What Do Mathematics and Physics Students Need from Learning English?

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Abstract: English is a compulsory subject that must be taken by all undergraduate students including students of Mathematics and Physics (MP) education. English teaching content and approach for MP education students should be appropriate and support the students' achievement of learning outcomes. This study would like to reveal what content and skills are required by the students related to English classroom. This research is a preliminary study with Cross-Sectional Survey method. The main findings of this research are (1) the difference in the main contents of learning English for every department (2) the importance of need analysis in determining English learning content and approaches for each department (3) the need for collaboration between English and content lecturers in preparing the syllabus. This study concludes that English classroom in MP Education Department should be adjusted to the students' needs and the learning outcomes of the department. This research recommends the establishment of team teaching for English classrooms.

1 INTRODUCTION

As a lingua franca, English life plays an important role in International relations. The dynamic globalization of economics, politics and socio-cultural developments have promoted the use of English as the language for communication between individuals and groups, including in higher education environments (Wilkins and Urbanovič, 2014). On that basis, many universities in the world, including Indonesia, put English a compulsory subject in the curriculum of education, including Mathematics and Physics (MP) education (Indonesia, 2005). To answer the need, English for Academic Purposes (EAP) is offered.

According to Flowerdew (2016), EAP is one of two main branches of English for Specific Purposes (ESP). Simply, EAP is defined as English Teaching which is related to the purpose of a study (Dudley-Evans et al., 1998) or English for non-native in an academic context (James, 2014). EAP/ESP evolved as a pragmatic solution to accelerate the integration of non-native English speakers into professional and academic disciplinary discourse communities. EAP has developed theories, methods and frameworks to investigate and illustrate the practice of teaching and learning from various disciplines and linguistic backgrounds (McGrath and Kaufhold, 2016). Finally, through the pedagogical applications derived from Intercultural Rhetoric, English as

Lingua Franca (ELF), and translingualism, EAP/ESP in the global world continues to grow and develop (McIntosh et al., 2017).

Theoretically, EAP is related to the research and teaching of English required by those using the language to perform academic duties (Charles, 2013). EAP is an interdisciplinary approach to an English instructor and a teacher of a particular content discipline (Tatzl, 2015). The learning of English in an academic set is based on the principle that what students learn must be associated with their expected goals after learning (Akbari, 2016). Therefore, English language learning in MP departments should consider course content and learning outcomes.

In MP departments, English is a compulsory subject taken at the first level. Time allocation for an English classroom is only 100 minutes per week. With a limited amount of time, it is very difficult for lecturers to provide their students the best learning. In fact, many competencies must be owned by students. Therefore, appropriate strategies are needed to choose. Materials which are relevant with students' needs and support their classroom are selected as well.

This research begins with a preliminary study in a department of MP education at a public university in Indonesia. The results of the preliminary study show that 68.5 percent of students stated that the English content they learned was not relevant to

their needs. One reason is that teachers do not perform the needs analysis. In fact, the assessment of learning needs is an important stage in the education process (Grant, 2002).

Previous studies have reported that needs analysis is an important part of the decision-making process related to course design specifications (Bosher and Smalkoski, 2002). It is even considered an indispensable component of the ESP course (Long, 2005). Through the needs analysis, the English teaching context will combine academic skills with subject-specific skills that derive directly from the subject disciplines of learners (Jordan, 2010). Ultimately, the development and implementation of a need-based ESP course and experimental syllabus can be considered highly effective in improving learners' performance and promoting their achievement in ESP regardless of their level of competence in general English at the beginning of the course (Chostelidou, 2011).

The English learning approach that takes into account needs analysis is expected to facilitate learners in the process of mastering the academic aspects and specific subjects of the target language as well as motivating them to be actively involved in the ESP course (Chostelidou, 2010). Seeing the importance of needs analysis, through the survey method, this research would like to express MP education students' needs toward English learning.

2 METHOD

The method used in this research is Cross-Sectional Survey method. According to Fraenkel (2009), this survey is used in order to collect information about samples depicted from predetermined populations. There are three characters of this survey. First, information of a group of people is collected to describe some aspects or characteristics to be known. Second, the main way chosen to capture data are to ask questions. Third, information is collected from the sample representing the population.

In education, Creswell (2012) divides the Cross-Sectional Survey into four forms: (1) examining the attitudes, beliefs, opinions and selected as well, (2) comparing two or more education groups in terms of attitudes, certain beliefs, opinions and practices, (3) measuring community needs for educational services related to a particular program, (4) evaluating the program and (5) large-scale assessment of a policy. In this study, the use of cross-sectional survey aims at evaluating English courses that have been done (type 4).

Data are processed and presented using descriptive statistics. This statistic analysis aims at describing the main needs desired by MP education students in learning English. The subjects being the research sample were 70 students representing two majors – Mathematics and Physics. Each major is represented by 35 students. The subjects are from 5th or 7th semesters of each department. Determination of research sample using the purposive technique. The reason for such sample sampling is to get a complete picture of what they have learned and experienced. Hopefully, they can optimally expose their experience in English classrooms. It involves teaching-learning content, method, and relationship between what they learn and their activities in classroom.

The used research instruments were questionnaires and interview guidelines. Questionnaires are used to capture quantitative data onto sample responses to English content that has been taught by lecturers, the chosen method and the relevance of content to the academic needs and the needs of students from each department. In addition to quantitative data, interview was conducted to explore their attitudes and expectations of learning English. The results of questionnaires and interviews were discussed in the Forum Group Discussion (FGD) of fellow researchers for more confirmed interpretation.

3 RESULT AND DISCUSSION

3.1 Primary English Learning Content Required

In general, English skills are grouped into four main clusters, namely reading, writing, speaking and listening. For students majoring in English, mastering the four competencies is a must. Without a needs analysis, all these competencies must be followed and mastered. However, in the end, everyone will choose certain skills for his professional path.

For students of MP education, the selection of their English competence will be tailored to the needs of their field. There is a priority scale - which competencies should be taken as a precedence and which competencies can be set aside or delayed first. Although each student has his or her own opinion, with simple survey and statistical methods, we can see the concentration of data from the subjects we

surveyed. Figure 1 below shows the MP Education student response to the main content they need.
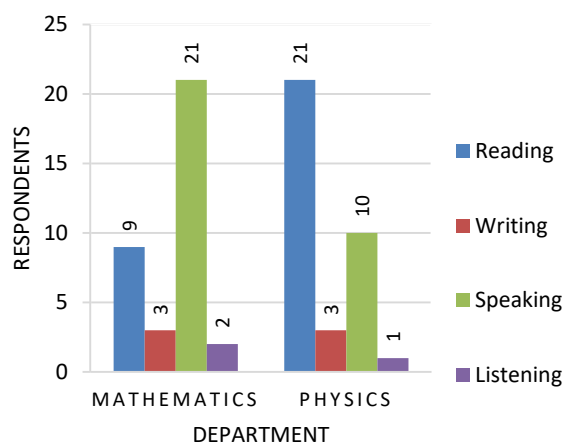

Figure 1: MP education students' response to the main content of learning English

The figure above shows that the majority of math students want that the main content of English to be learned is speaking (60%), reading (25.7%), writing (8.6%) and listening (5.7%). In contrast, for physics department students, the main content to be studied is reading (60%), speaking (28.6%), writing (8.6%) and the rest listening (2.8%).

Both students of the mathematics department and physics wanted the two preferred English skills, namely speaking skills and reading comprehension skills. These two capabilities are the priority scale required by the students. Speaking is an important language skill for effective means of communication. Mastery of speaking will increase students' confidence in communicating (Boonkit, 2010). Moreover, reading ability has proven to mediate mathematics and other sciences over time (Barnard-Brak et al., 2017).

Different results can be found for other courses. The study of (Aliakbari and Boghayeri, 2014) reported that in the architecture department of Ilam, University in Iran, reading comprehension was recognized as the most important skill, followed by writing, speaking, and listening respectively. Another study by (Dehnad et al., 2010) states that ESP learners in their research site expressed their first-required skill is writing, followed by reading, speaking and listening.

These data show that the analysis of English requirement in one department is not identical with other majors. Results in one place cannot be generalized to other places. The results shown in

Figure 1 are the results of preliminary research. With a simple survey method, of course, the revealed results are less valid, therefore external evaluators also need to validate their credibility and objectivity (Kazar and Mede, 2015).

3.2 The Needs for English Skills in the MP Education Department

The idea of the importance of learning English has been started by (Munby, 1978) with the term "communication needs processor". It is followed by West (1994) with the term "analysis of needs", until the publication of the book *Introducing Need Analysis and English for Specific Purposes* by (Brown, 2016). The thought or idea revolution shows how important the needs analysis of English learning is. Needs analysis has long been debated as a prerequisite for the design of English curriculum and syllabus (Malicka et al., 2017).

Because ESP / EAP requires comprehensive needs analysis (Gatehouse, 2001), the first and foremost thing that an English lecturer should do in MP education is to analyze stakeholders' needs in their classrooms. Under normal conditions, needs analysis should be performed on students who will take English courses. In practice, however, the first batch of students have not fully understood what English skills are required by them during their lectures in their majors. Consequently, the research subjects are from the higher semesters to get complete information about what MP students exactly need.

Table 1: The needs for English skill in MP education

Skill	The Need for English
Reading	▪ Reading the textbook ▪ Reading the PC programming language ▪ Reading papers/journals ▪ Reading the manual book from practicum tool ▪ Understand the names and abbreviations of the physics quantities
Speaking	▪ Presentation of international conference ▪ Discussing in a scientific forum ▪ Communicating through social media with foreigners ▪ Teaching at International schools, ▪ Further study abroad

Needs analysis in this research is done through a number of questions in the questionnaire which is followed up with interviews. Based on the questionnaire answers and interviews for several samples, the information needs mapping of MP Education students in English classroom is shown in Table 1. It is a summary of the questionnaire results and in-depth interviews to a number of students. It only includes the mainly required skills, namely speaking and reading. It does not mean that writing and listening are not important but the two skills are less prominent.

3.2.1 Reading Skill

There is no theory of reading because reading has too many components for a single theory (Perfetti and Stafura, 2014). At least, there are three disciplines that have the most direct application for the understanding of mental processes in reading, namely cognitive psychology, linguistics, and artificial intelligence (Spiro et al., 2018). In view of cognitive science, reading comprehension is complex, consisting of a combination of several sub processes and functions. This complex cognitive process opens up an interdisciplinary study space between theorists and practitioners (Kendeou et al., 2016) and inspires collaborative work between English teachers and content teachers, in articulating and conceptualizing instructional goals, and building shared knowledge to meet the diverse needs of culturally and linguistically diverse students (Martin-Beltran and Peercy, 2014).

An important part of facilitating reading ability is the selection of a learning context. It is important to choose the appropriate reading because students will understand more authentic academic readings when they are relevant to the disciplines they are taking, even if their English skills are low (Uso-Juan, 2006). However, great care must be taken when transmitting academic content of a foreign language. Supported explicit instructional language is required for effective learning (Roussel et al., 2017).

Relevant context and reading themes from English language learning are suggested to carefully select in MP Education department. The cooperation of English lecturers and content lecturers in designing and implementing contextual learning is necessary (Silver and Png, 2015). For example, for the physics department, the learning context that can be expressed in reading lessons is the story of how Newton formulates the laws of motion of objects or an extracts of textbook, like the book of Basic Physics by Halliday, Resnik, and Walker or the book

Calculus: Concepts and Contexts by James Stewart in the mathematics department.

Making contextual reading material is not enough. Huang (2006) states that learners will be willing to read in three situations: (1) a lecturer is available to answer questions. Lecturers should provide individual consultation services. When the teacher asks the student to read, he knows the purpose of the instruction. When a student has difficulty reaching that goal, he knows who to ask. The answer given by the lecturer must reflect the way that must be taken so that students come to the expected ability ; (2) the key points are clearly highlighted in the textbook. It is suggested that lecturers make relevant teaching materials. The teaching materials are specially designed for a particular department context. The theme is in accordance with the department, whereas the instruction is in the best interests in the English language and (3) the reading skill is taught. Another part that is not less important is that the lecturer should provide tips and tricks related to how to read. One of the tips that can be done is a metacognitive reading strategy as doing by (Reza Ahmadi et al., 2013). Metacognitive reading strategy is one of the important factors to facilitate reading comprehension of students.

In addition to proper contextual selection, improved reading ability depends on the vocabulary. Vocabulary plays a crucial role in early inference making and literal comprehension (Lai et al., 2014). Students who have a lot of vocabulary will have many opportunities to proficient in reading comprehension. The collaboration of vocabularies possessed with the ability to apply in appropriate contexts will improve reading comprehension skills as appropriate.

3.2.2 Speaking Skill

The main reason for poor speaking skills in students are their unwillingness to communicate due to many factors. Overcoming language barriers and building a strong will to communicate to allow students to be fluent speakers and not afraid to communicate under any circumstances (Kitchenko and M.P, 2017). Require strategies and appropriate methods to train speaking skills for students MP education especially related to their needs in supporting academic activity.

Speaking skills for MP education students are more emphasized in public speaking especially when they have to present research results of International conferences or communicate with

lecturers and researchers from abroad. Therefore, the approach of learning English in the classroom is dominated by the practice of speaking. Previous research has demonstrated the effectiveness of several learning methods in improving speaking skills such as through self-correction behaviors (Kormos, 1999), peer teaching (Rodriguez-sabater, 2005), learner-learner interaction (Saeed, Karwan;Khaksari, Mahta;Eng, Lin;Ghani, 2016) and drama (Barlow, 2013). All research results reinforce the importance of speaking practice, both in the classroom and outside the classroom.

Bordering on reading skill, speaking skill also requires a lot of vocabulary. Bahrani (2012) state that developing speaking proficiency requires more than just that the language learners are exposed to a pool of vocabulary and grammar descriptions. It takes a spectacular way for students to find a quick and effective way to collect as many vocabularies as possible.

Compared to other skills, speaking skills, as an active, dynamic language skill, may be strongly affected by demotivating factors. That factors including teachers, peers, materials, etc. (Soureshjani and Riahipour, 2012). Therefore, in order to improve this speaking skill successfully, cooperation and effort together both lecturers and friends during the learning process are required. Keywords for speaking skills are practices, practices, and practices – practices in class, at home and wherever he is and with whom he speaks are important.

Learning English in the majors of MP education is in a non-English speaking setting, therefore it is very important for students to express their own views and opinions, and to develop their oral fluency and accuracy which are essential for the successful communication. Classroom interaction, then, is necessary and useful as an educational strategy to enhance learning (Porhossein, 2014). In short, among all four key language skills, speaking is deemed to be the most important in learning a second or foreign language (Bahadorfar and Omidvar, 2014).

3.3 Designing the English Learning Syllabus

The further action of needs analysis is the design of English learning syllabus. The preparation of the English syllabus in the MP education Department involves two parties, namely 1) English lecturers that teach English learning techniques and methods

and 2) content lecturers who discuss the context of learning needs analysis results. A complete range of needs analysis and syllabus formulation can be seen in Figure 2.
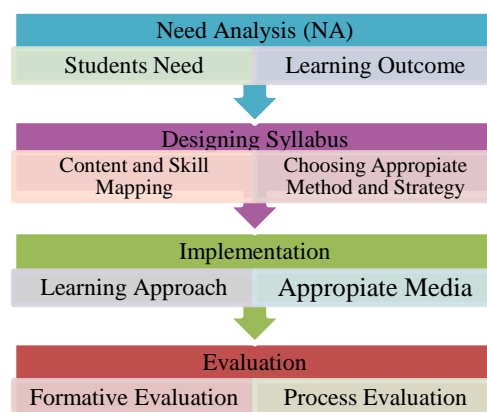

Figure 2: English learning design process in MP education

Stages of need analysis and designing syllabus (limited line of strict) are done before the teaching and learning practices. However, it is not possible to change the syllabus in the middle of the practice. Meanwhile, the sectioned implementation and evaluation is done at each meeting. From the implementation and evaluation, the change of syllabus can be done.

In the implementation phase, the first and foremost step in language learning is to cultivate learning motivation. In the current era of information technology, the use of online media can be an option. One of them is through podcasting (Asoodar et al., 2016), memorization of English sentence using ICT (Kitagaki, 2012) or mobile social networking (Sun et al., 2017).

Meanwhile, to reduce the saturation of learning, lecturers can use various methods, such as the use of blended learning – the combination of traditional methods (face-to-face interaction) and online learning (Thang et al., 2012) and different creative activities (Idrissova et al., 2015). Both of these methods have been proven to help improve the quality of language learning.

The evaluation stage is no less important. This section is needed as a means of reflection and measures the effectiveness of learning, both in terms of process and learning outcomes. Habib (2016) show that reading comprehension assessment is very important to English teaching because it provides important information about student's weakness, needs, constraints, and deficits. Thus, teachers can

apply appropriate techniques and use assessment results to change their classroom instruction and improve learning ability. The best way to assess reading comprehension are to use a combination method (Klingner, 2004). It takes joint efforts to develop assessments that help the identification of difficulty source and design of instructional approaches to prevent or correct this difficulty (Kendeou et al., 2016).

4 CONCLUSIONS

To get the appropriate English learning for the MP education students, needs analysis is a must. The result of this requirement analysis becomes the basis of English lecturer to arrange syllabus and instructional design. Coordination and collaboration between English lecturers and content lecturers is urgently required.

Based on the needs analysis, reading and speaking skills are the two first-prerequisite skills of the students. This need will be facilitated in syllabus preparation, instructional design, implementation, and evaluation. Practical and targeted English learning has been shown to significantly improve students' ability to communicate and socialize in the community (Şen et al., 2014).

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