

English in engineering education for Japanese graduate students *

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SUMMARY: *The implementation of English-medium instruction by non-native speaking lecturers to non-native speaking students is one of the challenging processes in Japanese engineering education. At the Graduate School of Engineering, Hokkaido University, the English program raises awareness of the importance of English among Japanese professors and students. This study uses feedback from Japanese professors and students over a period of time to examine the situation on English education at the school after the English program was introduced. It finds that Japanese students have become more alert to the necessity of English in their research and future career, and want to improve their English. On the contrary, a majority of professors fails to use the situation to create a momentum to improve the Japanese students' English. The study concludes that exchange of information among professors on the feasibility of using English in laboratory activities and its positive impact on the Japanese students is necessary.*

1 INTRODUCTION

Over the course of the last 10 years, mobility of students and academics around the world has become commonplace. Student flows among countries in the region and beyond continue to rise. There are increasing efforts to match student mobility with support programs for students and academics from countries that will benefit from the educational and cultural experience of overseas study and professional development programs (United Nations Educational, Scientific and Cultural Organization, 2006). One of the efforts is the change in the medium of instruction to English.

Following the Bologna Declaration that provides a framework for higher education across Europe, many universities in the non-English speaking countries in Europe started offering some of their engineering programs in English to remove language obstacles and increase student and staff mobility (Radu, 2006). In Asia during the past decade, international programs where the medium of instruction is English have gained popularity in many countries. These so-called "international" programs attract

students domestically as well as from neighbouring countries. The chief driver of international education in Asia is student demand, combined with a capacity and willingness to pay. Students seek a full foreign degree, among other reasons, to enhance their employability and opportunities for professional mobility (Marginson & McBurnie, 2004).

In Japan, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) announced its Action Plan to Cultivate "Japanese with English Abilities" in 2003. The plan clarifies the goals and directions for the improvement of English education and the measures that should be taken by the government to realise these goals. One of the goals states: "On graduating from university, graduates must be able to use English in their work. In order to meet this goal each university should establish attainment targets from the viewpoint of fostering personnel who can use English in their work." And to achieve this goal, Japanese students should be encouraged to participate in special courses taught in English that are provided at universities for foreign students (Ministry of Education, Culture, Sports, Science and Technology, Japan, 2003).

The number of English-medium programs in Japan has been on a rise since the 1990s, however, they are mostly short-term exchange. Using English has a longer history in private universities, for example, the pioneering program at the prestigious private

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Waseda University started in 1963 as a response to the needs of study abroad programs in the United States. In 1971, Kansai Foreign Language University, presently the private university accepting the largest number of short-term international students, started its program in English, with a similar motive. In private universities, attracting foreign students and establishing study abroad programs makes sense in many ways (eg. not only from an ideological standpoint, but also from a marketing perspective) (Tsuneyoshi, 2005).

As of 2005, 74 special graduate programs with English as a medium of instruction are offered by 43 national universities across Japan, out of which 33% are in engineering (Ministry of Education, Culture, Sports, Science and Technology, Japan, 2005). At Hokkaido University, the first special English program started in 1997 at the Graduate School of Agriculture and the second one at the Graduate School of Engineering in 2000. A major reason to start the English programs is to obtain a fixed number of the Japanese government (Monbukagakusho or MEXT) scholarships annually to attract quality international students who otherwise would have chosen to study in countries where the medium of instruction is English.

In this study, the perception of English education

at the Graduate School of Engineering, Hokkaido University, following an introduction of an English graduate program is examined. The result, which reveals the differences in perception between professors and students with regard to English education, is analysed. Although there are many special English medium graduate programs offered by the Japanese universities, no related literatures have been found. This may be due to the fact that universities offering English medium graduate programs considered themselves research oriented. To have quality international students is to enhance their research productivity, not the English ability of the Japanese students.

To obtain the data, three sets of questionnaire were used to survey participants and interviews were carried out during 2003-6. Participants are Japanese students in the Japanese program, international students in the English program and Japanese professors, all of whom are in the Socio-Environmental Engineering Group, Graduate School of Engineering, Hokkaido University:

- a questionnaire survey of Japanese students’ perception on English and internationalisation conducted in April 2003 (n = 340, 40% return rate)

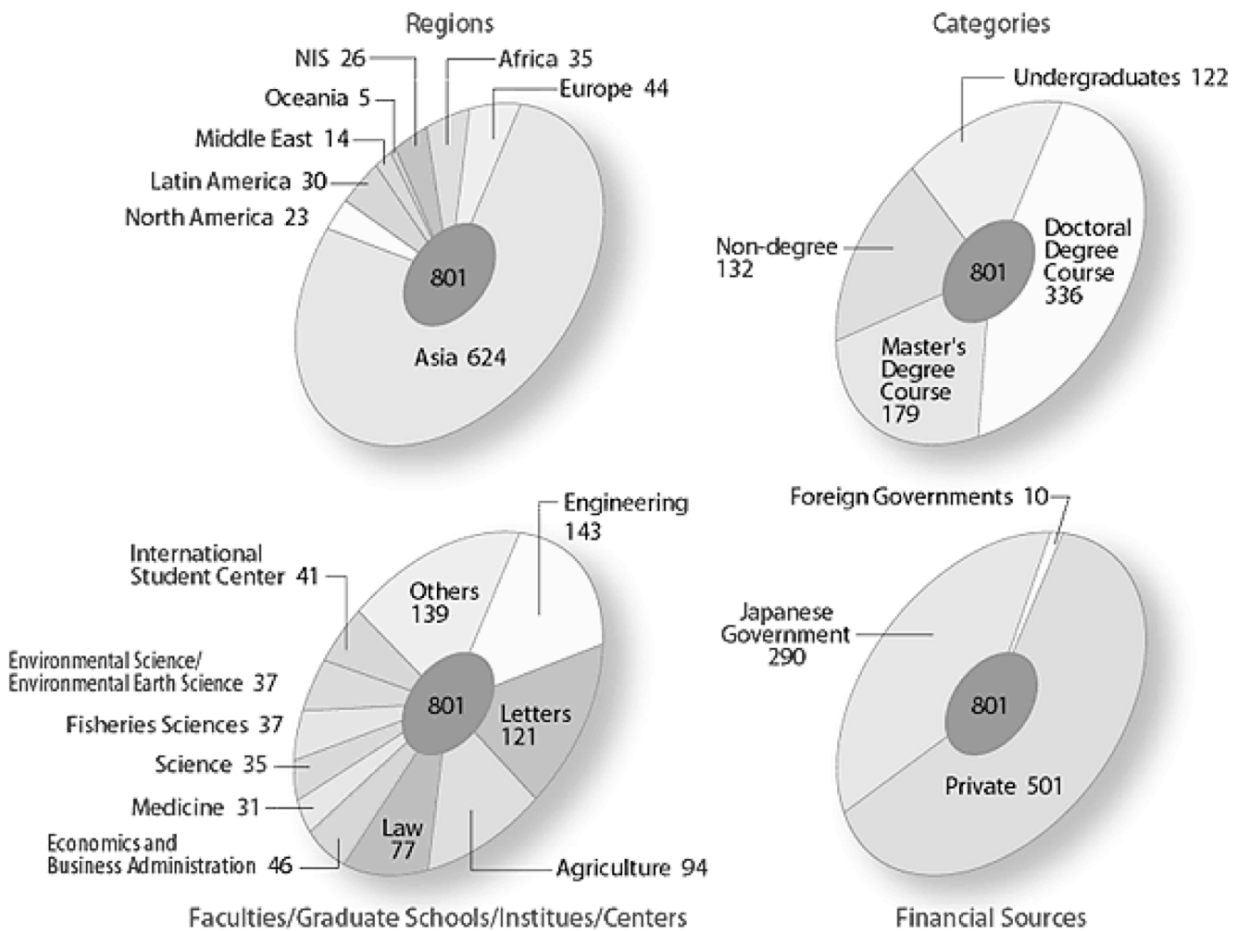


Figure 1: International students at Hokkaido University.

- a follow-up questionnaire survey of graduating students in the same group surveyed a year earlier on the English education situation in their laboratories conducted in March 2004 (n = 180, 45% return rate)
- a questionnaire survey of students in the English program on the internationalisation atmosphere in their laboratories conducted in November 2005 (n = 52, 88% return rate)
- individual interviews with six professors and two group interviews with six Japanese undergraduate students conducted during 2005-6.

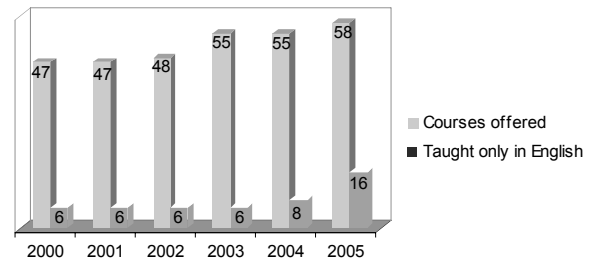


Figure 2: Number of courses offered at EGPSEE (2000 to 2005).

Table 1: Number of international students at Graduate School of Engineering.

Country	Students	EGPSEE
Brazil	1	1
Brunei	1	0
China	13	0
Cambodia	1	0
Colombia	1	1
Costa Rica	1	1
Czech	1	0
Egypt	4	3
Ethiopia	2	2
India	1	0
Indonesia	6	5
Korea	10	0
Laos	1	0
Mexico	1	0
Myanmar	1	0
Nepal	6	3
Nigeria	1	1
New Zealand	1	0
Pakistan	2	1
Palestine	1	0
Peru	1	1
Philippines	5	5
Poland	1	0
Russia	1	1
Sri Lanka	4	4
Thailand	7	7
Vietnam	5	4
TOTAL	80	40

The author is a lecturer responsible for the English program at the Graduate School of Engineering. This duty enables the author to conduct interviews and surveys and access to certain information presented in this paper

2 ENGLISH-MEDIUM PROGRAMS AT HOKKAIDO UNIVERSITY

As of May 2006, over 60% of the 801 international students at Hokkaido University are students from China, Korea and Taiwan (figure 1). Nationwide, they account for about 80% of the international students in Japan (Japan Students Services Organization, 2006). The main reason for the large number of students from these three countries is the similarities among the three languages that enable them to pick up the Japanese language faster than students from other countries. In fact, before the introduction of the English programs all international students enrolled in the regular programs where Japanese is a medium of instruction.

Following the establishment of the English Graduate Program in Socio-Environmental Engineering or EGPSEE, the number of English speaking students at the Graduate School of Engineering increases significantly. As of May 2006, 50% of the international students at the Graduate School of Engineering are EGPSEE students (table 1).

EGPSEE is a joint program among six out of 15 divisions in the Graduate School of Engineering (table 2). There are six to seven laboratories, each of which basically consists of a full professor, an associate professor and a research associate, in each division. EGPSEE has been operating since October 2000 with the main scholarships from MEXT. From 2007, EGPSEE will expand to cover six more divisions and rename itself the English Engineering Education or the e³ program.

All 65 professors (full and associate professors) in the six divisions are Japanese, with more than half having experienced studying, teaching or doing research overseas. Almost all, singly or jointly, offer courses in EGPSEE. Some professors choose to teach their courses in English to students in

Table 2: Divisions in Graduate School of Engineering.

Division	EGPSEE (2000-6)	e ³ program (2007-)
Applied Physics		
Chemical Process Engineering		
Biotechnology and Macromolecular Chemistry		
Materials Chemistry		
Materials Science and Engineering		✓
Mechanical and Space Engineering		✓
Human Mechanical Systems and Design		✓
Energy and Environmental Systems		✓
Quantum Science and Engineering		✓
Field Engineering for Environment	✓	✓
Engineering and Policy for Cold Regional Environment	✓	✓
Architectural and Structural Design	✓	✓
Human Environmental System	✓	✓
Built Environment	✓	✓
Solid Waste, Resources and Geoenvironmental Engineering	✓	✓
Engineering	✓	✓

EGPSEE and in Japanese to students enrolled in the Japanese program, while some choose to teach only in English to students in both programs. During the first four years, six professors chose to teach only in English. The number of courses taught only in English remained unchanged until 2004, when it increased to eight, then to 16 in 2005 (figure 2). The dramatic increase in 2005 is because the Division of Built Environment decided to use English as the only medium of instruction for all its 13 courses.

3 JAPANESE STUDENTS AND ENGLISH EDUCATION

With an increase in the number of English speaking international students, Japanese students have more chances to interact with international students through English. At the same time, many of them have

to attend classes taught in English. To find out their opinion about English and internationalisation, a survey was carried out in April 2003 among Japanese graduate students in the six divisions that form EGPSEE. 60% of the 134 students who responded had international students in their laboratories. In the survey the following questions were asked:

- Q 1. Are there international students in your laboratory?
- Q 2. Your division
- Q 3. Current student status
- Q 4. Sex
- Q 5. Have you ever lived in a foreign country?
- Q 6. Have you ever travelled to a foreign country?
- Q 7. Do you want to improve your English ability?

- Q 8. (For those who are currently studying English) What is the method of your study?
- Q 9. Do you think that your laboratory is keen in English education?
- Q 10. Do you feel that you need English in your research activities?
- Q 11. Do you think that you will need English in your future work?
- Q 12. Do you think the graduate school and your laboratory should put more effort on English education?
- Q 13. What is your opinion if all graduate courses are taught in English?

Over 70% of the Japanese students recognise that English is necessary for their research. At the same time, over 80% think that English is necessary for their future work. 93% of the students want to improve their English, however, 61% do nothing. Instead they expect the university and their laboratory to put more efforts in English education. One student wrote: "English should be educated by force".

The survey showed that 64% of the students do not object to the idea that English is used as the medium of instruction for all the courses at the Graduate School of Engineering. The reasons given are tabulated in table 3.

Japanese students' comments at the end of an English-medium course in 2003 also indicate that they do not oppose to using English as a medium of instruction:

- I could learn the English terminology through the class.
- Although I am not good in English, it gave me much knowledge.
- It was tough for me since I am not familiar with English. The homework that required

programming was also a tough job. Despite these facts, I could learn new things.

- I've been thinking to study English more after attending your lecture.
- Lecturing in English is unique and a good experience for me.
- Your way of teaching (using English) is suitable for graduate course. I'm happy with that. However, most of the students do not have enough English skill, hence some kind of English teaching or supporting class is necessary.

In February 2004, a follow-up survey on English education was carried out among Japanese graduate students who were expected to graduate in March 2004. Eighty-two students from 25 laboratories returned the questionnaire. In this survey the following questions were asked:

- Q 1. Which laboratory do you belong to?
- Q 2. Do you think your laboratory is keen about English education?
- Q 3. Do you think you should improve your English skill?
- Q 4. Do you think your English skill improved during your graduate program?
- Q 5. What in your opinion is the best way to improve your English skill?
- Q 6. Please write down your opinion about English education.

Students were asked whether they thought their laboratory was keen about English education. Only 26% of the respondents gave a positive answer, a 1% increase compared to the previous survey. As 60% of the laboratories in the survey have international students it was surprising to see that only a small number of professors took advantage of the existence of international students to accelerate the use of English within the laboratory.

Table 3: Reason to support/object to English as medium of instruction.

Support	Object
<ul style="list-style-type: none"> • To improve their English ability • English is necessary for their future work • English ability of Japanese is too poor • This system is adopted in some universities • They can concentrate during the class • Overseas lecturers can be invited • Can attend the class together with international students • Can learn English technical terms that are necessary 	<ul style="list-style-type: none"> • Degree of understanding in class will decrease • No class is conducted in English in undergraduate school • English education should be carried out in English class • It is difficult to understand the class if teachers cannot speak English well • Earning credits becomes difficult • Quality of class will deteriorate

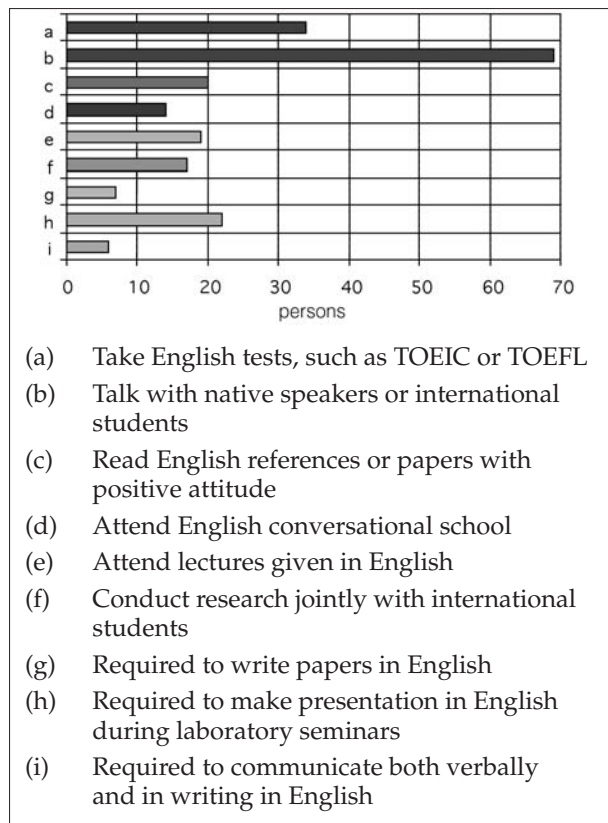


Figure 3: Ways to improve English skills cited by students.

While the laboratories did not put efforts in strengthening the students' English ability, 99% of the graduating students believed that they should improve their English because it would be needed in their future work. This figure is higher than the one obtained a year earlier. What the students believed was correct, according to a survey carried out by the Business University Forum of Japan in 1996 in which 40 young employees (87% from graduate schools) from 25 major Japanese universities took part. In the survey, over 90% of the participants said that they used English to some degree in their work, however, only 7% expressed satisfaction of their English ability (Itoh, 2000).

Students were asked whether their English had improved during the study program, 65% answer positively, i.e. from "improved a lot" to "slightly improved". The reason for this improvement included:

- becoming friends with international students
- being a tutor for international students
- carrying out research jointly with international students.

When asked what is the best way to improve their English ability, a majority of students answered: "Talk to native speakers or international students" (figure 3).

The students in the second questionnaire group are divided into two groups. Group 1 consists of those who answered that their laboratories are very keen

or keen in English education, and Group 2 consists of those who answered that their laboratories are not so keen or not keen at all in English education. When asked whether they think their English has improved during the two years, 86% of those in Group 1 answered from "much improved" to "slightly improved", compared to 56% in Group 2 (figure 4).

Since the two surveys were carried out only among graduate students, two interviews were conducted in 2006 to find out how fourth year students in two laboratories, which require Japanese students to prepare their presentation materials in English and graduate students to present and discuss in English, felt about the situation. Six students were interviewed. The students chose to have the interview done in English and were not shy to speak English in front of each other. All agreed that they did not find preparing the presentation materials in English too difficult. To them the most difficult thing was listening and speaking in English, however, seeing their seniors with better English ability motivates them. All the six students who joined their laboratories at the beginning of their fourth year said that they never had an opportunity to speak English before joining the laboratories. The students considered themselves "lucky" to be in the laboratories that have international students and where the professors put strong emphasis in English education.

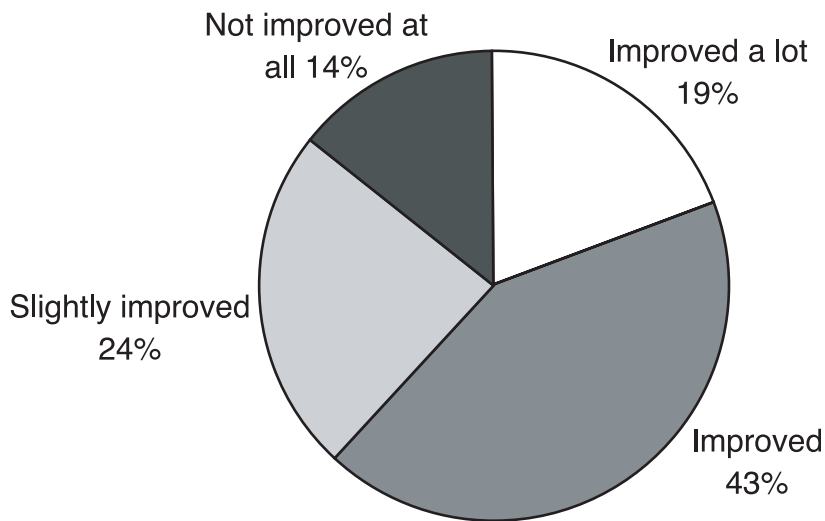
4 PROFESSORS ATTITUDE ON ENGLISH EDUCATION

Due to lack of experience with the English program, many professors in EGPSEE thought that offering courses and giving advice in English was enough to qualify for a status of an English program. In reality, apart from these two aspects of creating internationalisation atmosphere and improving the intercultural understanding skills of Japanese students, the professors are equally important and necessary to maintain a quality English program.

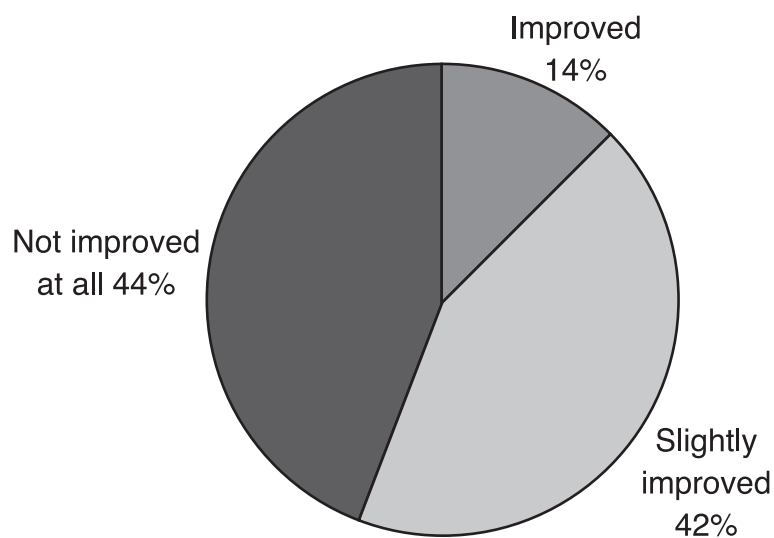
At the Graduate School of Engineering, besides regular courses, students attend and earn credits from seminars in their laboratory. The nature and frequency of seminars vary. In most laboratories, seminars are where students present and discuss the progress of their research with professors and students in the same laboratory. As a result, laboratories with EGPSEE students are expected to conduct their seminars in English. Since attendance at seminars includes fourth-year undergraduate and graduate students in both the Japanese program and EGPSEE, it was expected that the seminars provide a good opportunity for professors to enhance Japanese students' English proficiency. Feedback received in November 2005 from 46 EGPSEE students from 21 laboratories, however, revealed that, in fact, half of

Table 4: Level of English usage enforced on Japanese students during the seminars.

Answers	Professor Responses
Definitely YES.	2
Yes, everything will be in English except the Q&A part, which will be in Japanese, but will be translated simultaneously to the student.	2
Yes, but only the presentation materials of the students are in English and the rest in Japanese will be translated verbally to the students.	8
No, but EGPSEE students will not be required to attend the seminar in Japanese. A special seminar will be arranged.	1



Group1: Laboratories keen in English education



Group2: Laboratories not keen in English education

Figure 4: Impact of professors' attitude on English education.

the laboratories conducted their seminars totally in Japanese.

Six professors interviewed after the November 2005 survey shared the same opinion that reluctance expressed by professors to let the Japanese students present and discuss their research work in English is due to the lack of confidence in their students' English oral communication ability. The lack of confidence is not baseless. In 2003, the university conducted a TOEIC IP test of all undergraduate students, the average score obtained by the students was 436 (full score = 990).

In January 2006, 13 professors who planned to admit international students to EGPSEE were asked if it was feasible for them to introduce English in written and oral presentation for every student, as well as in the question and answer part in the seminar. Only two professors gave an affirmative answer, while eight professors would only require their students to prepare the presentation materials (slides) in English and the rest in Japanese with translation done by them and their assistant for the international students (table 4).

Questions relating to creating an internationalisation atmosphere in the laboratory were also asked, namely:

- Q 1. In case your laboratory does not have English manuals yet, are you willing to make such manuals and other necessary documentations (eg. for computer programs) available to the EGPSEE student that will help him/her carry out his research study efficiently?
- Q 2. Are you willing to translate the announcements (via email, circulation, notice board) that concern the EGPSEE student to English?
- Q 3. Could you think of other measures to be taken in order to provide an international environment that is beneficial to the

EGPSEE student in the conduct of his/her study? Note that these activities or recommendations may also provide an opportunity for the Japanese students to enhance his/her international communication skills.

All professors gave an affirmative answer to questions 1 and 2. In replying to question 3, the following activities were cited as measures to provide an international environment and an opportunity for the Japanese students to enhance their communication skills:

- Japanese students take turns in translating announcements to English.
- Discussion in English as the EGPSEE student helps the Japanese students write an English abstract of his/her paper.
- Group study/review of English journal articles, monographs, books, etc.
- Holding of "English Time" at a designated time of the day.
- Holding of "English Day" on a designated day of the week.
- Daily communication activity together.
- Orientation of the Japanese students about the importance of English.

5 DISCUSSION AND CONCLUSION

The advancement rates of the new graduates in science and engineering to higher degree program are shown in table 5. The continued rise in the number of undergraduate students advancing to the master's program is believed to have been propelled by the rising corporate needs in recent years for master's graduates as immediately effective workers in new-product development (Ministry of Education, Culture, Sports, Science and Technology, Japan, 2004). At Hokkaido University, 505 or 78%

Table 5: Advancement rates of new graduates in science and engineering (Source: MEXT 2006).

	Science		Engineering	
	<i>From undergraduate to master's course</i>	<i>From master's to doctoral course</i>	<i>From undergraduate to master's course</i>	<i>From master's to doctoral course</i>
1970	19.1	54.5	9.9	16.1
1980	16.8	38.8	9.8	7.8
1990	24.8	29.7	16.8	8.1
2000	38.0	29.3	27.7	9.6
2005	41.5	23.8	31.7	7.3

of the engineering undergraduates advanced to the master's program in 2006.

In Japan, students are required to take an entrance examination for graduate schools (although at some graduate schools selection is based on document evaluation only). At the Graduate School of Engineering, Hokkaido University, the exam subjects are: Japanese (for foreign students), English (for Japanese students), written tests on three relevant subjects and an interview concerning the subject of specialisation. Students will study English hard before the entrance examination, but once passed they pay little or no attention to English since they can learn and graduate using only the Japanese language.

The situation changed following an introduction of EGPSEE, since some courses use English as a medium of instruction and English is used to a certain extent in some laboratories. Japanese students have therefore become alert about the importance of English. However, they lack motivation to study on their own and would like the university and their professors to put more efforts in, or even force, requiring the study of English. On the contrary, a majority of professors do not seize the opportunity nor put any effort to enhance the English education among Japanese students.

During the seminars conducted regularly by the laboratories, some professors require Japanese students to prepare their presentation materials in English. Regrettably, instead of making them use English, Japanese students are allowed to present and discuss in Japanese. Some professors simultaneously translate important points to international students, which enable international students to know about the research their Japanese friends are conducting. However, the practice fails to provide Japanese students chances to improve their English presentation and communication skills, which they badly need.

The fact that Japanese students welcome chances to communicate in English and can actually present and discuss in English (although poorly at the beginning) during the seminars is not well publicised and known among professors. The author wants to believe that the lack of information on Japanese students' perception and adaptability to English usage contributes to the reluctance by professors to require their Japanese students to present and discuss in English. The success of Japanese students from the laboratories that emphasise internationalisation through English is not well publicised either. These cases include a Japanese student whose first chance to speak English came because he enrolled in a laboratory that had international students. The student was fluent in English by the time of his graduation and is currently a post-doctoral scholar at a renowned institute in Switzerland. There are also cases of Japanese students whose presentation

skills in English were superior to other applicants, enabling them to get the travel grants provided by the university to attend international conferences.

It is also true that the lack of efforts by professors to use more English in their laboratories may come from their own English deficiency despite the fact that their English ability has improved since EGPSEE started. Although these professors use English in their lectures and discuss research work with international students, it was done without the presence of Japanese students. Their reluctance to use English in front of Japanese students is a byproduct of the Graduate School of Engineering policy as recent as six years ago, which does not require English competency from professors. At present, English proficiency is required from all newly appointed professors.

This study concludes that exchange of information among professors on the feasibility of using English as a medium of instruction in the laboratories and its positive impact on the Japanese students is needed as an assurance and guidance to professors who have yet to implement such activities. Only when a majority of professors share the common perception on the feasibility and the positive impact of English education, will the benefits be realised more efficiently.

Although this study focuses on the perception of professors and students on English education, the surrounding environment that also affects the internationalisation process is worth mentioning. While efforts to create an internationalisation environment are being made in classrooms and laboratories, no efforts are being made in the administrative offices. Officers are not required to have even a basic knowledge of English and, as a result, student-related documents and announcements are all in Japanese. The issue on administrative matters will be discussed in a separate paper.

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