Ethnography of Scientific English: Towards the Development of a Curriculum of Scientific Communication for Graduate Students in Japan

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Ethnography of Scientific English:

Towards the Development of a Curriculum of Scientific Communication for Graduate Students in Japan

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ABSTRACT

The dominance of English as the international language of science communication is well documented. Little research, however, has been done for Japanese graduate students in Japan. The dissertation provides a general overview and problems of current tertiary education in Japan and review of the literature organized around English for specific purposes including its history, definition, subcategories and practical application, including comparison of two existing ESP programs in Japan. This dissertation recognizes a graduate school in science and technology as a community with distinct culture and the author conducted four studies.

Chapter 3 examines Japanese graduate students' attitudes towards studying English, needs/wants of ESP education, and perception and experiences of English as an international language through a small-scale questionnaire and focus group interview study. The study elucidated the graduate students' needs of learning both General English and ESP focusing on Scientific English, their perceived disadvantages including the slow speed of input and output, the learning burden of English, and the time taken for learning and mastering English.

Chapter 4 explores the problem of silence among Japanese graduate students during chemistry lectures by an American professor. Data were drawn from classroom observations and an informal group interview with the American professor, who was an invited lecturer, and four Japanese doctoral students who attended his lectures. The study found that the problem of Japanese graduate students' silence during American professor's lecture was the consequences of a mix of factors such as perceived lack of adequate language proficiency perceived incompetence to make relevant contributions differences in personality and culture of learning, and a cultural value symbolized by the proverb "The nail that sticks out gets hammered down."

Chapter 5 reports on a short-term study abroad program for Japanese graduate students specializing in science and engineering. The program included three weeks of intensive English training at a university in California and field trips to other local campuses and major companies. They study identified the students' perceived lack of basic English communication skills and courage (*dokyo*) to communicate with foreign researchers, and their belief that studying in English-only environment is imperative to overcome these lacks. Students overcame their anxiety of English communication by learning to initiate conversations with people, ask questions, and respond to questions promptly and clearly, and also felt the necessity to improve their English pronunciations and increase English vocabulary.

Chapter 6 provides an overview of a 12-week online scientific writing course designed for graduate students and young researchers. The study aimed to determine factors that hindered or facilitated the implementation of the online writing course. The effectiveness of the course and problems with its implementation are discussed from a variety of perspectives. The study found the three factors, 'course component', 'length of the study', and 'instructor's background', influence students' motivation and persistence for learning.

Based on these findings, the dissertation discusses the important topics in designing curriculum that are of value to both graduate students and faculty members in science as well as to technology and ESL and ESP practitioners. Suggestions for further research are also included.

Keywords: *ESP, Scientific English, course design, needs analysis*

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Glossary of Abbreviations and Acronyms

ATCYR: Authorship training course for young researchers

BICS: Basic interpersonal communication skills

CALP: Cognitive academic language proficiency

CARS: Create-a-research space

EAP: English for academic purposes

EFL: English as a foreign language

EGP: English for general purposes

EILS: English as international language for science

EIL: English as international language

ELT: English language teaching

EOP: English for occupational purposes

ESL: English as a second language

ESP: English for specific purposes

EST: English for science and technology

FGI: focus group interview

GE: general English

IMRD: Introduction-Method-Results-Discussion

METI: Ministry of Economy, Trade and Industry

MEXT: Ministry of Education, Culture, Sports, Science and Technology

JSPS: Japan Society for the Promotion of Science

NES: native English speaker

NNES: non-native English speaker

THE: Times Higher Education

QS: Quacquarelli Symonds

CHAPTER ONE

INTRODUCTION, CONTEXT AND THEORETICAL FRAMEWORK

Introduction

Since the beginning of the twenty-first century, the world has experienced a relentless information technology revolution. People, materials, money, and information now move globally. Within the context of the globalization of society and advancements in technology, scientists are subject to intense international competition. Obtaining a high citation rate has become a testament to a scientific researcher's recognition in the international community. Scientists, especially young ones, face tremendous pressure to publish in journals with a high impact factor (Heinrich, 2008). The journals with the highest impact factors publish almost exclusively in English (Montgomery, 2004). Thus, scientists must have a satisfactory command of English to obtain international recognition through visible journals and to access relevant publications (Meneghini & Packer, 2007; Tardy, 2004). Consequently, English is the dominant international language of cutting-edge scientists (Ammon, 2006; Crystal, 2003; Swales, 2004). Since the scientific field is the most internationally diverse within academia, science students must learn how to be effective in communicating cross-culturally (Wainwright et al., 2009). Under these circumstances, publication of a couple of research papers in recognized journals is often a requirement for graduating from PhD programs at research-oriented universities in Japan. Consequently, Japanese students in science and engineering are required to gain ability in English in order to successfully function in the professional setting. Through four ethnographic studies, this dissertation examines a graduate school in science and technology as a community with a distinct culture. The rest of this chapter provides contextual background, theoretical orientation, research methodology, and remarks on the significance and organization of this dissertation.

Contextual Background

This section provides the necessary background to understand the problems of contemporary tertiary education in Japan, by touching on such important key terms such as *Daigaku No Kokusaika* (internationalization of universities), *Gurobaru Jinzai* (Global Human Resources), and *Uchimuki Shiko* (inward-looking orientation).

Daigaku No Kokusaika

In recent years, there has been increasing interest in international university rankings, such as the World University Rankings (https://www.timeshighereducation.com) published by Times Higher Education (THE) and the QS World University Rankings (http://www.topuniversities.com) published by the British Quacquarelli Symonds (QS). In such rankings, universities around the world are compared based on performance criteria (Table 1).

Table 1

Performance criteria for World University Rankings

THE	QS
Teaching (the learning environment): 30%	Student-to-faculty ratio: 20%
Research (volume, income and reputation) 30%	Academic reputation: 40%
Citation (research influence) 30%	Citations per faculty: 20%
International outlook (staff, students, research): 7.5%	International faculty ratio: 5%& international student ratio: 5%
Industry income (knowledge transfer): 2.5%	Employer reputation: 10%

Employing citation as one of the important criteria, these rankings tend to favor universities that have specific strengths in the disciplines of natural sciences and that produce

many frequently cited scientific publications. Because such publications are written in English, two English-speaking countries—the United States and the United Kingdom—have had a virtual monopoly on the top 10 positions in both the previously mentioned international university rankings in the 2015-2016 academic year (Table 2).

Table 2

World University Rankings 2015-2016: Top 10

Institution	Country	THE	QS
California Institute of Technology	US	1	5
University of Oxford	UK	2	6
Stanford University	US	3	3
University of Cambridge	UK	4	3
Massachusetts Institute of Technology	US	5	1
Harvard University	US	6	2
Princeton University	US	7	11
Imperial College London	UK	8	8
Swiss Federal Institute of Technology Zurich	Switzerland	9	9
University of Chicago	US	10	10

In accordance with the slogan *Daigaku No Kokusaika* (internationalization of universities), both the Japanese government and Japanese universities have been striving to elevate Japanese universities' position and to increase the number of world-class universities in Japan (Yonezawa, 2013). The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) has long conducted a series of funded projects seeking to foster in students and researchers the ability to play active roles in the global arena; the projects also seek to internationalize Japanese universities in order to elevate the international competitiveness of Japanese tertiary education.

Rooted in the scheme of the "300,000 International Students Plan," which called for an increase in the number of international students in Japan from the 140,000 to 300,000 by

2020, the Global 30 Project, "Establishing a University Network for Internationalization," was conducted between 2009 and 2015. Under the Global 30 Project, 13 selected core universities implemented various approaches to internationalizing the academic environment, including launching English-taught degree programs.

With the aim of further internationalizing Japanese universities and strengthening the competitive global position of Japan's top universities, the Japanese government launched a decade-long funded program, the Super Global Universities initiative, in 2014 (Maruko, 2014). Contrary to expectations, however, Japanese universities dropped in the Times Higher Education's World University Rankings of 2015-2016. Specifically, the University of Tokyo fell from 23rd to 43rd position, Kyoto University from 59th to 88th, and three other former national universities, which had been placed between 100th and 200th position in the previous year, fell to below the 200th.

Gurobaru Jinzai

Along with *Daigaku No Kokusaika*, the term *Gurobaru Jinzai* (Global Human Resources) is the one most frequently used in discourse on human resource development in higher education in Japan (Yonezawa, 2014). According to a report by the Global Human Resource Development Committee of the Industry-Academia Partnership for Human Resource Development (2010), which was jointly released by MEXT and the Ministry of Economy, Trade, and Industry (METI), *Gurobaru Jinzai* reflects the person who has "communication ability in a foreign language (particularly in English, which is widely used in the world)," the "ability to understand and take advantage of different cultures," and "fundamental competencies for working persons," the latter of which is a concept proposed by the METI and includes the abilities to take action, to think well, and to work in a team.

With the aim of "foster[ing] human resources who can positively meet the challenges and succeed in the global field" (MEXT, 2012), MEXT launched another funding initiative, the Project for Promotion of Global Human Resource Development, in 2012; for this initiative, 11 university-wide programs and 31 faculty-based programs were selected. Most of these programs are intent on providing incentives and support to enable Japanese students to study abroad (Yonezawa 2014).

Uchimuki Shiko

Meanwhile, the *Uchimuki Shiko* (inward-looking orientation) of the younger generation in Japan, by which their attitudes are more domestically oriented than internationally oriented in character, has emerged as a social issue (Burgess, 2015) and presents a challenge regarding the future of the country's scientific community. This problem initially came into focus when Nobel laureate Akira Suzuki (for chemistry, in 2010), speaking to the Japan National Press Club, encouraged youths to study abroad. According to results from the "Survey on Mobility of Science and Technology Researchers in Japan," administered in 2009 by MEXT and the National Institute of Science and Technology Policy (NISTEP), the rate of young researchers' transferring to other institutions was 66.1%, representing an increase from previous years. Among those who responded, however, only 10.6% had lived overseas; of all the respondents, only 2.0% expressed an interest in conducting future research overseas (MEXT 2010). To encourage young researchers with *Sotomuki Shiko* (overseas-oriented attitudes), public institutions and tertiary educational organizations have been promoting a variety of study abroad options. In 2009, for example, Japan's Society for the Promotion of Science (JSPS) established a research fund to implement its "International Research Experience for Students and Young Researchers," which consists of the Excellent Young Researcher Overseas Visit Program (to support

individuals) and the Institutional Program for Young Researcher Overseas Visits to support universities and other research institutions that connect students and young researchers with research activities at foreign institutions. Likewise, a number of Japanese graduate schools have launched short-term study abroad programs for science and engineering students to develop their English communication skills and foster cross-cultural understanding.

Theoretical Framework

Purpose

The academic inquiry of this dissertation began as an attempt to deeply understand the unique culture of "Scientific English" at a graduate school of science and engineering in Japan. As important background, the dissertation recognizes the unique culture of education in the Japanese university classroom.

Snow (2001[1959], p. 169) noted that "the intellectual life of the whole of western society" is split into two cultures, namely the sciences and the humanities. The sciences are referred to as *Rikei* and the humanities as *Bunkei* in Japanese society, and differences between the cultures of these two realms are often discussed. This dissertation examines a graduate school in science and technology as a community with a distinct culture; I conducted several years of fieldwork to explore the culture of their language learning through a series of studies, which are reported in the following chapters of this dissertation.

Secondly, this dissertation also seeks to explore the current situation of teaching English for specific purposes (ESP) to Japanese graduate students majoring in chemistry-related fields; the dissertation discusses issues that are important in designing ESP programs for graduate students in science and technology. As noted by Dörnyei (2007):

> [a]pplied linguistics as a field has an inherent interest in intercultural communication and therefore ethnographic research has been embraced by scholars who look at language learning as a profoundly social practice and see 'second language learning', 'second culture learning' and 'language socialization' as inextricable bound. (p.130)

Finally, this dissertation also intends to discuss Japanese students' inhibition in English communication and the phenomenon of silence in the English lecture, which can be a source of conflict between foreign researchers/instructors and Japanese students, and, for Japanese graduate students an obstacle to acquiring necessary English communication skills.

In order to meet these research objectives, I conducted several studies, gaining insight into the situation of student needs from a variety of angles. The broad research questions are formulated as follows:

1. To what extent do Japanese graduate students in science and engineering want and need English education?
2. What implications do the findings have for ESP course design in the setting of graduate schools of science and engineering in Japan?

Scope

As indicated by the title of this dissertation, "Ethnography of Scientific English," this dissertation provides a preliminary overview of some of the important language-related issues among Japanese students studying at graduate schools of science and engineering in Japan. Although Scientific English started as a genre of English used for scientific writing, Goldbort (2006) provided a new and wider interpretation of the term:

> Scientific English is a number of things. It is a communication tool, a culture of writing, and a plain and readable manner of writing with specific compositional strategies and uses of language—all of which permit the community of scientific researchers to conduct its professional affairs (p. 1).

This dissertation reports on studies of the ways in which Japanese graduate students in science and engineering learn English as a communication tool in their academic environment, which includes not only writing scientific papers but also writing correspondence in a research setting, giving presentations, interacting during conference sessions, and communicating in the classroom.

Research Methodology

The overall purpose of the studies in this dissertation was to gain insight into the unique education culture of scientific English in tertiary education in Japan. To better understand Japanese scientists' experiences with English as an international language of scientific communication, all four studies, namely Chapters 3 through 6 of this dissertation, were conducted ethnography, which is one of the qualitative research designs.

Denzin & Lincoln (2000) offer the following definition to qualitative research:

> Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that makes the world visible. These practices ... turn the world into a series of representations including fieldnotes, interviews, conversations, photographs, recordings and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings,

> attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them. (Denzin & Lincoln, 2000, p.5).

Originally a research method in the field of anthropology, ethnography is defined by Watson-Gegeo (1988) as "the study of people's behavior in naturally occurring, ongoing settings, with a focus on cultural interpretation of behavior" (p. 576). Ethnography differs from other types of qualitative research in that it is holistic and it treats culture as integral to the analysis (p. 577).

According to Atkinson & Hammersley (1994), ethnography has a substantial number of the following features:

1. a strong emphasis on exploring the nature of particular social phenomena, rather than setting out to test hypotheses about them,
2. a tendency to work primarily with 'unstructured' data, that is, data that have not been coded at the point of data collection in terms of a closed set of analytic categories,
3. investigation of a small number of cases, perhaps just one case in details, and
4. analysis of data that involves explicit interpretation of the meanings and functions of human actions, the product of which mainly takes the form of verbal descriptions and explanations, with quantification and statistical analysis playing a subordinate role at most (p. 248).

Researcher

To report on the series of qualitative studies in this dissertation, I have drawn on five years of personal experience working as an educational support staff member in an

educational and research program at a graduate school in science and technology. My main responsibilities in this educational program were to assist with course design of English programs for the program students and to conduct special English courses, presentation workshops, overseas training, and online scientific writing courses for Japanese graduate students. Holding a master's degree in English linguistics and having ten years' professional experience as an ESL instructor, I draw on substantial background knowledge in the pedagogy of English education. In this program, I was also in charge of special lecture series by invited world-renowned researchers and educators from institutions abroad. Additionally, I used my English abilities to provide support to young post-doctoral research fellows. To undertake all these tasks, I needed to work closely with senior professors and ask them about their views and needs. Therefore, after my five years of work experience, I had a keen understanding of my field of study, chemistry departments in Japanese universities, although I was completely outsider in this discipline because I am not a chemist. My research continued after the end of this program as I stayed in the field as an assistant professor in the school of engineering at the university. In total, I spent eight years working in the field to complete this dissertation.

Setting

All four studies included in this dissertation were conducted at a graduate school in a large research-oriented university located in Western Japan. Thomson Reuters (2014) selected the university as one of Japan's top 20 research institutions, whose research activities are particularly distinguished in the fields of chemistry, materials science, immunology, and biology and biochemistry. The participants in all four studies in this dissertation were graduate students who belong to the laboratories in such fields. Additionally,

they all belonged to a government-funded Global Centers of Excellence (COE) program in which English education was the one of highlights of its education.

According to the program's website, the intent and purpose of this government-funded program are:

> The program will provide funding support for establishing education and research centers that perform at the apex of global excellence to elevate the international competitiveness of the Japanese universities. The program will strengthen and enhance the education and research functions of graduate schools, to foster highly creative young researchers who will go on to become world leaders in their respective fields through experiencing and practicing research of the highest world standard. (http://www.jsps.go.jp/english/e-globalcoe/)

With the high demand of cultivating the qualities and skills needed in the society, ESP Education was emphasized among the various special courses implemented to promote the global-mindedness of the PhD students in this program. I was struck by the tremendous need that PhD students in chemistry had for English. Thus, it was natural that I became interested in conducting this research.

Significance

Firstly, the findings reported here will be beneficial to ESP practitioners teaching in graduate schools in science and technology, because the findings provide a frame of reference for the design of ESP programs. This dissertation will help researchers in applied linguistics uncover critical areas in ESP education that many researchers may have been unable to explore.

Moreover, the findings of the studies reported here may hold benefits for the community of Japanese scientists. For over half a century, Japan has been a leader in innovation across many scientific fields, and a giant in the world economy. Japan has also been known for its world-class universities, established government laboratories, and several Nobel laureates. Japanese universities, however, lag behind their foreign counterparts in the number of publication citations. In this regard, Japan may have been held back by a lack of nearby partners in terms of collaboration, with international collaboration an important indicator of the standing of a country's research (Adams, King, Miyairi, & Pendlebury, 2010). Considering that English is the international language of scientists in the present global era, there is a greater demand for Japanese scientists with good English proficiency.

Finally, the current status of Japanese universities in the world rankings and the educational initiatives noted in the first part of this chapter show the Japanese government's awareness of the existing challenges to Japanese higher education. There are a number of well-coordinated ESP courses and programs at undergraduate level, but there remains a greater demand for ESP curricula at the graduate level, where students have higher-level needs in terms of ESP.

It is imperative for universities and colleges to provide ESP education to their students in science and engineering. However, there have been only a handful of fully coordinated and large-scale ESP programs for graduate students in science and engineering. Thus, the findings of the studies in this dissertation have pedagogical implications for ESP course design.

Construction of the Dissertation

This dissertation will be divided into seven chapters. Chapter 1 has

- provided background information of the study,

- the nature of the current problem,
- outlined the development of my interest in English Education for Japanese graduate students, particularly in science and engineering,
- introduced the theoretical orientation on which this dissertation is based, and
- indicated significance of this study.

Following the introductory chapter, the remaining chapters are organized as follows.

Chapter 2 contextualizes the study by presenting the overview of global spread of English including English as an International Language (EIL) and the English as an International Language of Science (EILS) and a ESP and its subcategories, and sets out its practical application. In order to facilitate understanding of the current context of ESP programs in tertiary education in Japan, this chapter also introduces and compares two existing ESP programs designed for tertiary students in Japan.

Chapter 3 examines Japanese graduate students' attitudes towards studying English, needs/wants of ESP education, and perception and experiences of English as an international language through a small-scale questionnaire and focus group interview study. The study will explore their priorities of English learning, the importance of learning ESP with a Scientific English focus, and the advantages and disadvantages of the dominance of EILS. Findings from the study are discussed from the viewpoints of students. This chapter is based on Tamura (2016).

Chapter 4 reports on silence among Japanese graduate students during chemistry lectures by an American professor. Data were drawn from classroom observations, a semi-structured interview with the American professor, who was an invited lecturer, and an informal group interview with the four Japanese doctoral students who attended his lectures. This chapter is based on Tamura (2014).

Chapter 5 reports on a short-term study abroad program for Japanese graduate students specializing in science and engineering. The program included three weeks of intensive English training at a university in California and field trips to other local campuses and major companies. Data were drawn from the statements of purpose written by the participants prior to their trip to California and from on-site interviews conducted during the program. This chapter is based on Tamura (2012).

Chapter 6 provides an overview of a 12-week online scientific writing course designed for graduate students and young researchers engaged in research in various fields of chemistry and life sciences at a public university in Western Japan. The study aimed to determine factors that hindered or facilitated the implementation of the online writing course. The efficacy of the course and problems with its implementation are discussed from a variety of perspectives. This chapter is based on Tamura & Joseph (2014).

Chapter 7 gives the summary of the findings and discusses the topics related to the development of a scientific communication course for graduate students in Japan and presents the challenges relevant to the design of ESP courses for Japanese graduate students in chemistry fields. Further implications of the study are also presented.

CHAPTER TWO

TEACHING OF ENGLISH FOR SPECIFIC PURPOSES

Introduction

This chapter explores the relevant literature related to the surroundings of English for International Language for Scientists (EILS) and English for Specific Purposes (ESP). The first part presents the global spread of English as an International Language (EIL) and as an International Language for Science (EILS). The second part gives an overview of English for Specific Purposes (ESP), the rise of which was strongly linked to the global spread of English as the dominant language of scientific and technical communication and the recognition of language variation (according to use and/or user) as a core property of language (Ferguson, 2007). The final part compares the effectiveness of two existing ESP programs designed for tertiary education in Japan.

The Global Spread of English

In the next section, I will provide the overview of English as an International Language (EIL) and sketch out the dominance of English as an International Language of Science (EILS) and discuss the advantages and disadvantages of English used as a standardized language in the community of scientists.

English as an International Language (EIL)

English has a key role in its influence in every walks of life and professions including the realm of social, economic, political, media, banking, travel, science, technology, and communications (Crystal, 2003). The dominant status is, according to Crystal (2003, p.59), primarily the consequence of two factors: the expansion of British colonial power with its

peak by the end of the nineteenth century; and the emergence of the United States as the leading economic power of the twentieth century and the process of globalization over recent years. Besides the two factors mentioned above, it is important to mention that sociolinguistic literature concerning the topic of English as a world language (e.g. Crystal (2003); Graddol (2000); Kachru (1986), etc.).

Kachru's Model. In discussing the global spread of English, the most influential model is Kachru's model of World Englishes. The model is predominately organized into three circles: the Inner Circle, the Outer Circle, and the Expanding Circle that "represent three distinct types of speech fellowship of English, phases of the spread of the language, and particular characteristics of the uses of the language and of its acquisition and linguistic innovations" (Kachru, 1986, p.122).

The inner circle refers to the countries where English is the primary, first or native language (L1), and includes the United Kingdom, the United States, Australia, New Zealand, Ireland, anglophone Canada, and some of the Caribbean territories. The outer circle refers to the countries where English is not the native tongue, but has second or additional language role (L2) and plays a part in the nation's institutions, either as an official language or otherwise, and includes India, Singapore, the Philippines, Malawi, Rwanda and Algeria and over 50 other territories. The third, Expanding Circle encompasses countries where English fulfills the role of a foreign language (EFL), and includes China, Korea, Japan, Greece, Poland, Norway and the rest of the world. The countries acknowledge the importance of English as an international language, nevertheless without any previous historical connection to English as in the first case (the Inner Circle) or the special status of English in their institutions as in the second case (the Outer Circle). Kachru (1992) distinguishes three types of varieties: First, the inner circle is 'norm-providing' varieties, including American English; British English and less-preferred Australian and New Zealand English. Second, the outer

circle is ‘norm-developing’ varieties, including Singapore English, Nigerian English, and Indian English. Third, the expanding circle, including much of the rest of the world, is ‘norm-dependent’, because it relies on the standards set by NES in the inner circle.

Graddol’s Model. Graddol (2000) points out one problem of Kachru’s model because it places the NES and Anglophone countries in the center of global use of English, which will not be relevant for describing English usage in the next century (p.10). Instead, Graddol (2000) suggests that the three circles of English first-language speaker (L1), second-language speaker (L2) and Speaker of English as a foreign language (EFL) overlap, with the ‘center of gravity’ shifting towards L2 English speakers at the start of the 21st century so that ‘those who speak English alongside other languages will be larger in number than first-language speakers in the next century. and, increasingly, will decide the global future of the language in the next century.

English as the International Language of Science (EILS)

For better or/and worse, English has become the de facto international language of science (Ammon, 2006; Crystal, 2003; Graddol, 2000; Swales, 2004). Here are two views regarding the dominance of English in scientific communication.

On the one hand, scientists may benefit from publishing in English, as it creates new opportunities and experiences (Meneghini & Packer, 2007, p. 112).

Sano (2002) discussed the effects of using English from three points of view relating to information transfer: for readers (the receivers of information), for the circulation of scientific information, and for authors (the transmitters of information). The need to understand other languages has significantly decreased in reverse proportion to the shift toward English only. This is how publication in English contributes to acceleration in the circulation of scientific information. By publishing in English, scientists can appeal to an

extended audience and obtain greater reader response. This encourages their further research and development activities (Sano, 2002, p. 48).

On the other hand, however, whereas the advantages are considerable, the dominance of English can be a heavy burden for scientists from non-English speaking countries. Swales (1997) described English as something of a Tyrannosaurus rex (Swales, 1997)—''a powerful carnivore gobbling up the other denizens of the academic linguistic grazing grounds''(p.374). "Most scientists with a PhD degree in these countries can read an English text in their area of knowledge, but they rarely have mastered English sufficiently to write a clear and concise text" (Meneghini & Packer, 2007, p. 114). Furthermore, "[s]cientists who do not have English as a mother tongue will take a longer time to assimilate reports in English compared with their mother-tongue colleagues, and will as a consequence have less time to carry out their own creative work" (Crystal, 2003, p. 16). Given that scientists are able to read English publications, they must still translate this knowledge into their mother tongue to pass along the benefits to their society (Meheghni & Packer, 2007, p. 112).

English is not only the means for publication. Taking the example of Korea, Madeleine (2007) elaborated further on the burden of English for non-English speaking scientists:

> They [scientists] must learn enough English to understand and deliver oral presentations, and to converse with colleagues of diverse backgrounds and accents. The time and effort detracts substantially from scientific work. Presenters feel humiliated by their language mistakes and struggle to understand what they hear and read in English (p. 454).

The same would hold true for other non-English speaking countries. In order to remain visible in their community, scientists need to keep publishing in English. Their work may be ignored by the international community simply because it is not published in English (Crystal, 2003; Meheghni & Packer, 2007; Tychinin & Kamnev, 2005). “Scientists who cannot place their work in English journals are doubly penalized; not only is their voice stilled, but they are denied the conventional rewards available through the academy” (Kaplan, 2001, p. 22). Without English, a scientist lacks a crucial tool for his or her career, and the future portends little change in this regard, as English becomes ever more dominant (Jeffe, 2003, p. 44).

English for Specific Purposes (ESP)

English for specific purposes (ESP) is “the language research and instruction that focuses on the specific communicative needs and practices of particular social groups” (Hyland, 2007, P.380). ESP originated within the field of English language teaching (ELT) in order to help international students with academic writing in English, and to help non-native English speaking (NNES) researchers get published in English (Johns & Dudley-Evans, 1991). This section will sketch out its historical overview of the development of ESP and its definition and practical application.

Historical Overview of ESP

Emerging out of Halliday, MacIntosh, and Strevens’ (1964) groundbreaking work, ESP has been a lively and stimulating area within the ELT field (Dudley-Evans, 2000, Hyland, 2007), and has long served as an alternative to general English teaching approaches (Anthony, 2009, Hyland, 2007). Hutchinson and Waters (1987) noted that there are three reasons common to the emergence of all ESP: 1) the demands of a Brave New World, 2) a

revolution in linguistics, and 3) focus on the learner (Hutchinson & Waters, 1987). They argued that a combination of these three important factors resulted in the growth of ESP.

The Demands of a Brave New World. First, Hutchinson and Waters (1987) argued that two important periods in history breathed life into ESP: the end of the Second World War and the oil crisis of the early 1970s. First, the end of the Second World War resulted in unprecedented expansion in scientific, technical, and economic activity on an international scale. English became the international language due to the economic power of the United States during the post-war period (Hutchinson & Waters, 1987). Second, the Oil Crisis of the early 1970s resulted in Western money and knowledge flowing into oil-rich countries.

> The general effect of all this development was to exert pressure on the language teaching profession to deliver the required goods. Whereas English had previously decided its own destiny, it now became subject to the wishes, needs and demands of people other than language teachers (Hutchinson & Waters, 1987, p.7).

A Revolution in Linguistics. The second key reason cited by Hutchinson and Waters (1987) as having a tremendous impact on the growth of ESP was a dramatic change in the field of linguistics. Pioneering linguists, unlike traditional linguists who had described the rules (i.e., the grammars) of languages, began to focus on the ways in which language is used in actual communication settings, and on the differences between spoken and written English. Linguists at that time realized that it is possible to tailor language instruction to meet the needs of learners in specific contexts, as language varies according to the context or setting in which it is used. In the late 1960s and early 1970s, English for Science and Technology (EST) was synonymous with ESP (Hutchinson & Waters, 1987).

In the 1960s, Garfield, the inventor of the Science Citation Index, recognized English as an international language for written communication among scientists. Emphasizing the significance of detectability as the key to whether or not an article will be read, Garfield (1967) suggested that researchers should write at least their contents pages in English. By the 1980s, more than 60% of scientific papers were being published in English.

During the same period, ESP researchers began to use genre analysis as a research and educational tool. Genre became an important notion within ESP and has made a significant contribution to ESP research. Swale's (1990) definition of "genre" is most widely accepted and applied in ESP:

> A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choices of content and style (p. 58).

Swales' (1985, 1990, 2000) work established the foundation for genre analyses in the field of ESP and had a strong influence on the teaching of ESP, especially the teaching of English for Academic Purposes (EAP) to graduate students. Regarding genre analysis, Swales (1985) argued that:

> it is not only texts that we need to understand but the roles texts have in their environments; the values congruent and conflictive, placed on them by occupant, professional and disciplinary memberships; and the expectation these memberships have on the patterning of the genres they participate in (p. 219).

In EFL/ESL context, Scientific English was recognized as a genre of English after the publication in 1971 of Swale's textbook of English as a foreign language for students of physical and engineering sciences, *Writing Scientific English*. Swales (1990) introduced the two types of rhetorical and thematic structures, namely the Create-A-Research Space (CARS) model and the Introduction-Method-Results-Discussion (IMRD) model.

CARS model attempts to explain and describe the organizational pattern of writing the introduction to scholarly research studies. The model proposes three "moves", accompanied by specific "steps", that reflect the development of an effective introduction for a research paper. This model has had a tremendous influence on genre analysis in ESP and on the teaching of academic writing, both to international or L1 students, or to professional writers wishing to publish in international journals (Dudley-Evans, 2000). Today, IMRD model is regarded as the conventionalized structure of the scientific papers.

Whereas Scientific English originated as a genre, Goldbort (2006) provided a new and wider interpretation of the term:

> Scientific English is a number of things. It is a communication tool, a culture of writing, and a plain and readable manner of writing with specific compositional strategies and uses of language—all of which permit the community of scientific researchers to conduct its professional affairs (p. 1).

Focus on the Learner. The final reason Hutchinson and Waters (1987) cite as having influenced the emergence of ESP was that a new development in educational psychology contributed to the emergence of ESP. They noted that there was a flaw in previous approaches to ESP, in that these approaches were 'based on descriptions of language use' (P.14). Rather than simply focus on the method of language delivery, more attention was

given to language learning, the way learners acquire language and their attitudes to learning. Learners were seen to adopt different learning strategies, different skills, different learning schemata, and be motivated by different needs and interests. Consequently, specific courses relevant to these individual needs and interests were designed in the belief that these would have a positive influence on their motivation to learn and on the effectiveness of the language learning.

What ESP Entails

A broad definition of ESP cited by Hutchinson and Waters (1987) is that "ESP is an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning" (p. 19). The following sections present the three key issues of: i) the distinction between the absolute and variable characteristics of ESP, ii) types of ESP, and iii) the characteristics of ESP courses. Then the discussion describes the benefits of ESP courses.

Definition of ESP. ESP is an umbrella term that includes two main areas of study, namely English for Occupational Purposes (EOP) and EAP (Hutchinson & Waters, 1987; Robinson, 1991). Regarding EAP, Dudley-Evans and St. John (1998, p. 34) stated that it "refers to any English teaching that relates to study purposes. EST is one of subcategories under EAP. "EST covers the areas of English written for academic and professional purposes and of English written for occupational (and vocational) purposes, including the often informally written discourse found in trade journals and scientific and technical materials written for the layman" (Trimble, 1985, p.5).

Thus, the definition of ESP focuses on its relevance to learners who learn English for a particular purpose, rather than merely learning the language system of English (Hutchinson

&Waters, 1987). Whatever the purpose may be, educational or professional, ESP seeks to prepare learners to successfully achieve their required purposes (Dudley-Evans, 2000). Hutchinson and Waters (1987) defined ESP not as a product (i.e., a particular kind of language, teaching material or methodology) but as an approach to language learning based on learner needs. Therefore, the core of all ESP is this question: "Why does this learner need to learn a foreign language?"

Robinson's (1991) definition of ESP is based on two key criteria:

1. ESP is normally goal-directed, and
2. ESP courses develop from a needs analysis which aim to specify what exactly it is that students have to do through the medium of English, and from a number of characteristics which explain that ESP courses are generally constrained by a limited period of time in which their objectives have to be achieved and taught to adults in homogenous classes in terms of the work or specialist studies (p. 3).

Characteristics of ESP. Dudley-Evans and St. John (1998, pp. 4-5) provided a comprehensive characterization of ESP as language teaching using absolute and variable characteristics, as set out below.

Absolute characteristics:

- ESP is defined to meet specific needs of the learners,
- ESP makes use of underlying methodology and activities of the discipline it serves,
- ESP is centered on the language (grammar, lexis, register), skills, discourse, and genre appropriate to these activities.

Variable characteristics:

- ESP may be related to or designed for specific disciplines,
- ESP may use, in specific teaching situations, a different methodology from that of general English,
- ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation. It could, however, be for learners at secondary school level, and
- ESP is generally designed for intermediate or advanced students. Most ESP courses assume some basic knowledge of the language systems, but it can be used with beginners.

Key notions about ESP. Pointing to the obscurity of the words needs and specific, which are key elements of ESP, Anthony (2009) noted that ESP is still largely misunderstood by ESL teachers. Firstly, there is a gap in the needs related to English between teachers and learners. Whereas ESL teachers may prioritize the teaching of grammar and vocabulary, learners may need to develop conversation skills, or strategies for improving their scores on proficiency tests. In the case of such a gap, the question arises as to whether an ESP approach should be adopted? Secondly, teachers who specialize in English teaching may lack specific knowledge of the English taught in ESP curricula. They may be concerned about explaining technical terminology of a discipline different from their own. Thus, a further question arises as to whether an ESP approach should be adopted when a teacher lacks sufficient knowledge of a specific discipline.

ESP in Practice

Key roles of ESP Practitioner. According to Hutchinson and Waters (1987), ESP teachers are ‘‘reluctant dwellers in a strange and uncharted land” (p.158). In order to survive

in the unknown land of ESP teaching, general English teacher have to struggle to master language and subject matter both.

An ESP teacher not only acts as a teacher but he has to play several other roles too. Thus Dudley Evans and St. John (1998) distinguished between the "General English teacher" and the so-called "ESP practitioner" and identified five key roles for the ESP practitioner: a teacher, collaborator, course designer and materials provider, researcher, and evaluator.

Firstly, the ESP practitioner as a teacher should create opportunities of learning in order to generate authentic communication and choose the teaching methods relevant to the students' needs. Anthony (2009) suggested that ESP practitioners are not necessarily familiar with the target discipline of an ESP course. In order to meet the specific needs of the learners and adopt the appropriate methodology, they should work closely with specialists of the target discipline since he or she lacks the knowledge of students' specialty.

The ESP practitioner needs to create his/her own materials and adjust the authentic materials used in the target situation. The central question of ESP practitioners as a course designer and material provider is how specific their teaching materials should be. Hutchinson and Water (1987) argue that different disciplines use the similar grammatical structures, functions, discourse structures, skills, and strategies, thus suggest use materials that cover a wide range of disciplines (p.165). More recent research, however, argues that using topics from multiple disciplines will make the material redundant and confuse the learners about what is appropriate in their discipline. Therefore, the teachers need to research the target field and students' goal and interest in order to develop original material which fulfills their students' needs and is relevant to teach in their ESP classroom (Anthony, 1998).

Finally, ESP practitioners will have to conduct tests to evaluate their students' progress and the effectiveness of their teaching. However, ESP courses are often tailor-made

for the students with specific needs. Therefore, there has been no ESP test which is well-researched and improved by a group of researchers specializing in testing.

Key topics in ESP course designs. In order to design the ESP course that meets the expectation of both the institution and learners, Dudley-Evans and St. John (1998) suggests that an ESP course designer ask the following questions to himself prior to planning course design:

1. Should the course be intensive or extensive?
2. Should the learners' performance be assessed or non-assessed?
3. Should the course deal with immediate needs or with delayed needs?
4. Should the role of the teacher be that of the provider of knowledge and activities, or should it be as facilitator of activities arising from learners expressed wants?
5. Should the course have a broad focus or narrow focus?
6. Should the course be pre-study or pre-experience or run parallel with the study or experience?
7. Should the materials be common-core or specific to learners study or work?
8. Should the group taking the course be homogenous or should it be heterogeneous?
9. Should the course design be worked out by the language teacher after consultation with the learners and institution, or should it be subject to a process of negotiation with the learners? (Dudley-Evans and St.John, 1998, p. 145)

Likewise, Basturkmen (2014) suggested four important topics in ESP course designs. 1) *Varieties of language*: There are two perspectives. There is a common core of general language that is drawn on common words and sentences used in all situations (p.16). Or there is no common core of language because all languages exist as varieties (P. 17). 2) *Needs*

Analysis: The highlight of ESP course design is that syllabus is designed based on an analysis of students' needs. When the students see the obvious relevance of what they are studying, they are likely to be motivated to learn. As the students in ESP program has limited time to learn English, it is important for ESP course designers to identify their students' needs as it will help them specify the contents of the syllabus relevant to their students (p.18). 3) *Types of syllabuses*: Syllabus is aligned with "philosophy" of the course. Specifying the content (what they study) and ordering the content (how they study) reveal the course designer's beliefs about the nature of teaching and learning (p.21). 4) *Wide- versus narrow-angle course designs*: Some course designers may divide the students into classes according to their disciplines and further split them according to their majors. Others might divide the students based on their occupant background or their language proficiency level. When the needs are specific a narrow-angled course may be appropriate. When the needs are more general, a wide-angle course may be preferable (p.25).

ESP Programs in Higher Education in Japan

This section of the chapter introduces case studies of two existing ESP programs designed for science students in Japanese universities and compares their effectiveness.

Center for English Language Education (CELESE), Waseda University

Background. ESP program by CELESE, Center for English Language Education in Science and Engineering is conducted at Waseda University, one of the oldest private universities in Tokyo, Japan. Along with demographic change of Japanese society and establishment of a strong presence among the best universities in Asia, the university has gone through a series of changes since 2004, the central to which was to globalize the student body by creating more opportunities for their students to study abroad and revising its

admission procedures for more international students to study in their university. Faculty of Engineering and Sciences decided to address the problems of its existing English program which was not coordinated by a fixed group of instructors, and established a new ESP center within in their faculty in 2004 (Anthony, 2009, p.28). In 2007, the program components was updated: increasing the number of required and selected courses and creating the two strands of program, which develop both academic skills and communicative skills so that their students improve English enough to perform successfully as a researcher at graduate program. The CELESE program is possibly the largest-scale and most fully-coordinated ESP program found in Japanese universities today.

Course Overview. CELESE program has two strands of courses: "Communication Courses" in which students develop their communicative skills (discussion, debate, negotiation skills, and so on), and "Academic Courses" in which students develop their academic skills (lecture listening, note-taking skills, technical writing, presentation skills, and so on). According to Anthony (2009), CELESE adopted many of the concepts proposed by Dudley-Evans & St. Johns (1998). In the first year the course is teacher-centered and rigidly structured and has rather general purpose ESP goal. Moving into the second year, however, the courses lean toward learner-centered and become gradually specialized. In the third and fourth year courses, when students start reading, writing and presenting in the theme of their specialty, the courses become even more learner-centered. Students take a central role as they discuss their writing and presentation proposals in small peer groups with limited instruction from teacher (p.30). CELESE's faculty is comprised of only ESL teacher. However, representatives from departments of science and engineering are involved as English management committee and join the discussion large-scale planning issue and recruitment of the full-time teachers.

Course Details. CELESE program places the greater importance on learning processes suggested in Hutchinson and Waters (1987). After graduation, students of CELESE will work for a science-technology company where knowledge acquisition (learning) processes and employer's ability to collaborate in a team project. The CELESE program is designed along several continuum including ESP content (general to specific), ESP Learner Age (freshman to senior), and ESP Methodology (teacher centered to learner centered), and maintains balance between product-based learning and process-based learning so that the students can master the language of their academic discipline and become successful in both academia and the workplace (Anthony, 2009, p.41).

Active Learning of English for Science Students (ALESS), the University of Tokyo

Background. Active Learning of English for Science Students (ALESS) is an ESP program established at the Center for Global Communication Strategies within the College of Arts and Sciences (CGCS) of the University of Tokyo in 2008. According to their website, CGCS collaborates with the Department of English Language and other organizations in the College and Graduate School of Arts and Sciences and other departments and conducts a variety of research to develop educational system helping students obtain communication abilities. With the aim to enhance students' ability to use the English language, CGCS developed the original curricula and implemented in the ALESS Programs whose focus is on academic writing for science students. Komaba Writers' Studio (KWS) was also established as a writing center under ALESS in same year. KWS is open five days a week and provides 40-minute private assistance to first-year undergraduates on their writing assignments (Nakatake, 2013). From 2015, the classes for Fluency-oriented Workshop (FLOW) whose focus is on training of spoken fluency in an academic setting have also been offered.

Course Overview. ALESS is a scientific writing course, which is a single-semester compulsory course for first-year science major students (Nakatake, 2013; Mishina 2015). In ALESS program, students design and conduct an original small experiment, write an IMRD (Introduction, Method, Results and Discussion)-style paper based on the experiment, and give an oral presentation in English (Nakatake, 2013). The class size of ALESS is average of 15 students and the total number of lecrures is thirteen. Students come to 90-minute session once a week (Gally, 2009, p.124). All ALESS classes are taught in English by the instructors who are native or near-native speakers of English with advanced degrees (Nakatake, 2013). The overall goals are to foster "autonomy and responsibility, collaborative and communicative learning, critical thinking and reflection, and the idea of active participation in a research community—the provision of an apprenticeship to the scientific community" (Middleton, 2013, p.3).

Two 'service' resources, KWS and the ALESS Lab, where students can seek supports from planning through performing the experiment and interpreting results, has become important part in the delivery of the ALESS Program (Middleton, 2013, p.4). According to Nakatake (2013), Students can receive supports in Japanese from writing tutors and science tutors in KWS. The tutors are graduate students who are native speakers of Japanese or are fluent in Japanese. Although they come from various departments, they take a one-semester course in second-language writing education as a pre-request to become a writing tutor with whom students can consult on their research. Science tutors hold science workshops and give advice on the experiment for their research paper. The two tutors occasionally hold a joint session where "the writing tutor focuses on issues related to organization and language and the science tutor provides feedback on how to analyze the data the student obtained in his or her experiment from a scientific and technical perspective" (p.18).

Course Details. ALESS incorporates a variety of language and general teaching methodologies including "active, autonomous, discovery-based, experiential, genre, project- and task-based learning" (Middleton, 2013, p.2). One key way of ALESS course is that there is no textbook used for the ALESS program and teachers bring the authentic published paper in the classes. Middleton (2012) suggests focus of in-class tasks is more on rhetoric, form, or function rather than the content of the paper (p.55). For their compositions, the data used is from a simple practical experiment. Students choose scientific topics based on an area of interest or an already published paper with the advice of some teaching faculty as they generate a research project and construct their original paper (p.56). Classes have the similar amount of workload and level of difficulty as the faculty members implement the main components of the curriculum through continuous collaboration (Gally, 2009, p.124). In-class peer tutoring (review) on each other's writing is another key of ALESS program.

Students can find resources through the ALESS website. Middleton (2013) introduces these resources, including the ALESS: A Collection of Student Papers and the ALESS Companion reference booklet as key materials facilitating students' autonomous learning. The collection magazine helps students generate ideas and provide additional models for writing, while the reference booklet helps students generate ideas and provide additional models for writing; the reference booklet helps students learning functional language and meta-language.

Discussion and Conclusion

CELESE program and ALESS program both are pioneers of the centralized ESP programs in Japanese university settings. A major difference is that the CELESE program is a 4 year program made by the Faculty of Engineering and Sciences of the university while the ALESS program, designed by the Faculty of Liberal Arts, is a single-semester compulsory

course for first-year science students. Here are also differences in four important topics in ESP course designs suggested in Basturkmen (2014): *Varieties of language, Needs Analysis, Types of syllabuses, Wide- versus narrow-angle course designs*. The content of 4 year's CELESE program is considered under the ESP philosophy suggested by Duddley-Evans & John (1998, p.8) whereas the ESP content shifts from general to specific as ESP learner age becomes higher. Anthony (2009) also suggests "most young university students without experience of conducting research are likely to find the highly specialized content and technical terminology of research articles beyond them. These learners would probably benefits more from a general explanation of paragraph essay structure, and exposure to general academic or so-called semi-technical vocabulary" (p.24). ALESS program teaches scientific writing and communication for first year undergraduate students. Although all ALESS students are science major, they are academically obviously inexperienced because they have not joined the laboratory yet. Middleton (2012, p.55) also admits the students "lack the natural content, context, and motivations that participants in science writing courses often have". However, as Middleton (2012) also suggests what the students study in ALESS classes focus on rhetoric, form, or function therefore the content is not the central of teaching.

The two programs have opposite views in terms of philosophy and angles for designing an ESP program. Anthony (2009) argues "If learners are young and/or have little experience in the field more general purpose ESP courses that are teacher-centered can be very effective. As the learners build necessary skills then teachers can start to address more specific needs using a more learner-centered methodology" (p.32). Accordingly in the 1st year course of the CELESE programs have general purpose ESP, teacher-centered instruction and rigid structured syllabus. As the students grade advances, however, the course leans toward specific purpose, student-centered, less structured. ALESS program where students conduct their own research, write a research paper and make a presentation based on it could

be call a student-centered course from the beginning. Gally (2009) suggested the number of challenges ALESS program has faced:

> Enabling first-year undergraduates to devise original research projects that are both creative and scientifically valid is not easy and there is a danger that too many students will fall back on "safe" project, perhaps even projects copied from students who have taken the course previously (p.126).

CELESE's curriculum seeks to train the students to master not only the language of their academic discipline but also the language necessary to be successful in workplace considering after they graduated from university (Anthony, 2009). Therefore it can be argued that CELESE program is in a wide-angle course designed. Gally (2009), on the other hand, discusses from different view point; "A liberal-art education, however, is focused not on the short term, such as the students' employment or research soon after graduation, but on their entire lives and careers, stretching decades into the future. On such a time scale, specific needs cannot be identified, let alone met, with certainty (p.128). As Anthony (2009) suggests, ESP learners' needs should be investigated from various angles as well as consideration of learners' lacks and their learning need (p.32).

Next chapter discusses Japanese graduate students' attitudes towards studying English, needs/wants of ESP education, and perception and experiences of English as an international language through a small-scale questionnaire and focus group interview study. Their priorities of English learning, the importance of learning ESP with a Scientific English focus, and the advantages and disadvantages of the dominance of EILS will also be explored.

CHAPTER THREE

UNDERSTANDING LANGUAGE NEEDS OF JAPANESE GRADUATE STUDENTS IN CHEMISTRY FIELDS

Introduction

The dominance of English as the international language of science (EILS) has been extensively documented, which has led to a somewhat ambivalent perspectives from NNES scientists: Some acknowledged the advantage of English as a shared common medium for scientific communication (Meneghini & Packer, 2007, Sano, 2002) while others suggests the linguistic disadvantages of NNES scientists relative to NES scientists (Meneghini & Packer, 2007, Madeleine, 2007, Tardy 2004) when it comes to scientific communication in English. The past researches have focused on the attitudes of experienced NNES scientists towards EILS: Ferguson et al. (2011) found that a majority feel at a disadvantage in publication compared with NES scientists, and that their attitudes are complex and multidimensional. Martin et al. (2014) also reported the ambivalent attitude of NNES scientists. While a majority of scientists surveyed feel that publishing only in English is advantageous for their careers, they also perceive disadvantage in their abilities to communicate in English. Previous research has provided useful insights into the experience of practicing NNES scientists and their use of and attitudes toward English as their common language. However, little research has focused on the attitudes of the "next generation" of scientists, or on graduate students. I'd like to look at two groups of graduate student researchers: NNES students studying in graduate schools East Asian countries, and NNES international graduate students at US universities.

Literature Review

NNES Students in Graduate Schools in East Asian Countries

Focusing on the perceptions of both PhD students and professors at a graduate school of science in Korea, Cho (2009) investigated the context in which papers are written for scientific journals. The study found that, in terms of linguistic aspects, both the graduate students and professors perceived themselves to be at a disadvantage when writing and publishing papers in English because of the longer time required, the psychological pressure of writing, and the process of making corrections following journal referees' suggestions. Studying similar circumstances in Taiwan, Huang (2009) also found the English proficiency affected PhD students' perceptions of publishing and learning to write for publication. Although the graduate students in that study felt disadvantaged, many were reluctant to learn to write for publication due to factors other than their perceived lack of language competence, such as the belief that English is not of primary importance in scientific research, their lack of confidence in the effectiveness of writing courses, and a perceived imbalance in the power relations between themselves and their advisers.

NNES International Graduate Students in US Universities

Tardy (2004) studied the perspectives of international graduate students, mostly South Korean and Chinese, studying at an American university, and discussed their attitudes toward English and its role in scientific communication. The study suggested that these students were more confident in reading than in writing or speaking English. Most of the students reported frustrations related to the time spent learning and mastering English, and the difficulty of communicating clearly in English. They also acknowledged the problem that research published in languages other than English tends to be overlooked, and even of bias

against papers not written in English. Furthermore, the graduate students in the study echoed the call for linguistic diversity, as they found their own multilingualism to be advantageous when they could use multiple languages in their work and thought processes. Meanwhile, Chang and Kanno (2010) addressed the issues of NNES international students' disadvantage due to their lack of the cultural and linguistic knowledge possessed by their native counterparts, and of the limitations of past studies that considered NNES students' experiences within the same or related fields. Analyzing how linguistic competence affected NNES students' participation in different disciplines, namely Economics, Chinese, and Mechanical Engineering, the study found that language competence was valued differently across disciplines, and may not determine the academic success of NNES students. The study also suggested that NNES doctoral students perceived themselves as peripheral but legitimate members of their disciplinary communities.

These studies in the East Asian and American contexts offer certain insights in understanding NNES graduate students' attitudes towards studying English. However, no study of this kind has focused on Japanese PhD students in the chemistry field. Therefore, the study reported here aimed to investigate the attitudes of Japanese graduate students in the chemistry field toward studying English, considering their perspectives, needs, and wants in terms of English education. To this end, the study aimed to address the following research questions:

1. What are the needs and wants of Japanese PhD students in the chemistry field studying English?
2. What perceptions of English are held by Japanese PhD students in the chemistry field?
3. What are the attitudes of Japanese PhD students in the chemistry field toward English as International Language of Science?

The Study

Context and Participants

The present study examined students' attitudes towards studying English and the needs and wants in terms of English education at the graduate school of engineering at a large research oriented university in Western Japan. The data were collected among a group of PhD students who specialized in different research areas within chemistry but all belonged to the same research and educational program.

Data Collection

For a preliminary background perspective, I began by conducting a questionnaire survey, followed by a semi-formal focus group interviews (FGI) with the graduate student participants.

Questionnaire. The questionnaire was developed to gather background information about the participants, including their results in terms of English proficiency testing, their experiences of living abroad, the use of English in their research laboratory, their future career path, their self-assessment of their English skills, their priorities in studying English, their interest in the ESP course focusing on Scientific English, and the importance of learning Scientific English in comparison to general English (see Appendix A). The questionnaire was completed voluntarily by 17 doctoral students. As shown in Table 1, the majority of the participants were in their second year of the doctoral course, with a few in their first and third years, and their levels of English proficiency varied as shown in Table 3. Participants are grouped by their study year and scores on the Test of English for International Communication (TOEIC) Reading and Listening. Provided by Educational Testing Service (ETS), TOEIC Reading and Listening is commonly considered by Japanese companies and universities to reflect a person's English communication skills, and are used to confirm

employees' or students' English proficiency levels. The TOEIC Reading and Listening gives a score between 10 and 990: The participants were divided in two three levels of score range provide by ETS: Level A (860-990), Level B (730-860), Level C (470-730).

Table 3

Respondents of Questionnaire

TOEIC Proficiency Scale	A (860-990)	B (730-860)	C (470-730)
Doctor 1		2	2
Doctor 2	5	1	4
Doctor 3	1	2	

Focus Group Interview. The FGI was used to probe for more detailed information on specific questions within a small group setting (see Appendix B). The focus group format was based on the collective experience of group brainstorming, whereby participants think together and react to emerging ideas and issues. Such within group interaction can yield high quality data, as it can create a synergistic environment (Dörnyei, 2007, p. 144).

Whereas one-on-one interviews may allow for a more in-depth understanding of individuals' views, focused group interviews, conducted with three to six people, are small group discussions that concentrate on specific topics. Small groups encourage collaboration among individuals, create memorable learning experiences, increase learner participation, and limit anxiety. Details of the FGI participants are given in Table 4.

Although the participants were from different laboratories, they were familiar with one another as they had been classmates for 12 to 15 weeks of their English course at the time of the FGI. At the beginning of the FGI, the purpose of the study was described to the participants, and the whole FGI was recorded with the participants' agreement. The interview was conducted in Japanese and later transcribed and translated into English by myself.

Table 4

Participants of Focus Groups Interview

Name	Grade	TOEIC Score	Previous EFL experience	Goal
Taka	Doctor 3	860	3-week language training in the US.	Getting a job
Jo	Doctor 3	780	3-week language training in the US.	Getting a job
Hisashi	Doctor 3	895	One-year language program in Canada	Getting a job
Koji	Doctor 2	965	One-year study abroad in American high school	Finding an academic position
Shuji	Doctor 2	880	3-week language training in the US.	Getting a job

*The names of the five participants shown above are pseudonyms.

Findings

This section summarizes the findings from the results, respondents' comments on the questionnaire and participants' comments during interviews, then attempts an overview of findings centered around three main themes: the priorities in English learning, the importance of learning Scientific English, and the advantages and disadvantages of English as International Language for Science.

Priorities of English learning

Questionnaire respondents, who were graduate students, were asked to compare their priorities for English learning, composed of the following 9 items: 1) to expand your general vocabulary, 2) to expand your specialist vocabulary, 3) to become a more fluent speaker, 4) to become a more accurate speaker, 5) to improve your listening skills, 6) to improve your pronunciation, 7) to improve your reading skills, 8) to improve your writing skills, and 9) to improve your English Test scores. Then, participants were asked to select one answer for

each topic from three choices: *not important*, *important* and *very important*. I will discuss the graduate students' language learning priorities based on their selection of *very important*.

Table 5

Priorities of English Learning

	Not important	Important	Very important
1. To expand your general vocabulary	0	7	10
2. To expand your specialist vocabulary	1	7	9
3. To become a more fluent speaker	2	6	9
4. To become a more accurate speaker	0	4	13
5. To improve your listening skills	0	8	9
6. To improve your pronunciation	2	9	6
7. To improve your reading skills	1	9	7
8. To improve your writing skills	0	6	11
9. To improve your English Test scores	10	6	1

The results of questionnaire in Table 5 allow us to see the students' priorities in their English learning. The results are summarized below. The percentage shown in parentheses is based on the number of students who chose "very important" out of the three choices of answers.

- Students want to gain both general vocabulary (59%) and specialist vocabulary (53%). The desire to improve general vocabulary is slightly higher than that for learning specialist vocabulary.
- The majority of students hope to become more accurate and fluent speakers of English. Accuracy (76%), however, is more prioritized than fluency (53%).
- Improving writing skills (65%) is more prioritized than improving reading skills (41%).
- Improving listening skills (53%) is more prioritized than improving pronunciation (35%).

- The desire to improve English proficiency test scores is very low (6%)

Lack of productive vocabulary knowledge. Consistent with the result of the questionnaire in which the priority assessment for learning both general and specialist vocabulary are high, the first issue that emerged from students' accounts was lack of adequate vocabulary for communication. Three participants—Jo, Taka, and Koji—express their frustration over situations in which they cannot think of the appropriate words for communication in English.

[Transcript 3-1]

Jo: I don't come up with the appropriate words.

Taka: Ah, the words. They don't come up, do they?

Koji: Like… "what is that called?" In the situation where I don't come up with the appropriate words, I feel frustrated.

All: Yeah.

(Jo, Taka, Koji, FGI, 8/9)

The questionnaire (see Table 4) found that students' priority assessment for learning general and specialist vocabulary was equally high. Hisashi explains the circumstances in which he feels that he lacks the appropriate vocabulary.

[Transcript 3-2]

Hisashi: Both in writing and speaking…..Ummmm. I don't come up with the suitable words…. Both in writing and speaking.

(Hisashi, FGI, 8/9)

Furthermore, Shoji states his problem with his lack of adequate vocabulary knowledge.

[Transcript 3-3]

Mika: How about you, Shuji?

Shuji: In my case, I don't come up with the verbs…. to communicate the meaning.

Koji: Verbs? (laughter)

Shuji: Say, when we say "Kore Mazete (Please blend this)….like…"Mix" is the only verb that comes to mind.

(Shuji, Koji and Taka, FGI, 8/9)

Taking the participants' relatively high English proficiency into consideration (see Table 4), I assume that they have vocabulary knowledge sufficient for both listening and reading comprehension. Knowing a word, however, is not good enough in the production of spoken or written language. Regarding the state of "knowing a word," Nation (1990) identifies two levels of vocabulary knowledge: *receptive* (the ability to recognize the form and retrieve the meaning in listening and reading) and *productive* (the ability to retrieve and produce the appropriate spoken or written form of a word in the target language; to express a meaning by speaking or writing). It could be said that these Japanese graduate students may have receptive knowledge of vocabulary, but they feel they lack productive knowledge of that vocabulary.

Inability to express ideas clearly. It became clear from the questionnaire responses that priority of accuracy in speaking was higher than that of fluency. A related finding from

FGI is the problem of students' inability to speak clearly. Taka highlights the problem of influence exerted by his first language, Japanese.

[Transcript 3-4]

Taka: When we say something, it is important to state it clearly so that others don't do the wrong 'guessing'. But we Japanese have difficulty doing it, don't we?

(Taka, FGI, 8/9)

Taka further explains this problem by comparing the two different languages (Japanese and English).

[Transcript 3-5]

Taka: American people generally have no problem saying what they want to say, don't they? But Japanese people, let's say, kinda, talk around, don't we? Probably in English, too. We talk around, then, we cannot articulate, something like that. "Your English is correct but what's your point after all?" Like that. I'm worried that this might happen to me.

(Taka, FGI, 8/9)

He continues to state his own understanding for the reason why Japanese scientists cannot express their ideas clearly when they speak in English. According to him, it is because they think first in Japanese and then translate their thoughts into English when they speak.

[Transcript 3-6]

Taka: Because we translate what we originally want to say in Japanese into English we tend to talk around, don't we?

(Taka, FGI, 8/9)

Analyzing communications, Hall (1989) identifies context as a major cultural dimension and categorizes two cultures, high-context cultures and low-context cultures, which are defined by how people communicate in different cultures. In high-context cultures where people have close relationship over a long period of time, very little spoken information is transferred during communication. On the other hand, in low-context cultures where people have extensive relations for a short period of time with specific purposes, a lot of information is communicated through speech (Hall, 2001, pp. 200-201). "Japanese language is a highly-contextualized language; the speaker must be fully aware of (1) whether the relationship with the listener is intimate, or (2) whether the communication is impersonal" (Minami, 2002, p.29).

Hisashi's additional explanation raises the issue of the difference between high and low context. Sharing the same experience means having the same research background and being in the same context.

[Transcript3-7]

Hisashi: When we are having a conversation based on the shared experience with them, they understand. But when we are not….

Shuji: They don't understand you at all.

(Hisashi and Shuji, FGI, 8/9)

I assume that the lack of productive vocabulary knowledge and influence of high-context Japanese culture are both contributing factors of the inability to speak clearly. In answering my question about conversation when the topic was his research, Hisashi explains the situation that occurs when he explains his research.

[Transcript 3-8]

Hisashi: About the research, if we share the same background, they can guess the general ideas.

Mika: Yeah.

HIsashi: If they are not from the same field, each of us gives up and says "Hmmm," and changes the subject. It happens quite often… with the research topic and at conference... it is frequent.

(Hisashi, FGI, 8/9)

Hisashi is a second-year doctoral student who spent one year studying at a Canadian university, and his communication skills are relatively strong. Also, as a PhD student, he should have a sufficient understanding of his own research. Thus, we can assume that his avoidance of talking about his research to a researcher from different field is caused by the influence from high-context Japanese culture.

Interest in ESP course focusing on Scientific English

Questionnaire respondents were asked to rate their interest in an ESP course focusing on Scientific English by selecting one answer from four choices: "*yes, very much,"* "*yes,"* "*no, not much,"* and "*no, not interested at all*" to the question "Are you interested in taking an English course that focuses on Scientific English"? The results are shown in Table 6.

Table 6

Interest in a course on Scientific English

Yes very much	Yes	No, not much	No, not interested at all
6 (35%)	10 (59%)	1 (6%)	0 (0%)

Questionnaire results show that almost all of the respondents (94%) are to some degree interested in taking a course on Scientific English. Out of this 94%, 35% have a special interest and 59% have general interest in the course. The number of respondents who have a particular interest in Scientific English is smaller than I had speculated. Respondents' comments showed their exceptional interest and needs in Scientific English. I assume this results show that respondents of the questionnaire appreciate the value of General English, which will be made clear in their answers to the next question. The students were also asked to write additional comments after their answers. Their statements are grouped in Table 7.

Table 7

Participants' comments on their interest in a course of Scientific English

#1 Yes very much	・ Because Scientific English is an absolutely essential skill for us. (D2, TOEIC-A) ・ Because we will have more opportunities to participate in international conferences, I want to learn the skills of Scientific English. Also, I think it will be helpful when I write my research paper. (D1, TOEIC-B) ・ I think English communication skills are necessary to explain my research content when I make a presentation or write a research paper. There are many occasions that English skills determine the value of research. (D2, TOEIC-B)
#2 Yes	・ I want to learn English for writing research papers. (D2, TOEIC-A) ・ I think it may be helpful if there is a course specific to Scientific English. But in the case of science major students, I think there is little trouble with it because everyone is reading and writing on a daily basis. (D2, TOEIC-A) ・ Because we can recognize the differences and mistakes of

	Scientific English Style. (D3, TOEIC-B) ・ I think the course is necessary because it is often the case for the scientific content that writing in English is more appropriate than writing in Japanese. (D2, TOEIC-B) ・ I think the course is very important when we write a research paper. (D1, TOEIC-C) ・ I want to acquire the ability of Scientific English so that I can have discussion freely in oral presentation. (D2, TOEIC-C)
#3 Not much	・ I'm more interested in learning native speaker's sense of English (D3, TOEIC-B)

From the respondents' comments in Table 6, we can see that graduate students in chemistry fields view learning the skills of Scientific English as essential for mainly two reasons:

1. Graduate students want to improve their writing skills specifically with respect to scientific writing styles, and

2. Graduate students have opportunities to participate in international conferences where they make presentations and need to explain their research clearly and enter into discussions with other researchers.

As one respondent writes, "There are many occasions that English skills determine the value of research." From these types of comments, we can conclude that there is a strong demand for an ESP course focusing on Scientific English because the skills of Scientific English are critical to the academic success of these graduate students. The next section summarizes the importance of learning the skills of Scientific English relative to General English.

The perceived importance of learning Scientific English

Questionnaire respondents were also asked to rate their perception of the importance of Scientific English in comparison with General English by selecting one answer from three

choices to the question “How important do you think ‘Scientific English’ is in comparison with General English?” The results are presented in Table 8.

Table 8

Perceived importance of learning Scientific English

More important than General English	As important as general English	Less important than General English
3	12	2

The results show that majority (71%) thinks ESP is as important as EGP, while portions of students think Scientific English is more important (18%), and less important (12%) than General English. From these results we see that the participants understand the necessity for both Scientific English and General English. The students were also asked to write additional comments after the question. Their statements are grouped in Table 9.

Table 9

Participants’ comments on perceived importance of learning Scientific English

View #1: Scientific English is more important than General English	• In everyday life, General English is more important, but you cannot acquire Scientific English without studying it because scientific English has its particular ways of expression and usages and words that have specific meanings. Also, while accurate English is not required in everyday conversation, Scientific English requires the ability of accurate communication. (D2, TOEIC-C)
View #2: Scientific English is as important as General English	• Of course I think it is important to speak English accurately about chemistry with foreigners, but I understand what lacks in Japanese scientists now is the skills of everyday conversation, so I think both are important. (D2, TOEIC-A) • Scientific English is required for work. But what is import is General English (D3, TOEIC-A) • Scientific English is required for work. But General English is necessary for communication. (D2, TOEIC-A) • The opportunity to speak English is not only at the presentation at the conference. By learning to be better at general conversation in English, you will be a better communicator. It will also be helpful in discussion. (D1, TOEIC-B) • In the course of living as a chemist, of course I think Scientific English is important, but I think there is Scientific English

	based on such a kind of English used in everyday life. (D1, TOEIC-C)
View #3: Scientific English is less important than General English	• General English is used more frequently than Scientific English. (D2, TOEIC-C)

From the students' comments in the questionnaire, we see that they need English not only for use in the professional/academic settings, such as writing a research paper, making a technical presentation or having a discussion, but also for their day-to-day lives; as one respondent writes, respondents perceive that Scientific English is based on everyday English. Out of all comments, two respondents' comments explain the perceived importance of both Scientific English and General English:

> Scientific English is required for work. But General English is necessary for communication. (D2, TOEIC-A, Questionnaire)

This respondent recognizes the importance of both Scientific English and General English because of their different purposes. On the other hand, this respondent perceives General English, as used in daily life, is the basis, and the Scientific English used for his work is built on it.

> In the course of living as a chemist, of course I think Scientific English is important, but I think there is Scientific English based on such a kind of English used in everyday life. (D1, TOEIC-C, Questionnaire)

The perceived advantages of EILS

By asking respondents of the questionnaire about of the perceived importance of both scientific English and General English, FGI elicited the Japanese graduate students' perception of the dominance of English as the international language in scientific communication. Tardy's (2004) findings, situated in a US university, suggest that the benefits to the use of English as language of science are:

1) ease of information sharing and access worldwide,

2) ease of communication among professionals worldwide, and

3) having a shared language to facilitate scientific progress (p. 258).

FGI uncovered that graduate students studying in a Japanese University have similar views. Here, Taka and Jo explain the advantage of English as international scientific communication.

[Transcript 3-9]

Taka: It is advantageous that we can communicate with the researchers from various countries, isn't it?

Jo: We can gain various knowledge.

Taka: In that sense, there is no border between the countries if you can speak English.

Jo: Ah…that is true.

Taka: You know both Germans and Indians speak English. So we can communicate with them. That is a benefit, isn't it? I think it is a great thing that we can standardize our language.

(Taka and Jo, FGI, 8/9)

The researcher takes special note of Taka's comments that there is no border between the countries and one can communicate with Germans and Indians if one can speak English.

In Kachru's classification of English as a World Language, English consists of three circles: the inner circle (native speakers), the outer circle (L2 speakers), and the expanding circle (learners of EFL) (Kachru, 1982, 1988). India is placed in the outer circle, and Japan and Germany are placed in the expanding circle. However, Kachru's recent proposal suggests that the inner circle is a group of highly proficient speakers of English. In this sense, there is a widening disparity between the two nationalities, German and Indian, who are highly proficient in English, and the Japanese. Contrary to what Taka said, Koji elaborates this disparity is an advantage for the people who are proficient in English.

[Transcript 3-10]

Koji: I guess it [disadvantage] is that it is more advantageous for the people who speak English, I mean whose first language is English. For the people who speak English as their foreign language, there is a huge difference, for example, in writing a research paper.

(Koji, FGI, 8/9)

The perceived disadvantages of EILS

Speed of input and output. Listening to Koji, Shuji brings up one concrete example that he considers to be a drawback compared with NES scientist. It is the speed of reading research papers, which is important for keeping up with scholarship. Then, Taka supports Shuji's view by using the difference in the number of research papers that they can read as an illustration.

[Transcript 3-11]

Shuji: You know, native speakers can read about ten English research papers while we are reading just one paper.

Taka: Yes. They can read 10. I think that is unfair.

(Shuji and Taka, FGI, 8/9)

The time lag caused by the slow input of information can snowball into more serious drawbacks: it can lead to the late start of experiments, which naturally will result in later publication of their research papers.

Here, Shuji elaborates on this drawback as "a huge difference in the speed of both input and output."

[Transcript 3-12]

Shuji: I mean, from our perspectives, there is a huge difference in the speed of both input and output.

(Shuji, FGI, 8/9)

A similar perception was found in Cho (2009): 92% of the graduate student respondents perceived themselves to be at a disadvantage when publishing their papers in English journals, because of the longer time they need to write papers in English and the psychological pressure of writing in English. The process of correcting English following the suggestions of journal referees was also another factor. The results of our questionnaire showed that the priority of improving writing skills (65%) is higher than that of improving reading skills (41%). I assume the speed of output is even slower because it requires Japanese researchers to do the process of writing and research in English, as well as peer review, as suggested in Cho (2009) and time of having the research paper corrected by NES proofreader.

Learning burden. Regarding the differences in the processes of reading and writing research papers, Taka concludes as a burden for Japanese graduate students. Shuji and Jo confirmed Taka's view.

[Transcript 3-13]

Taka: Yes there are differences. And, that is a burden for us.

Shuji: Yes, that is a burden.

Jo: That is surely a burden. We cannot catch up with them if we don't improve our English to get closer to their level.

Shuji: If we did, the time we can spend for our research would be overwhelmingly longer.

(Taka, Shuji and Jo, FGI, 8/9)

From Jo's narrative, we can understand the importance of English in being successful in their research activities. Additionally, Shuji' narrative has given us an insight into the effects of the improvement of English.

In discussing the burden of learning a vocabulary, Nation (2001) mentions:

> The learning burden of a word is the amount of effort required to learn it. Different words have different learning burdens for learners with different language backgrounds. Each of the aspects of what it means to know a word can contribute to the learning burden of a word. The general principle of learning burden is that the more a word represents patterns and knowledge that the learners are already familiar with, the lighter its learning burden. These patterns and knowledge can be from the

first language, from knowledge of other languages, and from previous knowledge of the second language (pp. 36-37).

Nation (2001) also mentions that "For learners whose first language is closely related to the second language, the learning burden of most words will be light. For learners whose first language is not related to the second language, the learning burden will be heavy" (p. 37).

In this sense, Japanese graduate students whose first language has different patterns from English have a heavy burden in learning English. Further, Hisashi and Taka describe the plight of this learning burden. Responding to them, Shuji describe the learning burden more explicitly.

[Transcript 3- 14]

Hisashi: Rather, the drawback from an inability to speak English is too big now. So, if I were asked what was the benefit, I wouldn't think about it because the drawback from the inability is too big.

Mika: I just heard a word "burden"….

Taka: Rather than a burden, I would say "disparity" by being compared, even if we have the same time for research. Because the speed is different, we need to start in the state with an invisible shackle. I guess that is the drawback...when I think in the level of competition.

Shuji: English absorbs our time. You see, we are still taking English lessons.

(Hisashi, Taka and Shuji, FGI, 8/9)

Discussing the drawbacks in a US university, EILS respondents in Tardy (2004) cited "(1) the great deal of time spent learning English for non-native speakers, and (2) the

difficulties that NNES researchers might face in communication." Tardy (2004) also discussed the inequality between NNES researchers and NES researchers: "Research not published in English may be overlooked, that NESs are at an unfair advantage, that professionals who do not speak English are at a great disadvantage, and that miscommunication among researchers can occur" (Tardy, 2004, p. 258). The participants of this study also claim there is inequality between themselves and NES researchers caused by the extensive time they need to spend on attaining a high level of English proficiency.

Gain and loss of opportunity

However heavy the burden of learning English is, there is a reason that Japanese graduate students need to invest their time and effort. Learning and mastering English is of significance to them as it will affect their futures. Here Hisashi elaborates in what way it will impact their lives.

[Transcript 3-15]

Hisashi: If you speak English, you will get more chances. There will be a great deal of lost chances when you cannot speak English.

Taka: Yes. That sure will be.

(Hisashi and Taka, FGI, 8/9)

Using TOEIC test score as a boarder line to get a job opportunity, Hisashi illustrates the situation:

[Transcript 3- 16]

Hisashi: As it were, TOEIC is something like National Center Test for University Admissions to enter a global company…like National Center Test for University Admissions

Shuji: English is used for the borderline of opportunity.

Hisashi: If you don't think at the level, I think you will lose opportunities more and more.

(Hisashi and Shuji, FGI, 8/9)

Discussion and Conclusion

This chapter has explored Japanese graduate students' perception and experiences of English as international language from their perspectives and has allowed us gain insight into several important aspects related to ESP Education: the priorities of English learning, the importance of learning ESP with a Scientific English focus, and the advantages and disadvantages of the dominance of English as the International Language for Science. Now, we stand back and look at a big picture. In what follows, we discuss the answers to the three research questions based on the findings from questionnaire results and FGI.

The needs and wants of English education

With previous experience in learning English for more than twelve years, the Japanese graduate students who responded to the questionnaire and who participated in FGI had relatively high proficiency in English. However, the questionnaire results on priorities in English learning and students' narratives in FGI identified that they need additional training of English. First, the findings from the questionnaire suggested that graduate students have high priorities in gaining both general vocabulary and specialist vocabulary, and that their

priority for improving their spoken English accuracy was comparatively higher than improving their fluency. There was also a stronger need to improve writing skills than reading skills. In FGI, the participants discussed the lack of productive vocabulary knowledge and difficulty of speaking clearly in English. The questionnaire found that the graduate students' interest to ESP courses focusing on Scientific English was high; however, there was no urgency present in the results. The results elucidated the perceived importance of Scientific English, demonstrating that the graduate students felt the need to learn both General English and ESP focusing on Scientific English; therefore, the focus of their English Education should be on both. Furthermore, I suggest intensive training in speaking clearly, vocabulary building, and writing scientific articles be provided in the curriculum so that Japanese graduate students can develop the well-rounded English skills necessary in their professional lives.

Perceptions toward the dominance EILS

In keeping with the findings of past research (Sano, 2002; Tardy 2004), this study suggested that Japanese graduate students acknowledged some advantages of EILS: standardizing a language will enable them to communicate with researchers across the borders of other countries and gain a wide range of knowledge in their research areas. As suggested by one student, "If I was asked what was the benefit (of EILS), I don't think about it because the drawback from the inability is too big." However, the present study found that the disadvantages of EILS are more significant than the advantages. Graduate students shared frustration related to the speed of input and output, the learning burden of English, and the time taken for learning and mastering English.

Attitude toward studying General English and Scientific English

Given that these disadvantages are caused by the dominance of EILS, the present study found that Japanese graduate students are facing a dilemma: improving their General and Scientific English skills is important because writing research papers is required for their academic success. Likewise, high proficiency in general English is essential for them to be employed by the company of their choice and be successful in their careers. Having said that, the study also found that Japanese graduate students are frustrated with the inequities resulting from dominance of EILS, which have placed them at a competitive disadvantage in their research because of the excessive time they need to take for reading research papers, preparing for presentations, and writing their own research papers. They struggle with Scientific English necessary for their research and spend extensive time taking English lessons to attain higher level of English proficiency.

The present study explored the perceptions of Japanese PhD students in scientific disciplines. In order to obtain appropriate English skills and reduce the discrepancy between them and NES researchers, the findings of this research call for the teaching of ESP courses in undergraduate and master's programs based on scientific language needs; this will allow PhD students to proficient enough to be able to focus on their scientific research. This in turn would lead to the facilitation of research progress and a greater publication level for Japanese students in science and engineering fields. It should be noted that this study has attempted only to understand the perspectives of PhD students. Therefore, further research should be conducted to investigate the needs of master's students and faculty members in order to develop a well-rounded ESP curriculum that is wholly relevant to graduate school in science and engineering in Japan.

Drawing its data from classroom observations and an informal group interview with the graduate students and an interview with American professor, the next chapter will discuss

the problem of silence among Japanese graduate students during chemistry lectures by an American professor.

Chapter Summary

Chapter 3 has explored Japanese graduate students' needs and wants of English education, their perceptions of the dominance of EILS, and their attitude toward studying English from their perspectives. First, the findings on their needs and wants of English education elucidated the graduate students' needs of learning both General English and ESP focusing on Scientific English. The Japanese graduate students have high priorities in gaining both general vocabulary and specialist vocabulary, and that their priority for improving their spoken English accuracy and their writing skills was comparatively high. It was also found that students perceive the lack of productive vocabulary knowledge and difficulty of speaking clearly in English. Second, findings on their perceptions of the dominance of EILS that suggested that the perceived disadvantages including the slow speed of input and output, the learning burden of English, and the time taken for learning and mastering English, which are more critical than the perceived advantages of standardizing a language which will enable them to communicate with researchers across the borders of other countries and gain a wide range of knowledge in their research areas. Third, the findings on their attitude toward EILS suggested that Japanese graduate students are facing a dilemma: improving their General and Scientific English skills is important for bother their academic and career success. The study also found that Japanese graduate students are frustrated with the inequities resulting from dominance of EILS, which have placed them at a competitive disadvantage in their research because of the additional time taken with Scientific English and spend extensive time taken in order to attain higher level of English proficiency.

CHAPTER FOUR

THE SOUND OF SILENCE IN CHEMISTRY LECTURE: CASE STUDY OF JAPANESE GRADUATE STUDENTS IN SCINENCE AND ENGINEERING

Introduction

Responding positively to globalization of the society, Japanese higher education is in the midst of change. The growing awareness that the Japanese society must promote and deepen educational reform persists, as recent reforms have stimulated the international-mindedness of Japanese higher education (Newby, Weko, Breneman, Johanneson, & Maassen, 2009). Universities provide their graduate students with plenty of opportunities to attend lectures given by English-speaking teachers. This trend is more prominent at graduate schools of science and engineering that have frequent visitors from foreign research institutes for the research collaboration. English is the dominant international language of researchers in science fields (Ammon, 2006; Crystal, 2003; Swales, 2004). Since the scientific field is the most internationally diverse within academia, students must learn how to be effective in communicating cross-culturally (Wainwright et al., 2009).

This chapter explores the phenomenon of Japanese graduate students' silence, reticence and lack of oral participation during chemistry lectures by an invited American professor.

Literature Review

Silence, an essential element of communication, has cultural aspects that determine its production and interpretation such as social and institutional structures, values, and attitudes toward speaking and not speaking and socialization of children and other new group

members to a speech community and its beliefs, values, and practices (Saville-Troike, 2006). Researchers in intercultural communication and English-language pedagogy have amply discussed the silence, reticence, or passiveness of East Asian students who take English as a Second Language (ESL), English as a Foreign Language (EFL), or regular college courses in Western English-speaking countries (Cheng, 2000; Ellwood & Nakane2009; Nakane, 2006; Xia, 2009). To set the stage for this study, it is important to review past studies regarding the problem of silence and reticence of East Asian and Japanese students from the viewpoints of both Western teachers and students themselves.

Anderson (1993) studied the cultural context of Japanese students' silence and reticence in the EFL classroom in Japanese universities. From a Westerner's perspective, the research identified the four characteristics of the culture-related behavior that lead to the classroom silence: 1) group-mindedness, 2) consensual decision making, 3)formalized speech making, and 4)listener responsibility, which is useful for understanding Japanese cultural beliefs and students classroom behavior. Yet, despite this study's implications, further classroom-based studies that focus on classroom interaction are required in order to adequately understand Japanese students' behavior in an academic setting.

Tsui's (1996) study examined the factors that secondary teachers in Hong Kong perceived as contributing to students' lack of participation; ultimately, they identified five factors: 1) students' low levels of English proficiency and lack of confidence, 2) students' fear of making mistakes and being targets of laughter, 3) teachers' intolerance of students' silence in their classes, 4) uneven allocation of opportunities to speak in the classroom, and 5) incomprehensible (complex) language used by teachers. Tsui took special notes on teachers' intolerance of silence. When they could not solicit responses quickly from students, teachers generally appeared uneasy and impatient; thus, they allowed only a short amount of time for students to think about a question and respond. This study provides insight into teacher's

perceptions of secondary students' silence. The researcher assumed, however, that age differences among participants might have contributed to differences in results.

Using a case study regarding differences between Japanese and Australian high school classrooms, Kato (2001) discussed differences in the "culture" of teaching and learning for Australian exchange students in Japan and their Japanese counterparts. Differences included aspects such as "how structured a lesson should be," "the formality of teacher-student relationship/nature of teacher-student relationship outside [the] classroom," and the "kind of specialization taking place in class." A finding from this study is that both Japanese and Australian students recognized the tendency of Japanese students to be silent in class. Further, Australian students perceived silent Japanese students as those who "don't express their opinions" or as "immature," while Japanese students see the loquacity of Australian students as immature (p.63). However, this study does not refer to Japanese students' perceptions regarding their tendency to be silent.

Nakane (2006) and Ellwood and Nakane (2009) situated in an Australian university provided us with important implications to understand how Japanese students' silence is perceived by Western teachers and how it negatively affects their learning experiences in intercultural classrooms. Nakane (2006) found that silence is extensively used by Japanese students to save face, while Australian students use verbal strategies and establish rapport with teachers more easily. Moreover, Japanese students' face-saving silence is poorly evaluated by Australian teachers. Ellwood and Nakane (2009), who studied Japanese students' silence in Australian universities through classroom ethnographies, revealed that Japanese students, in contrast to their stereotype, desire and attempt to speak while they struggle with their silence, but Australian teachers are often unaware of this and mistake the silence for incompetence, shyness, or lack of commitment to learning.

Focusing on Korean graduate students, Lee (2009) discussed the factors that influence students' oral participation in class discussions in an American university. Regardless of their length of study in the United States, all students feel challenged to take part in discussions, an indication that the silence or reticence of the graduate students is caused by multiple variables such as English proficiency, differences in sociocultural values and educational practices, individual differences, and classroom environment. Each factor, both in isolation and taken together, caused the graduate students' silence during class discussions. In the same vein, Coward and Miller (2010) explored the experiences of East Asian students who participated in graduate seminar discussions at an American university. Besides linguistic ability, this study found that other factors, such as goal orientation and sense of self in classroom discussions, are important in their learning experiences. Furthermore, it was argued that the relationships between instructors and students are significant contextual factors in the classroom experience of international graduate students, which American instructors and students should be informed of since intercultural communication is a two-way street. These two researches provide us with valuable insights into the experiences of eastern Asian graduate student in Western universities, the participants in the aforementioned study and their context are not identical to the one of Japanese graduate students who study bioscience or chemistry in their home country. Participants in these two studies were graduate students studying at an American university. Their English levels and motivations to attend English lectures should be different from those of Japanese graduate students studying science and engineering in environments where English speaking is not typical; however, there is a great demand by both teachers and students for English education.

Research Questions:

In light of the literature reviewed in this section, the following three research questions have emerged to guide my study:

1. How do Japanese graduate students in Science and Engineering themselves perceive their silence during the lectures taught by Western teachers?
2. How do Western teachers perceive Japanese graduate students' silence during their lectures?
3. What are the gaps between the perspectives of Japanese graduate students and Western teachers?

The Study

Context

This study was conducted at a graduate school of a large research-oriented university in Western Japan. The lecture I observed was a part of distinguished lecturer series arranged for doctoral course students who belong to the special educational program financially supported by the Japanese government. Five to seven foreign teachers from institutions abroad gave two- or three-day intensive lectures. The lecture I observed focused on a topic from biochemistry and biotechnology research.

The doctoral course students who attended this lecture consisted of two first-year students, six second-year students, and four third-year students, half of which were biochemistry majors while the other half were non-biochemistry majors. Their English proficiency levels varied as shown in Table 10.

Provided by the Educational Testing Service (ETS), a U.S. nonprofit test development institution, the TOEIC (Test of English for International Communication) Proficiency Scale is recognized as the global standard for English communication skill assessment and is used at many Japanese companies and colleges to confirm their workers' or students' English proficiency levels. The TOEIC Proficiency Scale shows the correlation between TOEIC scores and communication proficiency levels of examinees; further, examinees are

categorized according to four levels (A-D). The scale indicates that the examinees at the A level have sufficient ability to communicate as non-native English speakers; those at the B level can communicate appropriately in any situation; those at the C level demonstrate the proficiency to fulfill their daily needs and engage in limited business communications; and those at the D level demonstrate proficiency to communicate minimally in daily conversations (Education Testing Service, 2012). The participants of the current study were distributed over those four levels of the TOEIC scores as in Table 10.

Table 10

Students' English proficiency

TOEIC Proficiency Scale	A (860-990)	B (730-855)	C (470-725)	D (220-465)
No. of students	3	2	6	1

Participants

The participants of this study consisted of an American professor who was invited as a special lecturer and Japanese doctoral course students who attended his intensive lectures. The American professor who contributed to this study was a male American professor in his fifties who serves as chair of the Department of Pharmaceutics and Pharmaceutical Chemistry of a public research university in the United States. He is known not only as a distinguished researcher but also as a quality educator. He was a frequent visitor to Japanese universities as an invited lecturer. Having taught Japanese students for many years, he was thoroughly aware of their English proficiency levels and behavior in the classroom. Among more than 25 invited lecturers, he was the only professor who gave special lectures twice.

Although the four Japanese graduate students who participated specialized in a different research area of chemistry, all belonged to the research and educational program

established for doctoral course students, as shown in Table 10. Born and raised in Japan, they shared the same cultural and educational background. All four students took an English conversation class once a week. Their English levels varied because of differences in time spent studying English. All had participated in a couple of international conferences. However, Yasu's communication skills were comparatively higher because of his seven-month study-abroad experience in the United States.

Data Collection

In order to thoroughly understand the context of Japanese graduate students' classroom participation from the viewpoints of both students and a teacher, I conducted qualitative research that "seeks to understand the world from the perspectives of those living in it" (Hatch, 2002, p. 7). During the lecture, while sitting with the students, I observed and took notes of the interaction between the teacher and students. Because I was an educational support staff member and students regarded my presence as routine, I was an insider to them. After the lecture, I distributed the questionnaire sheet to the twelve Japanese students who took this lecture in order to collect background data for the interview. After reviewing the students' comments in the questionnaire, I conducted a semi-structured interview with the teacher in English. I asked the lecturer to confirm his experience and describe his impression of the interaction with Japanese graduate students during his lecture. On the next day, I also conducted informal interviews with a selected group of four doctoral course students as in Table 11. The interviews with the students were conducted in Japanese and later translated into English by me. All interviews were audio-recorded and later transcribed for data analysis.

Table 11

Participants' profiles

Name	Study Year	Research Area	TOEIC Score Scale	English Class Level
Hiroki	Doctor 1	Material Chemistry	C (Lower)	Lower-Intermediate
Yasu	Doctor 3	Biochemistry	B	Advanced
Shoji	Doctor 2	Biochemistry	B	Upper-Intermediate
Ichiro	Doctor 2	Applied Chemistry	C (Upper)	Upper-Intermediate

Findings

In this section, I present the major factors that influenced the Japanese graduate students' silence in the lecture given by a Western teacher.

Students' English Proficiency Level

In my interview with the teacher, I first asked him how he teaches Japanese students differently from American students. His response was immediate:

> I think it is based on the language use. I cannot cover so much. I cannot cover so much material here. I have to go slow. I have to make my language mechanical. I thought a lot about how to simplify language here. (Professor, 10/17)

From my observation of the classroom interaction, I noticed that he limited the vocabulary and grammar structure, spoke in short sentences, and slowed down his speaking. He also repeated and rephrased the questions by using both open- and close-ended questions. He recalled the following:

> Today I found myself repeating questions, trying to change questions so that they could understand, right? I spent a lot of time to get them to answer, and I couldn't do it. I couldn't understand if they understood the question. So, I spent a lot of time rephrasing the questions just to get the acknowledgement from somebody's face. (Professor, 10/17)

Tsui (1996) reported the teacher's belief that an "effective teacher should be able to solicit immediate responses from students and that a responsible teacher should be talking all the time" (p. 153). It is clear from the following accounts that this teacher also believed that an effective teacher should be able to obtain immediate responses from students.

> I thought, "They don't understand my questions." So, I tried to rephrase that again, but after three or four times, if I get no answer back, then I say, "Okay. Defeat." I admit defeat. I answer my own questions. Then I move on. (Professor, 10/17)

However, it is not this teacher's intention to talk for the entire lecture period as he emphasizes the importance of students' engagement. Meanwhile, the students' comments in the questionnaire indicated that the difficulty of listening to the teacher's English is derived from terminology that is different from theirs.

> My English vocabulary outside my field is very limited. (D2, TOEIC-C)
> I need background knowledge of technical terms. (D2, TOEIC-C)
> I think it is necessary that I know the technical terms that are used in the lecture. If I know the technical terms, I can guess the content when I listen to the lecture. (D1, TOEIC-D)

In addition, biochemistry students, who have sufficient knowledge of technical terms, mentioned that their difficulty in understanding English instruction is attributed to their poor English skills, particularly their listening skills.

> I think I need English ears. Finally, I was able to listen to the lecture. (D2, TOEIC-A)
>
> I need to improve my listening skills. If I focus on English, I cannot understand the broad outline of the lecture. (D3, TOEIC-C)
>
> I want to have the printed slide and electronic dictionary to understand English meaning. (D3, TOEIC-C)

In the interview with Ichiro, a non-biochemistry student, he admitted that his difficulty in listening to spoken English increases when he hears unfamiliar technical terms.

> I am not really good at English. So, I sometimes was not able to hear what the teacher was saying. It was difficult to understand, especially when I heard a line of difficult words. (Ichiro, 10/18)

Hiroki, whose English proficiency level is slightly lower than the average, attributed his difficulty in listening to American accents in the teacher's pronunciation:

> The professor probably asked us simple questions, but I couldn't pick up the words because of his pronunciation. So, I was a little intimidated (*chotto obiete shimaimasita)*. (Hiroki, 10/18)

Receiving schooling only in Japan, where English is neither the first nor the second official language, Hiroki represents the perception of many Japanese students who are not used to listening to spoken English. Hiroki's Japanese expression *obiete shimaimashita*, which means "intimidated" in English, explains why English spoken by a native English speaker inhibited him from speaking up in class.

Anxiety

Hiroki then mentioned another reason for his reticence:

> I was a little intimidated (chotto obietes himaimashita). I don't have enough English ability. Well, of course, even if I was asked questions in Japanese, I got freaked out, too. But, when asked in English, I get even more freaked out. (Hiroki, 10/18)

Instead of asking questions in the class, Hiroki talked to the teacher after the lecture. His explanation ("I was intimidated") and his confession that "when asked [a question] in English, I get even more freaked out" demonstrates his anxiety about speaking English caused by his lack of English proficiency, which is not sufficient to explain the anxiety of speaking up in the classroom. Explaining his reason for not posing his questions on site, he continued,

> I don't want to make a fool of myself in the crowd. Well, and also I thought it's better to ask later. One-on-one is easier to follow him. If I asked here in the crowd, I could give up. Even if I don't understand, I could possibly say thank you. (Hiroki, 10/18)

The researcher presumes that the expression “one-on-one is easier to follow him” has two meanings— it is easier to meet with the professor privately to understand him and the content discussed in the lecture. Hiroki’s research area is different from the theme of the given lecture, which focuses on the theme from biochemistry. Ichiro also expressed his concern for lack of knowledge derived from the irrelevance to the study. Despite his interest in the lecture topic, his perceived lack of background knowledge of the lecture theme inhibited his asking questions during class.

> My questions could have been irrelevant to his lecture So, I brought a couple of the papers and asked what he thinks of these researchers and the possible future development of their studies. (Hiroki, 10/18)

Here, Ichiro also explains the differences of the research caused anxiety as he takes this lecture.

> Although I’m from a different research area, I was quite interested in the research area of this lecture. But what I am afraid is that I could be beyond my depth in this area. (Ichiro, 10/18)

Teacher’s Intolerance of Students’ Silence

“Silence is golden”, a well-heard English proverb, means “it is wise to say nothing”, and is often used in circumstances where saying nothing is more preferable to speaking. This does not apply to the lecture taught by a teacher from a country with low-context culture, where extensive silence is received negatively.

Using wireless internet connection as a similar expamle, the professor explained the difficulty to get responses from Japanese graduate students,

> It is not a value judgment. I understand that there is a cultural gap. It's like, uh, hooking up to the Internet. You are logged in but still wireless. Then, you finally see the bars go up. Wireless says, "Okay, I'm connected." (Professor, 10/17)

Tthe reason for the professor's many questions lies in the students' unwillingness to respond, either verbally or non-verbally.

> I was looking for the single cognition of understanding. And I couldn't get it from this group. So, I rephrased the questions. Then, I saw some of them nod. I thought, "They don't understand my questions." So, I tried to rephrase that again. (Professor, 10/17)

The concept of high and low-context cultures was introduced by Hall (1989), and it refers to the linkage existing between culture and communication. Ting-Toomey (1999) compared the difference in attitudes toward silence by referring to high-context cultures and low-context cultures. In high-context cultures, which are more common in the Asian cultures, most conversational information lies in the context, silence may hold strong, contextual meaning, and is also seen as the essence of language of superiority and inferiority, affecting such relationships as teacher-student, male-female, expert-client. In low-context cultures, mostly common in English-speaking countries, context carries relatively little information. Thus, prolonged silence is often viewed as "empty pauses" or "ignorant lapses" (p. 110). Thus, the American professor's intolerance to students' silence, reticence, and lack of oral participation might have been influenced by this latter view.

According to Anderson (1993), the teacher finds it difficult to detect the nonverbal codes of "not understanding" in the faces and attitudes of the listeners, which would be verbalized in the West. The teacher illustrated the difficulty in reading the nonverbal codes of Japanese students:

> The reaction in Japanese classrooms is blind acceptance. I can read very little, but nonetheless I tried. I continued to try. It doesn't discourage me. It doesn't make me unhappy. (Professor, 10/17)

From his emphasis on the "try" and "tried" in the above quotation, his facial expression, and his low tone of voice used to explain that the absence of student responses "doesn't" discourage him or make him happy, the researcher assumes that, in reality, the professor was discouraged by the lack of oral participation. Yasu blamed students, not the professor.

> Yasu: He tried every way to solicit the students' questions, but it didn't work out. I think the problem was with our side.
>
> Shoji: Of course, he may think he failed.
>
> Yasu: But from our point of view, we are to blame for eighty or ninety percent of it, if the professor thinks his lecture didn't go well.
>
> (Yasu and Shoji, 10/18)

Listener Responsibility

Consider another aspect of the cultural gap, listener responsibility, the burden placed on the listener for making sense of a conversation, which is described by Anderson (1993) as

a characteristic of Japanese communication. In Western culture, on the other hand, it is the speaker's responsibility to ensure the message has been transmitted clearly. Therefore, listeners ask for clarification, and the speakers rephrase their words. In Japan, the listener assumes the main responsibility for interpreting a message. Requesting clarification is considered not understanding the message, and this embarrassment contributes to the reticence of Japanese students in foreign language classes. The teacher explained his expectation to the students as listeners of his lecture:

> The objective of the classroom is to provide knowledge. And if you go away with the wrong knowledge because you did not ask the question, I'm a failure. And, if I say, alright, it doesn't matter if your comment is stupid. It doesn't matter if you think your question is stupid; it doesn't matter if you think you are wrong. Ask and get this out, so we can solve the problem and move on—that's my intent. I don't care about the wrong answers 'cause who's rating you? (Professor, 10/17)

Differences in Culture of Learning

Kato (2001) investigated how the differences in culture of learning may influence teaching and learning. Besides the daily interactions between teachers and students, the culture of learning is formed by "their world view, how they see the classroom and its members, goals of learning, and the ways they are expected to behave and communicate with each other" (p. 53). Following teacher's accounts explain the responses from students the responses from the students are seen the important validation of the effectiveness of his teaching. Therefore his words here "those guys don't have to listen to me" contradicts to his real intention.

> So, those guys don't have to listen to me. But I want them to feel…I want them to feel that it's worth the hour that they spent to come in. I'm seeking all the time the validation that it was worthwhile. (Professor, 10/17)

In contrast with the teacher's concerns, his lecture was favorably received by the students in the questionnaire, as shown in Table 12.

Here, Yasu elaborated his perceptions of the teacher:

> Well, usually, if the teacher asks a question, Japanese people basically don't answer. If we don't answer, the teacher usually gives up. He gives up and answers himself to his question. And he moves on. This is how we, the students, are left alone. But the professor didn't give up today. He kept calling on the students to solicit an answer. He made us answer. That was stimulating to me. And that's why I liked his lecture. I felt he cares. He led us well so that we could follow. I thought that he was trying to close the distance between us. (Yasu, 10/18)

Then, Shoji agreed with Yasu:

> Yes…so that he could come to our side.
> (Shoji, 10/18)

Shoji's narratives "come to our side" shows that the teacher's tactics was effective to improve the rapport between the teacher and students. I also noticed that he made the lecture content relevant to the students by providing examples related to Japan. Here, the teacher also explains:

> I tried very desperately to make it local, ‘cause who cares about the United States’ system? They don’t have to care. So, I tried to make it local to this context. (Professor, 10/17)

Differences in Cultural Values

> I say there is no penalty for the wrong answer. It’s just between you and me and God. And nobody cares, right? We just want to establish a dialogue. And if you have a wrong comment and wrong answer, nobody cares.
> (Professor, 10/17)

Contrary to the students’ positive feedback and the teacher’s narratives, the following three students’ narratives indicate that they do in fact care about a third party, namely the other students in the class whom the teacher did not mention. Student’s narratives show that their reasons for silence include the fear of making mistakes and being ridiculed (Tsui, 1996) and the desire to save face (Nakane, 2006).

> Yasu: You know, the nail that sticks out gets hammered down. I was raised in such a culture. So, I don’t want to stand out.
> Mika: I see.
> Yasu: But the person who hammers is not a teacher but the people around me. I mean students, other students. You know, Japanese people don’t welcome the different people in their group. They just let the similar people in.
> (Yasu, 10/18)

Table 12

Questionnaire results about the teacher

		1	2	3	4	5
1.	Felt a sense of enthusiasm from the instructor			1	1	10
2.	Planned the lecture considering students' understanding			3	2	7
3.	Spoke in an adequate speed and volume				4	8
4.	Led the lecture at an adequate pace		1	1	4	6

Anderson (1993) took particular note regarding this problem:

> Where they [Japanese students] are compelled to offer an individual opinion, or where they are unsure of themselves, they will go to great lengths to have their response sanctioned by peers before presenting it; in other words, when put on the hot seat, students want to speak for a group safely rather than make themselves vulnerable as individuals. (p. 103)

Anderson's (1993) assertion is consistent with Yasu's analysis that the other students' reaction is the reason they refrain from speaking up in the class. He continues:

> Yasu: Positive. So, we only have friends who are of the same level. And if there is this outstanding person, he cannot fit in the group. If you think this person is not one of them, they will create a wall. Japanese people basically get lonely easily, so they basically don't want others to create the wall. (Yasu, 10/18)

Yasu's explanation that the Japanese "don't want others to create the wall" represents that silence is a tactic to ensure that they do not stand out in a group or feel left out. Shoji and

Ichiro listened quietly and pondered Yasu's detailed analysis regarding Japanese graduate students' concerns about how they appeared to their peers.

Shoji: I think that's why we don't talk in the class.

Ichiro: It is true. I tend to be worried about how I appear to others around me.

Yasu: Yeah. We are all obsessed about such things.

(Shoji, Ichiro, and Yasu, 10/18)

Even though students understand the professor's expectation of how the students should behave in the Western teacher's classroom, their obsession of how they look to other students inhibited them from speaking up.

Mika: Tell me, why do you think so?

Yasu: You know, because we didn't answer any of the questions all the students should know.

Mika: Why didn't you respond?

Yasu: I think that's because we are shy.

(Yasu, 10/18)

Throughout my interview with the students, I kept hearing the two phrases "I am Japanese" and "I'm shy" to justify not asking or answering the questions.

Mika: So, you prefer one-on-one communication?

Hiroki: Yes. You know, I'm Japanese. That's why I'm shy.

(Hiroki, 10/18)

In a similar manner, Shoji also attributed his reticence to the characteristics of Japanese.

> If I was sitting in front, I would answer. You know, it is because I'm Japanese. Even if it is not the lecture in English. I mean, even if it is the lecture in Japanese, I will not answer. (Shoji, 10/18)

Shoji cited lack of interest in attending the lecture as another reason for no questions.

> Although my research theme is close, I basically don't ask questions because I'm not interested. Basically I'm not into the research. Well, I enjoy listening to the lecture, but I don't have anything to ask. No questions come to my mind. I just don't think. (Shoji, 10/18)

His narratives demonstrate that the personality of each student could also be one of the causes of silence in the classroom.

Discussion and Conclusions

In Tsui (1996), the teachers identified five reasons for students' lack of participation: the students' low English proficiency; the fear of making mistakes and being ridiculed by classmates; the teachers' intolerance of silence, which leads to a very short wait time for students to ponder the question and formulate an answer; the unequal speaking opportunities afforded to each student by the teacher; and the overly difficult teachers' language input. This study found that the silence of Japanese graduate students in chemistry lectures was also attributed to a mix of factors, including perceived lack of adequate language proficiency,

perceived incompetence to make relevant contributions, differences in personality and culture of learning, and a cultural value symbolized by the proverb “the nail that sticks out gets hammered down. “Lack of English proficiency is a common explanation for Asian students’ silence in U.S. classrooms. The students in my study clarified this lack and identified listening skills and technical terms as areas for improvement in participating in English lectures. In addition to language anxiety, lack of knowledge, the content of the lecture, and the resultant anxiety seemed to lead them to feel uncomfortable speaking in class (Liu & Littlewood, 1997; Tsui, 1996).

While Japanese graduate students were well-disposed to the teaching style of the Western teacher who values the students’ engagement in the classroom, both verbal and nonverbal responses were hardly demonstrated by the Japanese graduate students. Linguistic ability aside, Japanese graduate students’ silence and reticence have been poorly evaluated; moreover, Western teachers have perceived the students’ silence as rejection.

The students understand and even appreciate the teaching style of the American teacher. Yet, at the same time, they retained much of their expectations of the Japanese classroom, as evident in their valuing the teacher’s responses or comments over those of other students, and in the belief that the instructor and students were responding not as co-contributors of meaning but as evaluators of their knowledge and ability. All of my participants identified sociocultural differences as playing a key role in their lack of participation. In particular, even though they had comparatively higher levels of English proficiency and sufficient knowledge of their research in science and engineering, their effort to meet Japanese social expectations seemed to prevent the graduate students in science and engineering from actively engaging orally in the classroom. This study has implications for both English-language pedagogy and tertiary education in Japan. To activate the classroom and create a more effective learning environment, it is important for Japanese graduate

students not only to learn the English language, but also to understand and appreciate the cultural differences that exist between them and Western teachers. In turn, Western teachers should remember that when Japanese graduate students are silent during a lecture, there are multiple factors other than a lack of English skills or anxiety that may be influencing their hesitancy to speak. Although the findings are limited by the small sample size, this study allowed us to gain insight into a problem that could not have been revealed using large-scale, close-ended surveys.

In the next chapter, I will reports on a short-term study abroad program for Japanese graduate students specializing in science and engineering. The program included three weeks of intensive English training at a university in California and field trips to other local campuses and major companies.

Chapter Summary

Chapter 4 found that the problem of Japanese graduate students' silence during American professor's lecture was the consequences of a mix of factors such as perceived lack of adequate language proficiency (especially, listening skills and technical terms out of their research field used), perceived incompetence to make relevant contributions (language anxiety, lack of knowledge to the content of the lecture, and the resultant anxiety), differences in personality and culture of learning, and a cultural value symbolized by the proverb "The nail that sticks out gets hammered down." Despite their comparatively higher levels of English proficiency and sufficient knowledge of their research in science and engineering, the students refrained from actively engaging orally in the classroom in ordered to meet the social expectation.

CHAPTER FIVE

A QUALITATIVE CASE STUDY OF *KAIGAI MUSHA SHUGYO*: YOUNG JAPANESE SCIENTISTS' OVERSEAS SHORT-TERM ENGLISH PROGRAM

Introduction

Since the beginning of the twenty-first century, the world has experienced a relentless information technology revolution. People, materials, money, and information now move globally. Consequently, English is the dominant international language of cutting-edge scientists (Ammon, 2006; Crystal, 2003; Swales, 2004). Besides publishing papers written in English, scientists must understand, as well as deliver, oral presentations in English and converse with colleagues from diverse backgrounds. Since the scientific field is the most internationally diverse within academia, students must learn how to be effective in communicating cross-culturally (Wainwright et al., 2009, p.381). Therefore, *uchimuki shiko* (domestic-oriented attitudes) of young Japanese researchers presents a challenge regarding the future of the country's scientific community. This problem initially came into focus when Akira Suzuki, who was awarded the 2010 Nobel Prize in Chemistry, encouraged youths to study abroad during a presentation to the Japan National Press Club. According to results from the "Survey on Mobility of Science and Technology Researchers in Japan," administered in 2009 by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the National Institute of Science and Technology Policy (NISTEP), the rate of young researchers transferring to other institutions was 66.1%, representing an increase from previous years. Among those who responded, however, only 10.6% had lived overseas; of all the respondents, only 2.0% expressed an interest in conducting future research overseas (MEXT 2010). To encourage young researchers with *Sotomuki Shiko* (overseas-oriented attitudes), public institutions and tertiary educational organizations have

been promoting a variety of study abroad options. In 2009, for example, Japan's Society for the Promotion of Science (JSPS) established a research fund to implement its "International Research Experience for Students and Young Researchers," which consists of the Excellent Young Researcher Overseas Visit Program (to support individuals) and the Institutional Program for Young Researcher Overseas Visits to support universities and other research institutions that connect students and young researchers with research activities at foreign institutions. Likewise, a number of Japanese graduate schools have launched short-term study abroad programs for science and engineering students to develop their English communication skills and foster cross-cultural understanding.

Literature Review

Effectiveness of short-term study abroad programs is well documented. Okamoto (2002) discussed the effectiveness of a four-week intensive English course for Japanese undergraduates at Boise State University in Idaho (USA) and analyzed students' comments; he found that the program increased their motivation to study and effectively promoted tolerance for other cultures. In contrast, Menking (2004) focused on the linguistic achievements gained by Japanese undergraduate students who participated in a three-week Intensive English Program at Central Washington University (USA). Despite the program's brevity, students demonstrated improvement in their English speaking skills, especially in amount of speech, fluidity of speech, questions and/or comments made to others, and clarity in communication. Study abroad programs are recognized as quick routes to achieving English fluency and strengthening cross-cultural relationships. Yet, there is a lack of research about Japanese doctoral students studying science and engineering; these disciplines require excellent English communication skills and intercultural competence. Kunioshi, Ahizawa & Tsuji (2006) and Fujita, Morimoto, Okunishi, Ike & Harashima (2009) reported the findings

for case studies from an intensive technical English course offered during the summer by the Osaka University Graduate School of Engineering. These studies, however, do not provide solid research implications for secondary language education and intercultural communication; therefore, analyses performed in the present study explore experiences of graduate students attending another short-term English language program.

Japanese scientists often refer to short-term study abroad programs as *Kaigai* (overseas) *Musha Shugyo* (samurai drill or knight-errantry). *Musha* was originally associated with a young samurai traveling around the country to learn from the masters of the martial arts. The word has apparently gained popularity among scientific scholars who view overseas visits by graduate students and young researchers to laboratories and research institutions as similar to a samurai's visit to another school of martial arts; he is expected to challenge (*dojo yaburi*) the school to a match and defeat every man there. This study explores *Kaigai Musha Shugyo* through the eyes of graduate students and investigates changes in attitudes toward English communication and improvements in intercultural competence.

The Study

Context

This study focuses on *Kaigai Musha Shugyo*, a three-week English training program (January 23–February 13, 2010) at San José State University (SJSU) in San Jose, California (USA); field trip experiences were also provided for visiting students. SJSU is a public university known as the founding campus of the California State University (CSU) system; it is the oldest public institution of higher education on the West Coast. With a highly diverse student body that includes substantial representation by Asians, Latinos, and foreign students, the campus is a cultural crossroads like the county in which it resides. It is located at the southern end of the San Francisco Bay Area in close proximity to the Silicon Valley, which is

home to several prominent universities and many of the world's leading IT companies. On Fridays, students visited UC Berkley, Stanford University, Google, and IBM, where they heard lectures by renowned professors, presented research, and exchanged views with researchers and graduate students. On weekdays (Mondays through Thursdays), the students participated in intensive English communication training taught by teachers from Studies in American Language (SAL), a language school affiliated with SJSU. Each day, students met with the leader of a conversation club, usually at the campus library, to practice speaking with SJSU peers. Sometimes, the conversation club was offered outside the building or in a nearby café. Located in the heart of the city, SAL is close to the city's popular tourist sites, which students and their host families visited after school or on weekends to prepare for their final presentations about the city's attractions.

Participants

I gathered data primarily from four graduate students who were among the 17 participants of the program, and me. I considered the following when selecting participants for the study: Department, School Year, TOEIC Score, and Experience Abroad. Department categories were Engineering and the Sciences, and all research topics were relevant to the field of chemistry. Participants included one graduate student, one first-year doctoral student, and two second-year doctoral students; their English proficiency level was average (TOEIC score 500–700). Although seven Chinese students attended the English training program, they were not included as informants for this research.

Table 13

Participants' profiles

Name	Department	School Year	Experience abroad
Taku	Engineering	Master 2	Presented for a symposium at a Korean University
Naoki	Engineering	Doctor 1	
Shinji	Sciences	Doctor 2	
Haru	Sciences	Doctor 2	Conducted research in Australia for five months during his first year of graduate school

Data collection

The aim of this study was to assess the impact of *Kaigai Musha Shugyo* on participating graduate students, identify specific changes in attitude toward speaking English and note improvements in intercultural competence. I analyzed narrative data taken from purpose statements submitted before students left Japan and during onsite interviews, which I conducted during my two weeks with them as staff member for the program. I took field notes while observing their English lessons and accompanying them on two field trips. I interviewed them in the classroom, at a café near the language school, and/or during walks on the college campus. The data were analyzed from an emic (insider) perspective, and I translated purpose statements and interviews from Japanese into English.

Findings

Data analyzed in this study included purpose statements submitted before the students left Japan and onsite interviews, which I conducted.

Statement of purpose

Each student's purpose for enrolling in *Kaigai Musha Shugyo* centered on the following two themes:

- to improve oral communication skills in English
- to improve intercultural communicative competence

In order to achieve these goals, students agreed that an English-only environment was essential to provide *Eigozuke* (Exposure to English).

Taku, a student in his second year of a graduate program, wrote in his statement of purpose (SOP) that *researchers need to not only do their researches but also present their research results to the world*. Since English is a lingua franca for scientists, young researchers, including graduate students, are expected to publish their research in English. However, English plays a greater role than just publication of research.

Challenges in English oral communication. For Taku, the primary challenge was daily conversation with a Chinese research fellow who works in his lab.

> This year, a foreign research fellow joined my lab. I realized the difficulty in concisely conveying in English what I do in my research. (Taku, SOP)

Taku also identified listening to English presentations and asking questions to the presenters from other countries as difficult.

> Also, when I listen to the talks delivered by foreign presenters at international conferences and symposia, I am interested in the research but, due to my lack of English ability, I often hesitate to ask questions or cannot understand what the speakers are saying. (Taku, SOP)

Shin, a second-year doctoral student who participated in the university's joint symposium with a Korean university also mentioned that the experience of presenting his research in English at a foreign institute made him recognize his need to improve his English communications skills; thus, he applied for this program.

> When I presented my study [at a symposium] in Korea, I recognized my limited ability in the area of communication. Through this program, I am hoping to obtain English ability that is accepted outside Japan. (Shin, SOP)

Haru experienced difficulty in his attempts to communicate in English with other researchers who were collaborating with him on a five-month research assignment in Australia during his first year of graduate school.

> I realized the difficulty in expressing everything in English and communicating with *gaikoku jin* (non-Japanese) there [in Australia]. Above all, I remember it was most difficult to make a presentation about my research in front of foreign researchers （Haru, SOP）

Certainly, the lack of English proficiency is a common cause of communication problems with *gaikoku jin* (non-Japanese). *Gaikokujin* is composed of three Chinese characters *gai* (outside), *koku* (country) and *jin* (people) and literally means people from other countries. Japan is an island country surrounded by the ocean and has a history of national isolation during Edo era for more than 200 years. It is interesting that Haru used this word to invisible wall separated him from the people in Australia while he was staying in Australia as a research student and it was him who was an outsider there.

Statements from graduate students also indicated that they perceived that an invisible wall separated the Japanese and people from other countries. Davis & Ikeno (2002) noted that the Japanese tend to differentiate between *uchi* (insiders from the home, school, or community/nation) and *soto* (outsiders) to promote a sense of security and group identification. Interestingly, Taku described the need to venture across the boundaries between *uchi* and *soto* to break out of one's comfort zone "by flying out" of his country, much like a bird that flies out of its cage.

> I became extremely conscious that I must effectively improve my English proficiency by flying out of my country and placing myself in an environment of "eigozuke" [exposure to English] with native English speakers. (Taku, SOP)

Importance of being in an all-English environment. Graduate students unanimously agreed that they needed to be in all-English environment (*eigozuke*) to improve their communication skills in English. Naoki explained how this type of environment would help him:

> Since this program carries out the English training in an English-speaking country, I can expect dramatic improvement in my English proficiency and gain confidence in speaking English. (Naoki, SOP)

Gaining confidence and courage in English communication. Naoki believed that this training would help students gain confidence and courage.

> In addition, this program offers us stimulating experiences through field trips to the various research institutions. I applied for this program because I think it is a precious opportunity to cultivate my international sense and courage [dokyo] through intercultural communication. (Naoki, SOP)

In like manner, Shin also stated that gaining confidence represented another important outcome for those participating in this training.

> Also, as I fumble in English conversation, I often hesitate even if I have the opportunity to talk to foreigners now. So, I'd like to participate in this program also with the purpose to acquire courage [dokyo] to talk with foreigners. (Shin, SOP)

A well-known proverb, *Otoko wa dokyo* (men should be brave), associates *dokyo*, or courage, with Japanese manhood; this prevailing concept began during the reign of samurai warriors. Nitobe (2009) also recognized *dokyo* as a virtue, along with valor, fortitude, bravery, and fearlessness.

Onsite Interviews

Change of attitudes toward communication in English. When I asked about his progress in this program, Naoki spoke warmly about his changed attitude in communication.

> Naoki: I think I have changed in many ways.
>
> Mika: In what way have you changed?
>
> Naoki: Here [in America], when you are in a place where many people gather, if you don't talk to the people, you will be left alone forever. In Japan, someone

> always talked to me when I was waiting, though. Here I learned to try to talk to someone from myself. And I gained the courage to ask questions when I don't understand. For example, here if I ask for directions, people are kind and willing to sh*ow me the way.* (Naoki, Interview, 9/2)

Learning to make clear and prompt responses. After listening to Naoki's comparison between America and Japan, Taku recalled his experience.

> In Japan, it is okay to speak with ambiguity [aimai] but I feel that's not how it works here in America. "Instantaneous force [ikioi]" is required. I mean there is no time to think it over. You need to respond right away. (Naoki interview, 9/2/2010)

Davis & Ikeno (2002) noted that the Japanese are generally tolerant of *aimai* (ambiguity), which is considered to be a characteristic of their culture; it is even regarded as a virtue in Japan. However, ambiguity can create confusion (p.9) and cause misunderstandings; people from other countries are often frustrated when Japanese people do not definitively respond to questions (p.13).

Lack of vocabulary. In addition to demonstrating attitude changes regarding English communication, Taku and Haru realized the necessity to increase their English vocabulary.

> Taku: I strongly feel a lack of vocabulary. I can talk about my research, but nothing other than that. I want to learn a lot of slang expressions that can be used in daily life. (Taku, Interview, 9/2)

> Haru: I realized that there are a lot of words I don't know. I don't know the words that can be used in daily conversations. Every day I get frustrated about words and about how I will say this and that in English. I want to learn how I can correctly use English words. (Haru, Interview, 10/2)

Importance of pronunciation and intonation. In his purpose statement, Shin wrote that he was "hoping to obtain English ability that is accepted outside Japan." Shin further described areas needing improvement.

> I think that you realize the importance of pronunciation and intonation only when you use it in your daily life. Even if you don't speak with correct grammar, people here will focus on the words and guess what you mean from the context. So, you can communicate with them somehow. (Shin, Interview, 11/2)

Naoki also commented on the importance of pronunciation and intonation.

> I think this experience was meaningful. There are a lot of things I didn't notice in Japan but I could after I came here. I learned that pronunciation and intonation are really important. I tried to use some words I have known but couldn't get across with my English in town at all. (Naoki interview, 9/2)

Effectiveness of short-term English training. Haru compared the three-week English training experience to the five-month research assignment in Australia. He stated:

> When you stay abroad for your research, you don't need to use English so much. Lab members tell you to do this or do that, but that is all. It may depend on the person.

> There are a good many opportunities to speak English if you want to. But you don't need to if you don't want to. In my case, I tried to talk with my roommate rather actively. But I was not in the environment to go to school every day and concentrate on speaking practices like I am doing now. I feel this three-week training has a higher level of English density [nodo ga koi].（Haru, Interview, 10/2）

Haru's experience is a testimonial that length of stay does not highly influence the attitude toward communication; additionally, focus and content carry decisive weight in terms of development of communication skills.

Discussion and Conclusions

This small-scale study allowed us to gain insight into the context of *Kaigai Musha Shugyo* from the viewpoint of the participants and to document their attitude changes toward English communication. In the analyses of purpose statements, I described a general perception among the participants that they lacked effective English communication skills and courage (*dokyo*) to talk aggressively with foreign researchers from other countries. To overcome these problems, they believed that it was imperative to learn in an English-only environment. Narratives of participants suggested that participants overcame their anxiety of speaking in English in many ways: they learned to initiate conversations with people, ask questions, and respond to questions promptly and clearly. The students also realized the importance of improving pronunciations of English words and increasing their English vocabulary. What kind of impact did the experience of *Kaigai Musha Shugyo* have on the graduate students in the long run? Additional studies are required to evaluate its long-term effectiveness. However, I had an opportunity to visit a graduate student who had participated in this program while he was completing a five-month research assignment at a Canadian

university. He told me that this three-week sojourn in the U.S. caused him to start thinking seriously about conducting research abroad. He can quickly adapt now to new environments and concentrate solely on the research experiments. In this regard, *Kaigai Musha Shugyo* program has social and linguistic significance on the basis that it served as a steppingstone for connecting young researchers with overseas research opportunities. Finally, it supported young researchers with *sotomuki shiko* (overseas-oriented attitudes). In the future, I would like to conduct follow-up research with a case study of the graduate student who completed a short-term overseas research assignment in Canada following English training at *Kaigai Musha Shugyo*

In the next chapter I will provide an overview of a 12-week online scientific writing course designed for graduate students and young researchers engaged in research in various fields of chemistry and life sciences. The study will explore factors that hindered or facilitated the implementation of the online writing course and discuss the efficacy of the course and problems with its implementation.

Chapter Summary

Chapter 5 explored the graduate students' *Kaigai Musha Shugyo* program which consisted of three-week English training program at an American university and weekend visits to the laboratories of other universities and famous companies. From analyses of prior-trip purpose statements, it was found that the students' perceived lack of basic English communication skills and courage (*dokyo*) to communicate with foreign researchers, and their belief that studying in English-only environment is imperative to overcome these lacks. From the on-site interview, Students overcame their anxiety of English communication by learning to initiate conversations with people, ask questions, and respond to questions promptly and clearly, and also felt the necessity to improve their English pronunciations and

increase English vocabulary. Although the training was not long, the study suggested that short-term English program had social significance on the basis that it would support young researchers with *sotomuki shiko* (overseas-oriented attitudes), serving as a steppingstone for connecting young researchers with overseas research opportunities.

CHAPTER SIX

DESIGNING ONLINE SCIENTIFIC WRITING COURSE FOR GRADUATE STUDENTS IN SCIENCE AND ENGINEERING

Introduction

This chapter provides an overview of an online scientific writing training course, which was designed for graduate students and young researchers of a graduate school in science and engineering in Japan, and explores the factors that impeded or facilitated the implementation of the course in the EFL/ESL context. Much attention in the present study is focused on the factors that lead to students' persistence or high motivation. Although the focus was on students, information from the instructors and curriculum developer was also obtained for data triangulation in order to increase validity. By referring to the feedback comments from the students, instructors, and curriculum developer, the study discusses the effectiveness and inefficacies of the online writing course from a variety of perspectives, thereby supporting the validity of the study. The study will contribute to ESP (English for Specific Purposes) and CALL (Computer Assisted Language Learning), and have positive implications for the niche area of English-language pedagogy in higher education.

Literature Review

Scientific Writing in English

Writing research papers is the most common means of communicating research findings and disseminating information to the larger community of scientists and researchers. Scientific research writing is a type of academic writing derived from scientific publication in which original research results are described based on the experimental, theoretical, and/or observational knowledge in any scientific field (Day & Sakadusuki, 2011). Day and

Sakaduski have emphasized that the fundamental purpose of scientific research is the publication of results, and the primary goal of publication of these results is to educate, to inform, and to record, and for some, to persuade the audience about one's findings in the research (P.1).

Scientific research papers are written in formal language through which authors present logical arguments and support their arguments with independent thinking and evidences, including appropriate citations of the source of the evidence.

Peat (2003), Glasman (2010), Day & Sakadusuki (2011) have opined that scientific writing involves a simple, formal, clear, and concise approach of writing. Scientific language is more direct and does not include artistic expressions. According to Close (1965), scientists focus more on the accuracy of theme and the findings rather than on the style of presentation. In addition, the pursuit of universal generalization in scientific texts enables the author to signal credibility, reliability, objectivity and ultimately authority to their readers and the research community (Marin-Arrese, 2002).

Clarity is the key characteristic of scientific writing. It is important for the author to explain the complex scientific arguments and evidences clearly which can be done by keeping the language simple. In addition, formal language is an essential element in scientific writing. An objective writing style and use of formal words is important in scientific articles. To achieve objectivity in scientific writing, ideas and opinion of other authors must be used with appropriate citations in order to make the argument more authoritative and persuasive. Moreover, structure is absolutely crucial to scientific papers. Two most important aspects are crucial about scientific papers. Though all types of writing are organized, scientific research papers are highly organized. Research papers typically have a standard structure to facilitate communication, which is known as IMRAD (Introduction, Materials and Methods, Results, and Discussion) format of organization (Day & Sakadusuki, 2011) although, of course, there

are variations on this basic format. However, often researchers are so committed to the technical aspects of their research that they neglect their writing skills. Researchers might have a great knowledge in their field of study but their writing skills may not always be good. Hence, writing a research article can be an overwhelming task, especially if the researcher is a non-native English speaker.

Writing practices of Japanese researchers

Gosden (1996) studied the writing practices of Japanese novice researchers in preparing their first scientific papers in English. The study found that they have dual constraints of limited research skills and limited knowledge of the mechanics of scientific writing in English, which leads to poor writing strategies in their research papers. The emphasis on grammar-translation and the use of Japanese throughout their English education in Japan lead the novice researchers to depend on their first language, because of which they may be unable to develop good writing skills in English. Further, they are still unfamiliar with the notions of external critique and audience awareness because the concept of integrated service language support and the tradition of Language for Specific Purposes (LSP) in the education system are not common in Japan. Okamura (2006) investigated the strategies used by Japanese researchers to cope with their difficulty in mastering scientific English in a non-English speaking environment. The study found that two types of strategies are used. All researchers focused on reading academic texts in their field to learn typical writing patterns. Some paid more attention to the language used by native English speakers. The study also found that the majority ended up working with their limited English due to time constraints, and further suggested that efforts to master the language were more effective in the long run.

Online learning and writing training

With the advancement in information and communication technology (ICT), e-learning or online learning has become prominent in today's higher education system (Song, Singleton, Hill, and Koh, 2004). These researchers sought to understand graduate students' perceptions of online learning, including helpful components, and observed the challenges based on their online learning experiences. The study indicated that course design, learner motivation, time management, and ease with online technologies are important to most learners for the success of their online learning experience. The challenges faced by learners were technical problems, lack of a sense of community, time constraint, and difficulty in understanding the objectives of online courses. The study provided suggestions to address the challenges of online learning. First, the course design should focus on the goals, objectives, and expectations of the learners together with the technological aspects of the course. Second, since learners are not used to the online learning system, in which information is sent in various formats and at different times, assisting learners to establish time management strategies would be helpful. Finally, helping learners to establish a feeling of community or connection among learners in the context of online learning is imperative. This requires integration of strategies for community building into the design of the course.

Yang (2010) suggested the importance of reflection, which is the mental process of an individual's internal problem-solving activity, and is seldom observed in classroom instruction. He also discussed the effectiveness of students' reflection and peer review in improving their writing skills through online instruction. Focusing on undergraduate students in an EFL writing class at a Taiwanese university, this study found that reflecting on the differences between self-correction and peer review enabled students to monitor, evaluate, and adjust their writing processes to improve their writing. Although self-correction helped

students detect grammatical errors, peer review allowed them to see their own writing through others' eyes, which enabled them to further improve their writing skills.

Jun and Lee (2012) focused on academic writing training using the Moodle course management system, and discussed students' preferences for online/distance learning and their experiences in a three-week online academic writing unit developed by the researchers themselves as part of an ESL academic writing course for international undergraduate students at a research university in the U.S. While they appreciated the convenience of time and place, ease of use, interaction with classmates in forums, and the peer response workshop, they felt that communication with the teacher was lacking, particularly with regard to immediate answers to questions and solutions to problems. It was also revealed that the students found some instructions confusing and considered a couple of tasks before the assignment to be irrelevant. This led to the students' low rating for the online academic writing course when comparing it (i.e., the online academic writing course) with other learning systems. The students mostly preferred a blended learning system, while the onsite and online systems were the second and third preference, respectively.

The Study

Context

In this study, the online writing course, the ATCYR (Authorship Training Course for Young Researchers) was implemented as part of an English education program for graduate students and young researchers who are involved in a government-funded educational program at a large research-oriented university in western Japan. The 12-week online scientific writing course was designed for graduate students and young researchers who wanted to improve their ability to write research papers in English. This course was conducted through an LMS (learning management system), which is a customized version of

Moodle 1.6. Moodle (modular object-oriented dynamic learning environment) is a web based e-learning system, which is a popular tool among educators and educational institutions for online education and training purposes. Typically, the LMS has an instructor to create and deliver reading materials, participate in discussion forums with students, and monitor and assess students' performance. In this course, students were instructed to write a research paper based on their own research. Reading materials were provided to help students write each section of the paper. The course was designed in a way that students had to make two submissions for each assignment: For the first submission, the students submitted parts of their research paper in the form of assignments and the instructor evaluated each assignment. In the first round of evaluation of each section, guidance was offered with regard to language and grammatical errors, while the evaluation of the second submission focused on scientific content and section-specific criteria of the paper. This approach was expected to encourage students to learn from their mistakes and help them to gain fairly good knowledge on how to write a paper.

Participants

The majority of the students were Japanese nationals; however, there were also students from other countries, such as China, Korea, Slovakia, Hungary, Thailand, Indonesia, and Nepal. The students were graduates and post-graduates from various disciplines of chemistry and the life sciences. Their levels of proficiency in English varied from lower-intermediate to intermediate and advanced.

Data Collection

This study is a collaborative project between a Japanese course coordinator and the instructor of the ATCYR course, both of whom are the authors of this article. Data were

obtained from students' responses to the questionnaire (see Appendix E) and the responses to the feedback sheets from the instructors and curriculum developer. Both the questionnaire and feedback sheets were given at the end of the course so that the results would help improve their performance in the next course. The questionnaire for the students included questions that solicited students' view on the course. All the questions were written in English. However, the Japanese students were allowed to write their responses in their mother tongue so that they could express their opinions freely and accurately. Later, these responses were translated into English by one of the researchers. Since the researcher shared a common language and cultural background, she was able to grasp the nuances in the students' responses. The feedback sheets for the curriculum developer and instructors did not have any questions. Therefore, they described their perspective on the course.

Designing Online Scientific Writing Course

The first round of the course consisted of two types of online writing training: Basic Course and Advanced Course. Both these 16-week writing courses, each comprising four lessons, started on November 10, 2008. The objective of the Basic Course was to help students build their basic writing skills; hence, the training included creating an outline for a scientific topic, writing an effective paragraph on a scientific topic, and writing an effective five-paragraph essay on a scientific topic. To meet the students' needs to write on a theme that was related to their area of research, ten topics were prepared for each student based on their actual research theme (they were asked to submit their research theme at the time of application). On the other hand, the Advanced Course focused on training to write research papers. Students were instructed to write a research paper, consisting of a title, abstract, introduction, materials and methods, and results and discussion, based on their own research. The students submitted three assignments in each lesson of both the Basic and Advanced

courses. For the first submission, the instructor provided suggestions on how to improve the assignment; the students then made corrections and submitted the second draft. The instructor then evaluated the resubmission and offered further suggestions. The students made final changes to their draft and submitted the final version of the assignment. The Basic Course was taught by an Indian instructor who has a master's degree in English literature from a graduate school in India, and has taught English literature at the undergraduate level. The Advanced Course was taught by an American instructor who has a bachelor's degree in sociology. All Japanese PhD students (seven lower-intermediate English level, one higher-intermediate, one advanced) chose the Basic Course, while three PhD students from other countries (Indonesian, Chinese, Korean) and all young researchers (three research fellows and four assistant professors) took the Advanced Course.

Both the Basic and Advanced courses began with a high assignment submission rate (Tables 14 and 15). After lesson 1, however, the submission rate of assignments in the Basic Course showed a gradual decline, whereas the submission rate in the Advanced Course remained relatively higher.

Table 14

Assignment submission rate for the Basic Course (2008)

Basic Course	Lesson 1			Lesson 2a			Lesson 2b			Lesson 3			Lesson 4		
Assignment	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii
Submission %	100	78	22	67	44	11	44	11	11	56	33	11	22	11	0

Table 15

Assignment submission rate for the Advanced Course (2008)

Advanced Course	Lesson 1			Lesson 2			Lesson 3			Lesson 4		
Assignment	i	ii	iii	i	ii	iii	i	ii	iii	i	ii	iii
Submission %	73	91	73	73	73	55	82	73	36	73	55	45

Due to less involvement of the students in the Basic Course, sufficient feedback was not received from them. However, the following comment from a student suggests some possible causes for the low submission rate.

> For me, the first assignment was good because it was appropriate. However, as the course proceeded, the pace of assignment submission increased. As a result, it became difficult for me to follow the course schedule. (PhD student, Questionnaire for the Basic Course, 2008)

This student points out that the pace of assignment submission was a challenge. From the schedule, we can infer that the level of difficulty of the assignments increased as the course proceeded. In the Basic Course, the students started with quizzes on grammatical mistakes, followed by creating an outline for a scientific topic, writing a paragraph on a scientific topic, and finally writing a five-paragraph essay. Given that the interval between two lessons was the same, it cannot be denied that this course schedule was a burden for the students. Meanwhile, the pace of the Advanced Course was moderate with a low frequency of submission, as shown in Table 15. The volume and content of each lesson was also of the same level since the students wrote different sections of the same paper. The following feedback from the instructor of the Basic Course implies that the Basic Course components were not at a level appropriate for the students who took the course.

> I think the lesson plan should be revised to give students more effective training on how to write, and there should be more comprehensive reading material. Also, the assignments could be in the form of quizzes instead of asking students to write whole paragraphs and essays. Further, a thorough needs analysis and learner-level analysis should be done before the lesson plan is finalized. (Instructor, Feedback for Basic Course, 2008)

The curriculum developer of the course echoed a similar view on the components of the Basic Course.

> It [the Basic Course] started out well with a 100% submission rate for assignment 1, which was a grammar quiz. From this, we can perhaps infer that the format of this lesson worked well: the reading material consisted of practical tips on grammar, and the assignment tested their understanding of that. (Curriculum developer, Feedback for the Basic Course, 2008)

> His reasoning for the low submission rate in the Basic Course was as follows:
> The submission rate started falling as the paragraph writing assignments began. This could indicate that the students didn't take well to being plunged into free writing. Maybe the students in this course would have liked a greater focus on writing instruction instead of writing practice. It could also be that they found it difficult to come up with content for the paragraphs and essays they had to write. On the other hand, the advanced course students wrote about their own research, so the raw content was readily available. (Curriculum developer, Feedback for Basic Course, 2008)

The important point here is that the students could choose either of these two courses; however, they decided to take the Basic Course after reading the lesson plan in Japanese, which was distributed prior to the course. This suggested that the Japanese PhD students felt the need to improve their basic writing skills before they obtained writing training on scientific writing. Since the PhD students spend a great deal of time engaged in research activities, they naturally found it difficult to write paragraphs and essays on themes that were not directly linked to their research.

Looking solely at the submission rate, it may be said that the Advanced Course was relatively successful. The feedback from the students and the instructor of the course suggested the need for improvement in the following areas: course components, evaluation, length of the course and instructor's background.

Course Components

Primary improvement was made in the area of curriculum, more specifically teaching contents and order. After improving the content in the previous round of the course, the new curriculum of ATCYR consisted of five lessons: 1) citations and integrating sources in a research paper, 2) writing the "introduction" section, 3) writing the "materials and methods" section, 4) writing the "results and discussion" section, and 5) writing the title and abstract; full-paper submission and formatting.

A lesson on "citations and integrating sources" was added to the new course. This change was made based on the suggestion from the curriculum developer, who found that students generally make mistakes in citations and references. The instructor also gave clear suggestions for restructuring the course:

> In the future, I would suggest that each assignment include previous ones. For example, when students turn in the second assignment (introduction), it should also include the title & abstract from their first assignment. This will help the instructor to see the paper as a whole, rather than as individual parts. Additionally, it would give the student the chance to see their paper come together as one piece, and if they decide to make a change in one section, they may find it necessary to go back to previous sections and make the same change. This might also help with context, assuring consistent use of abbreviations, etc. (Instructor, Feedback for ATCYR 2010)

In line with the comments of both the instructor and the students, writing of the title and abstract was made the last lesson, and full-paper submission and formatting were also added to this lesson component. Accordingly, the final assignment of each lesson in the last term was replaced with the new format. Consequently, the number of assignments decreased from three to two. Since students have a hectic schedule conducting experiments and attending research meetings and seminars, a four-week grace period was given to them at the end of the course, during which time they could make up for the delay, if any. In addition, the instructor gave suggestions for revamping the course structure and the reading materials. Therefore, additional reading materials that included examples of correct expressions in scientific writing were provided later.

> According to me, the structure of the course is appropriate and the study materials for each lesson are relevant and helpful for the students. However, it would be a good idea to include reading materials on correct expressions in scientific writing, particularly on grammar, stylistics, and word usage in scientific writing. This would

> enable students to have a proper judgment on the usage of appropriate expressions in their writing. (Instructor, Feedback for ATCYR 2011)

Evaluation

With the addition of two lessons and provision of the grace period, the duration of the course extended from the initial four months to six months; however, the number of assignments per lesson reduced. The change in the number of assignments was made to allow the students to review their writing based on two different perspectives; this enabled them to enhance their learning process through the course. In the evaluation of the first draft submitted by the students, the instructor highlighted errors and mistakes in grammar and vocabulary. Instead of directly correcting the mistakes, the instructor provided hints by using correction codes or abbreviations of each language function. The students then corrected the mistakes based on these correction codes and submitted the second draft. In the second draft, the instructor analyzed the students' writing in terms of scientific style, based on the section-specific criteria as in Table 16.

Table 16

Criteria for evaluation

Section	Criteria for evaluation
Title	Clear, concise, and properly formatted
Introduction	Adequate context and background; proper use of references; clear explanation of how the current study will contribute to existing knowledge
Materials and methods	Smooth flow of sentences and paragraphs in describing experiments; clear tables, figures, and images; proper units and numerals
Results	Logical sequence of results based on the experiments; adequately detailed tables, figures, and images; effective references to tables, figures, and images
Discussion	Clear identification of important and relevant results; comparison of these results with previous work; explanation of the implication of the results; acknowledgement of any unaddressed issues or problems with the results;

	directions for future work
Abstract	Information from all the sections of the paper; good beginning and ending; no wordiness

The instructor of this course emphasized that this two-step submission and evaluation for each section of the paper was effective in developing students' scientific writing skills. The instructor also emphasized the importance of the criteria for the various sections of a scientific paper.

> There was a remarkable improvement in the students' writing, particularly after they incorporated the suggestions in the first drafts. I feel the criteria for each section of the research paper helped the students to focus better on the scientific content and their approach towards the respective sections of their research paper. Moreover, the appreciative comments from the students indicate that they benefited from this course and could improve their scientific writing skills. (Instructor, Feedback for ATCYR 2009)

One student also mentioned that this two-step submission and evaluation according to the criteria for each section helped them to understand the style and format of scientific writing more effectively.

> The evaluations were clear and pointed out parts of sentences that require more clarity. (PhD student, Questionnaire for ATCYR 2009)

With the changes in the organization of the course, instructor, and the number of assignments, an improvement was seen in the students' completion ratio in this five-month training course.

Table 17

Assignment submission rate for ATCYR 2009

Lesson	1		2		3		4		5	
Assignment	i	ii	i	ii	i	ii	i	ii	i	ii
June 2009 (8 PhD students) submission %	100	92	100	100	100	85	77	62	62	62
September 2009 (1 master student, 4 PhD students) submission %	100	80	100	100	100	80	100	80	80	77

To facilitate further improvement of the course, the curriculum developer proposed a short course in which students submit their assignment only twice.

> One disadvantage of this course is that it is quite long: about five months. Maybe we should look into offering a shorter version of the course that's about two months long. ……The nature of the evaluations will remain the same as in the current course, but the number of submissions will be fewer. (Curriculum developer, Feedback for ATCYR 2010)

Length of the Course

The short course may be suitable and appropriate for researchers who had adequate experience in publishing research papers. However, the system of two assignment submissions did not seem to be suitable and appropriate for graduate students due to the concise approach of this kind of writing training. Therefore, suggestions to restructure the curriculum into the following three sections were implemented: 1) writing the title and

"introduction" section, 2) writing the "materials and methods" and "results and discussion" sections, and 3) writing the abstract and formatting the entire paper. Simultaneously, the length of the course was shortened from five months to four months. The latest ATCYR course is a four-month course, including a one-month grace period, and consists of three lessons with two assignments for each lesson, as shown in Table 18.

Table 18

Course Outline for ATCYR 2010

	Standard ATCYR
Course duration	16 weeks (12-week course + 4-week grace period)
Course start date	October 4
Number of lessons	3
Number of assignments	6 (2 per lesson)
Four-week grace period after the course	

The amount of study and quality of instruction remained the same since the graduate students used the same reading material and their manuscripts were evaluated by the instructor based on the same criteria. Thus, the reduction in the number of lessons did not negatively impact the educational effect of this online scientific writing course. Furthermore, the course with this new schedule had a higher completion ratio as in Table 19.

Table 19

Assignment submission rate for ATCYR 2010 and 2011

Lesson	1		2		3	
Assignment	i	ii	i	ii	i	ii
June 2010 (8 PhD students) submission %	100	100	100	100	75	88
July 2010 (1 PhD students, 1 research fellow) Submission %	100	100	100	100	100	100
May 2011 (7 PhD students) Submission %	100	100	100	100	71	71

Instructor

Another major change made in the new course was the appointment of an Indian instructor with a doctoral degree in science instead of the instructors with the background of humanities fields.

On the whole, the students were satisfied with the Advanced Course. The instructor had sufficient experience in writing and editing, and teaching English. However, because he did not have a scientific background, he found it difficult to evaluate scientific papers, which may have led to the above comments from the instructor. One postdoctoral researcher who received instruction from this teacher gave the following feedback:

> It would have been better more comprehensive suggestions or advices were provided. (Research Fellow, Questionnaire for ATCYR 2010)

The instructor had a PhD in the life sciences and has been teaching science and English for the past six years with an organization that provides editing, educational, transcription, and training services to individual and institutional clients worldwide. She has taught both science, because of her academic background, and English, because of her personal interest. She especially likes teaching scientific writing because it deals with both science and English.

The new teacher' instruction was well-received by the students. The following comment from the students clearly indicates that the course was effectively taught by the new teacher:

> The teacher's major was different from our research subject, but her evaluations and corrections were accurate. (PhD student, Questionnaire for ATCYR 2011)

With her fairly good knowledge of chemistry, this instructor did a very good job of evaluating the research papers. Moreover, her interest in scientific publications led to a deeper analysis of students' writings. Further, her experience in writing scientific papers helped her in providing appropriate instructions on the style and format of scientific writing.

Discussion and Conclusions

In this section, we summarize the factors that contribute to students' motivation and persistence in pursuing an online scientific writing course. First, the study raised the question of whether young researchers, especially graduate students require writing training. The graduate students were initially interested in basic writing training, which consisted of paragraph writing and essay writing. This could be because the students found it necessary to obtain a general foundation in English writing. Because of the mismatch with their English level and research field, however, the online course for basic writing training had a low completion rate. Although the graduate students were given writing topics that were relatively close to their research themes, a direct relation was lacking. Also, writing an essay requires a fairly high level of English proficiency. We assume that these were the two demotivating factors that led to students dropping out from the essay writing course. Even if a graduate student has the skill to write good essays, it does not necessarily mean that he is equipped to write a good scientific manuscript. Taking the students' needs into consideration, we suggest that the online writing course for graduate students should focus on training in writing scientific papers. Okamura (2006) suggests that researchers' efforts to overcome their limited English writing skills and become familiar with/aware of native English speakers' language usage are more effective in the long run and necessary if the researchers seek to be successful in the community. In the two steps of evaluation in the ATCYR course, the

students identify the mistakes in their language use and correct these by themselves based on the first evaluation; in the second evaluation, they can improve their manuscript based on the section-specific criteria. This evaluation style enhances self-reflection by students or the mental process of internal problem solving by an individual. Yang (2010) discusses the pedagogical effects of self-reflection that cannot be fully achieved in classroom instruction. He also suggests that by understanding the differences between self-correction, which helps in the detection of grammatical errors, and peer review, which helps in the objective reviewing of writing, students can monitor, evaluate, and adjust their writing processes to improve their writing. Since the manuscripts include unpublished research results, peer review may not be suitable for the scientific writing course. Thus, detailed analysis by the instructor in the second evaluation serves as an alternative solution. Since the students improve their English language skills as they complete their own research papers, the course also has salutary effects on the three factors that reduce students' motivation to learn writing for publication, as pointed out by Huang (2010): 1) their notion that English plays only a subsidiary role in scientific research, 2) their sense of inferiority in the university writing curricula, and 3) the perceived imbalanced power relations between them and their advisers. Thus, the course is effective and efficient in terms of the students' needs.

Another factor discussed in the study is the importance of the instructor's academic background. The students' feedback suggested that they preferred the evaluations of the instructor with a science background, who would be capable of providing a more accurate analysis and detailed evaluation of the students' writing. Jun and Lee (2012) attributed the students' low rating of the online academic writing course to a lack of communication with the teacher and perceived irrelevance of the instruction. The instructor who taught this course had background knowledge of the students' research areas and enjoyed reading and

evaluating the submitted assignments because she herself had a doctorate in chemistry. Therefore, her analysis was more detailed and appropriate than that of other instructors.

Song, Singleton, Hill, and Koh (2004) suggests that course design, learner motivation, time management, and ease with online technologies are important to most learners for the success of their online learning experience. This study also showed that the duration of the study including the frequency of assignment submission and the number of lessons affect the success of the online writing course. The length of the ATCYR course was shortened from five months to four months by reorganizing the course components. The same reading materials and evaluation based on the same criteria were provided. Therefore, the amount of study and quality of instruction did not change and the reduction in the number of lessons did not affect the quality of this online scientific writing course. The students benefited from the shorter duration because they could complete and publish their paper faster. We believe that the improvements in the course components, duration of the study, and instructor's background increased students' increased motivation and persistence in pursuing the online scientific writing course.

Chapter Summary

Chapter 6 presented the online scientific writing course for graduate students in science and engineering, and found the three factors, 'course component', 'length of the study', and 'instructor's background', influence students' motivation and persistence for learning. First, the online writing course for graduate students should focus on the training of writing scientific papers even though the students felt the necessity of obtaining a basic writing skills in English including paragraph writing and essay writing. The basic writing training course resulted in a low completion rate due to the irrelevance to their English proficiency level and research field. This study also found that the two-step evaluation

system where students correct their own mistakes of language use in the first stop and receive the second evaluation based on the criteria specific to each section of the scientific paper in the second step, can lead to enhance the students' reflection, or mental process of an individual internal problem-solving activity. It was also found that the instructor of scientific writing course should have a science background as he or she can provide more accurate analysis and detailed evaluation, and that the students could benefit from the shorter course so that they can complete and publish their research paper sooner. The length of the on-line writing course was shortened from five months to four months by reorganizing the course components. The reduction of lessons did not lead to the deterioration of the educational effect of this online scientific writing course because there was no change in the amount of study and quality of instruction.

CHAPTER SEVEN

TOWARDS THE DEVELOPMENT OF A CURRICULUM OF SCIENTIFIC COMMUNICATION COURSE FOR GRADUATE STUDENTS IN JAPAN

Introduction

In the previous chapters, this dissertation has addressed the various topics related to ESP education for Japanese graduate students in science and engineering: their needs and wants for English education, perceptions to the dominance of EILS and their attitude toward studying ESP (Chapter 3), the problem of students' silence during chemistry lectures taught by Western teachers (Chapter 4), effectiveness of a short-term study abroad program (Chapter 5), and development of a 12-week online scientific writing course (Chapter 6).

Drawing on the findings from these studies, this chapter first provides integrated discussion to answer the first research question from the introductory chapter: "To what extent do Japanese graduate students in science and engineering want and need English education?"

Following the discussion, this chapter also proffers the study's implication to answer the second research question from Chapter 1: "What implications do the findings have for ESP course design for graduate schools of science and engineering in Japan?" In this final section of this dissertation, I consider the implications of the study for ESP practitioners teaching in graduate schools in science and technology, the community of Japanese scientists, and tertiary education in Japan.

Integrated Discussion

In this section, some issues related to the topics that are of substantial importance in designing an ESP curriculum for graduate students in science and technology will be

discussed. As discussed earlier, the four parameters of ESP course design suggested by Basturkmen (2014), which were introduced in Chapter 2, will guide this discussion. The topics include *Varieties of language, Needs analysis, Types of syllabuses, Wide- versus narrow-angle course designs.* I In this section, each aspect of ESP course design will be discussed together with the findings from the studies in this dissertation.

Varieties of Language

First, Basturkmen (2014) introduced two conflicting ideas for *"Varieties of language"*: One is "there is a common core of general language that is drawn on in all areas of life and work" (p.15). The other is "there is no common core of language preexisting to varieties" (p.17). In Chapter 3, questions regarding their needs and wants of English education revealed the Japanese graduate students' needs of learning both General English and ESP focusing on Scientific English: The questionnaire results in Chapter 3 showed that graduate students prioritized learning both general vocabulary and specialist vocabulary (general vocabulary was a little more highly prioritized). In FGI of Chapter 3, the graduate students explained their frustration caused by the lack of their vocabulary necessary to clearly communicate their ideas in both writing and speaking. More specifically, one student explained the situation in the conference where he had difficulty in communicating with the researchers who are from slightly different field. In some of my studies, 'lack of vocabulary' in speaking English was repeatedly heard from the graduate students as their challenge. Participants in Chapter 4 also stated that he had difficulty in understanding the content of chemistry lecture because it was different from his research field although the lecture's level was set fourth year of undergraduate level. In Chapter 5, two students studying in English training course in America realized the necessity to increase their English vocabulary.

First, Basturkmen (2014) introduced two conflicting ideas in *"Varieties of language"*: First, "there is a common core of general language that is drawn on in all areas of life and work" (p.15), and second, "there is no common core of language preexisting to varieties" (p.17). In Chapter 3, the questions that were posed regarding Japanese graduate students' needs and wants for English education revealed their needs for learning both General English and ESP focusing on Scientific English: The questionnaire results in Chapter 3 showed that graduate students prioritized learning both general vocabulary and specialist vocabulary (general vocabulary was a little more highly prioritized). In FGI of Chapter 3, the graduate students explained their frustration caused by the lack of essential vocabulary that is necessary to communicate clearly their ideas in both writing and speaking. More specifically, one student explained a situation in a conference where he faced difficulty in communicating with researchers from slightly different fields. In some of my studies, the "lack of vocabulary" in speaking English was repeatedly expressed by graduate students as their challenge. A participant in Chapter 4 also stated that he encountered difficulty in understanding the content of a chemistry lecture because it was different from his research field although the lecture's level was set at fourth year undergraduate level. In Chapter 5, two students studying an English training course in America realized the necessity to increase their English vocabulary.

What can be suggested from these findings is that in the English curriculum for graduate students, teaching specialist vocabulary does not have to be the focus in the curriculum because they can gain their specialized vocabulary of their respective field from their literature readings, research writings, and conference presentations. Instead, basic general vocabulary, which contain general words used in daily life, and basic scientific vocabulary, which contain words used in all scientific fields, should be taught in the ESP course for Japanese graduate students in science and engineering. Nation (1990) suggested that there are two levels of vocabulary knowledge: receptive (the ability to recognize the

form and retrieve the meaning in listening and reading) and productive (the ability to retrieve and produce the appropriate spoken or written form of a word in the target language; to express a meaning by speaking or writing). The findings in Chapter 3 suggest that Japanese graduate students lack productive knowledge of both general and scientific vocabulary although they may have sufficient receptive vocabulary knowledge from their past language education in school curriculum. Also, it should be noted that the burden of learning vocabulary will be heavy for learners whose first language is not related to the second language (Nation, 2001). In order for them to acquire higher English proficiency, a lot more time is spent for vocabulary building by teaching vocabulary.

Needs Analysis

For *Needs Analysis*, Basturkmen (2014) argued "ESP is understood to be about preparing learners to use English within academic, professional, or workplace environments, and a key feature of ESP design is that syllabus is based on the analysis of the needs of students" (pp.19-20). Hutchinson and Waters (1987, p.54) defined needs as "the ability to comprehend and/or produce the linguistic features of the target situation," to introduce the two concepts of "target needs" and "learning needs" and differentiate them. "Target needs" refers to "what the learner needs to know and do in the target situation (the learner's "necessities," "lacks," and "wants" for functioning effectively in the target situation); while "learning needs" concerns "what the learner needs to do in order to learn" (the learner's motivation and attitudes, interests, personal reasons for learning, learning styles, resources, and time available) (Hutchinson & Waters, 1987, p.55).

Types of Syllabus Design

Regarding the *syllabus design*, Basturkmen (2014) suggests what language items be taught is the essence of language teaching, and that teachers and course students must carefully select the items to include in the syllabus, especially in teaching ESP program whose focus is on specific purposes and duration of time is limited.

Cummins (1979) differentiates between social and academic language acquisition: Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP). BICS refers to the language skills used in the everyday informal language needed to interact socially with other people; whereas CALP refers to formal academic learning including listening, speaking, reading, and writing about subject area content material, which is essential for learner to to successfully communicate in an academic setting.

The findings in Chapter 1 revealed that the Japanese graduate students perceive that improving both their General and Scientific English skills is important for their academic and career success. They are aware that communication is integral part of their research activity. For academic use they use English to write scientific papers and make the oral presentations to deliver their latest research known to the community. They also have discussions for exchanging the ideas and points of view. As a researcher, they draft a research proposal and add entries in their laboratory notebook. The language Japanese graduate students require is not limited to academic use. They require the ability to use the language of everyday informal talk to communicate effectively apart from the academic setting. Examples of this include chatting over coffee with their international colleagues in their laboratories or responding to email messages from the researchers overseas.

The findings of Chapter 4 regarding the problem of Japanese graduate students' silence during chemistry lecture in English revealed that there are additional barriers that they

need to leap other than lack of adequate language proficiency. These barriers included perceived incompetence to make relevant contributions (language anxiety, lack of knowledge to the content of the lecture, and the resultant anxiety), differences in personality and culture of learning, and a cultural value symbolized by the proverb "The nail that sticks out gets hammered down." An ESP course developer should integrate BICS, CALP and the difference in culture-embeded communication style into the syllabus so that Japanese graduate students can develop the well-rounded English skills necessary in their professional lives.

Wide- Versus Narrow-angle Course Designs

Basturkmen (2014) state that "When the needs are specific a narrow-angled course may be appropriate. When the needs are more general, a wide-angle course design may be preferable" (p.25). As the findings in chapter 3 suggest that there are both high needs of GE education and ESP education. In this light, the syllabus design of ESP program for PhD course should be both wide- and narrow-angled depending on the courses.

Limitations of the Study

All the studies that are reported in this dissertation were small in scale, with a limited number of participants. These qualitative studies of Japanese graduate students in science and technology, however, are important, as they illuminated current English education issues in Japanese universities from various angles. Faculties in Japanese universities are strictly separated, therefore, making it difficult for anthropologists or English educators to enter a scientific field to conduct ethnographic research. In this sense, the studies reported here fill a particular niche and contribute to an important cornerstone of applied linguistics. It is hoped

that future research might focus on Japanese graduate students in science because such research remains significant, as explained in the following section.

Implications of the Research

The findings reported here will be beneficial to ESP practitioners teaching in graduate schools in science and technology, the community of Japanese scientists, and tertiary education in Japan.

For ESP practitioners and future researchers

Firstly, the findings of this research, however, will have several implications in pedagogic practice and curriculum design in ESP in Japan. The studies in this dissertation have illuminated a number of issues in ESP education which need to be considered as they offer significant implications in the course design but many researchers may have been unable to explore.

The current study addresses the language needs of graduate students in chemistry fields, which is an area that has been little researched in Japan. It is imperative for universities and colleges to provide ESP education to their students in science and engineering. However, there have been only a handful of fully coordinated and large-scale ESP programs for graduate students in science and engineering. Thus, the findings of the studies in this dissertation have pedagogical implications for ESP course design.

For the community of Japanese scientists

The findings of the studies reported here may hold benefits for the community of Japanese scientists. For over half a century, Japan has been a leader in innovation across many scientific fields, and a giant in the world economy. Japan has also been known for its

world-class universities, established government laboratories, and several Nobel laureates. Japanese universities, however, lag behind their foreign counterparts in the number of publication citations. In this regard, Japan may have been held back by a lack of nearby partners in terms of collaboration, with international collaboration an important indicator of the standing of a country's research (Adams, King, Miyairi, & Pendlebury, 2010). Considering that English is the international language of scientists in the present global era, there is a greater demand for Japanese scientists with good English proficiency.

For tertiary education in Japan

The current status of Japanese universities in the world rankings and the educational initiatives noted in the first part of this chapter show the Japanese government's awareness of the existing challenges to Japanese higher education. One glance at the current rankings of the world's top 100 universities will reveal domination by English-speaking universities including those from the US, UK, Switzerland, and Singapore. These rankings are based on performance criteria including teaching (the learning environment), research (volume, income, and reputation), citations (research influence), international outlook (staff, students, and research), and industry income (knowledge transfer) as introduced in chapter 1. The universities that specialize in the natural sciences tend to be placed higher in the university ranking. English will be used increasingly as the medium of instruction in universities that wish to be recognized in the ranking. This implies that Japanese universities should further strengthen English education in the undergraduate and master levels so that Japanese students will acquire necessary English skills so that subsequently, as PhD students, they can focus more on research. This, in turn, will help Japanese universities strengthen their global competitiveness among other universities in the world.

Finally, enhancing English education is required to foster "international-oriented" human resources, or Gurobaru Jinzai with competent English communication ability as introduced in Chapter 1. Findings from the studies in this dissertation revealed the reality of the general English proficiency of the present Japanese PhD students in tertiary education. However, there remain a limited number of fully coordinated and large-scale ESP programs for graduate students in science and engineering. In order to maintain or improve Japan's global competitiveness, it is imperative to foster human resources with proficient English.

Chapter Summary

This chapter provided an integrated discussion of the main findings from the four studies which examines various topics related to the ESP education for Japanese graduate students in science and engineering: their needs and wants of English education, perceptions to the dominance of EILS, and their attitude toward studying ESP (chapter 3), the problem of their silence during chemistry lectures taught by Western teachers (chapter 4), effectiveness of a short-term study abroad program (chapter 5), and development of a 12-week online scientific writing course (chapter 6). To guide this discussion, the fours topics, *Varieties of language, Needs analysis, Types of syllabuses, Wide- versus narrow-angle course designs* in Basturkmen (2014) were used to discuss each aspect of course design. This chapter further outlined the multiple implications of the study for ESP course design in the setting of graduate schools of science and engineering in Japan. How this dissertation contributes to knowledge for 1) ESP course designers and future researchers and 2) community of Japanese scientists were presented. Finally, a brief description of this study's limitations preceded some recommendation for the ESP course design for master course students.

REFERENCES

Adams, J., King, C., Miyairi, N., & Pendlebury, D. (2010). *Global research report in Japan*. Leeds, UK: Thomson Reuters.

Ammon, U. (2006). Language planning for international scientific communication: An overview of questions and potential solutions. *Current Issues in Language Planning*, *7*(1), 1–30.

Anderson, F. E. (1993). The enigma of the college classroom: Nails that don't stick up. In P. Wadden (Ed.), *A handbook for teaching English at Japanese colleges and universities* (pp. 101–110). New York, NY: Oxford University Press.

Anthony, L. (1998). Defining English for specific purposes and the role of the ESP practitioner. *Center for language research 1997 Annual review,* 115-120.

Anthony, L. (2009). ESP at the center of program design. In K. Fukui, J. Noguchi, and N. Watanabe (Eds.) *Towards ESP bilingualism* (in Japanese). Osaka, Japan: *Osaka University Press,*18-35.

Atkinson, P., & Hammersley, M. (1994). Ethnography and participant observation. In N Denzin & Y. Lincoln (Eds.) Handbook of qualitative research. (pp. 248-261). Thousand Oaks, CA: Sage.

Basturkmen, H. (2014). *Ideas and options in English for Specific Purposes.* New York. NY: Routledge.

Burgess, C. (2015). To globalise or not to globalise?'Inward-looking youth' as scapegoats for Japan's failure to secure and cultivate 'global human resources'. Globalisation, Societies and Education, 13(4), 487-507.

Chang, Y. J., & Kanno, Y. (2010). NNES doctoral students in English-speaking academe: The nexus between language and discipline. *Applied Linguistics*, *31* (5), 671-692.

Cheng, C. (2000). Asian students' reticence revisited. *System*, *28*, 435-446.

Cho, D.W. (2009). Science journal paper writing in an EFL context: The case of Korea. *English for Specific Purposes, 28*, 230-239.

Close, R. (1965). *English we use for science*. London: Longman.

Coward, F. L., & Miller, P. C. (2010). Navigating the graduate seminar discussion: A qualitative analysis of international students' experiences. *International Journal of Communication, 4*, 1013–1031.

Crystal, D. (2003). *English as a global language*. New York, NY: Cambridge University Press.

Cummins, J. (1979). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. *Working Papers on Bilingualis*m, No. 19, 121-129.

Davis, R.J. & Ikeno, O. (2002). *The Japanese mind: Understanding contemporary Japanese culture*. North Clarendon, VT: Tuttle Publishing.

Day, R. A., & Sakaduski, N. (2011). *Scientific English: A guide for scientists and other professionals* (3rd ed.). Santa Barbara, CA: Greenwood.

Denzin, N. K., & Lincoln, Y. S. (2000). *Handbook of qualitative research* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Dörnyei, Z. (2007). Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies. Oxford: Oxford University Press.

Doumont, J., ed. (2010). *English communication for scientists*. Cambridge, MA: NPG Education. Retrieved on January 7m 2016 from http://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/contents

Dudley-Evans, T., & St John, M.J. (1998). *Developments in ESP: A multi-disciplinary approach*. Cambridge: Cambridge University Press.

Dudley-Evans, T. (2000). Genre analysis: a key to a theory of ESP? *Ibérica: Revista de la Asociación Europea de Lenguas para Fines Específicos (AELFE)*, (2), 3-11.

Educational Testing Service (2012). *TOEIC proficiency scale: ETS TOEIC*. Retrieved on June 20, 2014, from http://www.toeic.or.jp/library/toeic_data/toeic/pdf/data/proficiency.pdf

Ellwood, C., & Nakane, I. (2009). Privileging of speech in EAP and mainstream university classrooms: A critical evaluation of participation. *TESOL Quarterly*, *43*(2), 203–230.

Ewer, J. R., & Latorre, G. (1969). *A course in basic scientific English* (Vol. 382). London: Longman.

Ferguson, G. (2007). The global spread of English, scientific communication and ESP: Questions of equity, access and domain loss. *Ibérica: Revista de la Asociación Europea de Lenguas para Fines Específicos (AELFE)*, (13), 7-38.

Fujita, K., Morimoto, T., Okunishi, Y., Ike, M. & Harashima, S. (2009). A new way forward: Intensive English courses for science and engineering students. *Manufacturing and Technology*, *61*(4), 101-104.

Gally, T. (2009). Specific in general: Scientific writing and presentation within a liberal arts curriculum. In K. Fukui, J. Noguchi & N. Watanabe (Eds.) Towards ESP bilingualism (in Japanese). Osaka, Japan: *Osaka University Press*, 120-128.

Garfield, E. (1967). English: An international language for science. *The Information Scientist, December*, 19-20. (In *Essays of an Information Scientist*. Vol. 1. ISI Press.)

Goldbort, R. (2006). *Writing for science*. New Heaven, CT: Yale University Press.

Gosden, H. (1996). Verbal reports of Japanese novices' research writing practices in English. *Journal of Second Language Writing, 5* (2), 109-128.

Graddol, D. (2000). *The future of English?: A guide to forecasting the popularity of the English language in the 21st century.* The British Council.

Hatch, J. A. (2002). *Doing qualitative research in education settings*. Albany, NY: State

University of New York Press.

Hall, E.T. (1989). *Beyond Culture*. New York, NY: Anchor Books Editions.

Hall, E.T., & Hall, M. R. (2001). Key concepts: Underlying structures of culture. *International HRM: Managing Diversity in the Workplace*, 24-40.

Halliday, M., MacIntosh, A., & Strevens, P. (1964). *The linguistic sciences and language teaching*. London: Longman.

Heinrich, A. B. (2008). Publish or perish, but publish in high-ranked journals. *Environmental Science and Pollution Research*, *15*(5), 361-362.

Huang, J.C. (2010). Publishing and learning writing for publication in English: Perspectives of NNES PhD students in science. *Journal of English for Academic Purposes 9*, 33-34.

Hutchinson, T. & Waters, A. (1987). *English for Specific Purposes: A learner-centered approach.* Cambridge University Press.

Hyland, K. (2007). English for specific purposes. In I*nternational handbook of English language teaching* (pp. 391-402). Springer US.

Japan Society for the Promotion of Science (n.d.). Global COE Program. Retrieved on March 4, 2015 from http://www.jsps.go.jp/english/e-globalcoe/

Japan Society for the Promotion of Science. (n.d.). International research experience for students and young researchers. Retrieved on April 8, 2010 from http://www.jsps.go.jp/english/e-daikokai/01_youngresearchers.html

Jaffe, S. (2003). No pardon for poor English in science: written and spoken language skills are critical to careers. (Profession). *The Scientist, 17*(5), 44-46

Johns, A. M., & Dudley-Evans, T. (1991). English for specific purposes: International in scope, specific in purpose. *TESOL Quarterly, 25*, 297-314.

Jun, H. & Lee, H. (2012). Student and teacher trial and perceptions of an online ESL

academic writing unit. *Procedia - Social and Behavioral Sciences*, *34*, 128–131.

Kachru, B. B. (1986). *The Alchemy of English. The Spread, Function and Models of Non-Native Englishes*. Oxford: Pergamon Press.

Kachru, B. B. (1992). *The other tongue: English across cultures*. Champaign, IL: University of Illinois Press.

Kaplan, R.B. (2001). English- the accidental language of science? In U. Ammon (Ed.), *The dominance of English as a language of science: effects on other languages and language communities* (pp. 3-26). New York: Mouton de Gruyter.

Kato, K. (2001). Exploring 'cultures of learning': A case of Japanese and Australian classrooms. *Journal of Intercultural Studies*, *22*(1), 51–67.

Katz, M. J. (1985). *Elements of the scientific paper*. New Haven, CT: Yale University Press.

Kunioshi, N., Ahizawa, S., & Tsuji, K. (2006). Achievements and challenges in the US summer English program offered by the Graduate School of Engineering, Osaka University. *Journal of Japan Society for Engineering Education, 54*(3), 105–111.

Lee, G. (2009). Speaking up: Six Korean students' oral participation in class discussions in US graduate seminars. *English for Specific Purposes*, *28*, 142–156.

Liu, N. F., & Littlewood, W. (1997). Why do many students appear to be reluctant to participate in classroom learning discourse? *System*, *25*(3), 9–35.

Madeleine, B. L. (2007). Lost in translation, *Nature*, *445*(25), 454-455.

Marin-Arrese, J. I. (2002). Mystification of agency in passive, impersonal and spontaneous situation types. In J. I. Marín Arrese (Ed.), *Conceptualization of events in newspaper discourse: Mystification of agency and degree of implication in news reports*. (pp. 31–54). Madrid, Spain: Universidad Complutense de Madrid.

Maruko, M. (2014, October 22), Universities aim to boost their global ranking, *The Japan Times*, retrieved on November 23, 2015 from http://www.japantimes.co.jp

McVeigh, B. J. (2002). *Japanese higher education as myth*. Armonk, NY: M.E. Sharpe.

Meneghini, R. & Packer, A. L. (2007). Is there science beyond English? *EMBO Report, 8*, 112-116.

Menking, S. (2004). Enhanced English speaking skills: A short-term study abroad. *Studies in Language and Culture: Memoirs of the Faculty of Law and Literature*, *16*(1), 49–64.

Middleton, G. (2012). The Social role of the ALESS Program: The place of a science writing class in undergraduate education. *Komaba Journal of English Education, 3,* 53–64.

Middleton, G. (2013). Resource development and use in ALESS: An evidence-based approach to students' reception and use of the ALESS collection and companion. *Komaba Journal of English Education, 4*, 1–26.

Minami, M. (2002). *Culture-specific language styles: The development of oral narrative and literacy* (Vol. 1). Clevedon, UK: Multilingual Matters.

Ministry of Education, Culture, Sports, Science and Technology (MEXT) (2010). Science and Technology Systems that Mobilize People and Connect Knowledge, In *White Paper of Science and Technology 2010*. Retrieved on February 24th, 2011 from http://www.mext.go.jp/component/english/__icsFiles/afieldfile/2010/11/18/1299187_05.pdf

Mishina, Y. (2015). Simulating the Research Laboratory: Using Science to Teach English in ALESS, *KJEE*, *6*, 67-83.

Montgomery, S. L. (2004). Of Towers, Walls, and Fields: Perspectives on Language in Science. *Science, 303*(5662), 1333-1335.

Nakane, I. (2006). Silence and politeness in inter-cultural communication in university seminars. *Journal of Pragmatics*, *38*, 1818-1835.

Nakatake, M. (2013). Challenges and possibilities in tutorials in a writing center in Japan. T*he Language Teacher*, *37*(6), 17-20.

Nation, P. (1990). *Teaching and learning vocabulary*. New York: Heinle & Heinle.

Nation, P. (2001). *Learning vocabulary in another language*. Cambridge: Cambridge University Press.

Newby, H., Weko, T., Breneman, D., Johanneson, T., & Maassen, P. (2009). *Review of tertiary education in Japan*. Paris, France: OECD Publishing.

Nitobe, I. (2009/1900). *Bushido: The soul of Japan: An exposition of Japanese thought*. North Clarendon, VT: Tuttle Publishing.

Okamoto, D. (2002). Summer Intensive English Study Abroad Program 2001 A Case Study. *Journal of Aomori Public College, 7*(2), 2–23.

Okamura, A. (2006). Two types of strategies used by Japanese scientists, when writing research articles in English. *System*. *34*, 68–79.

Peat, J., Elliott, E., Baur, L., & Keena, V. (2002). *Scientific writing easy when you know how*. London: BMJ Books.

QS Top Universities (n.d.). QS world university rankings 2015/16. Retrieved on January 10th, 2016 from http://www.topuniversities.com/qs-world-university-rankings

Robinson P. (1991). *ESP today: A practitioner's guide*. New York: Prentice Hall.

Sano, H. (2002). The world's lingua franca of science, *English Today, 18*, 45-49.

Saville-Troike, M. (2006). Silence: cultural aspects. In K. Brown (Ed.), *Encyclopedia of language & linguistics* (2nd ed.) (pp. 379–381). Oxford, England: *Elsevier*.

Selinker, L., & Trimble, L. (1976, October). Scientific and technical writing: The choice of tense. In *English Teaching Forum* (Vol. 14, No. 4, pp. 22-26).

Snow, C. P. (2001) [1959]. *The Two Cultures.* London: Cambridge University Press.

Song, L, Singleton, E. S., Hill, J. R., & Koh, M. H. (2004). Improving online learning: Student perceptions of useful and challenging characteristics. *Internet and Higher Education*, *7*, 59–70.

Swales, J. M. (1971). *Writing Scientific English*. London: Nelson.

Swales, J. M. (1985). *Episodes in ESP: A source and reference book on the development of English for science and technology*. New York, NY: Pergamon Institute of English.

Swales, J. M. (1985) *ESP: The heart of the matter or the end of the affair?* In R. Quirk and H. G. Widdowson (Eds.), *English in the World*. (pp. 212–223.) Cambridge: Cambridge University Press.

Swales, J. M. (1990). *Genre analysis: English in academic and research settings*. Cambridge, UK: Cambridge University Press.

Swales, J. M. (2000). Languages for specific purposes. *Annual Review of Applied Linguistics*, *20*, 59-76.

Swales, J. M. (2004). *Research genres: Explorations and applications.* New York, NY: Cambridge University Press.

Tamura, M. (2012). Ethnography of Kaigai Musha Shugyo: Young Japanese Scientists' Overseas Short-term English Program. *Higashi Ajia Eigo Kyoiku Kenkyukai Kenkyu Ronshu* [Journal of the East Asian English Education Research Association], *4,* 51-58.

Tamura, M. (2014). The Sound of Silence in Chemistry Lecture: A Case of Japanese Graduate Students in Science and Engineering. *Kyushu Communication Studies. 12,* 46-59.

Tamura, M. (2016, March). Is ESP a need?: Understanding the language needs of Japanese doctoral students in chemistry fields. Paper presented at LIF2016 - The 3rd Language in Focus Conference. Turkey: Istanbul.

Tamura, M., & Joseph, L. (2014). Designing an online scientific writing course for graduate students in science and engineering. *Linguistic Science, 49*, 47-66.

Tardy, C.M. (2004). The role of English in scientific communication: Lingua franca or Tyrannosaurus rex? *Journal of English for Academic Purposes*, *3*(3), 247-269.

Times Higher Education (n.d.). World University Rankings 2015-2016. Retrieved on February 20, 2016 from https://www.timeshighereducation.com

Times Higher Education (2015, September 24). Change for the better: Fuelled by more comprehensive data, the 2015-2016 rankings probe deeper than ever. Retrieved on December 15, 2015 from https://www.timeshighereducation.com/news/ranking-methodology-2016

Ting-Toomey, S. (1999). *Communicating across cultures*. New York, NY: Guilford Press.

Testa, J. (2016). The Thompson and Reuters journal selection process. Retrieved on February 10th, 2016 from http://thomsonreuters.com/products_services/science/free/essays/journal_selection_process/

Thomson Reuters. (2014, April, 5). Thomson Reuters identifies Japan's top scientific research institutions and areas of study. Retrieved on February 2, 2015 from http://thomsonreuters.com/en/press-releases/2014/thomson-reuters-identifies-japans-top-scientific-research-institutions-and-areas-of-study.html

Trimble, L. (1985). *English for science and technology: A discourse approach*. Cambridge, MA: Cambridge University Press.

Tsui, A. B. M. (1996). Reticence and anxiety in second language learning. In K. M. Bailey and D. Nunan (Eds.), *Voices from language classroom: Qualitative research in second language education* (pp.145–167). Cambridge, MA: Cambridge University Press.

Tychinin D. N, & Kamnev, A. A. (2005). Beyond style guides: Suggestions for better scientific English. *Acta Histochemica*. *107*(3), 157–160.

Valiela, I. (2001). *Doing science design, analysis, and communication of scientific research,* New York, NY: Oxford University Press.

Wainwright, P., Ram, P., Teodorescu, & D., Tottenham, D. (2009). Going global in the sciences: A case study of Emory University, in R. Lewin (Ed.), *The handbook of*

practice and research in study abroad-Higher education and quest for global citizenship (pp. 381-398). New York, NY: Routledge.

Xia, S. (2009). Are they ready to participate? East Asian students' acquisition of verbal participation in American classrooms. *Issues in Applied Linguistics*, *17*(2), 137-157.

Yang, Y. F. (2010) Students' reflection on online self-correction and peer review to improve writing. *Computers & Education, 55,* 1202–1210.

Yonezawa, A. (2013). Challenges for top Japanese universities when establishing a new global identity: Seeking a new paradigm after "world class". In J. C. Shin & B. M. Kehm (Eds.), *Institutionalization of world-class university in global competition* (pp. 125-143). Netherlands: Springer.

Yonezawa, A. (2014). Japan's challenge of fostering "global human resources": Policy debates and practices. *Japan Labor Review*, *11*(2), 37-52.

APPENDICES

Appendix A: Questionnaire format used for the data collection of chapter 3

専門英語のニーズ分析

比較社会文化学府の田村美香と申します。このアンケートは、化学を専門とする博士課程の学生の方のニーズを理解するために実施させていただきます。ご協力の程、どうぞよろしくお願いいたします。このアンケートで得た情報は私個人の研究以外には使用しないことをお約束します。

１．個人プロフィール

氏名	性別　男□　女□
学府・専攻（講座）	学年　　Ｄ１□，Ｄ２□，Ｄ３□
TOEIC スコアレンジ	Ａ（860 点以上）□, Ｂ(730 点～860 点)，Ｃ（470 点～730 点）□, Ｄ（220～470 点）□，Ｅ（～220 点）□
海外渡航歴	□ 留学経験（国：　　、時期：　　年、期間：　　年） □ 海外の国際学会での発表経験（年　　回） □ 英語での論文投稿（過去に　　回）
研究室での英語の使用について	□ 研究室には日本語を話さない外国人 PD、留学生が複数名いる □ 検討会は全て英語で行われる □ 検討会ではスライドは英語で作成し、発表は日本語で行う。 □ 外国人研究者の訪問が多い □ 英語で実験のアシスタントをすることがある。 □ その他（　　）
進路志望	□ 企業での研究職　　□国内の大学でＰＤ・助教になる □ 海外の大学のＰＤになる　　□その他（　　）

２．英語力の自己分析

スピーキング	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
リスニング	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
発音・アクセント	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
プレゼンテーション	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
一般的な語彙	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
あなたの専門分野の語彙	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
一般的な作文	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
論文執筆	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
一般的な英語の読解	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい
専門分野の論文の読解	容易である＿＿＿：＿＿＿：＿＿＿：＿＿＿：＿＿＿　難しい

３．英語学習の優先順位

	あまり重要ではない	重要である	たいへん重要である
もっと流暢に話せるようになること	□	□	□
もっと正確にはなせるようになること	□	□	□
一般的な語彙を覚えること	□	□	□
専門的な語彙を覚えること	□	□	□
リスニング力をつけること	□	□	□
発音がよくすること	□	□	□
読解力をつけること	□	□	□
作文力をつけること	□	□	□
英語のテストスコア（TOEIC）を上げること	□	□	□

※ここで使用される「科学英語」は、理工系の研究者が論文執筆、学会発表等、研究討論等において使用する英語を意味しています。

4. 科学英語への関心、重要性

質問１：科学英語に特化した英語のコースに興味がありますか？

□ □□はい、とても興味があります, □はい, □あまり興味がありません, □全く興味がありません

コメント（自由記述）：

質問 2：科学英語は、一般的な英語と比べて重要だと考えますか？

□科学英語の方が重要である　□どちらも同じくらい重要　□一般的な英語の方が重要

選択理由（自由記述）：

ご協力いただき、たいへんありがとうございました！

九州大学　比較社会文化学府　博士課程 3 年　田村美香

Appendix B: FGI Questions

1. As I see the self-analysis results of English, many students seem to feel a difficulty in speaking. In what situation do you feel the difficulty the strongest?
2. How about the communication with foreign post-docs and international students in your lab?
3. It seems to me that many of you are going to get a job at a company. Will the necessity of English be different depending on whether you decide to stay in academia or get a job at a company?
4. English is recognized as the international language of science now. In your view, what are the advantages of English being a common language in the chemistry field?
5. What are the disadvantages of the dominance of English

Appendix C: original transcription of FGI which was used as the data in Chapter 3.

Transcript 3-1

Jo：適切な単語が出てこない。
Taka:あ〜、単語出てこないよね。
Koji:・・・なんだっけ、これ、みたいな、出てこない場面がもどかしい感じはする。
All：うん。

Transcript 3-2

Hisashi:書くにしてもしゃべるにしても、う〜ん、出てこないですよね。書くにも、しゃべるにも。

Transcript 3-3

Mika：Shuji さんどうですか？
Shuji:動詞が出てこないですね。伝えるための。
Koji:動詞？笑
Shuji:「これ、混ぜて。」みたいなのも、mix しか出てこないみたいな。

Transcript 3-4

Taka:自分が言うときは、相手に（間違った）Guess をさせないように伝えることが大切やろうし、日本人はなかなかできないですよね。

Transcript 3-5

アメリカ人は、だいたい言いたいことばっちり言えるじゃないですか。日本人は、なんていうか、こう、ふわって言いますよね。英語でもたぶん。
Mika:あー。そうですね。
Taka:ふわって言って、伝わんねーみたいなの、あるじゃないですか。お前何が言いたいんだ、結局、みたいな。英語は正しいけど、・・・みたいになるのが心配、みたいなのはありますね。

Transcript 3-6

Taka:日本語で言いたいことを英語で言うので、周りくどくなっちゃいますよね。

Transcript 3-7

Hisashi:経験に基づいた会話をしていたらわかってくれるけど、そうじゃないときは。
Shuji:何にも伝わんないよね。笑

Transcript 3-8

Hisashi:研究に関しては、ほら、もしバックグランドが同じだったら、だいたい予測してくれるんですけど、
Mika:うん、

Hisashi:そうじゃないときは、お互いに、「う〜んと」って話かえたりとか、結構ありますよね。研究の話でも。学会に行ったりしても、ありますよね。

Transcript 3-9

Taka：いろんな国の研究者とコミュケーションできるのはいいんじゃないですかね。
Jo:いろんな知識が習得できる。
Taka:そういった意味では、英語できれば国境はないんじゃないですかね。
Jo:あ〜そうですね。
Taka:ドイツの人、インドの人も英語で話すじゃないですか。コミュニケーションとれますよね。それがメリットじゃないですか。言語が一本化できているのはすごいいいことだと思いますけどね。

Transcript 3-10

Koji:それはやっぱり、英語が話させる、ファーストランゲージの人には有利ってことじゃないですか？セカンドランゲージの人からみたら、例えば論文書くにしても労力も全然違うし。

Transcript 3-11

Shuji:だって、俺らが英語の論文一本読む間に、ネイティブの人はたぶん 10 本ぐらい読めるよね。
Taka:読めるね。あれは、卑怯だと思う。

Transcript 3-12

Shuji:それは、こっちからするとインプットのスピードもアウトプットもスピードも全然違う。

Transcript 3-13

Taka:そう、違う。それは、足枷ですよね。
Shuji:うん。そこは足枷ですね。
Jo:それは、もう足枷ですね。それだけ、英語力を高くしないとついていけない。
Shuji:圧倒的に研究に費やせる時間が長くなる。

Transcript 3-14

Hisashi:むしろ英語ができないことのデメリットがでかすぎて、あまりもう、メリット何って言われたら、むしろやれないデメリットがでかすぎて考えないっていうか。
Mika:いま、足枷って言葉が出てきたけれど。
Taka:足枷っていうよりも、差別化されてしまうんですよね。比較されてね。研究する時間は同じだったとしても、やっぱりスピードが違うから、どうしても足に重しをつけた状態でスタートするじゃないですか。それが、デメリットかなって思いますね。こと競争という次元で捉えたらですよ。
Shuji:時間は奪われますよね。未だに英語の授業を受けているわけですし。

Transcript 3-15

Hisashi：英語ができた方がいろんな機会が増える。機会の損失が、英語できないと、半端じゃないと思います。

Taka：そうね。確かにね。

Transcript 3-16

Hisashi:言ったら、TOEIC は大学入試のセンター試験みたいに、たぶんグローバルの会社に行くための・・・、あのーセンター試験みたいな。

Shuji: 足切りですね。

Hisashi：そのレベルで考えてないと、どんどん機会損失になるんじゃないかって思いますよ。

Appendix D: Flyer for ATYCR 12 week course (Chapter 6)

Authorship Training Course for Young Researchers 12-week online course

Write a research paper that's ready for journal submission

The Authorship Training Course for Young Researchers 2010 (ATCYR 2010) is for doctoral students and researchers who want to improve their ability to write scientific research papers in English.

In the ATCYR 2010, you are expected to write a research paper based on your own research. Over three lessons, you will be given reading material to help you write each section of the paper. You will submit parts of the paper through the course, and you will receive feedback that will help you improve your writing. At the end of the course, you will have a research paper that can be submitted to the English journal or conference of your choice.

Curriculum

Lesson 1: Writing the title and "introduction" section
Lesson 2: Writing the "materials and methods" and "results and Discussion" sections
Lesson 3: Writing the abstract and formatting the entire paper

Outline

Course duration	12 weeks
Course start date	June 7 / July 5 / August 2 / September 6
Number of lessons	3
Number of assignments	6 (2 per lesson)

Salient features of the course

- Online course: You can study at a time that's convenient for you.
- The course instructor is an English teacher who is familiar with scientific writing.
- You can ask questions to your instructor over a forum anytime during the course.
- Reading material will be provided for each lesson.

Appendix E: Authorship Training Course 2011 – Survey (Chapter 6)

As the Authorship Training Course is now over, we would like to know about your experience in this course. Your comments and suggestions will help us to further enhance the course. Thank you for your participation in this survey.

1. Could you meet all the deadlines for the course? If not, please explain why.
2. Was the reading material for each lesson useful for doing the assignments?
3. Did the evaluation of the first draft of the assignment help you in doing the second draft?
4. What do you think of the evaluations in general? (Evaluations of both the first draft and second draft)
5. Did the course help you in improving your English writing skills?
6. Do you have any suggestions for improving the course? Please let us know if there were any difficulties.
7. If the paper which you completed through this course was published, please let me know the title and journal name (if possible).

Appendix F: Authorship Training Course – Second Review (Chapter 6)

SECOND REVIEW

Overall comments and suggestions
You've done a great job in correcting the language errors that I pointed out in the first draft. I've made a few edits to enhance the language further. Some of the sentences are rather long, and their meaning isn't clear. As a rough guide, try to not write sentences that are longer than two lines on the screen. If any sentence becomes longer than this, see if you can split it into two sentences. This way, your writing will retain its clarity. **Check this sentence:** This was also the same idea that breaking from the stem-loop structure to the single stranded DNA having the partially double helical structure by hybridizing **o8** and **p34s** because **pt6.G** was hybridized but there was a nick between 5' end of **pt6.G** and 3' end of **p34s**. This sentence is still unclear. I see that you've changed the last part of the sentence, but the part before that is unclear. Notice that this is a long sentence – over three lines. If you split it up into two or three sentences, there's a good chance that the clarity will improve.

Section-specific ratings

Section	Parameter	Rating		
		Good	Minor improvement needed	Major improvement needed
Title	Clarity	■		
	Conciseness		■	
	Formatting	■		
Introduction	Adequate context and background			■
	Proper use of references		■	
	Clear explanation of how the current study will contribute to existing knowledge		■	
Materials and methods	Smooth flow of sentences and paragraphs in describing experiments	■		
	Clear tables, figures, and images	■		
	Proper units and numerals	■		
Results	Logical sequence of results based on the experiments	■		
	Adequately detailed tables, figures, and images		■	
	Effective references to tables, figures, and images		■	
Discussion	Clear identification of important and relevant results		■	
	Comparison of these results with previous work			■
	Explanation of the implication of the results		■	
	Acknowledgement of any unaddressed issues or problems with the results (optional)	■		
	Directions for future work		■	
Abstract	Information from all the sections of the paper		■	
	Good beginning and ending	■		
	No wordiness		■	