Difficulties in Teaching Technical English in Japan

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The geographic isolation of the Japanese is the largest obstacle for the Japanese to learn English because there is no necessity to have the skills to live. Since the Japanese do not use the language learned every day life, the skills cannot be retained easily. Other related problems are linguistic and Japanese social are also presented.

Very few teachers of English in Japan are able to teach technical English because they are mostly non-science major. Therefore, science and engineering students are grossly deficient in technical terminology as well as general English skills.

To ease the situation, the following three proposals were made: 1) training teachers for special English in graduate school, 2) writing textbooks for the beginners and college students and 3) limiting to a manageable class to a manageable size.

1. Introduction

1.1 *A biochemist as an English teacher*

In this paper I would like to discuss some serious problems existing in teaching technical English to engineering students in Japan. A part of this discussion was presented at the 2nd International Conference of World Englishes in Nagoya, Japan, May, 1995. However, before going into detail, it would be useful to mention about my background for the readers of this journal.

I am a biochemist studied at a graduate school in the United States. After spent a year of my postdoctoral work, I engaged in a research project for three years. Then, I took a job in a clinical biochemistry section of a hospital near Washington, D.C. There was a labor dispute between the laboratory personnel and the administration. To solve it, I was asked to manage the place and stayed on for ten years.

In 1983, I took an administrative position in a hospital in Kurume, Japan retired at 60 and started teaching English privately.

1.2 *Genesis of my technical English class*

Seven years ago, a professor of the Electronic Engineering at Fukuoka University School of Engineering asked me to teach an elective course of technical English to junior and senior students of his department. I have been teaching this for the past six years. Recently, I began another class for the Electric

Engineering Department. The electronics students have only one semester and the other two semesters.

1.3 *English is a compulsory subject*

English is a compulsory subject from middles school in Japan. All high school students have to take some foreign language. Unfortunately, very few schools offer other languages.

The same requirement also exists for the general education in college. Again students have limited choices and hence, they take English to fulfill their requirement. Thus, upon graduation, a graduate has at least a total of eight or nine years of English education.

2. Students' English skills

To discuss problems of teaching technical English in Japan that confront me, I would like to present what I have found about general levels of English skills of my students.

2.1. *Vocabulary deficiency*

In the past three years, I have given a total of 112 students a list of 60 technical words commonly used in mathematics and electric science shown in Table I and asked whether they could recognize these words. The result was very discouraging.

There were 20 words which were not recognized by all students, 23 words by less than ten, eight words by less than 20, and five words by less than 50. Only three words, electron, electronic, and wave were known by more than 50 and only one word, atom, was identified by all the students.

It was startling that very simple and fundamental words such as ampere, circuit, current, impedance, semiconductor, transistor, etc. were unfamiliar to most of students. As you may have also noticed, none of them knew any basic mathematical terms: addition, subtraction, multiplication and division.

However, students realized many words after I pronounced them; ampere as anpea in Japanese, impedance as inpidansu, circuit as sakitto to name a few. (These Japanese words are not spelled in this way, of course). Other familiar words such as semiconductor, oscillate, and amplifier were 'recognized' as well.

In Japanese there are no equivalent sounds for r and l, b and v, m and n. We pronounce these sounds as r like sound for r and l, b for both b and v, and n like sound for m and n. I used here a term 'r like sound', because Japanese r sound is not exactly made it like English way. So as Japanese n sound for m and n.

Thus, these students cannot make out these words in English even though they are familiar with them in Japanese sound. They cannot associate a visual pattern of a word with its sound form as they pronounce.

The reasons for the gross deficiency is not only technical terminology but also non-technical vocabulary are attributed by at least the following three major factors:

> (1) There is absolutely no necessity to know these terms for their daily living.
> (2) Therefore, there is neither incentive to teach nor study these words at all.
> (3) Most English teachers cannot teach them because they themselves are unfamiliar with scientific terminology. (English teachers tend to have a humanities background).

2.2 *Dictionary dependency*

This lack of the vocabulary is just a fraction of the problem. The next problem is their dependency on a dictionary. It is natural to use a dictionary when one encounters an unknown word regardless of language. However, because of the manner in which English is taught in Japan, students are easily trapped in this dependency.

They can neither guess the meaning of an unknown word from the context nor ignore it and continue further. They just stop there. Because they have no knowledge of the etymology of English words, they cannot make any sense from a sentence which contains one or more unknown words.

Unfortunately, once this dependency is set in them, their flexibility and imagination are often suppressed as a result. If my students had a little of either flexibility or imagination, they could get the word 'ampere'. They knew how to pronounce both 'here' and 'there,' ere in the two words that could lead them to say and acknowledge it. Sadly, they did not.

2.3 Lack of dictionary skill

Students do not know how to use the dictionary well, although it seems contradictory to the previous dependency statement. Students are conditioned to look only at the first listed meaning of a word in a dictionary. Many words used in English textbooks are usually taken from the first meaning in a dictionary. Therefore, they do not bother to check for other definitions.

Another reason for the lack is that textbooks often provide meaning of new words in Japanese either in a footnote or a glossary section at the back. So, teachers often neglect to teach how to use a dictionary in detail. As a result, when students need to use a dictionary, they just look only at the first entry.

Once a Japanese meaning of a word is imprinted in their memory, students usually do not make an effort to find out other meanings with which a sentence in question was written.

As an illustration, take 'Fast' for example. Every Japanese student knows its meaning as 'moving at a great speed.' But very few of them know two other commonly used definitions in English speaking society, i.e., 'firmly fixed' and 'to sustain from food.' Some students might know 'fast asleep' but not 'fast color.'

I examined five popular dictionaries sold by Japanese publishers. All of them listed 'moving at a great speed' at the beginning. Interestingly, Webster's Seventh New Collegiate Dictionary placed 'firmly fixed' at the beginning and 'characterized by quick motion' as the fourth definition.

It would be very hard to find a Japanese person knowing breakfast as breaking overnight fasting. Even people working in medical fields like nurses, medical technologists and dieticians would most likely not know it. Physicians, I hope, would know the meaning of 'fast.'

It would be a wonderful surprise if some Japanese knew the meaning of 'fine' as penalty, penalize, powdery, thin and tiny. However, textbooks do not employ these meanings. The Japanese learn it as beautiful and good.

2.4 *Reading Skill*

Recently, I had the chance to help a group of chemical engineering graduate students who were writing their research papers. While I was once reading a draft, I detected several places that did not make any sense at all.

Being a biochemist, I could understand fairly well what they had studied. If there were some theoretical errors, I could see them. If they made logical mistakes, I could detect them, too. therefore, I asked for the papers that had been cited. I found that they had mistranslated important points in these papers.

In many of these cases, students also had mixed up theories proposed by the quoted authors. Because of the writing style and long length of the papers, students were completely confused about the theories presented. Fortunately, these errors were caught prior to submit for publication. I was disturbed by this finding since their professors did not notice the errors made under their guidance.

These problems are not limited to the graduate students. I have assisted physicians and biochemists in translating their papers for the past ten years. I discovered the same kinds of mistakes. It is painfully obvious that these errors limit the success for researchers in any field.

The reason for this problem is the absence of opportunity to read scientific and technological English articles during college life. If they had used English textbooks for their major, the problem could be alleviated greatly.

They might have the opportunity to read English technical papers and textbooks in their senior year. During the year each student has to choose a professor to be his/her graduation thesis advisor. This professor has several students and first asks his/her students to conduct a literature survey on the theme of their theses. The literature, of course, is not confined to Japanese papers.

According to professors, many students try hard to avoid reading English papers. When they are forced to review an English paper chosen by the teacher, they usually cannot finish it to the end.

2.5 *Writing skill*

Students also have difficulty in writing. They have little patience for sorting out facts and organizing their thoughts logically and putting them together in their writing.

I asked students to discuss their views on the future of the electric power supply. I told them to write it briefly in Japanese first. Being major of electric engineering. I thought that these students ought to have some views of their own.

I discovered another sad reality. None of them wrote more than two sentences. Sixteen students out of 22 said that its future would be bright. The rest said otherwise.

The students who took a positive stance could not support their position. Three students who took a dim view gave reasons like 'increasing carbon dioxide' or 'no certain solution for treating the wastes.'

I am troubled by their writing skill. Writing in either Japanese or English, is not dependent on utilizing language skills. It is a mere tool to convey a person's thoughts and feelings to others. It seems to me that the Japanese youth are losing one of the most essential elements of human beings that is critical thinking skills.

I told about this finding to professors over lunch and they were not surprised at all. They said that this has been getting more and more apparent in recent years.

There is another bad habit resulted from the poor English writing skill. I have observed the tendency of some Japanese who borrow sentences from papers written by English native authors. To copy someone's writings is bad enough but often these statements are misused because the Japanese writer has misunderstood the borrowed statements. Is it called plagiarism?

2.6 *Students' intelligence*

I would like to emphasize strongly one thing here before discussing the problems that make it difficult for the Japanese to learn English. That is, these students are by no means less intelligent than any other people on earth. Some students are very bright. Then what makes them like this? I like to bring up causes to this reality.

3. Causes of the difficulty in teaching technical English

3.1 *Geographical isolation*

I firmly believe that Japan's geographical isolation surrounded by seas is the root of the poor skills in English or any other foreign language.

Because of this isolation, the Japanese have never needed to use any foreign languages - unlike people who live in nations sharing contiguous borders like

Europeans and Asians. This unimportance of foreign languages gives no incentive to study them at all. This has been the reality of Japanese history.

There is no question that the Japanese could not have built their own culture alone. We owe a great deal to the Chinese and Koreans as well as Europeans and Americans.

Many Chinese and Koreans came to Japan nearly 1500 years ago and introduced their culture to the Japanese. At the same time, many Japanese went to China and Korea to learn about their cultures and brought them back.

However, this importation never demanded that all Japanese had to learn the Chinese or Korean language. Only the few Japanese who had contacted with foreigners were required to study foreign languages for the purpose of translation the documents into Japanese. This tradition continued when the Protuguese, Spanish and Dutchmen came to Japan about 500 years ago, and again when the British and Americans appeared on the shores 200 years ago on big black ships.

Prior to the arrival of the British and Americans, Japan had closed 300 years to the outside. Upon the appearance of the Black Ships, the Japanese were frightingly shocked by the advancement of western civilization. Therefore, the Japanese government sent many people to Europe and the United States to study western culture and science and technology. Ordinary Japanese were able to learn about the west's scientific achievements through translated materials.

The government also invited many western scholars and asked them to teach the Japanese their advanced systems. Only a limited number of Japanese were privileged to study under them. After World War II, many Japanese went to the United States and brought back the advanced science and technology with which Japan was able to rebuild the land to come to have the standing it now has.

Therefore, it has been necessary to have only a few Japanese to know English or any other foreign language. This lack of necessity weakens the incentive for most Japanese to acquire good English skills.

3.2 *No linguistic relation with English*

The Japanese language developed over 2000 years ago but it did not have a writing system until Chinese culture was imported. Our ancestors

utilized the Chinese writing system effectively and transformed it to fit to their own system. They adapted Chinese characters, which we call KANJI, without changing the original meanings. They also modified the characters completely to make phonetic letters called KANA which we are still using. We, thus, can guess meaning of some Chinese sentences as Europeans are able so surmise meaning of words of other European languages. Since the linguistic basis for the development of Japanese is very different from English, there is no reason to assume that students can even guess what 'ampere' means by just looking at it.

When someone tries to learn something completely foreign to any previous experience, it is difficult to do so even a simple thing. Take an example for calculation skill. For a small child thinking process of calculation with numbers is entirely different from that of speaking with words to which the child has been accustomed from the birth. As a result, many children have trouble with calculation because of the difference.

This can be applied to another way to explain why the Japanese are poor achievers in learning English. There is a huge gap of thinking processes between English and Japanese language grammatically and phonetically.

3.3 *Unfamiliarity with technical English*

Teachers of English in Japan are usually non-science majors and are unfamiliar with mathematic and science terminology. Teachers often told me that they were not interested in teaching technical words as scientists and engineers would decline to teach words outside of their field. A colleague who is teaching technical Japanese for graduate students in School of Engineering at University of Washington, Seattle, U.S.A., reported a similar situation to mine. Teachers of Japanese language are totally indifferent to teach technical Japanese. He therefore has had difficulty recruiting teachers for this purpose.

Medical English poses further difficulties. The Japanese are complete strangers to Latin, but medical terminology is mostly derived from Latin. Medical professionals and biologists have a very hard time writing their papers in English. I understand this difficulty when I had to learn the Latin names for botany. I

could associate the spelling of a plant name with its pronunciation. Since generic names of plants are spelled in Latin which are totally different from English spellings, I was unable to remember the names.

3.4 *Lack of textbooks for technical English*

The fourth point is directly related to the third. As textbooks for middle schools and high schools are generally written by non-science oriented people, they are not keen to include technical words in them. Needless to say, basic math terms such as addition, subtraction, multiplication, and division are not introduced in the textbooks.

Students might encounter terms might appear once or twice in a six-year span before entering college. I know that middle and high school students are taught how to express fraction, one third (1/3) or one tenth (1/10) for instance. If, however, I ask them to express fractions, they would recall studying this, but forget how to express it. If any language, even own native language, is not used often enough, it easily disappear from our memory.

In the past few years, I have noticed that good technical English textbooks are available for college students printed by British and American publishers. A problem, however, is that if the content of a textbook is suitable for students' intellectual and technical level, the level of English is too high for them. The reverse is also true. If English level matches their English skill level, its contents are too easy. In both cases students are too bored to study.

3.5 *Excessively large class size*

The Ministry of Education has been restricting a class size of 40 students from middle schools to high schools. As a result, teachers have disciplinary problems and have a hard time to maintaining an atmosphere conducive to good studying for any subject. When it comes to foreign language teaching with a class of this size, teachers are unable to provide good instruction.

At the college level, most students take at least two years of English. This makes most class size somewhere between 70 to 90 students. My two classes had 60 and 80 students last year.

How can a teacher teach English in a class facing this large number of students whose English level is far below their intelligence?

3.6 *Examination hell*

The final problem may be a purely Northeast Asian cultural characteristic. Japanese society believes that it is imperative to get into a highly reputable school from kindergarten through college to secure children's life long employment in a good company. Korean youths are also reportedly in the similar situation to the Japanese youth.

This social demand has forced educational institutes to become preparatory schools for upper schools which give very hard, competitive entrance examinations. We call this phenomenon as 'examination hell.' What teachers in those schools have to do is to squeeze all necessary information into a child's brain for succesful entrance into one of these reputable schools. We, therefore, call this 'canning education.' When a can is opened and the content is eaten, only an empty can is left alone. After the entrance examination is over, the canned knowledge evaporates quickly into thin air.

That is probably the situation in my students' cases. Their basic knowledge of English was supposed to have been acquired before entering college but this knowledge 'evaporated' after the examination hell was over.

4. Proposal for improvement

Having pointed out the serious English skill deficiencies of Japanese student and obstructions to learning English property, presenting ideas for overcoming them are in order. Here are some ideas.

4.1 *Producing teachers for special English education*

As I mentioned, there are very few teachers who are capable of teaching both ordinary English and technical English in Japan. I assume that this problem is not only specific to Japan. There are many countries where English is neither native nor an official language. These places may be also encountering the same

problem as in Japan. Korea and China perhaps are most likely facing the same predicament as Japan.

There is another good reason for the need of specialized English teachers. Professors of Electric and Electronic Engineering gave me papers for reading materials. I found many words which I could not even guess their meanings or their concepts.

A term 'ideal noise' as an example. The meanings of both ideal and noise are simple and easily understood. However, I had no idea what the combination stands for. Another cases were 'offset current' and 'offset voltage.' These two terminologies were also very hard to comprenhend and did not give me any clue to even guess the definitions.

As long as students' English skills stay low, even, I, having limited technical knowledge of a given field, can teach technical English. However, we educators have the obligation to make every effort to reach a set of goal at which students' English skills will match their intelligence and academic level. When we will have reached the goal, materials for reading and writing in English courses will be more technical and sophisticated.

To cope with this situation, teachers of English have to equip with English teaching skills as well as knowledge equivalent to at least undergraduate level of a discipline chosen. These teachers will be responsible for teaching students reading and writing technical papers.

There is no doubt that teachers who are capable of teaching special English are needed by natural and medical science and engineering fields. I also believe that social science areas are no exceptions.

Training of these teachers is done in graduate programs. Students who have majored in English in undergraduate school, they must concentrate on other area of their choice. If students have studied other than English, they will study on English teaching curriculum. Upon graduation, they will have graduate degrees in English education in a special field.

4.2 *Writing textbooks*

Most textbooks I have seen for middle and high school students in Japan are centered more or less on every day life because the authors are most likely English literature major. Therefore, it cannot be expected of them to write about

topics outside of their academic training. To overcome this problem, inter-disciplinary cooperation is imperative.

It is necessary to expose students to terminology of basic subjects of mathematics, physical and life science, economics, government, law and others. For that, we need to write textbooks containing such basic words.

Textbooks must be attractive enough to both students and teachers. Subjects such as population, food supply, environment, energy supply, science and technological advancement, health related materials, economics and many others would give awareness of the world situation as well as stimulate young people's dreams for their future. Dealing with such subjects technical terminology.

Content should be coordinated with students' academic progress. If not, students will become bored with the textbooks due to materials too easy or too hard as I had experienced myself with my college students.

Needless to say, college textbooks for upper class students who have started specializing their field must be provided. These types of textbooks are currently unavailable, unless they use college textbooks prepared for English speaking students.

4.3 *Limiting class size*

To learn foreign language an overcrowded classroom environment does not support foreign language development and produce students who can communicate with foreigners comfortable. The class must be small. I think that less than 15 for writing and oral conversation and not exceeding 25 for reading and grammar would be a good size.

A teacher's workload should be limited to a reasonable amount. Many colleges in Japan are asking a teacher to handle several hundred students. Obviously, it is impossible for anyone who wants to teach English conscientiously to succeed with such a huge number of students.

I have not taught regular English subjects and have no idea what is a reasonable workload for a teacher. Some guidelines can be made by some professional organizations such as the International Association for World Englishes and National Council of Teachers of English.

5. Conclusion

The purpose of this paper was to discuss the problems that give me difficulty in teaching technical English to engineering students.

I hope that I have shown the readers about the difficulty of teaching and learning English in non-English speaking society. My experience convinced me that a different approach must be created in order to teach English to people who live in a society where the language spoken has no relation whatsoever to a European language.

At the same time I like to emphasize the importance of teaching special English to the Japanese. It is a must for developing good international relationship which will be one of the most important aspects in the 21st century.

As I teach English to children and adults, a nagging question has always been in my mind. I would like to end this paper with the following very simple question: Why do Japanese have to study English that is unnecessary for living?

Once this question is answered, teachers will enable themselves to teach English with a clear aim and professional conviction. Students will understand that value in studying English or any other language and therefore, become motivated as a result.

Table 1
Terminologies recognized by 112 students

No	Terminology	No. of STD	%	No	Terminology	No. of STD	%
1	ampere	6	5	31	positive	22	20
2	amplify	0	0	32	rectifier	2	2
3	anode	0	0	33	resistance	34	30
4	atom	112	100	34	semiconductor	2	2
5	cathode	0	0	35	signa	1 54	48
6	charge	3	3	36	superconductor	15	13
7	circuit	6	5	37	temperature	2	2
8	collector	13	12	38	theoretica	1 0	0
9	condenser	15	3	39	transistor	15	13
10	conduct	3	3	40	wave	103	2
11	contact	17	5	41	addition	0	0
12	current	3	3	42	average	3	3
13	device	0	0	43	calculate	6	5
14	diagram	8	7	44	decimal	3	3
15	direct current	4	4	45	digit	2	2
16	discharge	0	0	46	division	0	0
17	discover	39	35	47	equal	39	35
18	distortion	0	0	48	equation	2	2
19	electrode	0	0	49	fraction	0	0
20	electron	101	0	50	function	0	0
21	electronic	99	88	51	geometry	2	2
22	element	3	3	52	infinity	0	0
23	impedance	0	0	53	linear	0	0
24	inpu	50	45	54	logarithm	10	9
25	instrument	7	6	55	mean	2	2
26	load	3	3	56	multiplication	0	0
27	magnetism	18	16	57	proportion	0	0
28	measurement	0	0	58	solution	6	5
29	oscillate	0	0	59	square	2	2
30	output	22	20	60	subtraction	0	0

Summary
Number of words that were recognized by students

0%	20 words (33%)
More than 0% but less than 10%	23 words (38%)
More than 10% but less than 20%	8 words (13%)
More than 20% but less than 50%	5 words (8%)
More than 50% but less than 100%	3 words (5%)
100%	1 words (2%)
Total	60 words