早稲田大学大学院教育学研究科紀要　別冊　26 号— 2　2019 年 3 月

Needs Analysis for Developing a Theme-Based Language Unit for Students at the National Institute of Technology

Noriko SUZUKI

1．Introduction

When developing any language course, it is essential that learners' and stakeholders' needs are sufficiently reflected in the curriculum and syllabus (Nation & Macalister, 2010). The National Institute of Technology (NIT), the research context of this study, has a unique educational system where students complete regular high school graduation requirements and also acquire specific engineering knowledge and skills in content classes over the five-year course starting from age 15. For these students, it is especially desirable that English courses are closely linked to their future English use, and possibly cover the content related to their field as well as general English use. In other words, a successful continuation from English for General Purposes (EGP) to English for Specific Purposes (ESP) needs to be made. To reflect such demand for the NIT English curriculum and syllabus, this small-scale study implemented a series of Needs Analysis (NA) to specify (1) the skills and tasks that involve English in content classes and (2) the possible topics to be covered in English classes to create a theme-based unit for NIT students. In the next section, the literature of needs analysis and theme-based instruction are reviewed.

2．Literature Review

2.1　Course development and needs analysis

A successful design of a language course requires needs analysis and it has a strong tradition especially in the course development for ESP (Brinton, 2017). Since the current study is conducted at an engineering college, it is desirable to take into consideration how English is used in the engineering content classes to make a reasonable link between their field of study and what students learn in English classes. In conducting NA, there are three important aspects, namely Target Situation Analysis (TSA), Learning Situation Analysis (LSA), and Present Situation Analysis (PSA) (Dudley-Evans & St. John, 1998). The first is TSA, which investigates the actual situation where students need to use the target language (Flowerdew, 2013; West, 1994). TSA can be conducted by looking into the situations and tasks

which oblige the target language use by means of interview, questionnaire or observation (Long, 2005). The second aspect is LSA, which addresses the leaners' subjective needs or "wants". In other words, NA should address what the learners feel they need to know for the successful task completion. The third aspect is PSA, which investigates the learners' current proficiency level and the gap between what learners already know and what they need to know. Although it is crucial to obtain information about all these three aspects to construct a satisfactory course, more emphasis are to be given on TSA, and task should be taken as the unit of analysis in NA (Long, 2005) so that the course to be based on the target tasks which correspond to what students actually need to do in an L2 in the target situation.

To obtain rich information for NA, it is essential that multiple sources of information be consulted. Regarding the valid process of information gathering, Serafini, Lake and Long (2015) reviewed 33 NA research articles, and confirmed that the crucial steps in NA are consultation of domain experts, triangulation of sources and methods, and obtaining information from in-service learners and materials. Serafini et al. also emphasized that NA studies need to increase the possible source×method interactions to enhance the validity of the analysis[1]. In sum, for an effective course development, the actual language use situation should be identified from multiple sources along with the identification of learners' subjective needs. Therefore, the current study varied the information sources (e.g., teachers, in-service students from two different years, advanced program students and graduates) and method (e.g., interview and questionnaire).

Regarding the English needs of Japanese engineers, Koyama (2016 for review) conducted a series of NA research to identify their needs at work. It was found that frequently encountered tasks by those engineers are (1) reading research articles, emails, technical manuals, and technical reports, (2) writing emails and (3) listening and speaking at a conference outside a company. From these results, it can be said that the tasks involving reading are dominant, but the other three skills are also indispensable. Meanwhile, there is not a sufficient number of research reflecting Japanese university engineering majors' English needs, let alone for NIT students. Among the limited number of research on NIT students, Fujita (2017) conducted a thorough needs analysis to specify the target tasks at both NIT and workplaces by interviewing eight advanced program students, 10 content teachers, and 10 engineers at seven different companies. Through a qualitative analysis of the interview transcripts, Fujita specified the following eight task types which are likely to be faced by NIT students: (1) introducing NIT, (2) collecting information about companies, (3) communicating with foreign students, (4) reading research articles and books, (5) writing and reading technical reports, (6) studying English, (7) introducing one's research, and (8) collecting information for conducting research. Fujita found that since fifth-year students are required to write a graduation thesis, many of the target task types are related to conducting a research. As for English skills, reading as well as writing and speaking appears

to be particularly important. Besides these findings, additional investigation on the interviewees' thoughts and wants about English education, which was not included in the scope of this study, might inform further curriculum development.

On the other hand, Sugiura (2009) investigated students' (*N*=882) perceived needs at one NIT through a questionnaire. She discusses that students perceived English as a communication tool and therefore they particularly noticed their lack of listening and speaking ability. It became also evident that they wanted to do more communicative activities in class. As for the content which students want to learn in English classes, the practical content such as daily conversation, business English and preparation for a large-scale English test were valued. Sugiura also points out that the students wish to improve on their grammar and English-to-Japanese translation skill. From these results, it can be assumed that NIT students may hope to improve their oral communication skills, but at the same time they need skills to ensure concise understanding of English supported by firm grammar knowledge and correct translation skills. Although a general picture of NIT students' perceived needs was successfully captured in this study, a more qualitative approach to address not only in-service students but other stakeholders' views may add value to the understanding of their needs.

2.2 Content Based Instruction (CBI): A theme-based instruction

With regard to the discussion about NA above, CBI has a potential to function as an effective syllabus type, which can be a platform to incorporate the wants, lacks and tasks reflected in NA. The integration of content and language learning has long been claimed beneficial for various aspects of language learning (Brinton, Snow & Wesche, 1989; Stoller, 2008). For example, the content provides an appropriate site for meaningful language input, output and interaction, cognitive involvement in the coherent and meaningful content leads to a deep processing and strengthens language recall, and the content of students' interest likely heightens their motivation for language learning as well (Fitzsimmons-Doolan, Grabe & Stoller, 2017; Stoller, 2008). As for the implementation of CBI, it can range from a language-driven end to a content-driven end according to each teaching context and students' proficiency level (Brinton et al, 1989; Lyster & Ballinger, 2011). The language-driven end of CBI is termed theme-based instruction, which is "structured around topics or themes, with topics forming the backbone of the course curriculum" (Brinton et al, 1989, p. 14). For those students who still need to develop their language knowledge and skills, theme-based instruction is especially suitable since it ensures contextualized language learning through the use of various source materials with sufficient attention focused on language learning. Moreover, although a typical language class in an English as a Foreign Language (EFL) context, notably in the context of Japan, tends to deal with language explicitly (i.e., focus on forms) with only a little focus on meaningful language use, the adoption of a theme-based approach may

counterbalance the focus on content and form (i.e., Counterbalanced approach: Lyster, 2007).

When deciding how to present content knowledge and which aspects of language to focus on in an actual class, Mohan's (1986) knowledge framework can lend support for making a reasonable choice. According to the framework, knowledge consists of two different but corresponding perspectives: the one with specific, practical knowledge that is used to illustrate a particular case (e.g., description, sequence, choice) and the other with general, theoretical principles underlying the knowledge mentioned earlier (e.g., classification, principles, evaluation). In other words, to learn a complex knowledge structure of a particular subject, one needs to *describe* a case and, at the same time, needs to *classify* the knowledge to give a full description. Similarly, one needs to *sequence* the knowledge based on *principles* and make a *choice* based on the ability to *evaluate* the content. The structure of knowledge described above can be presented visually using graphics (e.g., charts, graphs, tables), which is especially helpful for beginner-level English language learners to comprehend the content. The language focus can be drawn according to which of these six functions learners need to use to learn the content (see Mohan, 1986 for more detailed account).

To sum up, students at NIT all major in engineering-related fields and are likely to use English within NIT and also at work as an engineer in the future. Although there are a limited number of previous studies on engineers' English needs (Fujita, 2017; Koyama, 2016) and specifically on the target tasks (Fujita, 2017) and the students' perceived needs (Sugiura, 2009) in NIT, the number of such studies is still scarce and few studies have conducted NA aiming at creating a theme-based unit for NIT students to bridge EGP and ESP courses. Moreover, due to the scarcity of NA research for engineering students in Japan with regard to possible target tasks, skill areas to be covered and the theme/topic to be used in English classes, this study seeks to provide additional insights for constructing an English course for engineering students. Therefore, the current study addressed the following research questions.

1. What kind of tasks do NIT students need to do in content courses in English?
2. How do teachers and students feel about conducting these tasks?
3. What are the teachers' and students' perceptions about the theme/topic dealt with in English classes?
4. What form of theme-based unit can be suggested based on the NA conducted in this study?

3. Method

3.1 Research context

The National Institute of Technology is a college specialized in educating young, skillful engineers who are globally-minded. There are currently 57 NIT in Japan. Starting at age 15, students take general

subject courses for obtaining a high school diploma, and they also take engineering subjects whose number increases towards the end of the five-year curriculum. Fourth and fifth year students start to focus on their field of research and are required to complete writing a graduation thesis to obtain an associate degree in engineering. Students who hope to earn a bachelor's degree can study two more years at the advanced program attached to NIT. As a school education policy, the current school aims to equip students with the ability to read English materials related to their field and to work globally as an engineer.

3.2 Interviews with content teachers, advanced program students, and graduates

The data which inform the course development was obtained from multiple sources. In-depth one-on-one semi-structured interviews were conducted with 4 full-time content faculty members in one engineering department from December, 2017 to March, 2018. The total number of the faculty member in this department is 9 and these four teachers spared time for the interview. They have various backgrounds regarding their teaching experiences (5 to 26 years), previous work experience at a company (for T1 and T4), and their use of English in class. They were first asked to fill in a questionnaire which asked about the classes in which they use English at least for some part (e.g., What kind of activities do students need to do in your class using English?). They were also asked to indicate which English skills (e.g., listening, speaking, reading, writing, grammar, vocabulary) are important in completing their courses using six-point Likert scale. After filling in the questionnaire, an interview was conducted based on the information provided. Their thoughts on English language teaching were also elicited (e.g., What kind of themes/topics do you think are suitable for our students? What kind of English help do you provide to your students if any?). Each interview was conducted in Japanese at either the interviewee's office or a laboratory and it lasted for 56 minutes on average (see Table 1). Besides the interview, teaching materials for their content classes were obtained to inform the material development later on.

In addition, two advanced program students and three graduates of the current department were interviewed to obtain information about their English use in the NIT content courses and their perceptions. They were asked basically the same questions as the content teachers (e.g., the tasks they need to conduct in English at their current institution) and were also inquired about their perceptions on these tasks and the themes/topics dealt with in English classes. Due to the time and mechanical constraints, A1, A2, and G1 were group-interviewed and G3 was interviewed over the phone. G2 was interviewed one-on-one.

All the audio-recorded interview data was first transcribed by the author, and the author read and re-read the transcripts for the analysis. The data was analyzed qualitatively according to similar thematic unit (e.g., tasks in content classes, necessary English skills, their thoughts on content to be covered in

Table 1 The interview participants and their affiliation

ID	affiliation	service years/college year	interview time
T1	NIT faculty	5 years	57 min.
T2	NIT faculty	25 years	64 min.
T3	NIT faculty	21 years	48 min.
T4	NIT faculty	26 years	55 min.
A1	NIT advanced course student	2nd year	70 min.
A2	NIT advanced course student	2nd year	70 min.
G1	Undergraduate student	3rd year	70 min.
G2	Undergraduate student	4th year	35 min.
G3	PhD student	1st year	105 min

English classes). The author translated all the excerpts from Japanese to English. Table 1 summarizes the information about the interview participants.

3.3 Questionnaire survey with in-service NIT students

Informed by the interviews currently conducted and previous research (Koyama, 2016), a questionnaire which asked about necessary skills and tasks were constructed. 27 fifth-year and 37 second-year students in the target department answered the questionnaire in February, 2018. The data collection was conducted by the author visiting one of their regular classes and asked them to answer the questionnaire through the online questionnaire form. It inquired their perceived needs for each English skill (e.g., reading, writing, speaking, listening, grammar, vocabulary) when studying in the upper-level engineering classes offered at fourth and fifth year with 6-point Likert scale. Besides, to identify students' preference about the content they want to learn in English, they were asked to provide two topics they feel they would be most interested in, and the answers were qualitatively grouped to form categories. The data were obtained from these two years of students for the following reasons. First, the fifth-year students had already taken some content courses where English was used by the time of the survey; therefore, their actual experience of English use could be taken into account. Second, the theme-based unit created based on this NA was planned to be implemented to the second year students when they become third year students and thus the researcher considered it informative to know about their needs.

4. Results and discussion

The results of the interviews and questionnaires are presented jointly according to the following categories in the data: Tasks related to reading, tasks related to writing, tasks related to speaking and listening

and the themes/topics to be covered in English courses. In the current department, English was used mainly in two content classes: a seminar for writing a graduation thesis and an ESP class taught by the engineering teachers. These two classes are offered similarly to the fifth year and advanced program students. As for the fifth year ESP class, 7 classes (50 minutes for one class) are devoted to making a presentation in English about individual student's field of interest and the remaining 23 classes were conducted by each supervisor focusing on different activities (e.g., reading and translating research papers and manuals, learning about the structure of a research article). The findings were mainly based on these two classes.

4.1 Tasks related to reading

As previous studies have suggested alike (Koyama, 2016; Fujita, 2017), the most important and frequently used skill is shown to be reading. The questionnaire results by teachers indicate the importance of reading, followed by writing and vocabulary (See Table 2 for all skills). Regarding the importance of reading English, T1 emphasized that "the amount of information to be obtained differs significantly if students could read English" and A1 explained that certain information is only available in English (e.g., specifications for parts). More specifically, the tasks which involve reading are (1) reading research papers, (2) reading content textbooks in English, (3) reading manuals to operate experimental equipment and (4) reading a datasheet to understand the properties of a part. Students conduct these tasks as part of their course requirement or along pursuing their own research. The teachers emphasized that "Reading is the starting point" (T1) for conducting a research and students also perceived reading as "by far the most important" skill (A1, A2, G1). These four reading tasks are also dealt with in the ESP class taught by the four content teachers, mainly requiring students to translate these reading materials into Japanese. Translation seems to be a valued way of practice since all the four content teachers require students to either translate the whole research paper or manual, or make a summary of a research paper in Japanese to make sure that they understand the content. The emphasis on precise understanding of content made by earth sciences and mathematics content teachers at a Japanese university is also reported in Sawaki's (2017) interview study, highlighting the significance of accurate understanding of reading materials in the field of science. To support this side of English use, it may be justifiable to enforce the form-meaning mapping with the help of L1 in English classes.

Table 2 Content teachers' (n=4) perception about the importance of each language skill for engineering class (mean (SD))

	Reading	Writing	Vocabulary	Speaking	Listening	Grammar
Teachers	5.75(0.43)	5.25(0.83)	5.25(0.83)	1.5(0.5)	1.5(0.5)	4.5(1.12)

Related to text comprehension, T1 and T4 were concerned about the insufficiency of students' grammar knowledge. Even though students can understand the meaning of vocabulary used, according to T1's observation, they do not seem to understand the syntactic relationship of these words, which should be supported by the knowledge of grammar. In his ESP class, T4 provides language support by helping his students identify the structure of a sentence (identifying a subject, a verb and modifiers). On the other hand, T2, T3 and G3 commented that the grammar used in research papers is rather simple. These different views on English grammar for scientific writing may be explained by the systemic functional view of grammar (Parkinson, 2000, 2013). Halliday (1993) has shown that scientific meaning is communicated nominally rather than clausally, using grammatical metaphor extensively while applying less clausally complex structure. Therefore, it can be said that grammar is structurally "simple," yet identifying a noun phrase is more "difficult." Therefore, catering to this feature of scientific writing in English classes may benefit engineering students.

Other than the provision of grammatical support, content understanding seems to be scaffolded by teachers and students' L1 knowledge. T1 reported that he selects some relevant research papers for his students and assigns them with comments briefly explaining the main points addressed in them. In addition, T2 mentioned that students' understanding of research papers is scaffolded by their content knowledge gained in Japanese and T2 and T3 pointed out that formulas in papers greatly aid the comprehension. Thus students' understanding of English text is underpinned by the content knowledge in L1 and mathematical representations of the content.

4.2 Tasks related to writing

Although not mentioned as frequently as reading tasks by both teachers and students, there are two writing tasks identified: (1) writing an abstract for a thesis or an international conference and (2) writing a title and explanation of a chart in a thesis. Teachers consider writing as an important skill for content class learning (M=5.25), and provide sufficient support when students actually write an abstract. For example, when his students write it for the first time, T1 first assigns several abstracts and has his students find a pattern of the structure and write the first draft. Then he provides feedback on students' writing. A1 confirmed that he read several abstracts and learned inductively what kinds of vocabulary to be used in his writing. While teachers and students closely work together at NIT, G2 reported that at his university, masters and PhD students normally supervise undergraduate's abstract writing, with particular emphasis on the use of appropriate academic vocabulary. From the above examples, it can be rightly assumed that the abstract writing is inductively learned through reading first, and then it is refined through the eyes of knowledgeable people who are more familiar with the content and the genre. Regarding the second task, A1 and A2 answered that although their thesis was written in

Japanese, charts and their titles were required to be written in English. T4 considers this task rather as a scaffolding before writing a longer English text, such as an abstract and a full-length paper.

4.3 Tasks related to speaking and listening

Except for the required presentation in the ESP class, speaking and listening occasions for content learning are found to be rather rare. As shown by the low scores on the importance of speaking and listening for engineering classes in the questionnaire (M=1.5 for both scales), the content teachers said there are almost no occasion to speak and listen to English in their classes unless students participate in an international conference to present their research, which is not very frequent. Therefore, the tasks which incorporate speaking and listening are (1) to make a presentation at a conference and (2) interact with the audience at a question and answer session.

Despite the scarcity of the actual use of speaking and listening, two content teachers elaborated on these skills. Regarding the research activity, T3 holds a view that a series of research activities (i.e., reading and writing a paper, presenting it at a conference, listening and speaking at a question and answer session) involves all four skills and they are all important. From a slightly different perspective, T2 sees that speaking and listening at a conference can be successfully accomplished with a great amount of preparation beforehand. Similarly, G3 emphasized that speaking as well as reading and writing tasks can be overcome by deliberate preparation with the help of a dictionary and a translation application. Consequently, it can be summarized that students have an increased need for speaking and listening as they proceed to a more professional research community, but the demand can be to some extent mitigated by elaborate preparation.

To indicate the range of tasks actually conducted by the fifth-year students (N=27), the questionnaire asked whether they experienced conducting the above-mentioned tasks (see Figure 1). They were asked to choose all the tasks they performed in the content classes. Except for the presentation which is a requirement in their ESP class, it can be seen that not all students equally experienced conducting the tasks in their content classes, but reading research papers and translating them are the most prevailing tasks for the engineering students in this department.

As for the skills that the in-service students think they need for content classes, both fifth and second year students seemingly perceived necessity for all skills (4~6 on the 6 point scale for perceived necessity) as opposed to teachers' perceived importance on the skills other than speaking and listening. However, this relatively high perceived needs for speaking and listening may be drawn from the requirement of making a presentation in the ESP class. Another noticeable point is the lower average scores for the 5th year students compared to the 2nd year students. This result may indicate that the actual English demand for the content classes are not as high as the 2nd year students' expectation, and the larger SDs
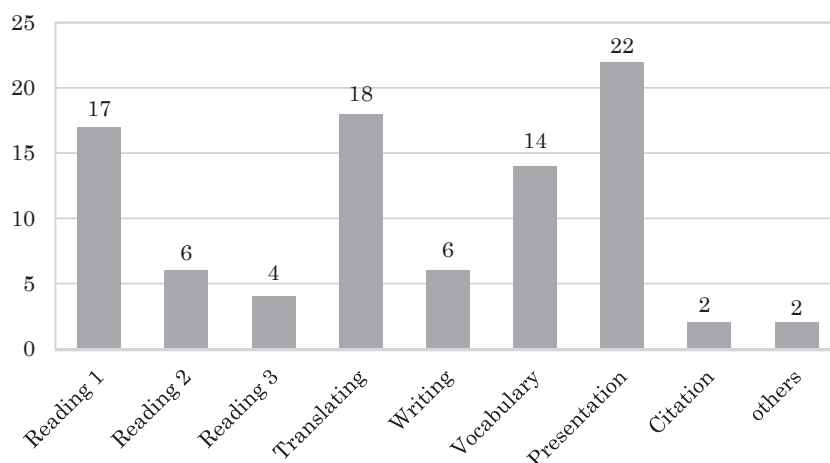
Figure 1 Types of tasks conducted by fifth-year students

Note. Reading 1: Read research papers in English; Reading 2: Read English manuals to use experimental equipment; Reading 3: Read a textbook in English; Translating: Translate research papers from English to Japanese; Writing: Write about their field in English; Vocabulary: Memorize technical vocabulary; Presentation: Make a presentation in English; Citation: Cite a research paper written in English; others: translate manuals, listen to English

Table 3 Fifth and second year students' perceived needs for each English skill in content classes (mean (SD))

	Reading	Writing	Vocabulary	Speaking	Listening	Grammar
5th	4.52(1.47)	4.00(1.31)	4.56(1.34)	4.22(1.42)	4.00(1.47)	3.89(1.45)
2nd	5.27(0.79)	5.00(0.96)	5.14(0.81)	5.24(0.79)	5.08(0.82)	5.11(0.76)

for the 5th year average scores may also show the differences in the use of English according to different supervisors. In addition, as the teachers rated reading as the most important, the students similarly acknowledged the needs for reading, along with vocabulary.

4.4 The themes/topics to be covered in English classes

The selection of themes/topics is a crucial aspect of English course planning since the language target (e.g., vocabulary, language forms, genre) and possible tasks stem from it, and learners' motivation is significantly dependent on it (Brinton &Snow, 2017). Despite this indispensable importance, only a few research has looked into the content selection of English classes for NIT engineering students (for exception, Sugiura, 2009).

When teachers were asked what kind of topics should be dealt with in English classes, all of them answered that the topics should be related to the content teachers' field of study with which students

will intensely be involved when they write their thesis. They mainly focused on three points when suggesting a content: (1) students' interest, (2) usefulness in the content class learning, and (3) vocabulary learning. T1 suggested that these topics possibly motivate students toward English learning, since they can see a connection between their interests and what they learn in English classes. T1 also indicated a possibility of using several research paper abstracts related to the content teachers' research, which can be used not only to learn about the subject specific knowledge but also to learn about the general structure of an abstract. T3 also mentioned that by reading about recent technical trends such as AI, electric cars and robots, students may encounter crucial vocabulary repeatedly, which should be useful for later English use in content classes. T2 also suggested utilizing popular scientific articles with the aim of familiarizing students with how to read mathematical formulas and how to explain a certain trend shown in a graph in English.

As for the students interviewed, they emphasized that they "don't remember the topics" covered in an English textbook used for the first to third year class. A1, A2 and G2 said they did not care so much about the topics of the textbook. It may be assumed that these students perceived English as a primary target of their learning and might not have seen it as a tool for learning something, and English teachers may have treated English likewise. When asked what kind of themes they want to learn in English class, after a relatively long thought, students mentioned two characteristics of suitable topics: (1) the content which is inherently interesting and relevant to them and (2) the content that is already familiar to them. For example, A2 suggested using best-seller books and G3 recommended dealing with practical English (e.g., how to get on a plane, how to write an email). A1 answered "To read something that students are already familiar with, such as famous stories, might promote learning." When asked about the use of scientific topics as a theme in English classes, all of them showed favorable feelings, except G1 pointing out that "Students might be interested in these topics but may not be for the first and second year students. They may rather study with a typical English textbook." This comment may reflect the notion that ESP is more difficult than EGP (Hasegawa, 2015) and the timing of the introducing ESP needs careful consideration (Takechi, 2014).

To investigate the second and fifth year students' topic of interest, they were asked to provide two topics that they would be interested in learning in English (see Figure 2). The analyzable answers (i.e., excluding NA) were 69% (37/54) for the fifth-year and 86% (64/74) for the second year students. Both groups of students chose the topics related to their field the most (e.g., energy development, programming), and it is remarkable that fifth year students are more inclined to these topics than second year students. From the results, it is assumed that fifth year students may have a clearer interest of their field and vision about their career path, leading to the highest percentage on topics related to their field. On the other hand, the distribution looks slightly more even for the second-year students. This may indicate
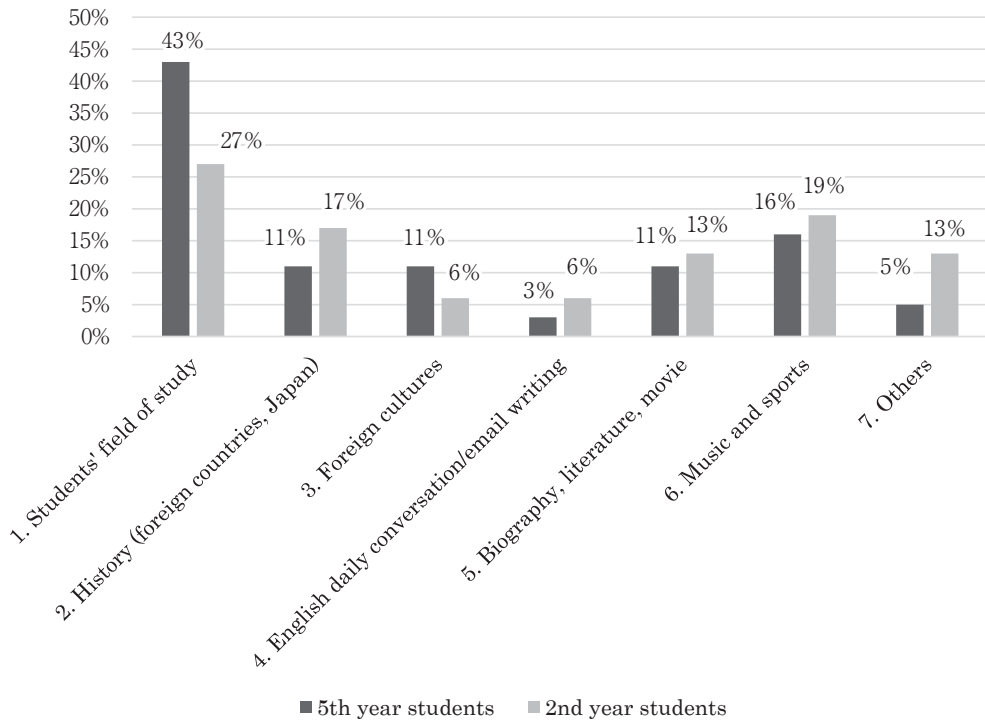
Figure 2 Fifth and second year students' interests in contents to be learned in English

that their interest is not as specified as their fifth year counterparts.

4.5 Summary of the findings

Through the interviews and questionnaire surveys conducted on 73 participants in total, it was found that the tasks related to reading was the most prominent and they were perceived as important from both teachers and students in the current NIT content classes. Through detailed interviews with domain experts, it was found that the teachers need to provide language support to help students understand the content. Taking their difficulty into account, English classes can collaboratively support students' language development. As for the possible themes/topics that could be dealt with in English classes, the content teachers suggested dealing with topics which are relevant to their field of study with the aim of familiarizing students with frequently used vocabulary and functions (e.g., explaining a graph). Although there was a difference in the number, both fifth- and second-year students found relatively more topics related to engineering suitable to be covered in English classes.

　For English classes at NIT to be responsive to students' fundamental language development and their specific English use in the later years, which was investigated in this NA study, a careful bridge with or appropriate continuation into specific English use for content classes should be planned and

implemented in the curriculum and syllabus level.

5. Theme-based unit development

Considering the five-year course of study at NIT, one of the possible ways to bridge the gap between the EGP classes for the first to third year students and more specialized English use for the fourth and fifth year students is to consult with content teachers and develop a bridge course. As a trial, a short theme-based unit (i.e., a group of lessons on one topic) which is relevant to the teachers' and students' field of study and hence prepares and motivates students toward learning a relevant topic was created and implemented as part of an existing English course for the third-year students from May to July, 2018.

This preliminary unit shown below is constructed based on the topic resulting from the current needs analysis. It is power generation (e.g., pros and cons of different methods used, proportion of each method used in the past, present, and future in Japan), which was one of the teachers' (T1) research field and appeared as a topic students are interested in in an open-ended item in the questionnaire (five written responses specifically mentioned power generation). For the author to gain knowledge in this field, relevant reading materials were obtained from T1 and the content was clarified with T1 as the author made the teaching materials. To provide rich, meaningful input, various source materials were chosen and integrated into the class (e.g., reading materials from websites of electricity companies, a brochure written by the Agency of Natural Resources and Energy, and presentation slides created by a researcher at a governmental research center, picture-vocabulary matching cards, a video clip created by National Geographic). Materials were presented to students as a form of handouts, power point slides and a video clip. Referring to Mohan (1986), the language and content objectives were set and graphics (e.g., charts, tables, pictures, illustrations) were used to organize the knowledge to be learned. The language objectives mainly targeted contrastive connectives and comparative forms which were necessary to learn the differences and similarities of each power generation method. Language features were highlighted with text enhancement (e.g., bold letters) and explicitly practiced after the content was sufficiently dealt with. The tasks utilized in the class focused on all four skills with relatively more time spent on receptive skills (i.e., reading, listening), using cooperative learning strategy mainly realized by pair works (i.e., sharing information and opinions by speaking and writing). Eleven 30-minute lessons were created. The key features (i.e., content and language objectives, tasks used, six categories of Mohan's knowledge framework) of the unit are summarized in Table 4.

Table 4 Key features of the preliminary theme-based unit

Unit	Content	Language	Tasks	Mohan's knowledge framework
1	Students identify and label different energy sources	Vocabulary (e.g., hydropower, electricity, coal, petroleum) Relative pronouns used to define each energy source	Brainstorm what energy sources there are Picture-description matching task	Description Classification
2~4	Students explain and give reasons for the changes of power generation methods used at three time points (1973, 2010, 2016)	Vocabulary (e.g., increase, decrease, remain the same) Comparative connectives (e.g., compared to, although, in contrast)	Label a pie chart Read a reading material and describe some noticeable changes in the use of power generation methods over time	Description Principles (cause/effect, explaining)
5~7	Students explain Japan's energy policy (S+3E) Students describe the pros and cons of thermal power and nuclear power generation	Comparative connectives (e.g., but, however, while) Comparative and superlative forms	Read and fill in a table describing characteristics of power generation methods Write a passage explaining pros and cons	Description
8~9	Students describe the pros and cons of renewable energy	Comparative connectives (e.g., but, however, while) Comparative and superlative forms	Watch a video clip and take notes on benefits and downsides of renewable energy	Description
10~11	Students predict the 2030 energy use	Vocabulary covered and expressions for compare/contrast	Write one solution to achieve the 2030 energy goal	Choice Analyze

6. Future direction and limitations

This study investigated the English use tasks in the NIT content classes and possible themes to be used in English classes which are relevant to teachers' and students' field of study. The results not only inform the design of an English course curriculum or syllabus at NIT but also that of a remedial course for students at an engineering department in universities. From the interviews with the content teachers, this study obtained detailed information about their practice related to content teaching and English use and their thoughts about the themes/topics to be dealt with in English classes, which is very limited in the previous needs analysis literature on engineering students in Japan.

Several limitations need to be mentioned. First, this study was conducted in only one department of one NIT, and the investigation into other departments may reveal different kinds of target tasks and the frequency to which students conduct the tasks. Second, although the topic was employed based on the NA as a very first step in the development of this preliminary unit, the tasks identified were not actually incorporated into the unit this time, and further development and application of pedagogic tasks based

on the tasks identified in this needs analysis needs to be conducted in the future.

Note（1）　Source × method interactions mean that the same data source is investigated with different methods and the same method is used to obtain information from different sources.

References

Brinton, D. M. (2017). Distant relations or kissing cousins? English for specific purposes and content-based instruction. In A. Snow & D. M. Brinton (Eds.), *The Content-based classroom: New perspectives on integrating language and content* (pp. 243–252). Michigan: University of Michigan Press.

Brinton, D. M. & Snow, M. A. (2017). The evolving architecture of content-based instruction. In A. Snow & D. M. Brinton (Eds.), *The Content-based classroom: New perspectives on integrating language and content* (pp. 2–20). Michigan: University of Michigan Press.

Brinton, D. M., Snow, M. A., & Wesche, M. B. (1989). *Content-based second language instruction.* New York: Harper & Row/Newbury House.

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

Fitzsimmons-Doolan, S., Grabe, W., & Stoller, F. L. (2017). Research support for Content-Based Instruction. In A. Snow & D. M. Brinton (Eds.), *The Content-based classroom: New perspectives on integrating language and content* (pp. 21–35). Michigan: University of Michigan Press.

Flowerdew, L. (2013). Needs analysis and curriculum development in ESP. In B. Paltridge, & S, Starfield (Eds.), *The handbook of English for specific purposes* (pp. 325–346). Chichester: Wiley Blackwell.

藤田卓郎（2017）．「工業高等専門学校におけるタスクシラバスの構築に向けたニーズ分析」『JABAET Journal』，21，5–33.

Halliday, M. A. K. (1993). Some grammatical problems in scientific English. In M. A. K. Halliday and J. R. Martin (eds.), *Writing Science.* (pp. 69–85). London: The Falmer Press.

長谷川由美（2015）．「大学で学びたい英語に関する一考察—遺伝子工学科１年生のアンケート調査より」『近畿大学生物理工学部紀要』，36，55–68.

小山由紀江（2016）．「特定目的のための英語（ESP）とニーズ分析—理論と実践—」石川有香，石川慎一郎，清水裕子，田畑智司，長加奈子，前田忠彦（編）『言語研究と量的アプローチ』（pp. 279–297）．東京：金星堂

Long, M. H. (Ed.). (2005). *Second language needs analysis.* Cambridge University Press.

Lyster, R. (2007). *Learning and teaching languages through content: A counterbalanced approach.* John Benjamins Publishing.

Lyster, R., & Ballinger, S. (2011). Content-based language teaching: Convergent concerns across divergent contexts. *Language Teaching Research*, *15*(3), 279–288. https://doi.org/10.1177/1362168811401150

Mohan, B. A. (1986). *Language and content.* Addison Wesley Publishing Company.

Nation, I. S., & Macalister, J. (2009). *Language curriculum design.* Routledge.

Parkinson, J. (2000). International Journal of Bilingual Education and Characterizing CLIL teaching : new insights from a lower secondary classroom classroom. *English for Specific Purposes*, *19*, 369–387. https://doi.org/10.1080/13670050.2018.1472206

Parkinson, J. (2013). English for science and technology. In B. Paltridge, & S. Starfield (Eds.), *The handbook of English for specific purposes* (pp. 5–30). John Wiley & Sons, Inc.

Sawaki, Y. (2017). University faculty members' perspectives on English language demands in content courses and

a reform of university entrance examinations in Japan: a needs analysis. *Language Testing in Asia*, *7*(1), 13. https://doi.org/10.1186/s40468-017-0043-2

Serafini, E. J., Lake, J. B., & Long, M. H. (2015). Needs analysis for specialized learner populations: Essential methodological improvements. *English for Specific Purposes, 40*, 11–26.

Stoller, F. L. (2008). Content-based instruction. In N. V. D.-S. & N. H. Hornberger (Ed.), *Encyclopedia of Language and Education* (2nd Editio, pp. 59–70). Springer Science + Business Media LLC.

杉浦理恵（2009）.「高等専門学校におけるタスクを中心とした英語教育の可能性―ニーズ分析に基づくタスクの開発―」『茨城工業高等専門学校研究彙報』44，7–16.

武知薫子（2014）.「ESP の新たな可能性の一考察―英語教育における他教科との部分的な科目間連携の取り組み」『近畿大学教養・外国語教育センター紀要 . 外国語編』5，157–173.

West, R. (1994). Needs analysis in language teaching. *Language Teaching*, *27*(1), 1–19.