Material Development of English For Chemistry Subject Based On The Needs Analysis of Students’ in Chemistry Education Study Program

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Abstract. The increasing demand for international communication and competition in the global work field have required someone to not only being competent in their major field of study, but also competent in English language as the international media of communication, in both oral and written form. Hence, it is crucial that the English Language learning in University must be able to provide a comprehensive and professional English that not only relevant to their field of study but also meet the demand and needs of the target learning and work field. It is unfortunate that the process of learning English, particularly English for Specific Purposes (ESP) classes at the University level do not meet the basic competence and learning outcome as prescribed and expected. Lack of lesson planning, unmet needs and expectations of learners and teachers as well as irrelevant material to the field of the study, are found to be some of the influencing factors contributed to the success of the expected teaching and learning in ESP class. Based on this fact, it is important to conduct a study that put more emphasis in identifying learners’ needs (Needs Analysis). This is particularly useful to facilitate the expectation of the learners to have an English class that is relevant to their field of study. In line with this aim of the study, this current research was conducted in Chemistry Education Program of Pattimura University where the ESP subject has been inserted in the curriculum under the subject of English for Chemistry since the year of 2017. Thirty-three students were involved as the participants in the survey by answering 20 items provided in the questionnaire. The result shows that the majority of the students (39.4%) admitted that they would be interested in learning English if the materials are relevant to the Chemistry study, but still has the linguistics elements in English. This finding was also supported by 69.7% of the respondents who said that they would be motivated in learning if the teacher uses contextual English materials in Chemistry that are possible to be implemented in their daily life. Additionally, students also gave several suggestions for the improvement of English Learning in terms of the focus of English
skill, the approach and activities in learning. These findings are principally constructive as the input to design and/or develop the English material (Material Development) that will be used to teach English for Chemistry subject in Chemistry Education study program.

Keywords: Needs Analysis, Material Development, English for Specific Purposes, English for Chemistry

1. Introduction

The competition and demands from the work field for a qualified employee requires the higher education institute to produce graduates who can compete in the global world. In relation to this work field, it is undeniable that the foreign language mastery such as the English Language, either written or oral, is one of the most important and sought-after criteria in a graduate. Therefore, curriculum for the courses in higher education which are implemented in textbooks must adhere to the competence needed to produce competence graduates not only for the subject matter but also competency-based skills needed for the work field.

In the higher education system especially in Pattimura University, English Course is categorized as General Course (MKU) which is compulsory for students in all faculty and department. This means that student from non-English departments must also passed this course as the requirement to graduates. Thus, keeping in mind the imperativeness of English course, it is necessary to develop English textbooks which suited the competency goals and graduates professional subject matter pertaining to the specific departments or faculty. As English course in this context is categorized into English for Specific Purpose (ESP), thus the course has to be designed and conducted based on the need of the learners [1]. To understand the specific need of the students in this study, Kusunomoto (2008, in Fitriana 2015) suggested to conduct a need analysis as an important first step to develop the curriculum. Need Analysis is a procedure commonly used to gather information on the need of students [2,3,4,5].

The need for English Textbook for specific and purposeful for subject matter is imperative because, for example, English need for Mathematics and Science students are different than the economics students. The different needs impacted the content of textbooks for English Course.

On the other hand, these needs presented teacher/lecturer with a challenge to choose the right English Study Textbook that is suitable and contributed to the subject matter that students are studying. Moreover, the textbook must not only suitable with the subject matter but also to the level of students’ ability and needs. This study focused on English for Chemistry Course where lecturers are more than often struggle to construct a tangible course content that is suitable for Chemistry student of FKIP Pattimura University. Puspitasari (2013) suggested that this struggle steamed from several problems [6]:

Science And Education For Improving Learning Quality In Moluccas Archipelago
Most English for Chemistry Textbooks are Non-Indonesian production textbook. Local or national production of these textbook which are deemed much easier to be understood by the Chemistry students are not easy to find.

Due to the problem above, the level of difficulties of the course content and the textbook are not suitable for the specific need and ability of students in Ambon and Maluku.

Based on the background above, the formulation of the problem of this study are:

1. What are students of Chemistry Study Department’s perspective on the teaching and learning of English for Chemistry Course?
2. What is the need of Chemistry Study Department’s students in relation to English for Chemistry Course content?
3. How are the production process of English for Chemistry Course textbook (draft) based on the students’ need analysis?

This study was limited to the development of draft textbook for English for Chemistry Course based on the need analysis of students of Chemistry Education Study Program batch of 2017 of Faculty of Teachers Training and Educational Sciences (FKIP), Pattimura University.

The main objective of this study was to collect the feedback of the students on the teaching and learning of English for Chemistry Course, students’ need on the content lesson and the development of draft textbook based on the need analysis of the students.

2. Methods

The location of the research was in Chemistry Education Study Program, Faculty of Teachers Training and Educational Sciences (FKIP), Pattimura University. Participants of this research were students of Chemistry Education Study Program batch 2017 who enrolled in English for Chemistry course. The reason to choose batch 2017 was based on the consideration that this is the first batch to enroll in the English for Chemistry, therefore, information obtained from their need analysis is beneficial for the development of future textbook for English for Chemistry.

The instruments used to do the need analysis was a 20 items questionnaire which are divided into two parts. Number 1 to 7 is to obtain information about students’ general opinion on the importance of learning English, the reason, benefit, challenges, solutions, and factors that effected learning as well as the weakness in learning English. Meanwhile number 8 until 20 is the section for student’s need analysis for English for Chemistry course. This section obtains information on aspects that will support learning achievements in the study program, relevant English Content with the specific sciences, assessment on the materials used and the expectation of the materials in the
textbook, learning approach and activities used in the classroom which also include feedback components and time allocation needed to learn English.

The first step before performing students’ need analysis is to design questionnaire to be used and followed by questionnaire validation to validate the questionnaire before distributing it to the respondent. The type of validation suitable for this research instrument is content validation according to Content Validation Coefficient theory – Aiken’s V [7]. Content validity concerns with the judgement or assessment by the expert to determine whether the content of the questionnaire is suitable and relevant with the purpose of the research [7,8]. Content validation is calculated with the formula proposed by Aiken as follows [7]:

\[
V = \frac{\sum s}{n(C-1)}
\]

Where:

- \( S = r - Lo \)
- \( Lo = \) lowest validity assessment score (e.q. 1)
- \( C = \) highest validity assessment score (e.q. 4)
- \( R = \) score given by the assessor

In this research, the score for validity assessment is given between scale of 1 to 4, from the irrelevant to relevant category. The assessment for each question is based on the criteria below:

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Constructive side, Materials and Good Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant</td>
<td>Indicators, skills, ability and language are suitable and relevant</td>
</tr>
<tr>
<td>Relevant Enough</td>
<td>Indicators, skills, ability and materials that will be assessed are already suitable but there are still several errors in word choices (Bahasa)</td>
</tr>
<tr>
<td>Less Relevant</td>
<td>Indicators, skills, ability and materials that will be assessed are not very relevant (need revision)</td>
</tr>
<tr>
<td>Irrelevant</td>
<td>The statements/questions do not reflect the Indicators, skills, ability and materials that will be assessed.</td>
</tr>
</tbody>
</table>

Theoretically, minimal threshold to determine the rate based on Aiken table are 2 people/respondent [9]. But to be accepted, an item will need to obtain the perfect V score, which is 1. Therefore, based on the judgement or assessment by two experts, it can be concluded that the questions and statements for this research has reached the acceptable content validity.
After the result of the validation is obtained, the next stage was to distribute the revised questionnaire post validation result which still consist of 20 items question to the respondent. Questionnaire was distributed to batch 2017 students of chemistry study program of FKIP Pattimura University. Admiratively, there were 60 students registered as 2017 batch. However only 33 students were present and participated in the research questionnaire.

After the respondents completed the questionnaire, the research was continued with data recapitulation to be analyzed. Data analysis was conducted with Descriptive Statistic which describe the data in a quantitative information and does not included the decision making through hypothesis [10]. Sarwono also suggested that descriptive statistical data is presented descriptively managed with statistical analysis techniques. One of the descriptive analysis techniques is to calculate the frequency most commonly known as percentage. The frequency calculation in the research uses the simple percentage formula suggested by Sudjana [11]:

\[ P = \frac{F}{N} \times 100\% \]

Notes:
- \( P \) = Percentage
- \( F \) = Frequency of answers
- \( N \) = Number or respondents
- 100% = Fixed numbers

The result of analysis based on the calculation was later interpreted based on the supporting theory from the expert. The data analysis was later become the guidelines to design the draft for the textbook of English for Chemistry.

The research is presented in the following flowchart:
3. Results and Discussion

The analysis and discussion of the findings were based on the three research questions on students’ perspective of English teaching and learning process, students need and content of English for Chemistry draft textbook.

3.1 Chemistry Study Program Students’ Perspective in English Teaching and Learning

The presentation on chemistry study program’s students’ perspective will be divided into several aspects: whether it is important to learn English, the reason to learn English, the advantages of mastering English, challenges encounter in learning English and its solutions and factors that affect the English learning success.

The result of the first question shows that 72.7% of the respondents stated that learning English is very important. Meanwhile, 27.3% stated that it is important. Interestingly, none of the respondents chose important enough or not important answers. This signify that as a whole, all respondents have a positive sense on the necessity English to support their learning process in the chemistry study program.

In relation to the answers above, 39.7% respondents stated that learning English is important because the improvement of their chemistry English vocabulary helps them to understand chemistry concept better. Meanwhile 25% of the other respondents stated that learning English is important to be able to communicate orally and written with other people. 20.6% of respondents agree that the reason they learn English is to be able to write and read research or academic articles in English as well as to be competent to compete in International events. From these results, it is clear that students have diverse reason and motivation to learn English. The main reason mentions the need for vocabulary building which signify that the English content learning material must be relevant and incorporated their study subject. Thus, the expanded vocabulary will help them to understand chemistry concepts either orally or written. This result is in line with the result of Budianto (2004) research on his students where his students also stated that English helps them to achieve more in their study and future career [12].

The next data is about the major benefit or main advantages that students get when they master English as one of their skills set. 90.9% respondents stated that the main benefit/advantages is that it allows them better understanding when reading chemistry textbook written in English. Budianto (2014) also stated that the facts that happen is that the science and technical department are often faced with majority of textbook that are written in English. This is closely related with the learning condition in Chemistry Study Program. Besides that, research and academic journal and supporting article for the courses are mostly in English. Therefore, the mastery of English is imperative to advance in the learning. Meanwhile, other respondents claim that English enable them to get better job quicker (3.03%), have friends from different countries (3.03%), and to be able to communicate in English well (3.03%). Another interesting fact, is that none of the respondents think that the advantages is to get better grades in English Course. This shows that achieving high grades is not their main target.
in learning English. Moreover, the mastery of their content subject is what they hold most high.

Even though English is considered imperative to be learned, students also suggested that learning chemistry concept in English is difficult (60.6%). This is influenced by the difference in students’ level of understanding. Understanding Chemistry concept itself is not the easiest task let alone trying to get a grasp of understanding in a different language. However, it is encouraging to see that despite this challenge, students are still motivated to try. This is shown in the research with 54.5% respondents stated that they try to overcome these challenges by learning to like English and trying different method to improve their vocabulary. This indicated that the main challenges lie in the vocabulary building which they considered crucial to help them understand content materials in English. This assumption is in line with the data collected through question number 7 which asked the students for their major weakness in learning English. 43.6% of the respondents stated that the limited vocabulary is their major weakness in learning English. Other factors mentioned are lack of English-speaking skills (36.4%), bad grammar (10.9%), very bad learning and writing skills (36.4%) and slow reading skills (1.8%).

The efforts that the student put in overcoming this challenge lies heavily on the internal factors from themselves. This is supported by the data collected by question number 6 which shows that the main cause of failure in learning English in Chemistry Study Program is that they simply do not like English (66.7%). Other contributing factors to the failures for English learning in Chemistry Study Program are the materials or topics in the lesson. 24.2% respondents answers that the reason they failed to learn English is because the materials/the topics are irrelevant and are not in their interest and need. Addhabiyyah, et.al (2014) agrees that the use of authentic learning materials that are relevant with the need and study subject are imperative to provide real sense of their future career or what they can do with it when they graduated. Therefore, the use of relevant materials in the course content will directly motivates students to learn the language. Further discussion on English Materials needed by the students of Chemistry Study Program will be discussed in details in the next section [13].

4.2 The Needs of Chemistry Study Program’s Students in relation to English for Chemistry Materials

The discussions on students’ need for English for Chemistry materials which are in line with their learning need is collected through question number 8 to 20 in the questionnaires. The descriptions of the answers are as follows:

There are 4 integrated skills in English Learning; Listening Skill, Reading Skill, Speaking Skill, and writing skill. Beside these 4 skills, conceptual mastery of English grammar is an inseparable aspect in the learning. All skills components must be taught
as integral process. Therefore, in the process of developing the materials, lecturer must consider the balance and equal distribution on development of each skills components.

Question number 8 in the questionnaire identified students responds on English skills that they consider important to be developed. The answer can be seen in the graphic below:

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<table>
<thead>
<tr>
<th>Skills</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening and Speaking</td>
<td>57.6%</td>
</tr>
<tr>
<td>Reading and Writing</td>
<td>27.3%</td>
</tr>
<tr>
<td>Reading and Vocabulary</td>
<td>9.1%</td>
</tr>
<tr>
<td>English Grammar and Writing</td>
<td>6.1%</td>
</tr>
</tbody>
</table>
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The above data shows that 57.6% students responded that listening skill and speaking skills must be prioritized in the learning process. This is followed by reading and vocabulary in the second place with 27.3%, reading and writing as their third priorities (9.1%) and English Grammar and Writing as their least priority (6.1%).

Moreover, when questioned about English skills that they consider play an important role in supporting the success of their study at Chemistry Study Program, 60.4% students stated that reading to comprehend English textbook or Academic Article or Research Journal is the most important one for them. This is closely related to the implementation of Chemistry Study Program courses which uses English textbook, article and research journal. Therefore, when students possess the ability to comprehend the text they are reading, this most certainly will help them to achieve more in their study in the class or when they write their research proposal. On the other hand, there are 24.5% students who admit that English language ability to present and communicate ideas orally is important. This is the reason why they choose Listening and speaking as their answer.

For the materials used in English for Chemistry Course, 48.5% students think that materials currently used are suitable and relevant enough to the characteristic of Chemistry Study Program. This relevancy is connected with question number 10 which ask them about the strength of materials used. Data shows that 45.5% students responded that the strength of the materials currently used lies on the fact that the materials allow them to build their vocabulary on concept, procedures and principle in Chemistry. 39.4% suggested that the balance between chemistry focused content and English language content. 9.09% and 6.06% respondents in order mentions that the materials already suited the Chemistry Study Program characteristic because the reading text allows them to learn the chemistry concept in English as well as the practice and worksheet they can work independently at home.
Based on this result, it can be concluded that the materials used during the teaching and learning process of English for Chemistry are diverse and have covered several important components in ESP teaching such as Specifically targeted vocabulary, availability of reading text that is relevant with the study subject and opportunity for independent practice outside of class with worksheet or practice or assignment. Adhabiyyah et al. (2014) stated that in developing teaching materials, linguistic aspect must be integrated with the 4 skills and presented in authentic text to motivate students. The result for question number 12 supported thus with 39.4% students responded that they like and interested to learn English at Chemistry Study Program because the topic/materials used corresponds with Chemistry subject where it also included the linguistic explanation in English. Budianto (2004) stated that English lesson that begin with the assumption and not need analysis will impact students’ attitude and lower motivation to the course itself.

The main objective of this research is to produce a draft textbook for English for Chemistry based on student need analysis. Therefore, information on students need is imperative. Thus, question number 13 shows that 69.7% respondents agree that the developed materials should be contextual and relevant to chemistry subject study and will be able to be implemented in their daily life. 27.3% respondents mentioned the need for up to date materials relevant to the development of the science world. There are only 3.03% respondents chose general English materials for everyday use.

From the result, it can be concluded that students feel the need to learn English that is relevant with the chemistry subject they are studying. The materials must also be applicative and contextual. Thus, materials should not only be a theory but for practical use as well. Harding (2007) suggested that the use of text relevant to the subject study, authentic materials and authentic practice or assignment must be carefully planned and designed based on ESP context [14].

51.5% of respondents agree that the classroom implementation of the materials should be conducted using varied learning approach. This means that students want the lecturer to not be the only source of information and learning or where lecturer is the sole source of learning (3.03). They wanted different learning approach that is student centered (39.4%) or online learning (6.06%). This is in accordance with students’ expectation that they express through question number 15. 72.7% respondents desired class activities that allow more opportunities for students to speak English. This signify students need to be actively involved in class process especially for the development of speaking skill.

In orchestrating classroom learning activities, one cannot deny that feedback from lecturer to the students on language performance is also important (63.6% respondents). They agree that feedback allows students to be aware of errors and this helps them to correct the error (81.8%). In giving the feedback, 57.6% respondents chose direct oral feedback compared to 39.4% who chose either oral or written. This
shows that Chemistry Study Program students are aware that feedback, either oral or written, is important for their development.

Overall, all materials, activities, approaches and feedback are needed by the students in English learning process. These can come to practice when the time allocation is sufficient. Concerning time allocation for English for Chemistry Course, 42.2% respondents stated that Course Credit System (SKS) is 2 Credit and it is enough for their need. 30.3% students responded that the 2 credits system is not enough. To accommodate the lack of time for English learning, 39.4% students suggested that they prefer to learn independently through internet and self-study materials or through private English courses outside of class (30.3%).

4.3. Textbook Development based in the Students’ Need Analysis Result

As mentioned before, materials can mean anything that can be used as the source of learning to aid the learners in the teaching and learning process [13]. Materials can be in the form of textbook, practice book, module, audio-video, handout, paper cuts etc. that become the source to aid language learning [15].

There are several considerations when designing and developing English for Chemistry Teaching and Learning materials. They are authentic materials, reading text and assignment practice which are relevant with the study subject [14]. Adhabiyyah et al. (2014) added several other important suggestions such as [13]:
- The writer must consider the topic, study subject content, learners’ condition, language skills and ability at the entry or exit levels, previous education background and cultural experience.
- The writer must also consider the type of skill that need to be develop and the expected outcomes of the learning.
- Considering the linguistic aspect and relate it with the contextual use of the content subject studied.

Therefore, based on the theory and result of the research for designing and developing English for Chemistry textbook, the study considers the followings guidelines which are in line with Chemistry Study Program students’ needs.
- Materials or topic used must be up-to-date, relevant and suitable with the chemistry study. They must also be practical to be implemented in everyday usage.
- Materials or topic used must accommodate students’ need to build their vocabulary which they indicate as one of their weakness in learning English. It must also able to accommodate their need for oral and written communication with others.
- Materials or topic used must accommodate their need to read and comprehend English Textbook and Research journals and articles to be able to support their learning.
- Materials or topic used must cover linguistic aspect
- Priority skills that needed to be develop in English for Chemistry are Listening and Speaking, follows by reading and writing.
- Approaches in teaching must be varied in accordance to the topic.
Based on the Students’ need analysis above, draft textbook for English for Chemistry consist of:

- Unit 1 Lab Equipment
- Unit 2 Safety in the Laboratory
- Unit 3 Biography of a Chemist

Activity in each unit covers the four integrated skill in English learning: Reading, Listening, Speaking dan Writing. Beside these four skills, there are also activities related to linguistic content such as vocabulary building and grammar.

4. Conclusion

The study shows that students of Chemistry Study Program of FKIP Pattimura University expresses the basic need for English for Specific Purposes based learning. The use of relevant and up-to-date materials are deemed imperative by the students. Moreover, four integrated skills development and other linguistic mastery are being expressed as important by the students. Out of the four integrated skills, listening and speaking skills are seen as priority. This does not mean that other skills are neglected. Students are simply signified that the desire to be able to communicate actively is an important component in the goal of their learning. The communication skills will not be beneficial during their study but also in their future career. These give positive contribution to the development of English for Chemistry based on students’ needs.

There are several suggestions that came out from this study:

1. To obtain more general result, the number of respondents used in the future research should involve all batches of Chemistry Study Program. This is meant to obtain diverse data to represent the whole population of Chemistry Study Program.
2. The use of other research instruments such as interview is highly suggested to collect more additional data which in turn will be beneficial to analyzed the questionnaire responses.

5. Reference


[8] Hendryadi. (2014). *Content Validity (Validitas Isi)*. Published in TEORIONLINE PERSONAL PAPER No.01/June-2014


