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Need Analysis of English for Mechanical Engineering

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ABSTRACT

To conduct an ESP instructional program, it is important to analyze the current situation of the students and the objectives of the program. This study explored the need analysis of English for mechanical engineering at Adisutjipto college of technology, Yogyakarta. This department offers aircraft maintenance, manufacture and material, and energy conversion majors that require the English instruction covers the needs of those concentrations. The data were collected from the students, lecturers, tracer study, and academic affairs officers by distributing questionnaire, interviewing, and observing the classroom activities. The finding showed that the compositions of the three concentrations and should involve aerospace engineering materials, the presentation of the materials should focus on the language skills development based, the teaching technique should involve classroom and digital instructions and the instruction should be outcome-based education (OBE).

Keywords: need analysis, ESP, mechanical, aerospace, engineering

INTRODUCTION

As one of the new developing universities in Yogyakarta, Adisutjipto College of Technology holds the vision of being a qualified college in developing technology and aerospace also being competitive in South East Asia. Mechanical engineering is one of the six departments to prepare the students ready to work either in mechanical or aerospace engineering with three concentrations; aircraft maintenance, manufacture and material, and energy conversion. Considering the demand for mastering English for mechanical engineering, English for specific purposes (ESP) appears to facilitate the students well prepared to face the global competitiveness in their professional development.

In relation to the recent paradigm, the educational program should rely on outcome-based education (OBE). Ristekdikti (2018) states that OBE is an educational system focusing on the learners' skills and abilities after they experience the learning program. Macayan (2017) adds that OBE should develop not only the success of learners academically but also in their real life. In ESP

context, developing effective materials should be started with a need analysis that will be used as the foundation of syllabus design and material development. It is a challenging job of a mechanical engineering course developer to identify the needs of the learners and then design the specific course (Basturkmen: 2010). This research is intended to identify the components that should be in the design of the English course materials for mechanical engineering purposes to facilitate effective instruction. By this need analysis, the improved curriculum is expected to give better English instruction.

The narrative of the keywords is interpreted. Teaching English for non-English department students is called English for specific purposes (ESP). The students are taught to complete the tasks in which the contexts are from the professional environment that the students are familiar with (Huhta, et al. 2013). The ESP purpose is not only to develop the language skills however to meet the objectives derived from the need analysis. Integration between general English and ESP are expected to facilitate the English instruction proportionally (Chen, 2008). Basturkmen (2006) states that subject-specific language and target performance competencies are the two main objectives of ESP. ESP is distinguished into EAP (English for Academic Purposes) and EOP (English for Occupational Purposes). Since there are a lot of fields need ESP it is distinguished into various professions such as business English, tourism English, engineering English, and agriculture English (Belcher, 2009). This study took the EAP to prepare the students to effectively learn English for mechanical engineering.

Need analysis is needed in an ESP study to get the data of what the students require to achieve that the course design might be developed in order to meet the goal of the instruction. Morrison, et al. (2004) introduce learners and contextual analysis and task analysis in designing effective instruction. Kaur (2007) adds the benefits of needs analysis in developing language curriculum. ESP instructors must start the instruction with needs analysis that is collecting and analyzing students' information in order to set objectives and appropriate content for a language curriculum. In addition, Ayoub & Khan (2017) say that need analysis is a technique for approaching learning or executing gap. It covers selecting the crucial needs and the most effective techniques to address them.

Hutchinson and Waters (1987) describe the difference between target needs and learning needs. Target needs are the goals the learners need to meet in the target situation. The target needs can be identified from the necessities of the learning, lacks, and wants. The learning needs are the learning situation that the learners prefer to learn effectively. In conclusion, an ESP is an English instructional program in which the execution should be based on the need analysis to gather the data of the learners' characteristics, the learners' needs, the learning needs, and the target needs.

Dragoescu and Sandra (2010) describe the main fields of mechanical engineering taught generally as mathematics, thermodynamics, fluid mechanics, material science, system & control engineering, information technology, electronics, product life cycle, management, economics, and communication. In addition, aerospace fields are introduction to aerospace, aerodynamics, aircraft propulsion, aircraft construction, aircraft materials, aircraft maintenance, aircraft hydraulic pneumatic system, aircraft power plant maintenance, engine supplement system, aircraft system, and propulsion maintenance technique.

There are two previous studies discussed. Hossain (2013) concerns needs analysis in English for specific purposes. He describes the needs and wants to require effective professional communication particularly in English writing and speaking proficiency for engineering students. In addition, a similar study was conducted by Ayoub & Khan (2017). They describe a needs analysis as in the undergraduate engineering students. Their research attempts to explore the English usage frequency, its significance for the students, their current level of English competence and their English language needs. The results showed that the students have positive attitudes towards learning English.

The needs analysis approach suits to this study is the theory proposed by Miyake and Themarco (2005). They summarize the components of needs analysis are 1) target situation analysis and objective needs, 2) wants, means, subjective needs, 3) present situation analysis, 4) lacks, 5) learning needs, linguistic analysis, discourse analysis, genre analysis, 6) the course goal, and 7) means analysis. Therefore, the framework involves the theory of ESP and related topics in mechanical engineering field.

METHOD

A survey study was carried out to collect the information about the learner characteristics, the target need, the learner need, and the learning need. As Otilia (2015) cites, the learning objective of an ESP is more adaptable than in the general English in which the students are generally more motivated in learning the related subject matters. Neuman (2000) adds in a survey many people (called respondents) are confirmed about their beliefs, opinions, characteristics, and behavior through the same questions. The research was conducted from June to August 2018 in the Mechanical Engineering Department, STT Adisutjipto, Yogyakarta. The instruments were 1) student questionnaires, 2) interviews from the senior lecturers and the academic officer, 3) observation during the course and 4) the tracer study data.

After collecting the entire data, each instrument was analyzed. The first step was analyzing the questionnaire responses. After the table had been completed, the data were described. Secondly, the result of interviews with the senior lecturers and the academic officer were analyzed to find deeper information. Thirdly, the result of observation during the course was analyzed to see the appropriate materials and techniques of the future program. Fourthly, to enrich the data of the alumni, the tracer study was analyzed. After completing the four instruments, the conclusion was inferred to make the general description of the need analysis of mechanical engineering English.

DISCUSSION

1. Description of the Learners

There were 62 students were in the English class in the academic year of 2017/2018. The ages ranged from 17 to 24 years old. Few of them

repeated the subject due to the low mark in the previous semester and most of them were the freshmen. They were from vocational schools (mechanical and aeronautical engineering departments) and senior high schools (natural science departments) of many provinces spread in Indonesia. One of them took a year pilot training program in the United States of America that he has better English competence than other students. In conclusion, their English competence is heterogeneous.

Based on the observation, the heterogeneous also lies in the economical background and learning motivation. Half of them were from the low middle economical family background and half of them were from high middle economies. This aspect affected learning motivation. Some students are engaged who are disciplined and have high respect for the lecture. On the other hand, some students are not engaged who just come and leave the class that encourages the lecturer to make the class as engaging as possible. Sometimes, they are engaged by group work and activities using mobile applications.

Because the students belong to the millennial generation, they love digital technology. They are more engaged when English instruction is conducted using digital tools than traditional media. They prefer assessing pdf to reading the printed materials. They prefer opening Wikipedia to get certain definition of opening the printed dictionary. They are even more engaged in video record their conversation than practice the conversation in front of the class.

2. Description of the Target Needs

The target needs were analyzed from the college's vision, department curriculum, and the interview. The vision of the college is being a qualified college in developing technology and aerospace also being competitive in South East Asia. To master the technology and aerospace, English as seen as the language medium. As we can see, many scientific resources about both subjects such as books, articles, journals are written in English. To be competitive in South East Asia, the students also need to have good English competence. Thus, to realize the vision, English plays an important role to help the students learn technology and aerospace and being competitive in South East Asia.

Specifically speaking, the vision of the mechanical engineering department is being a qualified mechanical engineering department, contributing to education, research, and community service and developing technology based on the aerospace field. Based on the interview with the two senior lecturers, English subjects might contribute to the educational goal. Reflecting the previous English curriculum in which it only taught the aerospace fields, the newer English curriculum should accommodate the three concentrations balanced and involve the activity using internet-based like the mission of the digital 4.0 era.

Considering the OBE trend, since the English lecturer is not from a mechanical engineering educational background, the materials of the English instruction should be carefully selected that the students are well taught and able to perform the skills and abilities after experiencing the English

instruction. It is not a matter of how many the materials have given but how deep the students learn. In addition, the English subject should prepare the alumni ready to hunt for a job in English that the students should be taught how to write an application letter, curriculum vitae, and practice a job interview. The senior lecturers also suggested to include the topics which frequently appear in the student's final project such as pipe and pipeline.

To enrich the target needs data, the interview was carried out to the academic officer. The result was selecting strategic materials and teaching techniques were two important things in the need analysis. Reviewing the strategic careers after the students graduate from, the English instruction might contribute to teach the materials which are needed in the industrial work field such as the standard of safety. Also, the presentation of the materials should accommodate the 4Cs; communication, collaboration, creativity, and critical thinking.

3. Description of the Learners' Needs

The learners' needs have analyzed the lacks and want from the classroom observation and the questionnaires. The lacks found from the observation is that some students have the background about mechanical engineering and aerospace (the students from vocational schools) and some do not have. In the classroom observation, it was found that most students are mobile phone users and Internet literate. Therefore, to adapt their millennial life, the presentation of the material should involve the activity of accessing the internet. To gain the data of the selected materials, students' questionnaires were distributed with the following results. The topics were based on the theory proposed by Dragoescu and Sandra (2010) and the spread of concentrated subjects.

Table 1. Questionnaire result of the materials

No	Topics	Agree	Disagree
1.	mathematics	42	8
2.	energy and temperature	44	6
3.	fluid mechanics	39	11
4.	material technology	43	7
5.	tool	46	4
6.	information technology	38	12
7.	electronics	35	15
8.	product life cycle	32	18
9.	future career	46	4
10.	aerodynamics	47	3
11.	pre-flight	47	3
12.	aircraft construction	49	1
13.	control surfaces	43	7
14.	basic flight instrument	50	0
15.	flight line	43	7
16.	aircraft control system	50	0

The questionnaires described that most students agree with the proposed topics. Only fluid mechanics, information technology, electronics, and product life cycle got under 40 agreed students that these topics needed to be considered more to develop.

The unit design was summarized from the second questionnaire. The presentation design is started from the attention-getter section and followed by the written cycle section and then the spoken cycle. The vocabulary section is integrated into the written cycle in which the terms are taken from the text. Meanwhile, in the spoken cycle, the focus is on the students speaking performance.

The result is most students prefer the written cycle tasks in terms of reading, vocabulary enrichment, and in the spoken cycle, the students prefer listening and answering the listening comprehension tasks. They are not really interested in the grammar section and speaking performance because they thought that the focus of mechanical engineering English is on the technical terms development.

Table 2. Questionnaire result of the presentation of the material

No	Components	Agree	Disagree
1.	Title	49	1
2.	Attention-getting opener	39	11
3.	Glossary and phonetic transcription before reading text	34	16
4.	Reading text	43	7
5.	Finding the meanings of the difficult words from the reading text	42	8
6.	Answering comprehension questions from the reading text	44	6
7.	Vocabulary knowledge presentation	48	2
8.	Using newly-introduced vocabulary in sentences	42	8
9.	Grammar knowledge presentation	28	22
10.	Grammar practice in small groups	34	16
11.	Grammar practice independently	37	13
12.	Listening to a model monologue/ dialogue	44	6
13.	Answering comprehension questions from the monologue/ dialogue	45	5
14.	List of expressions being introduced	35	15
15.	Task aims at practicing creating monologue/ dialogue	35	15
16.	Evaluation task – performing the monologue/dialogue	35	15
17.	Self-assessment sheet	38	12
18.	Technical terms list	42	8

4. Description of the Learning Needs

The learning needs are related to the learning situation suitable for the students. This is the final finding of what the need analysis is like. Considering the data from the students' questionnaire, classroom observation, senior lecturers interview, academic officer interview, and tracer

study the selected materials are put into the semester learning plan or *Rencana Pembelajaran Semester* (RPS) as follows:

Table 3. Semester learning plan

No.	Topic	Objective
1	Mathematics	Using numbers and reading mathematical operation
2	Energy and heat transfer	Describing types of energy and heat transfer
3	Material types	Identifying material types
4	Material properties	Identifying material properties
5	Tools	Identifying tools
6	Pipe	Describing pipeline components
7	Safety standard	Describing working safety standard
8	Aircraft components	Explaining basic airplane structures
9	Cockpit and flight instrument	Explaining flight basic instrument in the cockpit
10	Taxiing	Describing ground parts
11	Flight principle	Describing flight principle
12	Pre-flight check	Explaining the activities in the pre-flight check
13	Application letter and CV	Identifying application letter and resume
14	Job interview	Identifying questions in the job interview

Meanwhile teaching and learning technique is a lecture, discussion, group work, and MALL (mobile assisted language learning). The unit design of the material presented and the technique is presented as follows.

Table 4. Unit design

No.	Components	Activity
1.	Title	Discuss the title
2.	Attention-getting opener	Ask questions to prepare the students ready to start
3.	Reading text	Discuss a passage about the related title
4.	Finding the meanings of the difficult words from the reading text	Ask the students to access their internet to find the difficult words
5.	Answering comprehension questions from the reading text	Group work to discuss the answer
6.	Vocabulary knowledge presentation	Drill the vocabulary using MALL
7.	Using newly-introduced vocabulary in sentences	Group work to compose sentences
8.	Listening to a model monologue/ dialogue	Prepare the supported video then play the listening recording
9.	Answering comprehension questions from the monologue/ dialogue	Group work to discuss the answer
10.	Task aims at practicing creating monologue/ dialogue	Group work to video record the dialogue and assign to submit by an internet application
11.	Technical terms list	Drill the vocabulary using MALL

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CONCLUSION

This chapter describes the conclusion of the need analysis of English for mechanical engineering students in STTA. The need analysis reveals what the students and lecturers expect and reflect the industrial career need from the tracer study data. The results are as follows: (1) The English instruction is intended to facilitate the students qualified in mechanical and aerospace engineering; (2) The materials represent the three concentrations; aircraft maintenance, manufacture and material, and energy conversion and also the job hunting preparation; (3) The focus of the instruction is outcome-based education (OBE) that should pay attention to the final competence; (4) The unit design is reading, vocabulary enrichment, writing, listening, and speaking; and (5) The activity involves lecture, discussion, group work, and mobile assisted language learning (MALL).

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