An Interim Report of a Four-Year Joint Global Engineer

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An Interim Report of a Four-Year Joint Global Engineer Education Program Conducted by Japanese & US Universities

Abstract

The Kanazawa Institute of Technology (KIT), Japan, and Rose-Hulman Institute of Technology (RHIT), USA, started international educational and research exchange activities in 1992. Since then, they have actively engaged in faculty and student exchange programs. However, these are basically short-term, at most, one-year programs.

In order to expand the international exchange activities further, the two institutions organized the "KIT-RHIT Joint Committee" in 2010. The committee members discussed the objectives and agreed that they should aim for developing a new scheme to foster global engineers together over a longer period of time. The new program, "Joint Global Engineer Education Program" was launched in 2011. It is a four-year undergraduate program, and upon completion, a certificate of a second major is to be given. Both KIT and RHIT student participants attend special joint lectures and participate in joint project work in addition to required language courses and special subject courses at their own institutions. The joint lectures by the guest speakers who themselves have global work experiences are delivered through a web conference system and held about once every three months. The joint projects are composed of two types: Type A and Type B. Type A is a video-conference project in which students of both institutions stay in their own institution, form one joint team, and work together by communicating through a web conference system. Type B is a face-to-face project held during the 2nd and 3rd years of the program. What is unique about this program is that students are able to understand what the necessary skills and competence for globally-active engineers are through the lectures while developing such skills and competence for themselves through interaction with the project partner students using both English and Japanese.

The authors had an interim assessment of the students' performance and progress in learning objectives of the Joint Global Engineer Program. Initial findings reveal that the Global Engineer Education Program is effective in fostering global engineers.

1. Introduction

The 21st century has witnessed the rise of so-called "no-boundary" internationalization. The engineer of the 21st century will need to be much more socially and environmentally conscious

as engineering is now conducted on a global scale. The National Academy of Engineering of the United States released a report which concludes that an engineer in 2020 must be flexible and capable of operating in a world where "social, cultural, political, and economic forces will continue to shape and affect the success of technological innovation." [1] Dowell et al released a report which concludes that engineering colleges must not only provide their graduates with intellectual development and superb technical capabilities, but also follow the lead of industry to educate their students to work as part of teams, communicate well, and understand the economic, social, environmental and international context of their professional activities[2]. These changes are vital to the nation's industrial strength and to the ability of engineers to serve as technology and policy decision makers.

The Kanazawa Institute of Technology (KIT), Japan, and Rose-Hulman Institute of Technology (RHIT), USA, signed "Memorandum of Understanding Between Kanazawa Institute of Technology and Rose-Hulman Institute of Technology" in 1992 in order to promote international educational and research exchange programs. In order to expand the international exchange activities further, the two institutions organized the "KIT-RHIT Joint Committee" in February, 2010, including faculty and staff from each institution. The committee members discussed the objectives and agreed that they should aim for developing a new scheme to foster global engineers together over a longer period of time. The new program, "Joint Global Engineer Education Program," was launched in 2011.

The authors evaluated the students' performance and progress in intercultural communication skills, increase in international awareness, development of the technical and professional competence necessary to work in a team of global engineers, and their satisfaction in the program. Initial findings revealed that the Global Engineer Education Program effectively fosters global engineers.

2. The Previous International Exchange Programs

KIT and RHIT have been actively conducting education and research exchange programs after signing a Memorandum of Understanding in 1992. The international exchange programs include study abroad programs, a summer intensive Japanese program, and joint students' projects.

2.1 Study Abroad Program

KIT offers two study abroad programs: a senior students program and a graduate students

program. Both programs help participants learn American lifestyle, culture, and history. Students are expected to acquire knowledge considered essential for international competence by participating in the programs. The study abroad program started in 1994. A total of 65 students have participated in this program.

Senior students visit either RHIT or Rochester Institute of Technology and stay for six months, attending language courses and major subjects based upon their disciplines. They write monthly reports and present their achievements after coming back to KIT. Their monthly reports and presentation are evaluated by KIT professors and they can get eight credits if their reports and presentation are judged acceptable.

Graduate students visit the University of Illinois at Urbana-Champaign for nine months and participate in research projects. Although they cannot get any credit for their research activities, their international experiences help them develop communication ability and increase international awareness.

2.2 Summer Intensive Japanese Program

KIT offers a summer intensive Japanese program "the KIT-Intensive Program in Japanese for Science and Technology (KIT-IJST)" every year. KIT-IJST aims to give participants rich experience in 1) improving communication skills in the Japanese language, 2) learning basic technical terms and related scientific expressions in Japanese through various activities with Japanese students, and 3) understanding Japanese culture and society through lectures and cultural programs. This program is specifically designed for students majoring in engineering and technology or related fields. The program is six weeks long. Participants are enrolled in a total of 8 credit hours of language courses and in 4 hours of a cultural course. Those who complete all of the course work in the program will be given a certificate and granted 12 credits from KIT.

KIT invites students from RHIT, Rochester Institute of Technology, University of Illinois at Urbana-Champaign, and University of Hawaii at Manoa. A total of 478 students have participated in this program.

2.3 Joint Students Engineering Design Project[3]

KIT and RHT initiated a program of joint engineering design projects in 2004. The collaboration involves an engineering design course that is required for first- and second-year engineering undergraduates at KIT, and an elective course for engineering undergraduates at RHIT. Students from each institution, who stay in their own institution, form one independent team, select one project theme, and practice design activities separately. Each team independently worked on their project theme focusing on their themes of interest. Progress reports and final achievements were exchanged between the participating institutions through e-mail, website and/or video conference, and were exhibited in each class.

This collaborative design project provided a positive experience for students and also benefited the faculty members.

2.4 Joint Students Math Project[4]

KIT and RHIT conducted a Joint Students Math Project in 2012 in order to have students of the two institutions accumulate an international experience and to develop math courses which will be commonly used at both institutions. Participants in the project were KIT seniors, and RHIT sophomores and juniors. Prerequisites for participating in the project are for KIT senior students to complete "Statistics for Engineering Applications", and for RHIT sophomore and junior students to complete "Introduction to Probability with Application to Statistics".

Students of both institutions stayed in their own institution, formed one joint team, and worked together by communicating through Skype and e-mail. They investigated a stochastic process which counted the number of arrivals of customers at a bookstore, a gas station, a restaurant, and a library, and the time that these events occurred in a given time interval.

3 Newly Developed Joint Global Engineer Education Program

In order to expand the international exchange activities further, KIT and RHIT organized the "KIT-RHIT Joint Committee" in February, 2010, including faculty and staff from each institution. The committee members discussed the objectives and agreed that they should aim for developing a new scheme to foster global engineers together over a longer period of time. The program, "Joint Global Engineer Education Program," was launched in 2011. The new program is a four-year undergraduate program, and upon completion, can be used toward a second major. Figure 1 depicts the four year plan of the program.

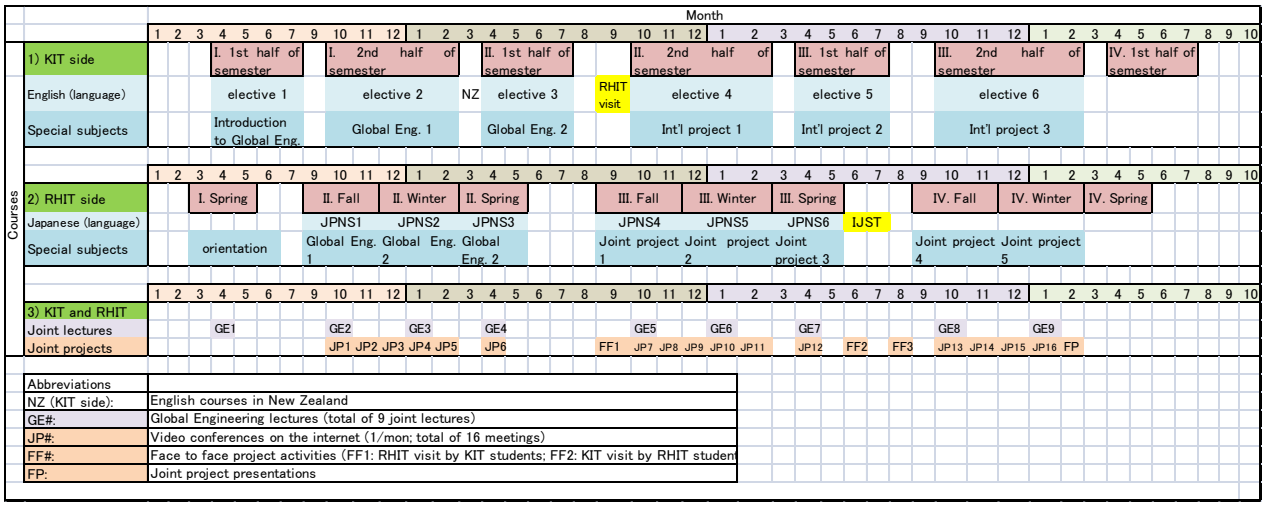

Figure 1 Joint global engineer education program

Both KIT and RHIT student participants attend special joint lectures and participate in joint project work in addition to required language courses and special subject courses at their own institutions. The joint lectures are delivered through a web conference system and held about once every three months. One of the examples of the lecture topics is "Difference in the workplace/work between Japanese and US engineers." The joint projects are composed of two types: Type A and Type B. Type A is a video-conference project in which students of both institutions stay in their own institution, form one joint team, and work together by communicating through a web conference system. Type B is a face-to-face project held during the 2nd and 3rd years of the program. First, KIT students visit RHIT for about a week in their 2nd year of the program and students of both institutions work on some face-to-face project activities at RHIT. Next, RHIT students visit KIT and work with KIT students on face-to-face project activities at KIT while participating in a 6-week intensive summer language program, the KIT-IJST. One of the examples of the face-to-face project is "Asking Japanese & US global engineers what are the most invaluable competencies you acquired at universities?" and "Making plans for a global engineer educational program."

4 Interim Assessment of Students' Progress in Learning Objectives

KIT students took three consecutive global engineering courses in the previous one and a half year: Introduction to Global Engineering, Global Engineering I, and Global Engineering II. The learning objectives of the courses are classified into 17: intercultural communication skills, increase in international awareness, development of technical and professional competence necessary to work in a team of global engineers, etc. KIT students evaluated their performance and progress in the learning objectives of the three courses. Some of the examples of their

performance and progress in achieving the learning objectives of the three courses are shown in Figure 2 through Figure 4. Figure 2 indicates the degree of satisfaction with the three courses. Figure 3 shows how much they enhanced their technical and professional competence required for global engineers. Figure 4 shows how much aspiration they have to become a global engineer. It was found that the Global Engineer Education Program is effective to foster global engineers.

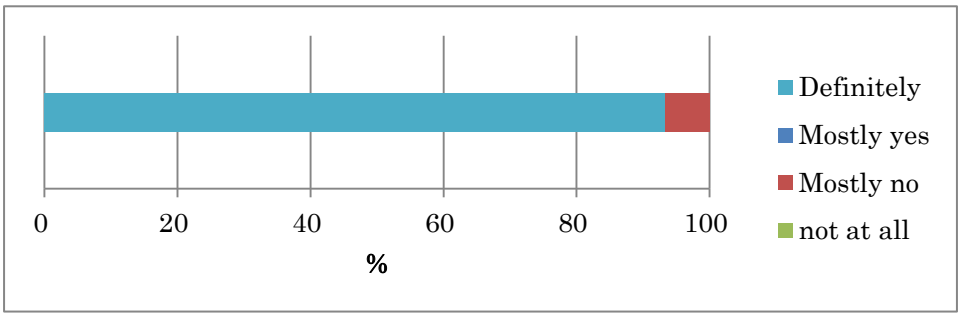

Figure 2 Are you satisfied with the three courses?

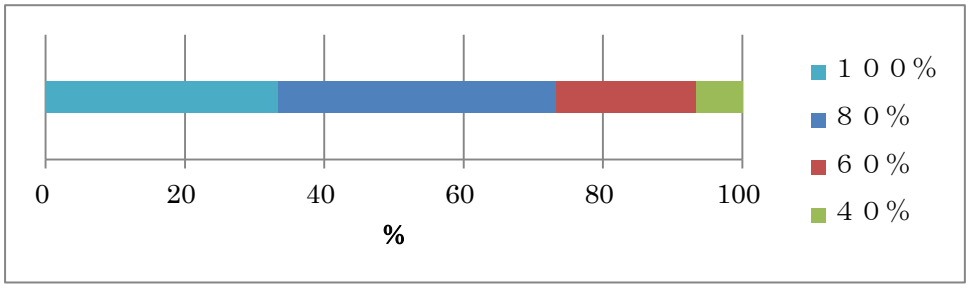

Figure 3 How much have you enhanced technical and professional competence to work in a team of global engineers?

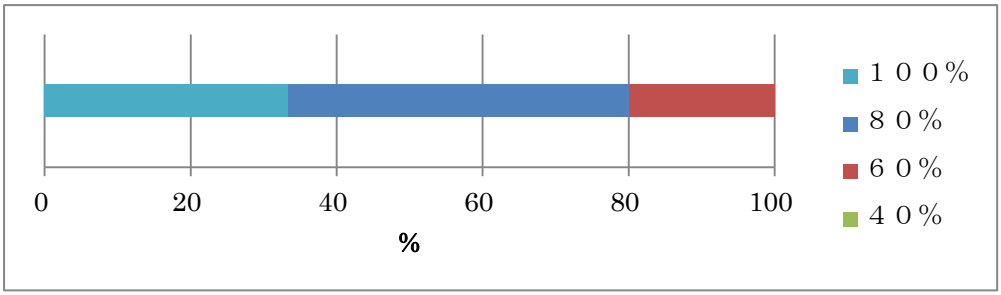

Figure 4 How much aspiration do you have to become a global engineer?

At Rose-Hulman, the participating students took three one quarter courses: Global Engineering

1, Global Engineering 2, and Global Engineering 3 with similar learning objectives. Student comments suggest that they found some of the practical topics to be particularly useful. An example includes a class meeting that featured a guest speaker who had recently been hired as an American expatriate engineer for a major pharmaceutical firm in Europe. The guest speaker outlined the elements of an expatriate job offer and described what can be negotiated as part of an expatriate employment agreement. Another example included a class on the differences in patent law between various countries and how that can impact a global engineer.

5 Future Plans

The two-year experience of the Joint Global Engineer Education Program shows that the program is effective in fostering global engineers. However it is an undergraduate program and we have not developed yet any graduate programs to follow the undergraduate program. Therefore, if we develop an additional global engineer program to graduate students, who completed the current undergraduate Joint Global Engineer Education Program, we can combine the undergraduate program and the new graduate program into a new integrated global engineer education program.

Although we have not yet officially started developing any graduate programs to follow the undergraduate program, one idea of graduate programs is a combination of "Study abroad" and "Work abroad". One possible example of a combination of "Study abroad" and "Work abroad" for graduate students of KIT, who finished Bachelor Course at KIT, would be to enroll in a Master Course at RHIT and to work at Rose-Hulman Ventures[5], a program of Rose-Hulman Institute of Technology that brings together outstanding students with technology-based companies. For students, that means the best engineering professional practice experience possible within an academic program. The Rose-Hulman Ventures experience will reinforce and enhance classroom knowledge through hands-on applications and interaction with project managers, faculty, and company executives. The students are part of an educational process that goes far beyond applying technical expertise. They will be able to learn the skills, attributes and qualities necessary to enable them to practice engineering in a professional manner.

6 Conclusion

KIT and RHIT developed a new program "Joint Global Engineer Education Program" in 2011. It is a four-year undergraduate program that leads to a 2nd major. The author evaluated the

students' progress in learning objectives of the Joint Global Engineer Education Program. Important information obtained is as follows;
(1) Students were satisfied with the Global Engineer Education Program.
(2) Students gained better understanding of the importance of the Global Engineer Education Program.
(3) The program enhanced technical and professional competence of students necessary to work in a team of global engineers.
(4) The program encouraged students' aspirations to be Global Engineers.

Findings reveal that the Global Engineer Education Program is effective in fostering global engineers.

7 Acknowledgement

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