PBL between KMUTT and SIT in both Thailand and Japan in cooperation with GTI consortium

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Abstract

As well known, problem based learning among different countries has large potential on the education. In our
Shibaura Institute of Technology(SIT), a lot of program are also already held among various countries, for
example Vietnam, Malaysia, Thailand and so on. The period of the most programs is less than two weeks due
to the limitation of the student’s cost and to the difference of the academic schedule among countries. Therefore,
the period two weeks for PBL is not sufficient in the case that the PBL’s work manufactured by students. In
this report, the PBL program between SIT in Japan and King Mongkut's University of Technology Thonburi
(KMUTT) in Thailand is presented. In the program, the students work 8 days in SIT and KMUTT
respectively. There is 2 months interval set between the PBL program in SIT and in KMUTT. Owing to the
interval period, the students can complete the work which is almost same amount spent in more than one
months. Additionally, in order to make the student’s motivation higher in the program, the topics of the PBL
is given by the corporation which is member of Global Technology Initiative Consortium(GTI).

Keywords: PBL, GTI consortium, global technology initiative, bi-directional education, industry-university
collaboration

1. Introduction

In a few ten years, a PBL program is introduced in university education in addition with the conventional
lecture, experiment and practice. Moreover, the PBL program with foreign students, we call global PBL, is attracting a
great attention in order to give the experience of the cooperation with foreign students and to broaden the sight to innovate
new engineering field through the global PBL program. In our Shibaura Institute of Technology(SIT), a lots of program
are also already held among various countries, for example Vietnam, Malaysia, Thailand and so on[1]. To increase
education effect of the PBL program with foreign students, we pay attention to the connectivity from practice or
experiment subjects opened from 1st year to 3rd year in our own curriculum to the global PBL program. The students
should be able to join the program actively and to grow largely during the global PBL. Figure 1 shows the curriculum
flow related on the experiment and the practice subjects from 1st to 3rd year of the department of the electronic

**Fig.1. Curriculum flow on practice and experiment subjects of Department of Electronic Engineering in SIT.**
engineering in SIT. The students learn the basic knowledge and skill about the experiment in 1st and 2nd year. And they do professional experiments and cooperated work in 2nd and 3rd year. By gaining the knowledge and skill in the experiment and practice, the student apply to attend the global PBL program. In SIT, we have 5 sending global PBL programs where the students work in the foreign university. In some programs, we collaborate other departments in SIT. In each program, we set the priority year for the attendances according to the program contents. Moreover, we have 4 accepting programs where the students work in our universities with foreign student. In other 4 sending programs or 3 accepting programs, the start subjects are given to the student, for example extension of line trace robot or the creation of the system using camera and raspberry PI. And the member in accepting is different from the member in sending program. When we start our PBL program, we announce the students that the program consists of sending and accepting schedules.

In this report, the PBL program between SIT at Japan and King Mongkut's University of Technology Thonburi(KMUTT) at Thailand is presented. In the program, the students work 8 days in SIT and KMUTT respectively. There is 2 months interval set between the PBL program in SIT and in KMUTT. Owing to the interval period, the students can complete the work which is almost same amount spent in more than one months. Additionally, in order to make the student's motivation higher in the program, the topics of the PBL is given by the corporation which is member of Global Technology Initiative Consortium(GTI).

2. Overview of the Program

In our PBL, the students aim to complete the system related to the keywords, "microcomputer, sensor, control, communication, sound, bio-signal, light". We expect the students to cooperate more tightly and to communicate each other more frequently in order to determine their goal. 10 students from both universities attend the program. Each team is two SIT students, two KMUTT students. And they work together in 8 days at KMUTT, Thailand. After the PBL in KMUTT, they work in 8 days at SIT, Japan. Table 1 shows the brief introduction of our PBL. As is introduced in the previous section, our department in SIT has 5 sending programs. We announce the students to call for all global PBL programs in the beginning of new academic year. Because the start month in the new academic year, the announcement of the PBL in KMUTT is different from in SIT. The difference of the academic year gives the some disturbance to going and coming to each university in global PBL program like our program. After the selection, the students need to create project plan. And they determine the team by reviewing the project plan and discuss their project goal before the program starts. At first, the PBL program starts in KMUTT. In this year, the program is held in the beginning of September. Until the program in SIT starts, the students proceed each project at own university. Next, the program in SIT starts and the students complete the project and give the final presentation.

Table 1. Schedule of PBL.

<table>
<thead>
<tr>
<th>April</th>
<th>Announcement of the PBL in SIT and selection of the member form SIT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>Announcement of the PBL in KMUTT and selection of the member form KMUTT.</td>
</tr>
<tr>
<td>Mid., August</td>
<td>Submission of the project plan from SIT and KMUTT</td>
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<tr>
<td>End., August</td>
<td>Students discuss each other by LINE or e-mail and determine the pair after reading the project plan.</td>
</tr>
<tr>
<td>September</td>
<td>PBL program in KMUTT. Students determine the goal and schedule of the project in each team.</td>
</tr>
<tr>
<td>October - November</td>
<td>Students proceed the project at each university.</td>
</tr>
<tr>
<td>December</td>
<td>PBL program in SIT. Students try to complete the project and give a presentation in each team</td>
</tr>
</tbody>
</table>

3. Student's works and evaluation

The students can determine the project goal freely in the relation of the keywords. In this year, to increase the student's motivation, TAKAMISAWA CYBERNETICS CO., LTD. who are the member of GTI consortium gives the hints of the project goal. By relating the practical problem, we expect the students to work more actively. Table 2 shows this year's project titles.

Table 2. Title of the student's goal.

| Identification of coins and calculate total coins |
| Recognize a coin by "Sounds" |
| The development of identification sensor |
| Removing some bugs and dirt from light sensor |
| Identify coins by detecting differences in sound vibrations |

TAKAMISAWA CYBERNETICS CO., LTD. develops and manufactures transport equipment like ticket vending machines, mechatronics modules like a ticket printing module, entrance/exit control gate system for train platform. Before beginning of the creation of the project plan, Takaisawa Cybernetics engineers explained the students...
their manufacturing products and the problem on their products. And then, the students decided the project goal. This year, the all team were able to finish the system and to demonstrate in the final presentation owing to two months duration.

   About the student's idea, several comments were described as follows;
   1) Change of sound or vibration generated by the collisions of coins is thought to be quite interesting. I think it interesting that, on group 1, three sound components were observed during operations (when coins are collided with aluminum block, the shapes are distorted, and finally they are settled)
   2) How to light up the objects during capturing the image of coins is a quite important issue. It was also hard for us to optimize the way to light up to improve the detection accuracy.

4. Collaboration with GTI member company
   In 2015, GTI Consortium was founded to foster global engineers / scientists and create technological innovations by strengthening the collaborations between industry-government-academia based in Japan and Southeast Asian countries.[2] From TAKAMISAWA CYBERNETICS CO.,LTD., the managers and employees participated in the final presentation and looked the demonstration of the student's work. They were impressed and got inspired with the student's work. They also gave the following comments;

   1) General manger, Takeda described "First of all, I was very impressed to see that students were working very positively. Also, I thought that I could fully appreciate the attitude of trying a method that we normally do not think of and trying to shape it somehow. I think it is difficult to immediately put these ideas into practical use, but it was a great stimulus for us as well."

   2) Deputy general manager, Uehara described "Before attending the final presentation meeting, we had no idea how the students had tried to such a specific technology. However, we found that each group extracted appropriate features from measured signal for classification or discrimination, and they paid attention deeply to the fluctuation of features by the perturbation or the change of external environments. We were pleased to see that each group did the best by using original methods. The students had tried to solve the problems by unique ways. We found all the groups focused on how to extract the parameters for discriminations on the try and error basis."

   3) Deputy director of Technical center, Tokumura described "It was my pleasure to know that every participant was working so hard on their topic. I hope they were able to gain the happiness or some feeling to achieve their goals, throughout this workshop. In addition, frankly speaking on their final output, I think they will later learn the sense about the scale or the speed of the product itself in their future. However, It was very interesting to see their idea to utilize the material such as ceramic or marble stone as a coin-detecting sensor. About their final presentation. Overall, it was not so unique and free method as expected since the topic was provided at short notice and there was not much time to prepare. One thing I got concerned about was that a group was using the laser sensor that can be harmful to human body. When using this king of harmful sensor, we have to be careful about the surrounding environment, and I wonder if it was the environment that we could completely avoid the laser light hitting the eyes in the room."

5. Conclusion
   We consider to create the PBL with foreign students that gives the high education effect in the corporation with the company. To make the educational effect of the program increase, we also ask the students the questionnaire on the following terms;
   1. You enjoy the PBL.
   2. The PBL inspired your communication with foreign people.
   3. The PBL improved your English communication abilities.
   4. The period of PBL is appropriate.
   5. This PBL need to be held at both Thailand and Japan.
   6. Activities in Thailand
      6-A. The factory tour is necessary in Thailand. (This PBL doesn't have a factory tour in Thailand.)
      6-B. The field trip is necessary in Thailand.
   7. Activities in Japan
      7-A. The factory tour is necessary in Japan.
      7-B. The field trip is necessary in Japan.
   8. The number of presentations is appropriate.
   The students answered above questions by 5steps, "strongly agree", "agree", "neither agree nor disagree", "disagree", "strongly disagree". Most of students answered "strongly agree" and "agree". We continue to develop this program to make the students foster greatly.
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Biography

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References