Promoting Cultural Awareness and Understanding in Engineering Education Curriculum

Yuko Hoshino[1], L. Wayne Sanders[2]

Abstract - **Many of us may assume that science and technology share a universal basis of communication and, as long as we limit our discussion to technical content, we could come to an understanding. However, a number of college graduates who have worked abroad or worked with people with different cultural backgrounds have encountered difficulties in getting their work done. They might have gotten the technical meaning across, but the process of doing business may not be the same. Therefore, one needs to have a broad understanding of the target culture. This paper discusses the attempt to respond to this issue. Many engineering schools already have a full curriculum, and Kanazawa Institute of Technology, a private college of engineering and science in Japan, is one such college. Classes specifically for teaching cultural impact on technology cannot be added to the already busy schedule. Instead, a foreign language curriculum (Chinese) has incorporated cultural topics into its project-based classes. Students are exposed to various cultural issues before they engage in projects of their choice. Throughout the 10 years of the course, science students have expressed strong interest in target culture information and have been choosing cultural themes for their projects over technical subjects. By preparing for their project presentations, they find for themselves norms and values of the target culture, as well as their own, and come to respect them. At the end of the course, ways to apply this process for the workplace are discussed. Student evaluations show that the students have become more confident in 1) their knowledge of the target culture, 2) skills to locate needed information in the target language, 3) strategies to teach themselves foreign language(s), and 4) their ability to adapt themselves to new cultures.**

Index Terms - Culture, Engineering education, Project-based learning, Foreign language

INTRODUCTION

Engineers have been working worldwide and the need to be able to work cooperatively with other engineers with different background is increasing. As a result, engineering students are increasingly required to obtain skills related to such working situations.

Herbeaux and Bannerot [1] reported one intriguing example of cross-cultural understanding, or lack of it, in engineering education. They compared designs of chopstick rests by American engineering students and by their Japanese counterparts. Chopstick rests are profoundly tied to Japanese culture. Understandably, American students' who probably have not had much exposure to Japanese culture prior to this project produced designs that may not be commercially successful. Their designs are novel and creative but may violate their target cultural norms. The same problem may occur if Japanese students attempt to design products that are tied to American culture. It is interesting to note that Japanese college students are aware of their lack of skills in international communication and cultural adaptability [2]. Among their many skills in mathematics, physics, information technology, etc., these students evaluated themselves very low in foreign language (namely English) and cultural adaptability.

DEVELOPING CURRICULUM

The authors, a language professor and an engineering professor, have been working together in developing a course to help engineering students acquire cultural skills for their future global workplace. One most challenging factor is that engineering students have many required technical courses and do not have much time for other subjects. With that constraint, we have chosen to incorporate cultural contents into an elective language course, beginning Chinese, at Kanazawa Institute of Technology (KIT).

KIT is a private technical college in Kanazawa, Japan and has approximately 7000 undergraduate and graduate students. Chinese language has gained popularity and has been receiving large number of registered students. (In spring of 2005, 600 students out of 1800 sophomore students registered for beginning Chinese.) By choosing the Chinese course, we can provide a large part of the student body with cultural lessons.

One might argue that cultural lessons may not be taught successfully for students at the very beginning level. However, Shigeta [3] noted that such instructions could be She employed Lave and Wenger's "legitimate peripheral participation" [4] to encourage her students to acquire language skills and also to grow as individuals as members of their target culture community. The authors' aim in the KIT curricula does not extend to that goal at this point, but it is important to keep in mind that these students also would be members of the communities of their choice in the future and that their learning process should also be community-oriented.

[1] Yuko Hoshino, Nihon University Graduate School of Social and Cultural Studies and Kanazawa Institute of Technology, hoshino@neptune.kanazawa-it.ac.jp
[2] L. Wayne Sanders, Rose-Hulman Institute of Technology, sandersw@rose-hulman.edu

CHINESE PROGRAM AT KIT

I. Structure of the program

The Chinese program at KIT has three courses – Chinese I, II, and III. Each course meets twice a week, 60 minutes each, and 10 weeks per term resulting in 20 hours of instruction, practices, and exams each term.

Chinese I is mainly devoted to learn the sound system of Chinese, for pronunciation is the most challenging part for Japanese speakers. Students also learn and practice learning strategies for foreign languages. Some cultural information such as appropriate occasions to greet certain ways is incorporated into the course.

Basic vocabulary and grammatical information are introduced in Chinese II. Some cultural readings (Chinese festivals and cerebrations, daily life of Chinese people, etc.) are provided to prepare students for project work in Chinese III. Chinese word processing software is introduced at this point. It is interesting to see students improving their pronunciation of Chinese by using the software. The main reason for their improvement seems to be attributed to the fact that they have to use pronunciation code (PinYin) to type Chinese characters. It forces them to accurately remember the codes and leads to more accurate pronunciation.

The first half of Chinese III is devoted to learning more vocabulary and grammar. The latter part is for project work. This means that students work in groups and choose their own themes to explore their language skills. The course contents are summarized in Table. 1

TABLE I
CHINESE COURSE

Term offered	Course	Contents
SPRING*	CHINESE I	Sound system Pronunciation practice Greetings Cultural information Learning strategies
FALL	CHINESE II	Basic vocabulary Grammatical information Cultural readings Introduction to Chinese word processing software
WINTER	CHINESE III	More vocabulary More grammatical information Project work Presentation of project

*COLLEGES AND UNIVERSITIES IN JAPAN START THEIR ACADEMIC YEAR IN SPRING

II. Characteristics of Chinese III

Chinese III is the last course of the whole Chinese program at KIT. It is a project-based course. In the latter half of the course, students are asked to form groups of 2 to 5 people depending on their interests. They choose project themes and begin gathering information in Japanese and in Chinese. They are required to present their projects at the end of the course entirely in Chinese. By preparing the presentation, they have to teach themselves necessary vocabulary and grammar. At this point, instructors shift their roles from teachers to guides or facilitators. They provide guidance and suggestions but not instructions. Students have to write their own scripts and teach themselves pronunciation for the final presentations. This process often happens after language courses are over and students start working in industry. However, by going through the process while instructors are available, the first experience is made much easier for students. The second time around in the real world would be much easier as well. Some graduates' comments have indicated this.

Peers in the group can become indispensable resources for learning. Students with stronger skills often become group leaders and teach vocabulary, grammar, and pronunciation to group members. If group members are modest or too shy to take initiative (that is often the case in Japan), the instructors can assign them appropriate roles such as project leader, sub-leader, pronunciation coach, and so on. Group members' skills often improve dramatically when their peers help them. Some students have commented later that they felt more pressure to be better when their friends rather than teachers were helping them. The learning is autonomous in the large part. This should be supported by the course grading system. Instructors should monitor each member's interaction with other members and their progress and give credits accordingly. In other words, the perfection of the language use is not the only basis of the evaluation. Originality of the theme, creativity for the presentation, group contribution, and degree of improvement can also be the basis.

CULTURAL INFORMATION

Cultural information is provided throughout all three courses in order to expose to students the target culture and its value system as much as possible. The information does not have to have separate instruction time. It is sometimes better to be embedded in vocabulary or grammatical explanations so that it can be discussed in short time, and class could move quickly.

Cultural symbols such as Figure 1 and 2 are good examples to introduce in class. Hofstede [5] proposed an onion-shape model of culture that represents the multi-layered nature of cultures. He explains that the outer side (the most explicit form) of culture is symbols. Because of their graphical nature, they can attract students' interest. Engineering students often enjoy decoding the meanings of these symbols just like they enjoy decoding quizzes. This is an ideal tool to promote cultural awareness. Figure 1 shows an inverted Chinese character of Spring that implies "spring has come". It is because the sound of word "inverting" is the same as "reaching" in Chinese. This symbol is common among Chinese communities throughout the world, and students can find the similar characters and can understand their meanings. Figure 2 shows cultural icons of baby boy, carp, and lotus flowers. The baby boy will carry family name and implies continuity of bloodline. The carp will climb up a stream and will transform into a dragon, the most celebrated

imaginal animal in China. This symbolizes the social success. Lotus flowers grow from mad. Humble upbringing can be overcome. The flower is also a symbol of Buddhism and enlightenment.

FIGURE 1
EXAMPLE OF CULTURAL SYMBOL
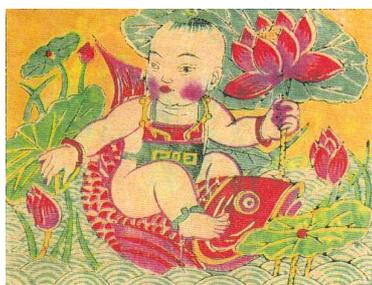
FIGURE 2
EXAMPLE OF CULTURAL SYMBOL

PROJECT WORK

I. Process of project work

Steps of the project work are:
1. Forming groups of students with similar interests
2. Discussing possible themes and selecting one
3. Finding and obtaining necessary information
4. Understanding the information (in Japanese and/or in Chinese)
5. Translating and/or rewriting information to meet audience (classmates)' comprehension
6. Practicing pronunciation
7. Making additional materials if necessary for final presentations
8. Giving rehearsals
9. Continuing practicing presentations
10. Giving final presentations
11. Reflecting on own work

Instructor(s) is/are there mainly to consult and to make suggestions rather than to give students answers. The students have to find answers themselves. Group members help and teach each other.

II. Themes of the projects

Project themes students chose in the past 10 years are listed in Table 2. They reflect engineering students' strong interests in target culture. It is very important to note that many of these themes are closely related to the cultural information introduced throughout the program. It suggests that this information can be the building basis for the students' own projects. The students often do not create themes out of nothing, but rather they are intrigued by the existing information and tend to expand on it. Therefore, authors have been analyzing the themes of past projects and continue adding and renewing cultural information that is incorporated into Chinese I and II.

TABLE 2

THEMES OF THE PROJECTS

Category	Subcategory	Theme
CULTURE	CHINESE	History of Chinese characters
		Chinese costumes
		Chinese tea
		Chinese tea ceremony
		Chinese cuisine
		Chinese liquor
		Tale of three states
		Four novels of China
		Chinese poems in Tang Dynasty
		Chinese proverbs
		Chinese songs
		Chinese festivals
		Life in China
		Popular culture in Taiwan
		Sightseeing spots in China
	JAPANESE	Japanese cuisine
		Japanese pop music
IMMEDIATE ENVIRONMENT		Introduction of KIT
		Kenrokuen garden*
		Sightseeing guide of Kanazawa
		My hometown
MAJOR RELATED		Theory of electric current
		Buildings in SuZhou and Venice

*ONE OF THE THREE CELEBRATED GARDENS IN JAPAN THAT IS LOCATED IN KANAZAWA

III. Presentations

Four classes are usually offered for Chinese III. All students in these four classes get together at one two-hour class period to give their project presentations. Other students, professors, and guest are invited to attend.

FIGURE 3
GUESTS OF THE FINAL PRESENTATIONS.

This helps the presenting students experience formal presentations. It also encourage them that there are interests in what they have done in the course. Those guests also benefit from participating. They can learn what is going on in other courses. This also promotes them to take Chinese courses in the future.

FIGURE 4
STUDENTS' PRESENTATION

FIGURE 5
AUDIENCES OF THE PRESENTATIONS (STUDENTS AND GUESTS)
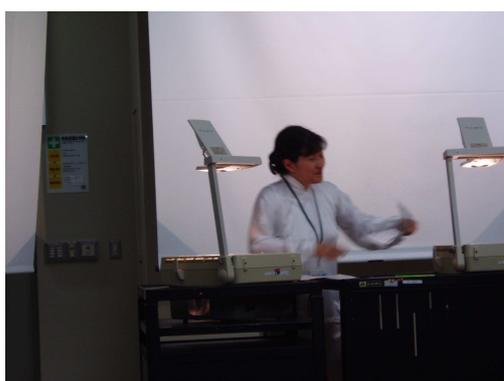
FIGURE 7
INSTRUCTOR'S PRESENTATION.

The choice of presentation forms varies. Many groups use power point files to show their findings. Some prefer to perform dramas, music, puppet shows, and demonstrations. Instructors can give their presentations as good examples of cultural presentations for the students. Several students over years commented that they welcomed their teacher taking a part and going through the same process that the students did.

III. Evaluation of the projects

The purpose of the project work is not just to improve students' language skills but also to give them opportunity to teach themselves necessary knowledge and skills. Therefore, evaluation of the students' projects should reflect on it. The criteria of the evaluation are:
1. Completion of the project work
2. Originality of theme and presentation
3. Comprehensibility of pronunciation, sentence patterns, and grammar
4. Learning process by themselves
4 should receive the highest priority over the other three, particularly over 3 which tends to have the highest priority by language instructors.

STUDENTS' EVALUATIONS AND COMMENTS

This Chinese program has had approximately 3000 students since its started in 1998. Based on each academic year's students' evaluation, the students view the project work experience as a positive experience and preparatory practice before going into the real world.
Exit questionnaires showed that the students gained confidence in 4 aspects of the courses. 1) Their knowledge of the target culture, 2) skills to locate needed information in the target language, 3) strategies to teach themselves foreign language(s), and 4) their ability to adapt themselves to new cultures.
For the first year of the program, some students were not sure of the reason why they had to go through the process. We have resolved this problem by giving detailed explanations at the beginning of their project work. In recent years, a number of students specifically gave us comments on the projects as being a rewarding experience and helpful. It clearly indicates that they understood the purpose of the work and took advantage of it for their future career.

SUGGESTIONS

This course is by no means ideal. We would like to have more diverse selections of courses to expose engineering students to cross-cultural issues. However, with current constraints of time and resources, this would be one feasible way to provide the students an opportunity.
For those who would like to develop similar courses, we suggest:
1.Communicating with other instructors and try to share concerns for students' skills on cross-cultural issues. If the same content is dealt with in multiple courses, it would reinforce learning.
2. If possible, going and observing other classes to find different ideas.
3.Seeking the possibility of collaborating with other instructors in order to bring multiple perspectives to courses
4. Trying to be a consultant or facilitator with students instead of being an instructor in order to give the students chances to be their own teachers

5. Evaluating students on the process (teaching themselves, helping other members, etc.) more than on the products (perfect command of the language)
6. Trying to be open to students' feedback for continuous improvement.

REFERENCES

[1] Herbeaux, J-L, and Bannerot, R, "Cultural Influences in Design", *Proceedings of 2003 Annual Conference of American Society for Engineering Education*, 2003, CD-ROM

[2] Nakayama, M, Takahashi, H, Kusakabe, O, Otaguchi, K, Mizutani, T, "A Survey on Engineering Students' Human Skills", *Journal of Japanese Society for Engineering Education,* Vol. 53, No. 4, 2004, pp. 46-51

[3] Shigeta, M, "Japanese Culture and Society Class for Basic Japanese Learners: The Case for First-Year University Students", Journal of Japanese Language Teaching, No. 131, 2006, pp. 41-49

[4] Lave, J, and Wenger, E, "Situated Learning - Legitimate Peripheral Participation", Cambridge University Press, 1991

[5] Hofstede, G, "Cultures and Organizations - Software of the Mind", McGraw-Hill, 1991