An Analysis of English in the Workplace: The Needs of Engineers in Writing in English

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Abstract

This paper aims at investigating the needs of engineers when writing in English. The subjects of this study were managerial engineers, operational engineers, ESP teachers, and engineering students in Thailand. Through questionnaire surveys and interviews, detailed results were obtained concerning the writing communication demands placed on engineers in their work, including an exploration of the issues of context and situation. These results have enabled the author to develop teaching and learning materials that match the specific workplace needs of engineers.

Keywords: Needs analysis; Engineers; English for specific purposes; Needs analysis in workplace

Introduction

With the expansion of international business today, English has become the *lingua franca* for people all over the world, including engineers. This is because it is the era of globalization, which has led to the use of English throughout the world (Crystal, 2003). Therefore, more and more people study English for various purposes—ranging from socializing to professional work. In addition, English is also important in terms of education, as it helps people gain access to knowledge. Engineering students are one such group of people that study English. They need English as a tool to help them read academic and technical documents in English and to help them communicate in various situations. Additionally, English is also crucial for their future careers. As engineers always need to use English to write, read, and speak with colleagues, customers, subcontractors, suppliers, and other related people, it is necessary for teachers and course planners to design effective English courses to help engineering students meet the needs of the industrial sector. The language needs of engineers have been investigated in several countries other than Thailand. Silyn-Roberts (1997 cited in Silyn-Roberts, 1998) investigated the specific professional workplace environment defined by the great majority of his engineer participants. He reported that on average engineers spent between 30% and 95% of their time on writing. Many engineers at all levels of experience reflected that when they were undergraduate engineering students, they had not realized that engineers spent so much of their professional life writing (Silyn-Roberts, 1998). According to Silyn-Roberts, writing is one of the most required language skills for engineers. This means that engineering students should also learn to write well in order to work effectively in the future. Similarly, Beer (2005) mentioned that over 40% of the working time of engineers is spent on writing, and ordered the ability to write as one of the most important skills in engineers' success.

In Thailand, Wattanasakulpusakorn (1996) examined the ability of the engineering students at Rajamangala Institute of Technology using technical English by developing a standardized test to evaluate

the students' abilities. The results revealed that the undergraduate engineering students had limited writing ability because 179 engineering students (71.6%) from the total sample of 250 could not pass the writing exam. This study showed that the writing ability of many, if not most, engineering students could not meet the standard, although writing is an important and required language skill in the engineering profession. As for King Mongkut's University of Technology North Bangkok (KMUT-NB), most of the students are engineering and science students. They have problems with writing although they have taken two English fundamental courses in the first year of their study, together with at least nine years at the primary and high school levels. Wanchid (2007) conducted small-scale research with 30 heterogeneous ability engineering students. She examined the students' writing ability in the Writing I course, and found that the mean score of writing was 15.99 out of the total score of 30. This is one piece of evidence that the writing ability of Thai students is generally low. Based on the opinion of these scholars (Silyn-Roberts, 1998; Beer, 2005) it can be concluded that writing is an essential language skill for engineering work. Additionally, according to the results of the work of Wattanasakulpusakorn (1996) and Wanchid (2007), it can be said that some Thai engineering students have problems in writing English. Therefore, engineering students need an effective English writing course to help improve their language ability and prepare them for work in the engineering community in the future. One of the elective courses offered by the Language Department, Faculty of Applied Arts at KMUTNB, is the English for Engineers course (a specific-purpose course), which was first launched in 2002 and revised in 2006. One of the arguments after the revision was to develop more English for specific purpose courses for engineering students to better serve their needs, since there have been only a few courses particularly designed for them. The development should expand from the existing course, English for engineers, by dividing it into English for engineers I and II. Moreover, the content of the course must focus more on all four language skills and also based on the needs of engineering students, stake holders, engineers, and the policy of the national

education plan. Therefore, developing English courses for engineering students which focus on different language skills need to be undertaken. In order to design the ESP course, a needs analysis was carried out as the first stage of the course design. The main purpose of this study is to investigate the needs analysis for the revision of this course. The emphasis is placed on writing skill.

Research question: What English writing skills are needed by operational and managerial engineers in Thailand?

Literature review

Needs analysis

Referring to the term 'needs analysis', it is an important element in order to help teachers or scholars to develop an effective course. Hutchinson and Waters (1987) provide more details on the term, stating that a needs analysis is the process of determining the needs for which learners or groups of learners require a language, and arranging the needs according to priorities. In addition, needs analysis can be used as a basis for setting the goals and objectives of the course. The term "needs analysis" is part of curriculum development and is normally required before a syllabus is designed for language teaching. In addition, Graves (2000) offers a definition of needs analysis which focuses on process. According to Grave, needs analysis is a systematic and ongoing process of collecting information about the students' needs and preferences, information interpretation, and designing the course based on the results of the needs analysis. According to Graves' definition, the needs analysis can be conducted not only before starting the course, but it can be undertaken during the course as well. This is because a needs analysis can be used with different aims. It is possible that teachers may need to know, for example, the needs of students before developing the course in order to develop the course to serve their lacks, necessities, and wants. Also, teachers may require the results of the needs analysis in the middle of the course so as to determine the attitude of students toward the course and to

find out what students need more so that adjustment of the remaining of the course can be appropriately done.

In conclusion, it can be said that needs analysis is important, as it is a factor to help teachers make decisions about developing a course. This is because the needs analysis results provide us with the data concerning the required content, target situations, etc. The process of the needs analysis can be undertaken at any stage of designing the course, depending on the aims of teachers.

Within the ESP context, the needs analysis concept is required since it will provide important information for the design of the course. Many scholars have proposed the concept and process of conducting a needs analysis (e.g. Munby, 1978; West, 1994; Hutchinson and Water, 1987; Dudley-Evans and St. John, 1998). Their concepts are similar in general; however, they also differ in certain areas depending on the focus of each concept. For this study, the focus is placed on the work of Hutchinson and Water in 1987. The framework of Hutchinson and Water (1987) was employed in this study because this framework provided the required information for designing the target course, such as the target situations, lacks, and necessities. They define needs in terms of "target needs (i.e. what the learners need to do in the target situation) and learning needs (i.e. what the learner needs to do in order to learn)" (1987: 54). However, this study focuses on target needs, investigating the ideas of necessities, lack, and wants. Necessities are what the learners have to know. Lack is the gap between what is expected of learners to know and their existing performance. Finally, want means what learners need to know. According to these definitions, the researcher created the following questions as a guideline to identify the target needs and learning needs in designing the questionnaires that were used as one of the instruments in this study.

• How important is the skill of writing in English for engineers, engineering students, ESP teachers?

• How will the English language writing skills be used?

• What are the kinds of English language writing skills used in

the workplace?

• How frequently and with whom will the English language writing skills be used?

• With whom will the engineers communicate in English?

• How competent are engineers in performing their writing skills in English in the workplace?

• What are the writing contexts of engineering work?

The work by other researchers has also contributed to the investigation of ESP needs analysis. For example, Koetpo-kha (1994) investigated the needs and problems in English for science and technology at Silapakorn University. The results revealed that ESP courses should be designed for occupational uses and academic studies. Li So-mui and Mead (2000) investigated the needs of merchandisers, using questionnaires and telephone interviews. The study showed that the subjects ranked using fax as the most common channels of communication. The main purposes for the use of written communication were following up on orders, obtaining updated information on order status, and clarifying order queries. Another research was reported by Jiranapakul (1996). She conducted a needs analysis to survey the language needs for communication of 21 operational engineers and 21 managerial engineers of 21 sampled companies in Thailand. The instrument used was an interview. The results revealed that four skills of English were required, and they perceived that their reading skill was better than their listening, speaking, and writing. The operational engineers ranked the order of importance of their English skills first as reading (2.7), followed by listening (2.6), speaking (2.6), and writing (2.5). As for the managerial engineers, they perceived listening (2.8), speaking (2.7), writing (2.7), and reading (2.5) as the important English skills in that order.

With respect to the conceptual framework, figure 1 illustrates the conceptual framework in designing the needs analysis in this study.

Figure 1: conceptual framework of the study

Materials and Methods

Subjects

There were three groups of subjects in the present study: managerial and operational engineers, undergraduate engineering students, and ESP teachers. They all were Thai. The details of each group of subjects are explained below.

Group I: One-hundred and ten operational engineers and 17 managerial engineers in Thailand were the first group of subjects in this study. The sample size was selected based on Fraenkel and Wallen (2000 cited in Wasanasomsithi, 2004), indicating that at least 100 subjects are the minimum number suitable for descriptive studies. The number of operational engineers was higher than that of managerial engineers since normally there are more operational engineers than managerial engineers in a workplace. These groups of individuals were recruited by means of the purposive sampling method because they were supposed to know the answer to the questions of this study, and they met the set of recruitment criteria which was imposed by the researcher of this study. That is, first of all, they could be any engineers that worked in companies or factories that were a part of the five groups of industries based on the criteria of the Federation of Thai Industries (FTI). The five industrial groups are the automobile, electronics and electricity, material, petroleum, and mechanics industries. Secondly, the engineers have at least one year of working experience. Finally, the engineers were required to be willing to participate as the subjects of the needs analysis stage since engineers generally have a busy schedule and their time is restricted. It was quite

difficult for them to spend time as the subjects of this study, so only engineers that were willing to participate in this study were recruited.

As for the interview, three managerial engineers (from 17) and 10 operational engineers (from 110) were selected as the representatives for the interview. The number was suitable since it represented 10% from each group.

Group II: This group of subjects included 354 engineering students from six engineering departments (electrical, civil, mechanic, industrial, chemical, and productive). They were second-, third-, and fourth-year students. According to the sample size table of Yamane (for precision of ± 5%), when the number of population is about 1,500, the sample size is 316 (Yamane, 1967). Moreover, when the population is 2,000, the sample size is 333. For this study, there were 1,853 engineering students at KMUTNB in 2008. Thus, the sample size was between 316 and 333. However, the sample size of this study was 333 because a larger sample size would provide more reliable results.

Group III: The subjects in this group were derived by means of purposive sampling because only teachers that taught English courses to engineering students were recruited. The number of population as well as the sample size of this group of subjects was 31 ESP teachers. This number was derived from surveying nine universities providing ESP courses to engineering students in Bangkok and its vicinity by the researcher.

Instruments

A questionnaire and an interview protocol were used as the instruments for the needs analysis.

1. Questionnaire

The questionnaire was written in Thai in order to prevent language barriers. Three sets of questionnaires were used to collect data from different groups of subjects. There were 11,11, and 16 questions for engineering students, ESP teachers, and engineers, respectively. The questionnaire was designed using a review of existing theories and related research, and interviews (semi-structure interview) with three managerial

and 12 operational engineers. It was then constructed based on the needs analysis model of Hutchinson and Waters (1987). The questionnaire was divided into three parts as follows:

Part I: Demographic characteristics of the subjects

This part of the questionnaire focused on general information for each group of subjects. However, the questions were different for each group. The ESP teachers were asked to identify the information about their age, sex, university, work experience, and the writing ability of the engineering students. As for the engineering students, they needed to provide personal information, including information about their writing ability. With respect to the engineers, they provided more information about their work in this section. Therefore, the subjects needed to discuss different types of information, such as their workplace, position, and gender. Moreover, details of their education, writing experiences, number of years of working, their writing ability and background information about their English proficiency were also elicited. Checklist, five-point Likert scales ("very good," "good," "fair," "poor," and "very poor"), and gap filling items were used as the form of responses in part I. The questions in those three sets of questionnaires were similar, but more information about their working situations was also required from the engineers.

Part II: Required English writing content and situations for engineers' work contexts and writing problems

The aim of this part was to determine the English writing content that most engineers need for communication in their professional community, including their writing problems, both in general and in the professional areas. This part was designed using a five-point Likert scale. All of groups of subjects had the same questions.

Part III: Suggestions and expectations regarding an English writing course for engineers

One open-ended question was provided in this part to give the subjects opportunities to express their suggestions and expectations about desirable English writing courses for engineers in Thailand. All of groups of subjects had the same questions.

Validation

The content validity of the questionnaire was examined by three experts in the field of engineering, language assessment and evaluation, and business English. Then the IOC index was used to calculate the content validity of the questionnaire. The IOC calculation results revealed that the three experts accepted all questions, with a content validity of 0.93. The reliability of the questionnaire was verified by using Cronbach's alpha coefficient. The reliability of the questionnaire for engineers and engineering students was .89 and .93, respectively.

2. Interview protocol

Semi-structured interviews were used to gather in-depth information only from the two groups of engineers, managerial and operational engineers, after they had completed the questionnaire. This was because the aim of the interview was to gather in-depth information about writing contexts and situations of engineers, including sociolinguistic knowledge in the workplace. Thus, the engineers were able to provide the required information because they had direct experience, whereas the engineering students and ESP teachers would not have that kind of information because they did not have direct experience about the work of engineers. The interview questions were pretty similar to the questions in the questionnaire in terms of the topics in forming questions such as writing context based on the required genre and sociolinguistic knowledge used in writing those target genres. Most questions for operational and managerial engineers were similar, with slight variations in terms of the managerial engineers' opinions about their subordinates in the aspect of their writing ability and cultural knowledge.

Validation

The interview questions were validated by the three experts (two English teachers that had worked in the field of English business correspondence and in the field of language assessment, and an engineer). The value of the IOC index was 0.9.

Data collection procedure

The questionnaires were distributed to the three groups of subjects. After analyzing the questionnaires of those three groups, an interview was conducted with two groups of engineers: 10% of 17 managerial engineers (three subjects) and 10% of 110 operational engineers (ten subjects). Each interview lasted approximately 20-30 minutes. The interview data were collected using an electronic voice recorder.

Data analysis

Questionnaire

The data obtained were calculated by using SPSS and content analysis. The content analysis was used to analyze the data gathered from the questionnaire in part III. As for parts I and II, the data were calculated by using statistical devices. The statistical devices used in the present study were percentage and mean. An F-test or One-way ANOVA was used to investigate the significance of the differences in opinion among the engineering students, ESP teachers, and engineers.

Interview

Content analysis was used to analyze the data from the interviews. Counting frequencies of occurrence (existing words in the collected data: writing situations, forms and functions, writing contexts, and sociolinguistic knowledge) was employed as a tactic for generating meaning from the collected data for this study (Miles and Huberman, 1994 as cited in Cohen et al., 2007).

Results

Research question: What English writing skills are needed by operational and managerial engineers?

The results of the question were to be used as the content, activities, and exercises in the course. The details regarding the results of the questionnaire and interview are explained below.

1. Questionnaire

Part I: Demographic characteristic data

1. Engineering students

Most of the subjects were male (72.3% or 256). About half of the subjects were fourth-year students (50.3% or 178), while 27.4% or 97 and 18.1% or 64 were third- and second-year students, respectively. Only 3.4% or 12 were fifth-year students. They were representatives from all engineering majors in similar numbers: mechanical engineering (17.5% or 62), electrical engineering (18.9% or 67), productive engineering (15.5% or 22), civil engineering (15.5% or 22), chemical engineering (16.9% or 60), and industrial engineering (14.4% or 52).

As for their ability to write in English, the students rated themselves as poor writers (37% or 131), fair writers (32.5% or 115), very poor writers (16.4 % or 58), good writers (3.1% or 11), and very good writers (0.3% or 1).

2. ESP teachers

The data showed that 25.8%, or 8, of the ESP teachers were males and 74.2%, or 23, were females. Most of the ESP teachers graduated with a master's degree (87.1% or 27), while 9.7%, or 3, graduated with a doctoral degree. In addition, more than half of the ESP teachers (58.1% or 18) had experience in teaching ESP courses for more than five years, while 22.6% or 7, 9.7% or 3, and 6.5% or 2 of them had 3-5 years, 1-3 years, and less than one year experience in teaching ESP courses, respectively.

Regarding their students' writing ability, it was found that the teachers thought that their students' writing abilities were "poor" (25.8% or 8) and "very poor" (25.8% or 8). The ESP teachers agreed that 16.1% of the students' writing ability was "fair," and 9.7% or 3 was "good." No one considered their students' writing ability to be "very good."

3. Managerial and operational engineers

Concerning the demographic characteristics of the managerial and operational engineers, the results in each category of the two groups showed the same direction. Engineers (both operational and managerial) graduated with a bachelor's degree (74.5% or 82 and 52.9% or 9). More

than half of them had not previously attended an English writing course for engineers (59.1% or 65 of the operational engineers and 76.5% or 13 of the managerial engineers). Most of the engineers that had attended an English writing course before had attended the course at a university (16.4% or 18 operational engineers and 23.5% or 4 managerial engineers).

As for the information concerning the opinion of the managerial and operational engineers about English writing, it was found that almost half of the engineers agreed that their writing ability was "fair" (48.2% or 53 and 41.2% or 7, respectively). Seventy-eight operational engineers (70.9%) reported that they had writing problems during the first few years of work, while ten managerial engineers (58.8%) stated that they also had writing problems at the beginning of their work. Also, the results showed that 62.7%, or 69, of the operational engineers, and 35.3% of the managerial engineers, or six, had writing problems.

With respect to the frequency of writing of engineers each day, it was found that, on average, most of the engineers from these two groups wrote 1-5 pieces per day relating to the work of engineers (72.7% or 80 of the operational engineers, 76.4% or 13 of the managerial engineers). Moreover, most of their written texts were in the form of formal and informal e-mails. Seventy percent or 77 operational engineers wrote formal e-mails, whereas 82.4% or 14 of the managerial engineers wrote formal e-mails. Fifty-one point four percent, or 56, of the operational engineers wrote informal e-mails, and 58.8% or 10 of the managerial engineers wrote informal e-mails.

In addition, it was found that English was used similarly by operational engineers and managerial engineers in various contexts and situations. The two groups of engineers used English writing most with their headquarters (operational engineers = 3.55 and managerial engineers = 3.33), overseas companies (operational engineers = 3.31 and managerial engineers = 3.12), and between departments (operational engineers = 3.11 and managerial engineers = 3.18). In conclusion, the results show that the different groups of participants had both similar and different ideas about demographic characteristics. For example, engineers thought that they had

writing problems in some aspects, and they also had those problems at the beginning of their work. The ESP teachers agreed that most of their students were poor or very poor in their writing ability. In addition, the engineers agreed that they had to write at least 1-5 pieces per day.

Part II: Required English writing content and situations for the work contexts and writing problems of engineers

Part II involves three topics; namely, problem areas in writing English in general, the importance of genres in the engineering context, and writing problems associated with different genres in engineering contexts. The results of each topic are reported as follows.

1. Problem areas in writing English in general

It was found that engineering students considered grammar, structure, vocabulary, spelling, punctuation, and writing procedure to be their important problem areas in writing in English in general, and ESP teachers also thought that grammar, structure, vocabulary, spelling, punctuation, and writing procedure were important problem areas in writing in English in general of engineering students. As for operational engineers, they also agreed that grammar, structure, vocabulary, spelling, punctuation, and writing procedure were their problems in writing in English. These problem areas were not ranked in a similar order. However, an important problem area for every group of subjects, except for managerial engineers, was grammar.

While engineering students rated their problems in most areas as only "quite important," grammar was rated as "important." However, the ESP teachers thought that their engineering students had writing difficulties in most areas, except for spelling and punctuation, which they ranked as "quite an important problem." From the point of view of ESP teacher, the most important problem areas for the engineering students were vocabulary, grammar, structure, and editing of their written work.

Moreover, the operational engineers felt that most of their general problems in writing were "important," with their most important problem area being grammar. As for the managerial engineers, they rated most of their problems as "quite important" and "not so important." They

considered their most important problem area to be outlining.

The mean scores of the problem areas in writing in English in general for the four groups of subjects were calculated using one-way ANOVA or F test. The result indicated that there was a significant difference among the four groups of subjects at p value < .05 in four problem areas; namely, vocabulary, spelling, punctuation, and writing procedure. Also, it was found that three problem areas were common to all the groups were grammar, structure, outlining, and searching information.

Importance of genres in engineering contexts

It was found that inquiries ($\bar{x}$ = 4.05), reports ($\bar{x}$ = 4.07), and minutes of meetings ($\bar{x}$ = 4.09) were the first three important genres for engineering students. ESP teachers saw inquiries ($\bar{x}$ = 3.93), memos ($\bar{x}$ = 3.70), and reports ($\bar{x}$ = 4.29) as the first three important genres. The first three important genres for operational engineers encompassed requests ($\bar{x}$ = 3.63), inquiries ($\bar{x}$ = 3.97), and reports ($\bar{x}$ = 3.83), while the first three important genres for managerial engineers were also requests ($\bar{x}$ = 3.69), inquiries ($\bar{x}$ = 4.00), and reports ($\bar{x}$ = 3.81).

With respect to the comparison among the four groups of subjects using the F test, it was found that there were only two genres, namely, requests and enquiries, which were not significantly different (p < .05). Simply put, these two genres were considered as "important" by the four groups of subjects. Findings on the importance of the genres are summarized in Table 1.

Table 1: Importance of genres in engineering contexts

Content	Students (354)		Interpret	Teachers (31)		Interpret	Operation-eng. (110)		Interpret	Manager eng. (17)		Interpret	Variance	F	Welch's ANOVA	P-value
	$\bar{x}$	SD		$\bar{x}$	SD		$\bar{x}$	SD		$\bar{x}$	SD					
1. complaints	3.70	.90	important	3.22	1.01	quite important	3.14	1.15	quite important	3.31	1.13	quite important	2.51	10.35*	-	0.00
2. requests	3.76	.89	important	3.56	.84	important	3.63	.95	important	**3.69**	.79	important	.74	.91	-	.43
3. inquiries	**4.05**	.94	important	3.93	.95	important	3.97	.88	important	**4.00**	.7	important	2.32	.28	-	.83
4. memos	3.75	.93	important	**3.70**	.99	important	3.10	1.09	quite important	3.21	.57	quite important	1.82	12.97*	-	.00
5. reports	**4.07**	.90	important	**4.29**	1.08	important	**3.83**	.91	important	3.81	.91	important	.65	2.96*	-	.03
6. minutes	**4.09**	.93	important	2.7	1.06	quite important	3.41	1.11	quite important	3.13	1.18	quite important	3.10*	-	24.47*	.00
7. agenda	3.79	.95	important	2.37	.96	not so important	3.21	1.08	quite important	2.60	.82	quite important	.47	29.00*	-	.00
8.Informative notes	3.84	.92	important	3.44	1.05	quite important	3.34	1.05	quite important	2.75	.85	quite important	1.27	12.98*	-	.00

p value < .05

very important genre = 5 (4.5-5.0) important genre = 4 (3.5-4.4)

quite an important genre = 3 (2.5-3.49) not so important genre = 2 (1.5-2.49)

not important at all = 1 (1.0-1.49)

3. Writing problems associated with different genres in engineering contexts

Most of the engineering students thought that they had problems when they have to write different genres in engineering contexts. They rated minutes, agenda, and reports as the three most important writing problems with mean scores of 3.7, 3.64, and 3.60 respectively. The ESP teachers felt that students had problems in writing reports (3.86), minutes (3.59), and inquiries (3.58). As for operational engineers, most of their problems in writing in different genres were considered as "quite important." The first three important problems in writing in different genres of operational engineer were complaints (3.10), reports (3.13), and minutes (3.11). In contrast, managerial engineers agreed that problems in writing in different genres were not "so important." The first three types of writing problems noted were writing requests, minutes, and agenda.

When calculating the mean scores using F test or one-way ANOVA, it was found that the writing problems associated with different genres of the four groups of subjects differed significantly at the level of .05 ($p < .05$). In other words, these four groups of subjects had different problems when having to write different types of writing. Details on the writing problems are reported in Table 2.

Table 2: Writing problems associated with different genres in engineering contexts

Content	Students (354)		Interpret	Teachers (31)		Interpret	Operation eng. (110)		Interpret	Manager eng. (17)		Interpret	Variance	F	Welch's ANOVA	P-value
	$\bar{x}$	SD		$\bar{x}$	SD		$\bar{x}$	SD		$\bar{x}$	SD					
1. complaints	3.61	.97	important	3.56	1.21	important	**3.10**	.98	quite important	2.38	1.12	not so important	2.39	11.79*		**0.00**
2. requests	3.47	.97	quite important	3.52	1.08	important	2.96	.94	quite important	**2.46**	.877	not so important	1.88	10.67*		**0.00**
3. inquiries	3.47	1.03	quite important	**3.58**	1.17	important	3.02	1.00	quite important	2.38	.961	not so important	1.91	8.80*		**0.00**
4. memos	3.34	1.06	quite important	3.38	1.16	quite important	2.92	1.05	quite important	2.27	1.01	not so important	1.27	6.89*		**0.00**
5. reports	**3.60**	1.07	important	**3.86**	1.04	important	**3.13**	.97	quite important	2.38	1.12	not so important	1.77	10.58*		**0.00**
6. minutes	**3.7**	1.14	important	**3.59**	1.36	important	**3.11**	1.01	quite important	**2.45**	1.12	not so important	3.37*	-	10.31*	**0.00**
7. agenda	**3.64**	1.09	quite important	3.5	1.36	important	2.99	1.07	quite important	**2.42**	1.08	not so important	3.10*	-	10.53*	**0.00**
8.Informative notes	3.47	1.00	quite important	3.43	1.06	quite important	2.82	1.02	quite important	2.23	.927	not so important	.40	14.93*		**0.00**

p value < .05

very important problem = 5 (4.5-5.0) important problem = 4 (3.5-4.4)

quite an important problem = 3 (2.5-3.49) not so important a problem = 2 (1.5-2.49)

no problem at all = 1 (1.0-1.49)

In conclusion, it was found from Table 1 and 2 that requests and enquiries were considered as important by the four groups of subjects. Also, they showed that these four groups of subjects had different problems when they have to do different types of writing.

2. Interview protocol

It was found that formal and informal e-mails were required in the engineering community. The reasons for writing either formal or informal e-mails were based on the status of the recipients, the relationship between recipients and senders, the topics, and objectives. Writing formal or informal e-mails was evident in the language they used in parts of the e-mails; namely, the opening salutation, body, closing salutation, and closing correspondence. For example, In writing formal e-mails, in the opening salutation, they used "Dear + first name" and "Dear + surname" with Thai and foreign engineers whom they were not familiar with, or who were in a higher status,. In contrast, they used "Dear + nickname," "Dear + first name," "Hello + name," and just "name" with anyone whom they were familiar with or who was of similar status. However, they normally used "Regards" or "Best regards" as the closing salutation with people they communicated with, regardless of familiarity or unfamiliarity.

Some Thai engineers were aware of sentence structure when they wrote e-mail to foreign engineers. Thus, they tried to use simple and compound sentences in their writing to minimize their mistakes. Some engineers also paid attention to the nationality of foreigners. They found that the cultures of different countries were different, so it was necessary to focus on this. For example, Japanese and Chinese customers or engineers preferred very polite and formal communication. They started writing e-mails with an introduction, and then purpose or state the main point of writing. In contrast, American and European engineers preferred going to the main points of communication without introduction. Normally, this happened when they had already contacted each other a few times. Chinese engineers or suppliers sometimes did not provide information about things directly, especially when they made mistakes. They preferred indirect communication. In contrast, American and British engineers

preferred direct communication. An example can be found in one subject's description below.

> *We need to use "Dear + surname," not "Hi" to make it formal and polite. It is better if you put the word "san" after the surname if they are Japanese. Also, Japanese engineers or customers are strict about time. We have to keep our promise when we deal with them on any matter such as exporting products. (Engineer #7)*

In addition, most of the engineers agreed that the decision to use technical terms, semi-technical terms, and general vocabulary depended on whom they were talking to and what the topics were. Interestingly, most engineers thought that the formats of their writing were not important; they simply used the formats they preferred. It was also revealed that engineers had different writing problems, such as inadequate vocabulary and English background knowledge. As for the writing context of writing request and enquiry emails, the results also showed that most engineers wrote to suppliers, colleagues, and people in their headquarters. Most of the purposes of writing request and enquiry emails were to ask for action or any specific information about a product/service/work, etc. As for type of report writing, it was found that engineers wrote many kinds of reports, such as accident reports, laboratory reports, and investigation reports. These reports have different types of organization, and the frequency of writing these reports was based on the necessity of each engineer, e.g. every week or every month. However, it seemed that the investigation report was the type of report that most engineers had to write.

Sociolinguistic knowledge in writing requests and enquiry e-mails and reports was therefore necessary for appropriate communication. Most engineers agreed that they used "please…" and "could you please…?" and "would like…" to show politeness and formality in requests and inquiry e-mails. In addition, referring to previous contacts or events were characteristics to show politeness and formality. Using appropriate words was also a way to indicate politeness as well

as using appropriate closing salutations and closing correspondence. For example, "regards" and "best regards" in a closing salutation could be used with any group of readers to show politeness. Moreover, it was appropriate to use expressions such as "urgent reply is appreciated" and "feel free to ask any questions" in closing correspondence. As for the sociolinguistic knowledge of writing reports, it was clear that the language must be polite and formal, since engineers had to write to supervisors and customers. They did not use spoken language, contractions, exclamation marks, or personal pronouns which were common features in informal speech.

In addition, it was found that the writing strategies or tactics varied according to the individual purpose of writing. The needs analysis results were translated into the content of the course.

Discussion of the Findings

An important result of the needs analysis was the types of genre or English writing contents required for engineers' working context. The results showed that operational and managerial engineers thought that the three most important types of genre for engineering work were request e-mails, enquiry e-mails, and reports. It is noteworthy that although operational engineers do not work on administration teams, they shared the view of the managerial engineers about the important types of genres. Likewise, it was found that ESP teachers also saw enquiry e-mails, memos, and reports as the three most important types of genres, while enquiry e-mails, reports, and minutes of meetings were the three types of genre most needed in the view of engineering students. This means that although ESP teachers and engineering students do not have direct experience as engineers, they were nevertheless aware of the writing requirements of their professional colleagues. This might be because the engineering students were fourth-, fifth-, and sixth-year students, so they may have had some experience in engineering work from the required professional training when they were third year-students. As for ESP teachers, they may have taught English courses relating to engineers for

quite a long time such as English for work and technical English. For this reason, they might have had chances to talk to engineers and their ex-students about engineering work and were thus familiar with the required genres in engineering work.

The findings of this study are in some ways similar to the results of Jiranapakul, who also conducted a needs analysis among Thai engineers in 1996, and Li So-mui and Mead in 2000. According to the findings of Jiranapakul's work concerning the required types of writing-related activities of engineers, the first three types of written work required by operational and managerial engineers were business letters/faxes, reports, and office forms. As for Li So-mui and Mead, their results revealed that writing and faxes were the most common channels of communication. However, even though the results of the present study were partly similar to those reported in Jiranapakakul's needs analysis, Jiranapakul's study is rather dated because the technologically-dynamic environment of engineering has adopted new forms. Moreover, this study has also gone further in specifying the types of business writing that engineers need (request e-mails, enquiry e-mails, and reports). More specifically, this study has focused on writing e-mails, whereas Jiranapakul's work and Li So-mui and Mead's work emphasized letters and faxes. This might be because letters and faxes were the channels that people mainly used to communicate with each other at the time of Jiranapakul's and Li So-mui and Mead's study, while e-mail is the primary mode of communication at present. Yet it can be said that the types of genre currently required by engineers are still somewhat similar to the types of genre required in the past, with the important difference being that the "new" technology of the Internet has enhanced electronic communication. Simply put, the contents of written work required by engineers at present have not changed much from the past, but the form has been changed due to new technologies.

In brief, the needs analysis highlighted similar aspects of the required genres for the work of engineers among ESP teachers, engineering students, operational engineers, and managerial engineers. The results of the needs analysis were also similar in some ways to Jiranapakul's and

Li So-mui and Mead's work. That is, all three studies have identified the same generic field, but this study disagrees with Jiranapakul's study and Li So-mui and Mead's study when it comes to the genre forms (letters/faxes and e-mails).

Implications and Conclusion

This study reveals the substantial English writing communication demands placed on engineers in their work. The results show the required genres for the work of engineers. This shed some light on development of English courses to meet the demand of the market. The followings are some implications for educators in constructing and implementing ESP courses for engineers.

Course designers

1. For the first- and second-year engineering students, English core courses should be developed to make the students confident and to help them master their language ability both concerning receptive and productive skills. For example, this can be undertaken by asking students to do some extra activities in class such as role play and interviewing foreigners. For the third- and fourth-year students, more ESP courses for engineers should be implemented. Engineering students should be enrolled in more courses that are based on the activities involved in real work situations, which are listed in the findings of this study. Possibly, to make it more meaningful, the courses can include integrated skills with more emphasis on reading and writing skills.

2. It is worth noting that English writing in the community of engineers also required sociolinguistics knowledge, and a lack of sociolinguistic knowledge was part of the students' problem. Therefore, using appropriate language to show the degree of formality in writing based on the relationship between the readers and writers is necessary. As a result, course designers as well as teachers should design activities and exercises to help students see how to use language appropriately based on different social contexts.

3. Finally, one of the results of the needs analysis revealed

that engineers have to write to people from different cultures in English. Therefore, different cultural contexts should also be emphasized in lessons, and written samples from different cultures should be collected and analyzed. Activities and exercises to help students practice writing to people from different cultures should be created, since cross-cultural understanding helps people communicate effectively.

Teachers

1. As the results showed that engineering students have problems in writing in English, teachers should measure their students' writing ability before beginning a writing course for engineers. Then, teachers help improve the students' writing ability so that they are ready to write in the English writing course for engineers.

2. Learning materials should be produced in-house from authentic materials, as they need to be updated from time to time. Additionally, real situations should be simulated so the students can be familiar with the variety of work situations of engineers. For example, asking students to listen to telephone conversations and writing emails according to the situations on the phone.

3. Teachers should try to motivate students to see the importance of English in terms of achievement in their work career. Possibly, teachers should invite successful former engineering graduates to meet with the students and to talk to them about the importance of English to their success.

4. Collaborative work with engineers and engineering teachers is recommended. This is important since engineers and engineering teachers can give the teachers ideas about the real situations of working as engineers, including samples of written texts.

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Appendix A

Questionnaire (for engineering students)

Questionnaire for engineering students

Part I: Demographic information

Instructions: Please fill in the information or put / in the space given.

1. **Sex:** ☐ Male ☐ Female
2. **Age:** ……years old
3. **Academic year** ……. **Major** ☐ ME ☐ CE
   ☐ EE ☐ CHE
   ☐ PE ☐ IE
4. **Educational background**: ☐ Matthayom 6 ☐ Vocational school ☐ others ….
5. **Number of years studying English:**
   ☐ 3-5 years ☐ 6-10 years ☐ 11-15 years ☐ 15+ years
6. **English I course grade**…….. **English II course grade** ……
7. **Experience in writing English** ☐ Yes ☐ No
8. **Please rate your ability in English writing by filling in / in the required space.**

Writing ability	Meaning
	5 (very good): write effectively and fluently; use language correctly and appropriately based on the required objectives, content, and social context; have no problem in writing; able to edit and revise written work by yourself
	4 (good): write fluently with few mistakes; cover required information; able to edit and revise your writing; may have some problems in writing such as word choice and grammar

	3 (fair): write fluently but with mistakes; sometimes make readers confused; able to edit and revise your writing in main errors; have problems in writing such as organization, word choice, grammar, spelling
	2 (poor): write quite fluently, but make readers confused sometimes; able to edit and revise your work in simple errors; have many problems in writing such as organization, word choice, searching for content, spelling, and grammar
	1 (very poor): cannot write; make readers misunderstand many times; need written samples; always use a dictionary; cannot edit or revise your work; have a lot of problems in writing such as using inappropriate structure and language, cannot use language according to the purpose of writing, have problems with word choice, or organization, use language inappropriately for readers

Part II: Problem areas in writing English in general, types of genre in engineering contexts, and problems in writing associated with types of genre in engineering contexts

Instructions: Please put / in the space given

5 means a very important problem

4 means important problem

3 means quite an important problem

2 means not so important a problem

1 means no problem at all

2.1 Please identify problem areas in writing English in general.

Problems in writing	Scale					For researcher	
	5	4	3	2	1		
1. Vocabulary							
2. Grammar							
3. Structure							
4. Spelling							
5. Punctuation							
6. Writing procedures 6.1 Outlining							
6.2 Searching							
6.3 Writing							
6.4 Editing							
7. Others							

2.2 Please identify importance of types of genre in engineering contexts and problems in writing associated with types of genre in engineering contexts.

Importance					**Types of genre**	**Your problems in writing**				
5	4	3	2	1		5	4	3	2	1
					1. complaint and adjustment					
					2. request and reply					
					3. inquiry and reply					
					4. memorandum					

					5. progress and problem-solving report					
					6. minutes of the meeting					
					7. agenda					
					8. informative note					
					9. others					

2.3 Please identify importance of knowledge of writing English in engineering contexts and Problems associated with knowledge of writing English in engineering context

Importance					**Knowledge of writing English in engineering contexts**	**Problems of your knowledge of writing English in engineering context**				
5	4	3	2	1		5	4	3	2	1
					1. Appropriateness in terms of relationship between reader and writer					
					2. Relevance between the content and context					
					3. Logical knowledge					
					4. Appropriate layout					

Part III: Suggestions and expectations for an English writing course for Engineers

Instructions: Please give comments, expectation, and/or suggestion on the English writing course for engineers.

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APPENDIX B

Interview questions for engineer

1. What is the writing format you often use: letter format or e-mail format?
2. What are the criteria to choose between formal and informal e-mail?
3. How do you show whether the e-mail is formal or informal?
4. How do you use language to show the relationship between readers and writers in different contexts?
5. If you have to write to people who are in a higher status, or work in other companies, what are you aware of?
6. If the reader is a foreigner, what do you pay attention? And Is there any differences between foreigners who are in America, Australia, Europe and Asia?
7. What kind of sentences do you normally use in your writing/
8. What kinds of vocabulary do you normally use (technical terms, semi technical terms or general vocabulary)?
9. Is the format of writing important or engineers?
10. What are writing problems of Thai engineers in your opinion?
11. What are engineer writing contexts and situations for writing request e-mails and enquiry e-mails?
12. What types of report writing do you normally use and what are your writing contexts and situations?
13. What sociolinguistic knowledge are you aware of when you write request e-mails, enquiry e-mails, and reports?
14. What writing tactics or strategies do you use when you write request e-mails, enquiry e-mails, and reports?

15. As a managerial engineer, what is your expectation on the writing quality of engineers? What are their writing problems?
16. In case of new engineers (graduate from a Thai institute), what is their writing competence? What do you want from universities to prepare engineering students to work in the future?