarify contents and receive support on how to solve the given problems (test).

4) Interactions between students and and the teacher are held via forums to acquire knowledge and be related to all over knowledges organically. These sessions are held informally, and their development is not structured. These sessions are especially important for students that were unable to attend the face-to-face session.

5) There is permanent e-mail support, and queries should be answered within 24 hours.

6) An online assessment is held every week, where the students have to complete a test.

7) A final face-to-face assessment is held immediately after the course has finished. Students have to undergo examination, where they will be expected to complete short exercises on a common problem similar to the ones used in the good problems. The examination typically lasts 1 hours. Learner evaluation takes into account the scores achieved in this test, the solution of the weekly tests, the learner report during long holidays and a score of proficiency test.

IV. INFORMATION KNOWLEDGE PROCESSING USING PBL

It is related to the creativity of the learners to resolve problems. The problem resolution process consists of a series of stage1, stage2 … stage7. To perform PBL learning process becomes following.

IV.1 Stage1 (Group Setting)

Last year, 21 advanced course students learned the subject of Knowledge Information Processing. We divide them into a group of 7. The number of the students in each group is 3. The members of the group set basic rules for the group. The members work out their roles. The each group selects one of the members as group leader. After school we welcome the questions from the group leader.

IV.2 Stage2 (Problem Identification)

We give students the following problems. The students make the expert system by using personal computer. The each group use Windows8 operating system. The Program Language is Visual C# by using Windows 8.

The system infers use the common sense. The expert system response is corresponding to the inputs. The system deals with common sense and complicated theme. The system is indispensable to following two items at least.

1) The system has the explicit knowledge structure.
(Formatting)
2) The system has the specific knowledge of a domain and acts intellectual operations.
(Context and and Ability)

When the students design the system, they use a typical system development method in business world. The students make a project-team and try to resolve the problems by themselves.

IV.3 Stage3 (Idea Generation)

The members of each group discuss the problems given beforehand. The students choose the appropriate theme and organise their ideas. They try to resolve the problem with knowledge. The teacher give them some advice and observe the using their students.

IV.4 Stage4 (Learning Issues)

We take it into consideration how the students learn the problem spontaneously by being displayed samples of the problems and resolve concrete examples. The students make action plan. The students learn by practical form such as assumption of project planning, examination of procedure, gathering data, programming, experiment, arrangement of result, induction of conclusion, presentation.

IV.5 Stage5 (Self-directed learning)

The students acquire essential knowledge in order to resolve problems by themselves. The students acquire wide knowledge such as input response system and natural language processing. They summarize the resolved problems.

IV.6 Stage6 (Synthesis & Application)

The students acquire the new knowledge. They will integrate their former knowledge with the newly acquired one. They work hard to slove the problems.

IV.7 Stage7 (Reflection & Feedback)

The students carefully think about the given problem. If the system causes some problems, students go back to the stage 1 again. The facilitator needs to give some good advice.

IV.8 Assessment of the PBL

We assess their report and presentation and group accomplishment. The percentage of each evaluation is 30%, 40 % and 30 %.

V. EXPERIMENTS

We organized 7 groups of the students last year as following Figure 1.

Group	Staff	Theme(System)
Group1 (G1)	3 members	Homework Topic management system
Group2 (G2)	3 members	Color Diagnosis application
Group3 (G3)	3 members	Sport Score board application
Group4 (G4)	3 members	Exercise Calorie Calculator
Group5 (G5)	3 members	Car Selection application
Group6 (G6)	3 members	Face Character application
Group7 (G7)	3 members	Quiz Game application

Figure.1   Theme and staff of the Group

Every student struggled for the group work.

They understood given topic for the subject within limited time. Their prototype system was checked by computer and their program had good operation. The report and experimental system by computer operating gave us good evaluation.

Program Language is Visual C# by using Windows 8.

V.1 The Group1

[Problem:]

There are many reports for advanced course student. It is difficult to manage the report from teacher to submit the report or not ,

[Resolution:]

Therefore the system manages each report deadline and submission system.

The system is as following Figure2.

Figure.2   The G1 of system menu

V.2 The Group2

[Problem:]

There are many fortune-telling system that are reading stars (astrology), blood type and name fortune-telling, The system take some procedure and long time. But some user want to short time easily.

[Resolution:]

The G2 group make simple fortune-telling system to take short time.

The system is as following Figure3.

Figure.3   The G2 of system menu

V.3 The Group3

[Problem:]

There are many scenes using mobile application with tablet. There are increasing outdoor sports applications.

[Resolution:]

The system calculates score when we take part ins some sports such as basketball and volleyball.

The system is as following Figure4.
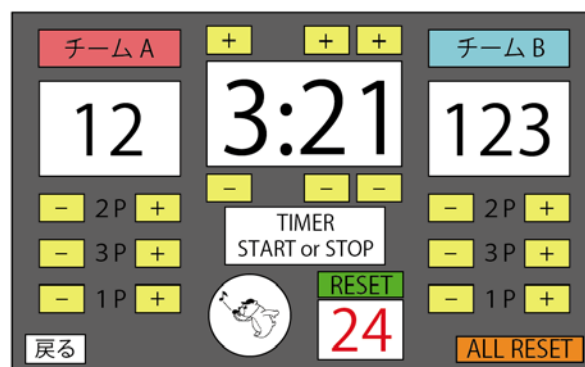
Figure.4   The G3 of system menu

V.4 The Group4

[Problem:]

Diets have lately been surging in popularity. There are food lists to view the calorie value. We are poplar to become diet. It is necessary to calculate our calories that we ate food. We want to know how to burn calories

[Resolution:]

The system shows excercise such as waliking, running swimming and radio exercise how long does use exercise for burnig the calories. The system menu is as following Figure5.
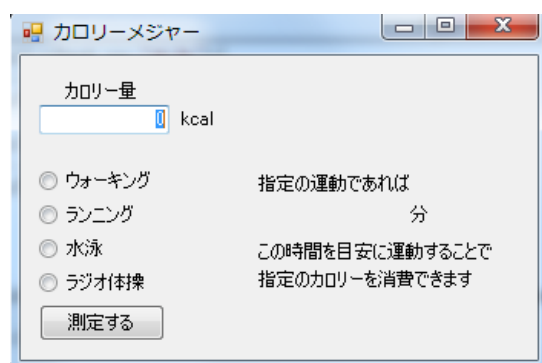
Figure.5   The G4 of system menu

Ⅴ.5　The Group5

[Problem:]

There are increasing car away of youth. The system require the model, color and price information.

[Resolution:]

The system find the best cars. We input some item and answer the result of best car (cf. Figure6.)
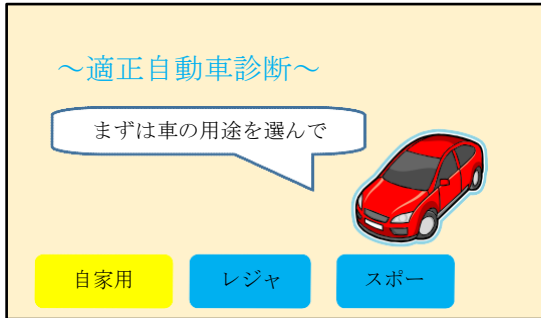
Figure.6　The G5 of system menu

Ⅴ.6　The Group6

[Problem:]

Our communication means are changing by the rapid development of social media such as Twitter and Facebook. It was possible to use face character with many emotions. But the system takes a lot of times.

[Resolution:]

If we input the sentence with emotion words, the system creates a face character automatically.
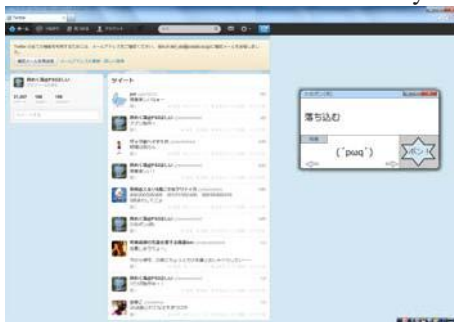
Figure.7　The G6 of system menu

Ⅴ.7　The Group7

[Problem:]

The Group7 make KCT quiz system.

[Resolution:]

The system have some selecting problems about Kosen. The system shows following Figure 8.

Figure.8　The G7 of system menu

Ⅵ.　RESULTS AND DISCUSSION

We strongly assert that our BL system is effective to make the students acquire the skill of problem solving, especially for those who have insufficient experience and communication skill. We emphasize the value of group work. The PBL gives the advanced course students the valuable chances to experience the flexible ways of thinking before they become a researcher.

We used BL in order to edify the instructional strategies.

(1) BL could be successful in teaching and learning cases. The BL system is easily used. The records of student-teacher interaction could be saved in an online database for future educational use.

(2) Instructional options seem more likely to succeed because they allow unforced, active participation.

(3) It is not prudent of all instructional activities to focus on 100% online education because some students require face-to face instruction. Online education is important because it is quick and easy. Internet teaching materials allow for higher student participation.

Ⅶ.　CONCLUSION

We proposed a new framework BL system to study subject of information knowledge processing using problem-based learning. We had the PBL presentation. In the future, we will consider the approach to assess our PBL assessment.

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A PBL STYLE PROGRAM "PROJECT WEEK" IN JAPAN: INTERNATIONAL COLLABORATION IN EDUCATION BETWEEN ANAN KOSEN AND OSUNABRUECK UNIVERSITY OF APPLIED SCIENCES

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Abstract

This paper describes i n d e t a i l, the activities and outcome of "Project Week" held at the National Institute of Technology Anan College (NIT-AC), Tokushima. German students from t h e Osnabrueck University of Sciences (OAS-OS) came to ANCT in February 2014. "Project Week" was a PBL program under the supervision of our Japanese faculty where 14 Japanese and 13 German students worked together as a team on individual projects and then made a presentation to share each result.

The following were the project themes of each department of our college: 1)Nanostructured Environmental Photocatalysts from Department of Mechanical Engineering, 2) Measurement of Electrical and Optical characteristics for LED from Department of Electrical & Electronic Engineering, 3) Toward a New Business Application of Speech Recognition and Spoken Dialogue from Department of Systems & Control Engineering, 4) Make a Bridge Model from Pasta and Test its Structural Integrity from Department of Civil & Construction Engineering, 5) Mystery of Glowing Ceramics from Endowed Courses, 6) Renewable Energy Education by Designing for a Small Hydro Power Plant from Renewable Energy Research   Croup.

At first, it was expected that the language barrier would prevent the students from carrying out their project duties smoothly. Every student had to work hard to communicate in English in order to find the solutions to a variety of problems. By using their thorough knowledge of their subjects, students were able to come to an understanding and reach a productive conclusion with foreign students. In the end, students became more communicative, and were able to make themselves understood. At the same time, each student gained some positive inspiration and motivation from their foreign teammates, despite experiencing some difficulties while communicating with each other. As a result, students have become more open-minded and confident in their major, and are able to view English more positively as a tool to communicate. A PBL style "Project Week" with international students is important to create such opportunities that will be necessary for work experience or foreign experiences abroad, for the future.

Introduction

This paper describes the activities and outcome of "Project Week" held at National Institute of Technology-Anan College (NIT-AC), Tokushima, in detail. German students from Osnabrueck University of Applied Sciences (UAS-OS) came to NIT-AC in Feb. 2014. "Project Week was a PBL program under the supervision of Japanese faculty where fourteen Japanese and thirteen German students worked together as a team on individual projects and then made a presentation afterwards to share each result.

Background of Project Week

NIT-AC and OAS-OS have had MOU for 7 years. We exchange students from each other's campuses. Anan students conduct research under the supervision of German professors, as well as German students in Anan. Before two of the German exchange students wrote a bachelor of engineering thesis at Anan under the supervision of a Japanese professor. Their home university examined it and they were awarded a bachelor of Engineering degree. One student enrolled in Japanese graduate school in an English program. The other student who returned to Japan currently works for a Japanese company. As for Japanese students, their international experiences were appreciated practically when they hunted for jobs. The exchange programs seem to benefit both sides. From this relation, the German university requested Anan to hold a project week similar to the annual project week held in Osnabrueck. It was held for the first time between 20 and 21 in February 2014. It was limited to two days due to the college's schedule; usually it lasts 5 days.

Seven Factors

The following seven factors are important for implementing a PBL program between international students.

1. Preparation. How much do we prepare for each program, such as literature on how to get started. Well prepared literature may tend not to encourage conversation among international students.

2. Technical skill. (There were no technical issues because the Japanese professors estimated the appropriate level of the material as related to the students.)

3. Language ability (English)/communication. Basic language skill is needed.

4. A participant's major. It slightly affects his or her engagement in a project.

5. Sense of purpose.

6. Age difference, including experience, maturity and independence.

7. How to familiarize team members. Sense of humour. Some kind of icebreaking might be needed according to members of a team, such as the topic of Japanese animation, for example, Dragon Ball and Detective Conan etc.

Project Week Schedule

The following schedules were carried out. Anan National College offered 6 programs. Each team consisted of two or three Japanese and German students. They were supervised by Japanese faculty.

General Timeline
The schedule of each group varies slightly according to a program.

Feb 20
9:30-12:00: Orientation, lecture and Discussion
13:00-16:00: Experiments /activities

Feb 21
9:00-10:30   Preparing presentation materials
10:30-12:00   Making presentation
14:00 -16:00   Final Presentation
16:00 -16:30   Closing Ceremony

1. Department of Mechanical Engineering
Theme: Nanostructured environmental photocatalysts
Program summary: We intend to increase the photocatalystic activities by introducing nanometer-sized crystallites which have large specific surface areas. We will evaluate the visible-light-induced decomposition abilities of our original nanostructured photocatalysts, for methylene blue molecular, in comparison with the commercial micrometer-sized photocatalysts.
Procedure: The supervisor explained what photocatalysts are via power point and how to evaluate. The ultimate purpose is to develop a new photocatalyst. Instead of creating brand new photocatalysts, they bought 3 types of commercially available ones. The students coated silicon wafers with P25, ST-01, and ST-21. They made sure the three photocatalysts were coated effectively and observed via X ray tests. They took on the roles: making samples (P25, ST -01, ST-21), collecting data, analysing data / discussion.

Problems & Findings: As for language, there was no problem. As for technical skill such as how to deal with equipment, there was no problem. Discussion & analysis depended on the student's area of emphasis and major. A structural engineering major student was very enthusiastic and made more questions than anyone in the group. An electronic major student was enthusiastic, too. A Japanese mechanical engineering major student asked many questions as a kind of facilitator. She communicated very well when they were making the P.P. slides. However, the supervisor said, "Generally speaking, German students seem to have a more clear purpose due to the German internship system that lets German students see the society. They become more matured and go back to enroll in university." This "Project Week" program provided an opportunity for the supervisor to reflect on his Japanese students.

2. Department of Electrical & Electronic Engineering
Theme: Measurement of electrical and optical characteristics for LED
Program summary: In order to use LED efficiently, it is important to understand the characteristic of LED. In this theme, the student measures electrical and optical characteristics for LED as shown below. Because LED has the property of an optical sensor like a photodiode, the characteristic of photo detector for LED is also measured. In those experiments, the student uses equipment such as power supply, current meter, spectrometer and Peltier unit.

- ・Voltage－current characteristic
- ・Wavelength－emission intensity characteristic
- ・ Temperature dependence for electrical and optical characteristics
- ・Spectral sensitivity of LED optical sensor

Procedure: Skilled -based training. Students need to acquire the basic skills to get to know the main purpose of LEDs. LED properties vary according to the environment. LEDs have 2 properties - semi-conductor and photovoltaic effect. Supervisors direct students, and then support students, and help make them feel confident. Once they acquire those skills, they can be applied to other areas of LED technology. 1) Measurement of each characteristic for one LED. 2) Measurement of each characteristic for various LED. 3) Summarization and consideration about experiment results. 4) Preparing for presentation.

Problems & Findings: At the beginning, all of the students seemed to be distant and shy until, as a icebreaker, one student, who had stayed at OAS-OS as an exchange student in the previous year, brought the topic of Japanese animation "Detective Conan" that is popular in Germany. They became closer.

German students did not hesitate to ask questions. However, the project was carried out almost in silence because preparation was made entirely in English.

Strangely speaking, too extensive preparation of materials seems to lead to limited communication between students. If materials are left somewhat unclear, then students must work together to solve the issue.

3. Department of Systems & Control Engineering

Theme: Toward a new business application of speech recognition and spoken dialogue.

Program summary: In recent years, speech recognition and spoken dialogue are becoming increasingly important components of many applications:

* Automatic captioning for YouTube video
* Transcription system in parliament
* Apple's Siri
* Interactive voice response for call centers

In this theme, students experience some basic tools of spoken language processing and explore new business applications of them. This program is conducted as brainstorming-based.

Procedure: 1) Learning about the basic tools of speech recognition, spoken dialogue and speech synthesis. 2) Research and discussion about new applications of spoken language processing. 3) Summarization of discussion.

Problems & Findings: It was a good practice to come up with new ideas and make a summary in a limited time (one and half days), and to determine how is this technology used in the business world? - Application/ products etc. But the supervisor observed that Japanese students hesitated to talk to a computer. On the other hand, German students enjoyed talking to it without hesitation. Some affective filter prevented Japanese students from being active leaners. In addition, regarding brainstorming, German students were more actively engaged in it. They seemed to get used to it. They were good at PBL and public speaking, while Japanese students talked less except for a student who was good at speaking English. The supervisor said: In fact, Japanese education is input-based. It needs to be more output based. We need to provide more output based learning opportunities to foster Japanese students in an international condition.

4. Department of Civil & Construction Engineering

Theme: Make a bridge model from pasta and test its structural integrity.

Program summary: The intensity contest of the small bridge built with from pasta is planned. It is a very small version of the "Bridge Building Contest". The bridge is completed using uncooked pasta and hot glue. It may become a subject for studied for practical intensity design.

Procedure: 1) Preparation written in English. Lecture, making model and loading test. 2) Discussion and making model and loading test. Which structure skillfully and evenly distributes the weight?

Competition style, Japanese team versus German team. 3) Discussion and making presentation.

Problems & Findings: We reconfirm our difference in a concrete way, with strong evidence. Japanese students tried to fit their bridge within the dimensions of the case. German students built their bridge too large. So they asked to change the rule and make the case bigger so it will fit. Germans made a 3D design. Japanese made several 2D designs and fit them together. Germans were more successful at evenly distributing the weight than Japanese due to the trapezoid design, a larger base and smaller top may represent different way of thinking, and Japanese faculty notice the difference in thinking, "aha" moment.

5. Endowed Courses

Theme: Mystery of glowing ceramics.

Program summary: Phosphorescence materials are commonly used in our daily life, for example, alarm clocks, evacuation guides, and fishing floats since they glow bright in the dark. Strontium aluminate-based pigment, which was first invented in Japan about 20 years ago, is now the most popular phosphorescence material. There are some people, however, who think the material is still mysterious since they are not familiar with how it is produced and how it re-emits light. In this exercise, we will prepare our own phosphorescence pigment in the laboratory, measure the emission properties, and get to the heart of the emission mechanisms.

Procedure: 1)To learn safety techniques→goggles, gloves, masks. Stop the air-conditioner/circulation when powder is used. 2) Lecture, exercise. 3) Discussion and making presentation.

Problems & Findings: Questions from German students were graduate school level. Regarding communication, it was maintained by the willingness of German students to guess at what the Japanese wanted to say when they got stuck. Both made efforts to get the point. As for making slides for the presentation, German students seemed to take only a little time due to the use of Japanese Power Point.

6. Renewable Energy Research Croup

Theme: Renewable Energy Education by Designing for a Small Hydro Power Plant.

Program summary: Students visited the site to examine real working small hydro power plants. They observed the creek and river area in order to design a small hydro power plant. They visited the town-hall to discuss renewable energy, such as small hydro power plants and biomass. They selected two of the four small hydro power plant models and assembled them. After assembly, they ran a test operation at a man-made-stream. The assembly was successful, so electricity was generated and the LED bulb lit up. The purpose is to foster an environmentally conscious generation through renewable energy education. They held a discussion in order to create a new system. They utilized the 3 elements of nature: wave energy, wind energy, solar

energy and created a design of the new machinery. Its nickname was *Super Stream.*

Procedure: Lecture. Go to the site and visit the town-hall. Discussion and making presentation.

Problems & Findings: As for language, there was no problem. But German students were more talking actively. Actually Japanese students have good scores of TOEIC and also stayed for 3 months in Germany as an exchange in the previous year. But they seemed to wait for their turn to come around. The three-month period seemed to be too short for them to become talkative and aggressive in personality.

Conclusion

According to the questionnaire for 12 German students and13 Japanese students, the questionnaire 1 "Do you recommend this program?" Yes: 24 out of the25 students. No: 1/25.

"Why?": For Japanese students, they improved English. As a second reason, the PBL program was stimulating. For German students, they enjoyed cross-cultural communication. In addition, they learned a different way of thinking as well as different things. "Why not?" A Japanese student says "busy."

The questionnaire 2 "Do you want to work outside of your country in the future?" For German students, Yes: 9/12, for Japanese students, Yes: 9/13. They expect to work in a foreign country. This means we have to prepare for a curriculum to accommodate future generations. The newly created curriculum should be attractive in order to appeal to prospective students who want to enroll in Anan College. Actually we utilize our several international programs for advertising our college.

At for the project, it was expected that the language barrier would prevent the students from carrying out their project duties smoothly. Actually every student had to work hard to communicate in English in order to find a solution to a variety of problems.

But by utilizing their thorough knowledge of their subject, they were able to come to an understanding and reach a productive conclusion with foreign students. In the end, students became more communicative-oriented so as to make themselves understood. At the same time, each student gained some positive inspiration and motivation from their foreign teammates, while experiencing some difficulties to communicate with others.

As a result, students have become more open-minded and confident in their major, and are able to view English more positively as a tool to communicate. A PBL style "Project Week" with international students is important to create such opportunities that will be necessary for work experience or foreign experience abroad in the future. It will also help us to shift from an input-based curriculum to an output-based one.

EDUCATIONAL FRAMEWORK FOR COMPANY ENGINEERS IN COLLABORATION AMONG FOREIGN INSTITUTIONS

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Abstract

In this report, we propose a new educational framework for Thai engineers working in Japanese industrial companies in Thailand. Five National Colleges of Technology in Japan and King Mongkut's Institute of Technology Ladkrabang (KMITL) in Thailand made a team to establish a new framework. In a Japanese company, OJT (On Job Training) Method is generally considered valid for nurturing human resources in engineering. In the method, a senior engineer at work plays an important role. In foreign manufacturing companies, most senior engineers are the Japanese engineers, who face difficulties communicate with foreign freshmen who speak different languages, have different customs and come from different cultural backgrounds.

The purpose of a new framework we have established is to support companies with a complementary education system for young engineers. A consortium was established with institutions and companies which have branch factories in Thailand. In the consortium, needs were collected from companies before fixing a curriculum for young engineers working in Japanese companies or factories in Thailand. As a result, we made the framework composed of three phases.

In the framework, we pre-supposed that the companies send their Thai engineers to Japan for training in the main factory. A curriculum of Phase 1, which was held in Thailand before training in Japan, includes lectures for Thai engineers to understand cultural tendencies in Japanese companies. For example, a lifetime employment system. Next, lectures of Phase 2 were conducted in the Japanese National Colleges of Technology, when Thai engineers stayed in Japan. The phase 1 and 2 are a basic training curriculum adopting PBL (Problem Based Learning) Method about PLC, Microcontroller and so on. Finally, Phase 3 concerning higher level engineering topics and management of technology such as Quality Control management was provided by KMITL. After the lectures, the researchers examined how these lectures were conducted to educate engineers in companies. This framework could create a cooperative relationship among companies, and Thai and Japanese institutions, by implementing co-education and collaborative research.

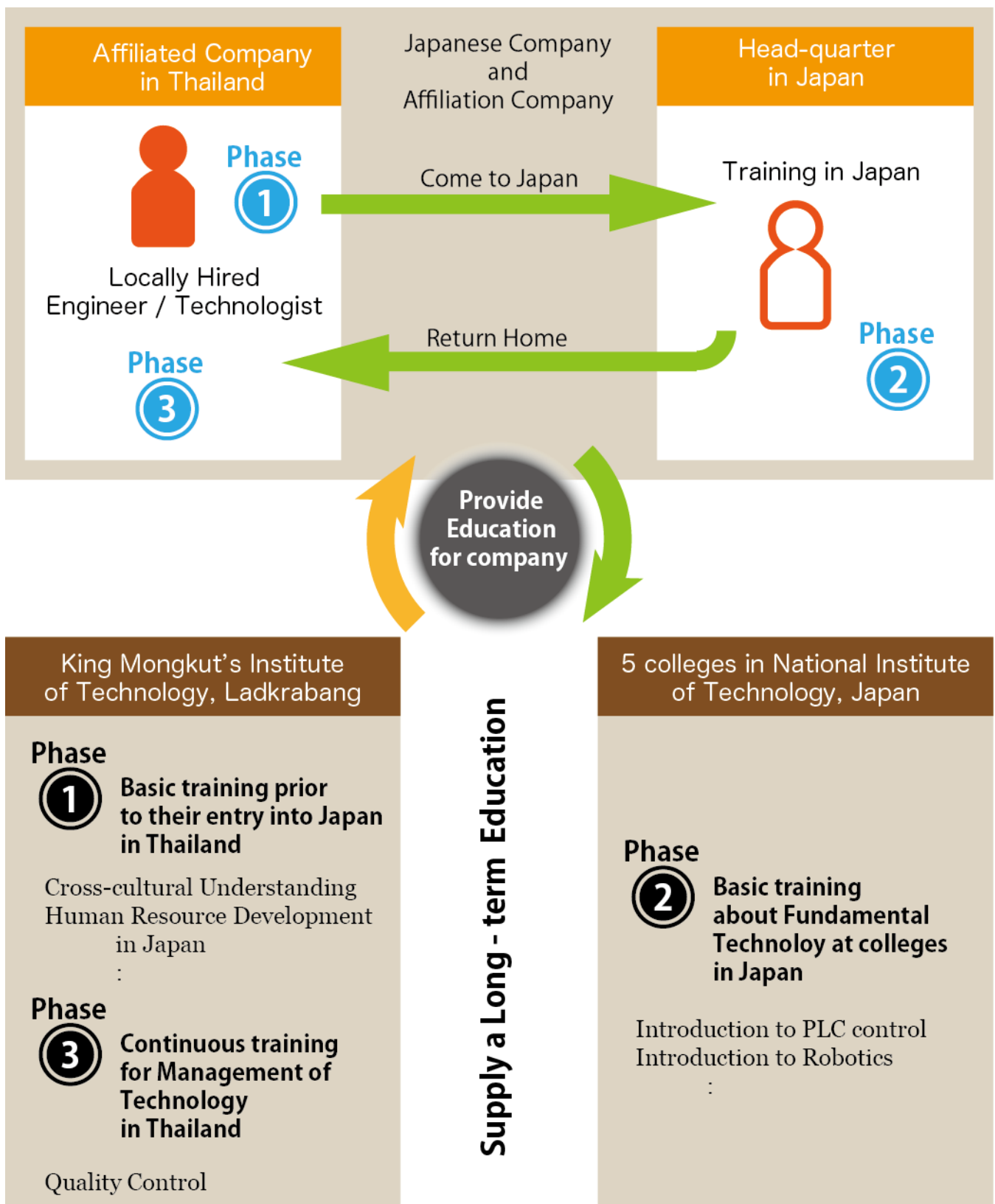**Keywords:** *Education, Company, Employee, Thai, International, Collaboration*

Introduction

Overseas factories which Japanese companies have in foreign countries are facing various problems especially in human resource management such as talented engineers and technologists. Most of this problem originates from a different custom of a career development in human resources between Japan and other countries.

Around the world, job-hopping is common among engineers and technologists to gain more talented skills. On the contrary, in Japan, the engineers and technologists directory get employment for companies after they graduate from universities and colleges. In companies, they accumulate experiences in various sections to become a manager. The Japanese companies have to pour the funds to foster employees' skills.

Large Japanese companies often have their own education system inside the companies. However, there are a few probabilities to lose educated and skillful engineers or technologists by their job-hopping. Furthermore, they are easy to obtain them by the job-hopping due to images of corporate brand. However, in most cases, small and medium scale companies cannot provide their employees with enough opportunities to educate them by their own, so they face a risk of losing engineers or technologists with higher skills and performances by job-hopping.

For example, Japanese automobile industry in Thai consists of Japanese suppliers divided into 5 classes referred as "Tier 1" to "Tier 5", under main car manufacturers. In this industry, some employees aim at

Affiliated Company in Thailand

Japanese Company and Affiliation Company

Head-quarter in Japan

Phase ① Come to Japan → Training in Japan

Locally Hired Engineer / Technologist

Return Home ← Phase ②

Phase ③

Provide Education for company

Supply a Long - term Education

King Mongkut's Institute of Technology, Ladkrabang

Phase ① Basic training prior to their entry into Japan in Thailand

Cross-cultural Understanding
Human Resource Development
in Japan
:

Phase ③ Continuous training for Management of Technology in Thailand

Quality Control
:

5 colleges in National Institute of Technology, Japan

Phase ② Basic training about Fundamental Technoloy at colleges in Japan

Introduction to PLC control
Introduction to Robotics
:

getting a job with a higher salary in a famous company, and others intend to step up to get another job to raise their technological skills.

Fig. 1   Concept Diagram of TIE-UP Project

Because of these industrial situations, the small and medium scale enterprises are required to prolong the term of employment and improve their working environment. As one of improvements, an education system for young employees should be improved. In 2011, the Small and Medium Enterprises Agency in Japan performed a questionnaire survey about improvement of the medium and small scale companies which have overseas services. As a result, 48.8% out of 892 companies worried concerning security, development and management of local human resources. Especially this tendency is remarkable in Thailand.

The Small and Medium Enterprise Agency (2011). *Environment-related Issues and risks faced on by affiliated Japanese-overseas companies.* Retrieved from https://www.mirasapo.jp/overseas/data/(Japanese).

Overview of Framework

To support small and medium scale enterprises which occupy a great majority of Japanese overseas affiliated companies from the side of employees' education, collaborative efforts have been made to set up a new framework among Japanese companies, a university in Thailand and the five colleges under National Institute of Technology, Japan. King Mongkut's Institute of Technology, Ladkrabang in Thailand (referred as KMITL) and National Institute of Technology will continue to have close cooperation for some years.

This pilot project was launched in 2013 and has been conducted for 2 years. As an important part of these elaborations, the education for employees has to be improved. The Small and Medium Enterprises Agency in Japan performed a questionnaire survey about competitiveness improvement of the medium and small-sized business on overseas expansion in 2011. In the result, 48.8% out of 892 companies worried concerning a secure, a development and a labor management of local human resources. Especially this tendency is remarkable in Thailand.

The Small and Medium Enterprise Agency (2011). *Environment-related Issues and risks faced on by affiliated Japanese-overseas companies.* Retrieved from https://www.mirasapo.jp/overseas/data/(Japanese).

Overview of Framework

To support the small and medium enterprises occupying a great majority of Japanese overseas affiliated companies from an aspect of the education, we are trying to construct a new framework in a collaborative effort among Japanese companies, a university in Thailand and 5 colleges under National Institute of Technology, Japan. King Mongkut's Institute of Technology, Ladkrabang in Thailand (referred as KMITL here after) and National Institute of Technology have a closely cooperation for some years.

This pilot project has been launched in 2013 for 2 years, and is referred as 'TIE-UP Project'. The term of TIE-UP is derived from "Education for International Technology Under Partnership". The concept of this project is shown as Fig. 1. In this project, KMITL, 5 colleges (Ishikawa / Okinawa / Turuoka / Fukui / Toyama) in National Institute of Technology and some industrial companies in Japan are participating.

In this project, it is expected that a Thai employee (as engineer or technologist) working in a Japanese affiliated company in Thailand can take a training at the headquarter in Japan.

First, it provides the Thai employee with basic trainings (called 'Phase 1') prior to their entry into Japan. The training includes "Cross-Cultural Understandings", "Human Resource Development in Japan", and other topics.

Second, while the employee stay in Japan, he/she can visit the nearby college, and take trainings for a basic technology (referred as 'Phase 2') such as "Introduction to PLC control" and "Introduction to Robotics", coordinated by each colleges.

Finally, 'Phase 3' is for higher technologies and a management of technology produced by KMITL in Thailand. An example of contents included in this phase is "Quality Control for Process Improvement".

This project through these 3 processes provides the employees working in Japanese affiliated companies, a most suitable and long-term education system.

Trial for 'Phase 1'

'Phase 1' supply contents for enhancement of 'Soft Skill' such as 'Cross-Cultural understandings between Thai and Japanese'. It was demonstrated to 15 Thai people for 3 days from November to December in 2013.

Trial for 'Phase 2'

5 colleges made various topics for the 'Phase 2' and tested with Thai students studying in each college.

(1) National Institute of Technology, Ishikawa College
    "PLC and Sequence Control"

(2) National Institute of Technology, Tsuruoka College
    "Introduction to Sequence Control"

(3) National Institute of Technology, Toyama College
    "Design and Production of Robotic Car
                        running on Line"

Topic (1) and (2) contributes to understand a usage of PLC, and it become a basic skill to control various production system.

Fig. 2   Photos of Trial for 'Phase 1'

Fig. 3   Photos of Trial for 'Phase 2'

Plan for 'Phase 3'

The department of engineering in KMITL formulated a plan for 'Phase 3' over several meetings. The plan contains following themes.

(1) Quality Control for Process Improvement
(2) Process Safety Training
(3) "OSHA29 CFR 1910.119 Process Safety Management of Highly Hazardous Chemicals"
(4) Workshop on Microelectronics Fabrication
(5) Workshop on Labview Programming with Applications on Industrial Communication Systems
(6) VHDL and FPGA Applications Workshop
(7) Hydraulic and Pneumatic Course
(8) CAD / CAM Course
This year, a few themes are scheduled to be held in some companies or KMITL.

Acknowledgements

TRAINING PROGRAM OF TECHNICAL ENGLISH USING ACTIVE LEARNING AT NGEE ANN POLYTECHNIC

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Abstract

As students in Japan rely heavily on the use of Japanese as the primary medium of instruction, we sought to expose them to an English-speaking learning environment by displacing them to a foreign school, where they had to attend technical lessons and give oral presentation in English, facilitated by non-Japanese-speaking instructors. In this paper, we report on the two-week technical English training program held at Ngee Ann Polytechnic in March 2014 for National Institute of Technology (NIT) students of Japan. A total of 8 students, 7 from the advanced course and 1 from the fifth year course, of various NIT's, from Hakodate, Kumamoto, Hiroshima and Tsuyama, participated. The technical English program was organized into 3 parts: (1) Lectures of physics, general English and presentation; (2) Research presentation; (3) Excursion.

Japanese students often find it difficult to present their research work in English due to the lack of lessons conducted in the English language. Through attending lectures in fundamental physics and general English, students re-learned these subjects in a different approach. They observed the way technical concepts were introduced in words and through the use of tools like pictures and animation. These lessons have not only provided them with valuable models to follow, but also provided them an experience that helped to strengthen their confidence in overcoming the language barrier. As a first step in encouraging students to present in English for the first time, we adopted a progressive methodology in giving them presentation assignments. There were three altogether. First, students were invited to explain their studies. In the second, students were given freedom to select topics of their choice in the area of quantum physics. They were asked to discuss and work together for the topic and the presentation. In the last presentation, students were asked to explain their studies again. It is interesting to see the improvement in the students' presentation skills in their last presentation assignment compared with their first. We noted that the lectures helped students in expressing technical terms and ideas, and assert the effectiveness of the physics and English lectures. As the last part of the program, the excursion created multiple opportunities for Japanese students to make Singaporean friends and interact with them in an informal mood. As they travelled together to Malaysia, many topics about cultural differences between Japan, Singapore and Malaysia arose naturally for conversational exchanges in English. To evaluate the effectiveness of the program and gather suggestions on points of improvement, we conducted a questionnaire with the student participants. Almost all felt that the lectures were substantial and were satisfied with the program. In view of the encouraging feedback, along with our observation of the students' interest and progress in class over the two weeks, we consider this program effective in improving students' technical English skill.

Keywords: *Technical English, Overseas training, Active learning, Intercultural understanding, Student exchange*

Introduction

This paper reports our technical English program at Ngee Ann Polytechnic in 2014. Abe et al. (2012) reported that National Institute of Technology (NIT) held a technical English program at Temasek Polytechnic with favourable outcome. The main focus of the NIT program at Temasek Polytechnic seemed to be the improvement of students' presentation skill. While the students had plenty of opportunity to speak, they might not have enough of it to attend lessons in English. In our technical English program at Ngee Ann Polytechnic, lessons in English were given considerable weight. Our main purpose was to import basic knowledge and skill of giving a presentation in English. We considered that these could be achieved through lessons in English. The instructors served as role models for the Japanese students to imitate, and their lessons as reference for learning presentation techniques. The lessons in our technical English program were organized into 3 parts:

(1) Lectures of physics

(2) Lectures of general English

(3) Lectures of presentation

In addition, students were required to present their research projects and to go for company visits and excursion.

This paper presents the program outline and the lecture details in Section 2 and Section 3 respectively. Section 4 analyzes the results of a questionnaire survey conducted with the student participants. Conclusions follow in Section 5.

Programme

The outline of our program is as follows:
Term: March 1 to 16, 2014
Number of participate students: 8
Grade of the students: 5th students or 1st student in advanced course
TOEIC Score: more than 400
Table 1 shows the affiliation, grade, and number of various student participant groups.

Table 1: Details of student participant groups

College	Grade	Number
Hakodate	Advanced 1st	4
Hirosima	Advanced 1st	1
Kumamoto	Advanced 1st	1
Tsuyama	Advanced 1st	1
Tsuyama	5th	1

The average TOEIC score of student participants is 478.75, with a range from 370 to 560. We regard these numbers to be typical of college students'. These students might not be strong in English but were motivated English learners. Before leaving for Singapore, they were asked to submit short self-introduction and their research project reports in English. Since no serious mistake was found in the reports, we gathered that the students had acquired basic English skills. A photo of the student participants is shown in Figure 1.

We prepared a guide brochure for this program and distributed it to the students before departure to Singapore. We had no time to meet all student participants, since they came from different colleges. Each student was to prepare for the program by himself. The cover of the guide brochure is shown in Figure 2. It included the Singapore map, the subway (MRT) route map, travelling and daily life information in Singapore, flight and immigration details, unchecked baggage limit, hostel and room assignment information, participants' list, and program schedule.

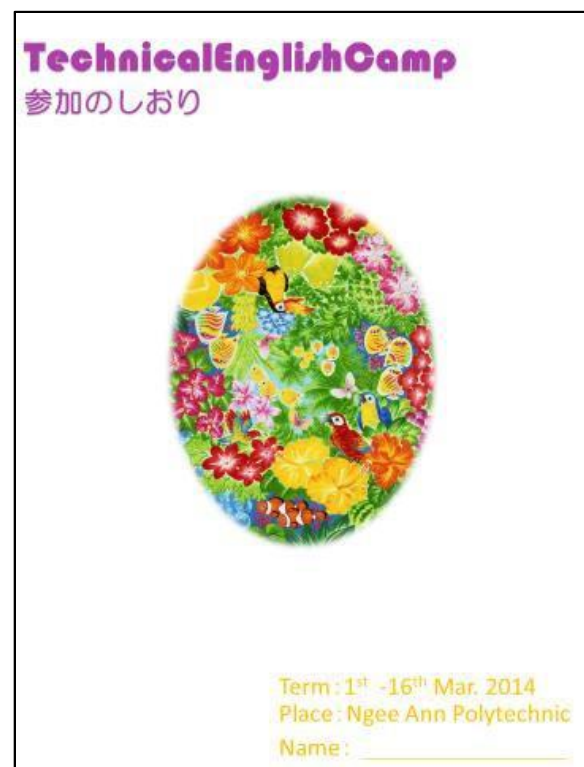**Figure 1: All student participants at the front of the hostel**

Figure 2: The cover of guide pamphlet

Contents of the technical English program

The lectures in this program can be separated into the following 3 parts:

(1) Lectures of physics

(2) Lectures of general English

(3) Lectures of presentation

There were three lectures on presentation skills in the program. In the first lecture, students learned to design Power Point animation. As they had all used Power Point before, they had no problem understanding the lecture.

The students learned how to use Prezi in the second lecture. As it was their first time to use Prezi, the tool appeared hard for them to use efficiently. In the third and last lecture, students were asked to present their research projects for the second time. The first time was in the opening session of this program. Their presentations in the last lecture were better than in the opening session. We attributed that to an improvement of their presentation skills through the program (see Figure 3).
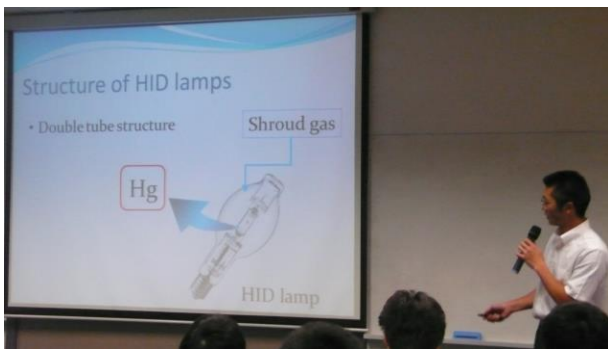

Figure 3: A scene of a student's presentation in the last lesson

On a daily basis, students attended lessons in physics and general English. If the physics lesson was taken in the morning, then the general English lesson would fall in the afternoon. As each lesson lasted for about three hours, the students took six hours of lesson in total on a typical day.

The physics lessons dealt with classical mechanics mainly. Besides topics like vector, velocity and speed, distance and acceleration, more advanced ones such as relativity were also discussed. The teaching materials were original and were shown by projector to students (see Figure 4). The topics in the lessons were similar to those in first grade physics in the participants' colleges. However the students did not have much experience of taking them in English and some students had forgotten some of those topics. The physics lessons were fruitful but still hard to the students.

Conversation accounted for a majority of the general English lesson activities. Student participants were a little shy and some might not be able to follow the conversation. However the general English lessons were not harder than physics to the students, since fewer technical terms were involved. Moreover the textbook,

"NORTHSTAR 1 Listing and Speaking", was pitched just right at the level of the student participants.

The students sometimes worked on physics and general English assignment at the hostel until midnight. These lessons seemed to have a positive impact on their attitude towards learning English.

Besides the lessons introduced in the above, the program comprised campus tour, company visits and a one-day trip to Johor Bahru in Malaysia.
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Figure 4: A scene of physics lesson

Figure 5: A photo taken during the campus tour

Students visited the Alpha Center of Ngee Ann Polytechnic during the campus tour (Figure 5). They were invited to a demo of the micro mouse and the image recognition robot, and had a glimpse into biomedical engineering in a laboratory. They went to SingTel and NEWater for the company visits. The one-day Johor Bahru tour was for sightseeing but absolutely enjoyable to the students.

Result of questionnaire survey

After the program, we conducted a questionnaire survey with the students to identify areas of improvement for the program. The survey contained 16 questions; 13 of them were multiple choice questions, and the remaining 3 were narrative type of questions.

The multiple choice questions are shown in Table 2. The numbers in the parentheses indicate the frequencies at which the choices appeared. Students supported their choices with reasons in some of these questions.

Table 2: Summary of questionnaire results

No.	Question	Response
1	The length of period:	Short(2)

		Long (2)
		Appropriate(4)
2	Timing	Suitable(7)
		Unsuitable(1)
3	Cost	Inexpensive(1)
		Expensive(2)
		Appropriate(5)
4	Degree of satisfaction	Satisfied(5)
		Almost satisfied(3)
		Dissatisfied(0)
5	Visiting SingTel	Very meaningful (0)
		Meaningful(4)
		Not meaningful(4)
6	Visiting NEWater	Very meaningful (2)
		Meaningful(5)
		Not meaningful(1)
7	One-day trip	Very meaningful (5)
		Meaningful(1)
		Not meaningful(2)
8	Difficulty of the lessons	Very easy(0)
		Easy(2)
		Suitable(0)
		Hard(5)
		Very hard(1)
9	Comprehension of the lessons	About 30%(1)
		About 50%(1)
		About 70%(6)
		About 100%(0)
10	Meaningfulness	Very meaningful (3)
		Meaningful(5)
		Not meaningful(0)
11	Activity for lessons	Active(2)
		Little bit active(5)
		Not active(1)
12	Motivation to learn English	Enhanced(6)
		Enhanced slightly(2)
		Same as before participating(0)
		Deteriorated slightly
		Deteriorated(0)
13	Attitude for different culture	Changing very(4) much
		Changing slightly(3)
		Same as before participating(1)

Question 4 asked the students to rate the degree of satisfaction for the program. No student participant was dissatisfied with the program. Based on the comments, the students found the experiences in this program meaningful and their life in Singapore enriching. Furthermore they managed to make Singaporean friends and to communicate with them in many occasions. That was one of the reasons for choosing "Satisfied". Question 5 asked for their impression of the SingTel visit. The students did not choose "Meaningful", since the briefing by a SingTel staff seemed to be too complicated for the students understand. A student felt that the visit was too short for him to understand much.

Question 6 was about the impression of the NEWater visit. The students could identify with Singaporeans on their water problem and understand the different positions Singapore and Japan are in with regard to water resource. NEWater has a variety of facilities in place for visitors and a guide at NEWater could speak Japanese. As a result, almost all students chose "Meaningful".

Question 7 asked for the impression of the one-day trip. It was the first visit to Malaysia for all students and some felt that Malaysia was very different from Singapore. There were many opportunities for the Japanese students to communicate with Singaporean students in this trip. The Japanese students made an effort to talk to Singaporean students in English. They chose "Meaningful".

Question 10 inquired about the meaningfulness of the lessons. The students chose "Very meaningful" or "Meaningful". There were several reasons for the students' answers. It was their first time to take a series of lectures in English and the lecture style in Singapore is very different from that in Japan. The students felt that attending these lectures was a very valuable experience. That was one of the reasons for the students' choices. Another reason was that the lectures had many helpful points in introducing technical presentation in English. A student answered that the lectures provided a means for preparing presentation in English and the physics lectures conducted in English were meaningful.

Question 12 was concerned with the change of students' motivation to learn English. The students felt that their motivation was enhanced after participating in the program. The implication is that this program could serve as a stimulus to the students' motivation. Some students felt that their listening skill or communication skill could be improved. Others would like to speak English well since they were aware that their English skill was inadequate and would like to expand their English vocabularies. Moreover some students would like to talk to Singaporean friends fluently. They chose "Enhanced" or "Enhanced slightly".

Question 13 was concerned with the change of the students' attitude towards a different culture. A student chose "Changing very much", since Singaporean students were very friendly and he enjoyed communicating with them. Communication with Singaporean students had an influence on the students' choices.

From the students' answers in the questionnaire, it is evident that the program was successful in enhancing students' motivation to learn English and in improving the students' English skill.

Conclusions

This paper reports the technical English program at Ngee Ann Polytechnic in 2014. We consider that this program has completed successfuly. Nevertheless we think that the program can still be improved in some

areas as specified in the students' comments in the questionnaire.

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TO INCULCATE THE WILL TO LEARN ENGINEERING IN STUDENTS BY MAKING IT RELEVANT

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Abstract

The aim of this program is to inculcate the interest of students to study Engineering by linking it to the immediate life of the student increasing his will to study. A lecture was conducted on concrete as a part of composite in a class at a junior high school. Before and after the lecture, questionnaire surveys were carried out for 308 junior high school students and evaluated the change of the will to learn by linking the lesson to the immediate life of the students and changing in their impression of the topic, for example that of concrete on students. At first, the lecture asked about concrete that was used for downtown living and was just another part of life in the state of things. Later, it was taught that a safe and convenient way of living was possible thanks to concrete. Then, the materials included in the constitution of concrete were taught. It was explained that the quality of the concrete increased because good use was made of a lot of things like industrial waste and industrial by-products mixed with concrete.

In addition, a concept called "the eco-concrete" was explained, with many people having an image that concrete destroyed the environment. However, the concrete which considered the environment recycled materials and their usage introduced in many cases. The viewpoint that the lecturer kept in mind during the lecture was that "the concrete is interesting". As a result, more than 80% of the students wanted to know more about concrete, thanks to the imminent use of concrete around them, as taught by the lecture. Children staying away from Science is of concern in Japan, but it is caused by the fact that scientific or technical concepts are not made real to the experiences of the students. As from this lesson, it became clear that if teachers could share the results of research with the immediate life of the students, then the depths of learning can take place, like this lecture.

Keywords: *concrete, ecological concrete, the changes of impressions about concrete, junior high school students, integrated study*

Introduction

Concrete is used to construct various structures so that there are a lot of advantages as construction excels in strength and durability, is large degree of freedom in the design, and is easy, and is economical, etc. However, someone doesn't know well about concrete and doesn't notice almost constructions are built with concrete.

There are a lot of negative images "Inorganic quality" and "It is cold" as for the general image that concrete gives people. It can be expected to lead to new development of concrete if such a concrete negative image is wiped out, and various people can be told a concrete charm.

The aim of this program is to improve opening width of interest, the interest of students by knowing the imminent technique, learning will wanting to study. A lecture was performed about the concrete as a part of composite learning class carried out this time at a junior high school. Before and after a lecture, questionnaire surveys (Figure 1) were carried out for 308 junior high school students and evaluated a change of the learning will of the interest by knowing the imminent technique in life and the change of the impression for the concrete.

Contents of the lecture

At first the state was lectured that concrete was used for around downtown and lived a life among concrete in state of things, or it was explained whether a safe, convenient living was found thanks to concrete (Figure 2,3). It is too important to notice all technologies make our life safety, convenience and prosperity. Then, Concrete t was introduced here.

Then, included materials to constitute of concrete were explained (Figure 4). The recent concrete explained that performance and quality of the concrete increased because a lot of things that industrial waste and an industrial by-product were made good use of mixed them with concrete on this occasion.

In addition, a concept called "the eco-concrete" was explained. Many people had an image to destroy environment about the concrete, the concrete which considered environment in use materials and usage introduced what was developed in many cases. In these slides show planting plants by using porous concrete, one of the eco-concrete (Figure 5).

(a) for before lecture

(b) for after lecture

Figure 1 Questionnaire survey

(a) concrete at city   (b) roles of concrete

Figure 2 Slides about introduction of the lecture

The surprising is the most important impression to make people have interest. Then, music instruments made with concrete and small articles made with coloured concrete in this section (Figure 6).

As the viewpoint of this lecture, the lecturer has to keep mind as "the concrete is interesting" during the lecture on this occasion.

Results and Discussion

Figure 7 shows results of questionnaires survey and images about concrete were changed by the lecture. Negative images, cool, dismal and dirty, of concrete were decreased. And positive images, warm, interesting, cheerful, fun and beautiful, were increased. It has been

(a) concrete for flood control

(b) concrete for pavement
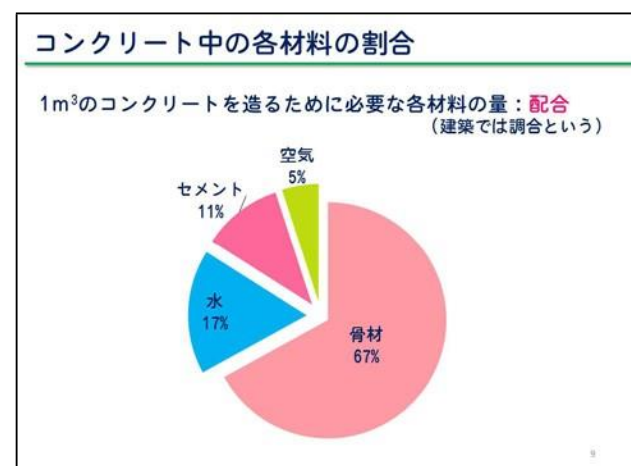

(c) concrete of underground

(d) concrete for railways

Figure 3 Slides about concrete at around our life

(a) materials of concrete

(b) mix proportion of concrete

Figure 4 Slides about materials of concrete

(a) planting test with Porous concrete

(b) putting down root to inside of porous concrete

Figure 5 Slides about Eco-Concrete

(a) concrete guitar

(b) coloured concrete
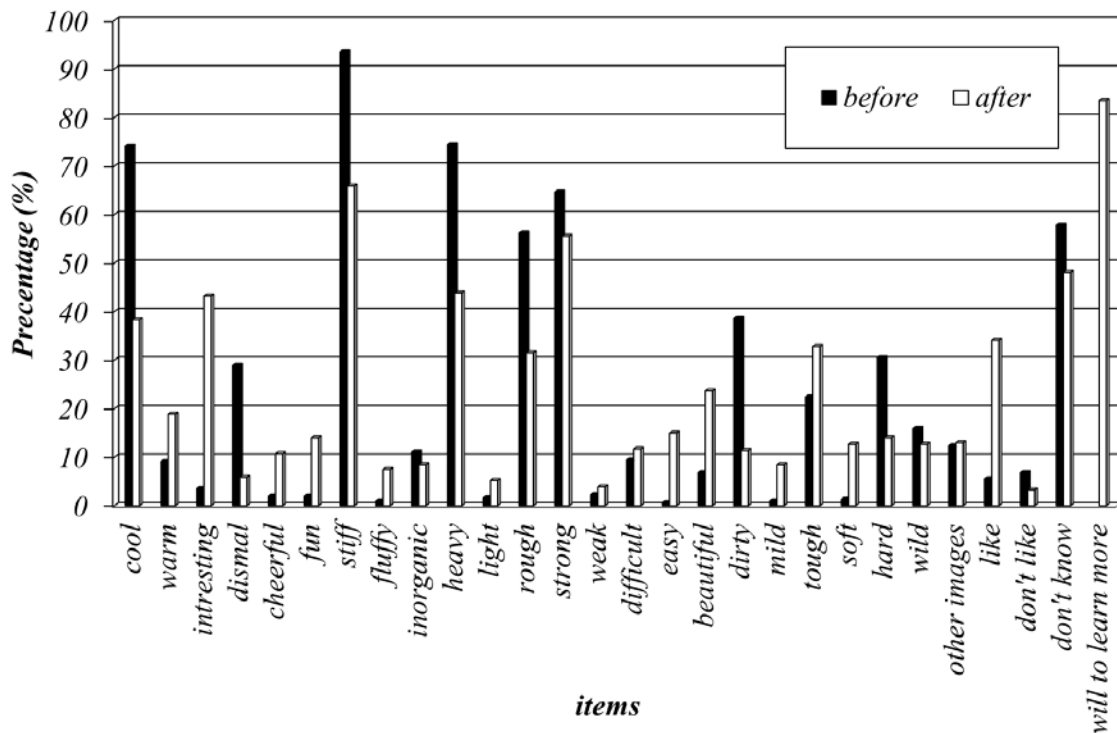
Figure 6 Slides about concrete of interests

Figure 7 Results of questionnaires survey

understood that the lecture was effective in the improvement of the image of concrete from this.

The number of students who "like" concrete and who "will to learn more" about concrete were increased after the lecture. From the results, the most important thing is a lecturer's mind In Japan, keeping away from science of children becomes the problem. However, the problem is an adult's problem, not for children.

Conclusions

As a result, more than 80% students wanted to know more concrete by knowing the imminent concrete by the lecture. Keeping away from science of children is concerned about in Japan, but is caused by the fact that it is scientifically or technically rare by imminent various phenomena and opportunity to think now. As for this problem, what was solved became clear if teachers could tell about various results of research and in the depths of an imminent thing from development section like this lecture.

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DEVELOPMENT OF ROBOT DESIGN AND CONSTRUCTION PROGRAM BASED ON PBL EDUCATION

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Abstract

System design and development are fundamental capabilities for an engineer. The Department of Control Engineering of the Nara National College of Technology has been offering "Practical System Design" in the fourth grade for about 20 years. In this class, students have 45 hours to design and construct an autonomous mobile robot. Each class of about 40 students is divided into six teams (six–seven students per team). Additionally, the end of the school year is highlighted by a robot competition. "Practical System Design" is a unique opportunity for students to experience the entire process of developing an autonomous mobile robot. But in recent years, robot design and construction have become a huge challenge for them.

To address this problem, we have worked on improving the curriculum. First, we have introduced a problem-based learning (PBL) education program in all engineering experiment classes in grades 1–3. By increasing the students' exposure to robot design and construction, they are able to substantially improve their system design and development capabilities. The second step in solving the problem is to collaborate with corporate technical experts, who participate in class sessions. Through these experts, we can introduce practical methods for design concept and development, to the class. At the same time, the students can consult them regarding the robot they are building. Third, we have heightened the students' awareness of the PDCA (Plan, Do, Check, and Action) cycle. We have required them to hand in a work report after each class. The report is reviewed by the teachers and corporate technical experts and then returned to the students, and their technical writing capability in quantitative form is honed in the process. By improving the curriculum, we aim to cultivate engineers who not only have practical skills, but also have problem-solving abilities as well. In this paper, we discuss the approach, the progress of the improvements, and future subjects, in detail.

Keywords: *engineering education, PBL education, engineering experiment, cooperation work, system design, autonomous mobile robot*

Introduction

Problem solving skills are important for engineers, and they are usually honed through practical experience. In the Department of Control Engineering at the Nara National College of Technology (NNCT), Japan, the course "Practical System Design" has been offered in the fourth grade for 20 years (Michishita et al., 2011). In this class, students study system design and development capabilities through the design and construction of autonomous mobile robots. However, for some students, it is challenging to design and construct autonomous mobile robots owing to a lack of design and construction experience. Additionally, it is difficult for students to gain problem solving skills because of insufficient practice involving schedule management, role sharing, report writing, etc.

The aim of this research is to develop a new robot design and construction program based on problem-based learning (PBL) education. In this paper, we discuss in detail the approach that was employed, the current state of the improvements, and future related issues.

Approaches and Methods

To solve these problems, our approach involves two steps. First, we focus on the introduction of a multistep experience-based problem-solving program in grades 1–3. In this program, students construct an autonomous mobile robot using LEGO MINDSTORMS. Thus, students have many opportunities to experience the process of robot design and construction. Figure 1 and Figure 2 show the schema of this program and the contents of the program for each grade. By offering the opportunity to experience the process of robot design and construction from the first grade, students can understand the need to learn special subjects such as

electric circuits, control engineering, material mechanics, and engineering drawing. Moreover, the contents of this program evolve as the students advance to the next grade. For example, in the first grade, students work on the program using GUI-based programming and attached components. In the second grade, they work on the program using control circuits that they have developed themselves, and CUI-based programming.
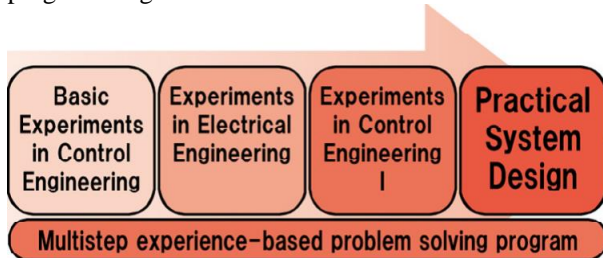

Figure 1 Multistep experience-based problem solving program.

Figure 2 Contents of the multistep experience-based problem solving program in each grade

Second, we introduce to the class several new approaches such as report writing, awareness of the PDCA (Plan, Do, Check, and Action) cycle, and 3D CAD. Additionally, we increase the number of teaching staff members from 8 to 10 (3 academic, 1 corporate technical expert, and 6 technical). The corporate technical expert who designed the basic robot used in the class can respond to technical questions presented by students. Technical staff members can offer guidance for machining.

Table 1 shows the schedule of the class. The class consists of 30 sessions, each of which lasts for 90 min. In the class, 40 students are divided into 6 groups (6 or 7 students per group). Students in each group design and construct an autonomous mobile robot using the basic robot (Figure 3). Specifications of the basis robot are as follows: it has Omni wheels, several sensors are mounted (acceleration sensor, angular velocity sensor, ranging sensor, and light sensor), and Raspberry PI is adopted as the CPU board, and can be used for the processing of sensor data, wheel control, and the control of the USB camera. Further, Raspberry PI offers a C programming environment.

The challenges and rules of the competition change yearly. The outline of the competition contents for the

Table 1 Schedule of Practical System Design class

Week	Course contents
1	Guidance of the class, Disassembly of the robots which made last year
2	Study of mechanism (cam mechanism)
3	Explanation of the contest rule, Description of the base robot 1
4	Description of the base robot 2 (programming practice), Grouping (7 students × 6 groups)
5	Description of the base robot 3 (programming practice)
6	CAD lecture
7	Concept design review （Reviewer: subject teachers, staffes of technical support section)
8	Robot design (circuit, program, mechanism), drawing
9	
10	Due date of submission (design drawing, parts ordering sheet)
11	Construction of robot
12	
13	
14	
15	1st competition (remote control, debris removal)
16	Construction of robot
17	
18	
19	
20	
21	2nd competition
22	Improvement of robot
23	
24	
25	
26	
27	
28	Final competition
29	Presentation
30	Review

Figure 3 Basis robot (omnidirectional mobile robot)

current year is as follows. Students are instructed to design and construct a rescue robot. In the competition, students are to control the constructed robot by remote control, and rescue 10 dolls (we used dolls as survivors in need of help) left behind on the competition field (1.6 m × 3.6 m). After rescuing the dolls, the students

control the robot and drive the dolls to the designated help station. The competition field is littered with debris. Therefore, the students are also required to collect the debris using the robot. The time limit for completing this task is 3 min. Each group gains points after each success of the designated motion. The overall ranking is determined based on the total number of points gained.

Results and Discussion

The approaches described above were newly introduced this year. Thus, we have not obtained adequate results to discuss their effectiveness. In this section, we summarize the current status of the class.

We require students to submit a written report after each class. The goal of the report is to help to improve the students' schedule management, role sharing, and work recording skills. In addition, it helps to increase their awareness of the PDCA cycle. These reports are reviewed by subject teachers and assessed for logicality and quantitative representation. Students then go through the results of the review and resubmit corrected reports. Figure 4 shows the format of the work report.

Work Report

Date :

Robot name

Name

| Objective of this week PLAN |
| Describe today's your work with figure. DO |
| Describe today's status of the achievement in quantitative foam. CHECK |
| Find and describe some helpful things from working of other students and reports written by other students. |
| Describe your next problem based on your reflection and the helpful things described above. ACTION |

Figure 4 Format of the personal work report

The number of marks allocated for the report indicates the need for modification, and decreases as the written report is repeated. Therefore, we believe that this work report helps to improve students' writing capabilities, especially with regards to the logicality and quantitative representation.

Students designed and constructed an autonomous mobile robot using handwritten drawings prior to the introduction of 3D CAD. After the introduction of 3D CAD, students can easily review their robot design, including interference caused by different parts. This approach also helps in their description of the robot, sharing of the robot design, and work efficiency. Figure 5 shows an example of the 3D robot model designed by some students.
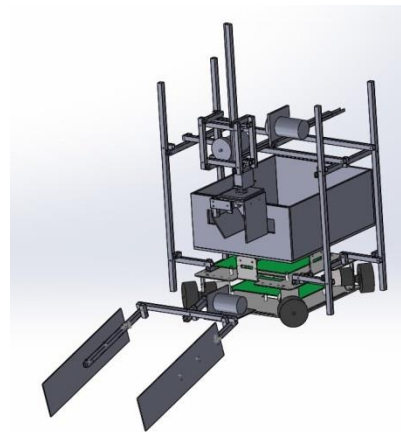

Figure 5 Robot design using 3D CAD system

Conclusions

To improve the problem solving skills of students, we have introduced a multistep experience-based problem solving program for first to third grades students. This program enables the seamless transition to the "Practical System Design" class, which is offered in the fourth grade. Further, we designed the contents of this program such that it evolves as students advance to subsequent grades. We also made improvements to the Practical System Design class, including to the class an introduction to report writing, awareness of the PDCA cycle, and the 3D CAD system. We have also increased the number of staff members teaching different subjects. Since carrying out these improvements, there has been a reduction in the number of marks indicating the need for modification of work reports. Because this class is currently in progress, we will present an update of its status at the conference. There remains a need to develop a quantitative evaluation method for problem solving skills.

Acknowledgements

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