The Design of E-Learning System to Support Academic Writing Skills for Engineering Students of Vocational Higher Education

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Abstract: Engineering students seem to have a great potential to globally disseminate their research. However, their low proficiency in English skills, particularly academic writing becomes their major obstacle. In response to that problem, this paper proposes the design of e-learning system encouraging their ability improvement in doing so. The design of e learning is called Waterfall and it is applied as a method of software development. It has 5 phases namely: communication, planning, modeling, construction and deployment. This paper discusses its process including: communication, planning and modeling. Modeling phase is visualized through DFD (Data Flow Diagram). This system is operated by three different actors namely administrators, teachers, and students. Their roles are different. Administrator refers to the users who manage all the management system. While the teachers manage the content of e-learning, the students can access the learning materials, quizzes, as well as the template of abstract.

1 INTRODUCTION

The ability of writing skills particularly among academician tends to show low quality. In line with this, several studies show that students' ability in writing skill including their critical thinking through writing is poor (Setiyaningsih, 2008)). Buchori (2001) highlighted that poor writing skills remained a common problem to numerous students. In the same line, Alwasilah (2003) pointed out that the ability of writing skill of universities alumni is categorized in low level. This is signposted by the process of writing a final assignment, such as thesis or dissertation. Their final assignments frequently have still got the errors even they had been revised by their supervisors. These errors occur mostly in linguistic matters covering orthography, linguistics, and logical writing (Soewandi, 1992).

The problem of poor writing skill ability occurs in Indonesian language, and it gets worse when it comes to English as a foreign language. This is worrisome because English proficiency pins down very demanding in globalization era nowadays for it is an international language.

Therefore, a study investigating writing skill could be beneficial for university student for future life in wider scope.

The curriculum of education in Indonesia sets the English as a mandatory course which is taught in elementary school or early junior high school. However, the students' proficiency is still far. To be proficient in English means that they have to learn four skills covering listening, speaking, reading, and writing. The latter is considered as the lowest level of proficiency. As a matter of fact, the students' ability tends to low although they are formally taught writing skills earlier in lower education level of schools before enrolling the university (Waloyo, 2017). On the contrary, language learners who study English have been given writing skills as one of the cores of curriculum. Because it is one of the four skills that should be accomplished (Yamin, 2009). Hence, the difficulties are possible to be overcome to achieve the competency.

On the other hand, non-English learners face bigger problem. The writing skills do not become the main core of non-English field of

studies, engineering for example. As a result, when the engineering students write the academic writing using English, they obviously find some obstacles. The research which encompassed the engineering students as the object of the research found that their writing skills are the lowest than other three English skills; listening, speaking and reading (Xu, 2012). It can be concluded that the ability of Indonesian scholars in English academic writing is still poor, particularly those whose the background of study is not English.

The low level of English proficiency particularly academic writing has been pointed out as the cause of the low number of international publication. In fact, the percentage of Indonesian contribution is only 0.0012% in the whole world international publication. Paradoxically, this number is the lowest number compared to other Asian countries, i.e. Philippines (0.035%), Malaysia (0.064%), Thailand (0.086%) and Singapore (0.179%). The number becomes considerably lower than European developed countries, i.e. France (5.6%), Germany (7.2%), Greta Britain (7.9%), Japan (8.2%), and United State of America (30.8%). Some factors affecting the low number of Indonesian contribution in global publication are likely the low level of English academic writing in terms of standardized English as well as the ungrammatical tenses (Adnan & Zifirdaus, 2005). Poor academic writing is credited to the most students' opinion that learning to writing academically is very difficult (Susanti, 2003). It is more difficult and challenging than other skills like listening, speaking and reading. According to (Oshima & Hogue (2006), academic writing is difficult, indeed.

The result of preliminary survey which involved engineering students at Polytechnic in Malang found the difficulties on academic writing in particular writing abstract for their final assignment. It showed that they were confused how to construct the words into sentence (70%). Other obstacles were grammar (15.7%) and followed by vocabulary (14.3%). The findings of the preliminary survey was that it is required a great effort to write standardized abstract. The students might intensively consult to the lecturers, English lectures (38%), and two lectures as their final assignment

supervisors (31.5). They needed to see them more than 3 times (56.1%) at least until they felt confident that their abstract was good. Consequently, these are time consuming for their lectures and required their efforts as well. Furthermore, they still need translation application though (87%).

A preliminary study showed that the respondents need the learning aids to enhance their ability to support their academic writing. Learning aids ease lecturers' efforts to supervise them particularly in their busy time for other agendas such as, preparing and evaluating teaching materials, undertaking and disseminating research projects, and etc. Therefore, this research aims to design e-learning system as it is perceived that such medium could improve the ability of academic writing. A study conducted on Faculty of Letters UPI in particular Germany department indicates that e-learning is more effective to improve students' ability in Germany writing academic. Findings show that those who use e-learning achieve better result than those who use conventional learning (Permana, 2013). In the same line, an empirical data from nursery students at Akademi Keperawatan Aisyiyah Bandung-Indonesia showed that the use of e-learning effectively increased their ability in academic writing particularly medical record documentation (Yualita, 2011) Thus, this research design e-learning system aiming to improve the academic writing ability for students who study engineering at diploma 3 program. It is expected that they are able to increase their ability in academic writing and lessen the lectures' work when guiding them to produce good academic writing.

2 LITERATURE REVIEW

2.1 E-Learning

One of the important roles of technology in education is e-learning. The words of e-learning derived from two words i.e. 'e' which stands for electronic and learning. E-learning is the activity of learning process using electronics as the main

media (Wena, 2010). It is online learning using internet and intranet requiring a specific media to display learning materials-course materials and frequently asked questions. In addition, it still needs the media to communicate for exchanging the information among teachers and learners as the users (Riyanto and Prasojo, 2011). Meanwhile, Markwell (2003) define e-learning as the instruction conveyed through computer using CD-ROM, internet or Intranet employing the following features:

a. Consisting of contents which are relevant to the goal of learning.
b. Using instructional method such as examples and exercises to support the learning process.
c. Using media communication, such as words and pictures to deliver the contents and methods.
d. Building knowledge and skills leading to the goal of learning for individual or teamwork.

In conclusion, e-learning is the media of learning delivered by electronic media providing learning facilities in terms of learning materials, questions, as well as information exchange requiring by teachers and learners.

(Siahaan, 2002, p. 9) points out that the function of e-Learning is supplement, complement, and substitution. It is explained as follows:

a. Supplement

E-Learning is called a supplement when learners freely have the options to use it. There is no obligation for them to access it. However, for those who do so seem to have more additional knowledge.

b. Complement

E-learning becomes a complement when the learning materials in e-learning aimed to complete the learning materials in the class room. It means that e-learning serves as the reinforcement or remedial media for the students when commonly attending the class. E-learning also becomes enrichment particularly for those students who are considered as fast learners in a class room are given the opportunity to access e-learning materials which are specifically designed for them. This e-learning aims to review all the materials given by the teachers in classroom.

On the other hand, for students who are felt as slow learners, e-learning turns into remedial program. They get the difficult to understand the learning materials in class room. Therefore, they could access e-learning materials which are particularly designed for them. Such e-learning purposes to make slow learners easier to understand the materials given by the teachers in class room

c. Substitution

Universities in developed countries offer the alternative learning models to their learners. The objective of this model provides students' flexibility to manage their time to learn in their daily activities. There are three models, i.e. 1) fully face to face meeting in a class room just like ordinary learning process (conventional class); 2) partial models which mean that learning process through conventional class and internet; and 3) full internet.

In this research, the development of e-learning aims to provide complement functions to support the process of learning academic writing. There are some components which should be taken into account when developing the e-learning. Therefore, e-learning could run well. These following three components may develop e-learning (Wahono, 2007):

a. Infrastructure of e-learning

The infrastructure is the main devices used to run the e-learning program such as personal computers (PCs), computer networks, internet, and multimedia application. Teleconference is also part of it when it provides synchronous learning through teleconference.

b. System and application of e-learning :

The system of software application is virtualized the conventional learning process. This includes how to manage class activity, create learning materials or content, conduct forum discussion, assess learning process, carry out the online examination, and other features relate to classroom management. Those software systems often called Learning Management System (LMS). There are many LMSs in open source that is simply operated. What is more there are free of charge.

Content or materials of e-learning

The content or learning materials will be put in

Learning Management System LMS). It is in Multimedia-based Content (interactive multimedia content) or Text- based Content (as a common printed books or references. These should be put in storage system in LMS. The content is easily operated by the user in anytime and in anywhere.

An important component of infrastructure is software of e-learning. One of the e-learning software which plays the important role is Learning Management System (LMS). LMS is a set of solution designed to deliver, track, report and manage the learning materials, monitor the progress and interaction of the learners as well. LMS is a software application for teaching and learning process, such as running administration, filing documents, creating report of learning process via online connected to internet. The content or learning materials are provided online web-based and accessed through internet. In other words, LMS is an application to make the learning process deliver automatic and virtual electronically (Wahono, 2007). It provides features to meet the needs of users in learning process. Currently, there are many types of LMS embedded with the specific features as required application.

LMS consists of materials in multimedia (texts, animation, video, and sound) version serving as a supplement and enrichment for learners' aptitude. LMS offers innovative learning system covering information technology particularly virtual-based through online learning web, multimedia, and video conference. LMS web-based learning enables to be developed dynamically or commonly known as a dynamic e-learning (Munir, 2010). In general, LMS is able to (Setiyo, 2013):

a. Upload and share the materials: LMS provides the features to make the learning materials easier to share. Course tutors will upload learning materials as designed syllabus. The materials could be in the form of main topic of the materials, notes, articles, quizzes, assessment, etc.;

b. Carry out forum and chat: Forum and online chatting are a dialogue or conversation between tutors and their students synchronously or asynchronously (forum and emails). The

forum and chat allow the learners to write their comments and discuss them with their classmates.

c. Create Quizzes and surveys: Online quizzes and surveys let the learners present a quick score. This instant grading is very good to get the learners' direct responses to their achievement and understanding of the learning materials;

d. Gather and review assignment: The result of evaluation on learning achievement provides the score to the learners automatically and online.

e. Record grades: LMS enables to monitor and record the learners' achievement automatically.

In the design of e-learning system conducted in this research refers to the concept of LMS as above.

2.2 Academic Writing

Academic writing is a part of writing skill that follows particular rules and format referring to academic circumstances. The certain rules and format differ the academic writing to personal writing, such as writing on Blogs, writing on walls of Facebook walls or articles in newspapers and magazines. Swales & Christian (2017) outline that academic writing is one of writing products that should pay attention much to readers, goal, organization, style, plot, and layout. Besides, academic writing must present strong argumentation as the state of the art unifying the whole passage. Academic writing is classified into several types (Phil, 2010):

a. Summary

Occasionally, reading summary lets readers' choice catch the main idea of the whole passage. The summary is a typical brief text taken from written-scientific works such as books, articles, journals, research, etc. The goal of writing summary is to convey the most prominent idea from a text to readers and to present the concise explanation providing by the robust argumentation to support the main idea (Friedman, 1989). A summary consists of the main idea of the background, point of view, argumentation supported with the details of justifications, methods (if it is a research), and conclusion linked back to the conceptual background without providing analysis, interpretation, and evaluation (Friedman and Steinberg, 1989). In general, a summary is 750-

1000 words length (Phil, 2010). The summary of books or research will significantly help students when they prepare to write their assignment on scientific works such as paper, thesis or dissertation. Students tend to refer the summary of any types of written-scientific works to support their own writing, particularly writing critical review.

b. Critical Review

A critical review is thought writing which is more complicated than a summary. A critical review requires the ability to analysis texts as the authors' point of view, thesis, organization techniques, and summary. The purpose of writing critical review is to provide the evaluation on quality of writing. There are two essential questions to evaluate a critical review. The former is 'is the information is objectively presented?' The latter is 'is the authors' opinion fair and reasonable (Phil, 2010).

The organization of critical review covers introduction, summary, critics, and conclusion. The content of introduction of critical review is similar to a common introduction of other written-scientific works. Whereas, its summary provides the point of view, main ideas, and authors' conclusion. Critics presents the evaluation of the importance of writing elements such as topics, actuality, length, authors' objective, data interpretation, detail explanation and authors' practical ideas. The conclusion of critical review gives the evaluation to references. The average of critical review length is around 1000-1500 words (Phil, 2010).

c. Essay

Essay is one of the academic writings that students are most familiar with. Every semester, not a few lecturers require their students to write an essay. Hence, the ability to write essay is demanding for students. Regardless numerous definitions on what essay is, the acceptable organization comprises introduction, body of the content, and closing or conclusion. The average length of essay is about 2500-3000 words with the proportions around 10-20%, 60-70%, 15-25% for each part respectively (Phil, 2010)

d. Final Project

Any program of higher educational levels requires students to write paper as their final assignment,

thesis or dissertation. The main differentiation of final assignment in each level of program lies on the depth of discussion and the number of words count. Each institution has particular rules and format for each type of final assignment. However, the average number of words from academic books from universities around the world is about (Phil, 2010).

- Bachelor dissertation: 15.000-25.000 words
- Master dissertation: 30.000-40.000 words
- Doctoral dissertation: 80.000-100.000 words

Any types of written-scientific works aforementioned above, whether it is summary, critical review, essay, or final assignment require abstract as a part of its paper. Abstract is short cut for readers to get the main ideas of the whole paper. Abstract is about 250-300 words for the average length (Phil, 2010). There are 9 types of abstract, i.e.: informative, indicative, informative-indicative, critics, mini, sideways, basics, statistics, or numeric, and authors' abstract (Basuki, 1989). The aim of abstract is: 1) to complete the part of writing which will be published in journals, or magazines letting the readers inform about the articles that are going to be published; 2) to share the information to library visitors that there are documents that they need; 3) to help the readers to gain the information that they need faster for carrying out the research, supporting teaching matters, or updating the up-to-date facts about science and knowledge which are suitable to their background field of study; 4) to hinder the language problems (Sophia, 2002).

2.3 Waterfall Design Model

Waterfall model is a classic model to build software in a systematic method. The real name of this model is linear sequential model (LSM). It is well-known for classic life cycle either or waterfall method. Waterfall lets the steps of sequence run orderly. In other words, the first step should be perfectly finished then continued to the second step and so on (Permana, 2015). Conversely, it could not run steps randomly or in parallel way. This model is categorized into a generic software model in software engineering (SE) which is proposed by

Winston Royce in around 1970. This model is underestimated as an out-of-date type, but it tends to be widely used in SE. In short, this model applies the systematic method as the following sequences:

1. Communication (Project Initiation & Requirements Gathering)

Setting the need requirement by conducting communication or interview with the users is the starting point to develop the software. Need requirement is the first step to collect the predominant information beforehand to meet the users' goal of developing software. The result of this need requirement is an initial project covering analysis of the users' problem, collecting required data, defining features and determining function of the software. Searching relevant information from other references such as journals, articles, and internet is also required to collect supporting data

2. Planning (Estimating, Scheduling, Tracking)

The next step is planning to outline of technical works that are going to do such as: predicting the risks including force- major, providing resources to create the system, determining the outcomes, scheduling the standard operating system containing what are going to do, and tracking time line of the working process of the system.

3. Modeling (Analysis & Design)

This step is designing and modeling the architecture system focused on data structure design, software architecture, interface display, and algorithm program. It is aimed to fully understand the framework of description on what to be done.

4. Construction (Code & Test)

This step is translation process from design into code or particular language that is readable by machines. After coding finished, the system and code are tested. This aims to detect the errors and to fix them afterwards.

5. Deployment (Delivery, Support, Feedback)

This step is implementing the software application to customers, maintaining software periodically, fixing software, evaluating software, developing software linked back to the customers' feedback to make sure that the system works properly and develops as the determined function.

3 METHOD

3.1 Data Collection

Before designing and building a software system, depth analysis on functional requirement is required to meet the users' demands. This study utilized interview and questionnaire to collect the data from end-users.

The first step to determine the functional requirements of e-learning system is to conduct a preliminary survey. This survey aims to investigate the problems encountered by students in academic writing, particularly writing abstract of final assignment. The survey was conducted by distributing questionnaires to students of engineering at Polytechnic in Malang, Indonesia. There were two types of the participants; 1) students who were writing abstracts in English for their final assignment; 2) alumni who have graduated for 2 years maximum. The result of questionnaire is used to support data in interview process.

Interviews involved the lecturers of English course supported by the result of preliminary survey. The results of the interview became a general overview of the solution for solving the problems encountered by the students which was collected in the preliminary survey from the English lectures' point of view. In addition, these results turned into the basis for determining the list of functional requirements of e-learning system. The list of system functional requirements then should be tested to meet the needs of the users.

3.2 System Design

This research discussed about the process of communication, planning and modeling. The sequences of the waterfall are:

1. Communication (Project Initiation and Requirements Gathering)

The initial step of the waterfall is building communication with the end-users known as the system requirement. Two types of instrument were applied to attain system requirement. The former was questionnaires which were distributed to students of engineering at Polytechnic in Malang.

The latter was interviews involving lecturers of English course at Polytechnic in Malang.

2. Planning (Estimating, Scheduling, Tracking) Planning is the second step of waterfall sequence covering four main divisions: 1) data collection; 2) interviews; 3) analysis and design of the system, and 4) system development and tests. Data collection was the only division engaging the field assistants who are familiar with informatics to make easier to collect data. The researcher was the person-in-charge to conduct the remaining divisions but the last one required a programmer to help the researcher.

3. Modeling (Analysis & Design) Data Flow Diagram (DFD) was used to design system. The system is divided into 2 sub-systems. The first is a subsystem which relates to academic writing. Whereas, the final sub system relates to English grammar.

4 FINDING AND DISCUSSION

4.1 Data Collection Result

The preliminary survey found that the most common problems encountered by students in academic writing were the difficulties in arranging standard abstract. The difficulties lie on composing words into sentences as well as the abstract format (70%). The next problem was grammar constraints (15.7%) and vocabulary (14.3%). This preliminary data was useful to lead the interviews involving the lecturers of English course.

The data analysis on questionnaire and interview determined a list of functional requirements of e-learning systems. The functional system should provide:
a. Theory framework of academic writing.
b. Quizzes to improve the understanding of academic writing.
c. Grammar matters such as tenses, synonym, antonyms, paraphrasing, etc. to support the grammatical sentences in abstract composition.
d. Quizzes on grammar matters.
e. Templates for organizing abstract composition to minimize the errors when writing abstract.
f. Print menu after finishing writing abstract on a given template

g. Login feature for each user to provide security service

4.2 System Design

The e-learning system was designed using DFD (Data Flow Diagram). The main system of the e-learning is divided into 2 sub-systems as explained previously; 1) English grammar sub-system; and 2) academic writing sub-system. The former subsystem contained grammar matters commonly found on abstract composition and exercises to support writing grammatical sentences, such as tenses, antonyms, synonyms, and paraphrasing. The latter contains conceptual framework on abstract composition. The academic sub-system also provides a template menu to help the users organize abstract composition. This menu attempts to diminish the common errors on abstract format.

The e-learning system allows users' permission into 3 types of users, i.e.: 1) administrators, 2) students, and 3) lecturers. The user administrators are users who have responsibility to set up the entire of e-learning system and confirm all e-learning registries. This type of users is the persons who are appointed by language centre at Polytechnic in Malang. User students are users who flexibly access all contents of e-learning, quizzes, generate, and print abstract as well from given template. They could be students from all over Indonesia who are registered in DIKTI FORLAB and have successfully registered on this e-learning system. User lecturers are the lectures who run the main materials as the contents of e-learning. These users are the lectures who have been registered and have permission to access e-learning application from the administrators.
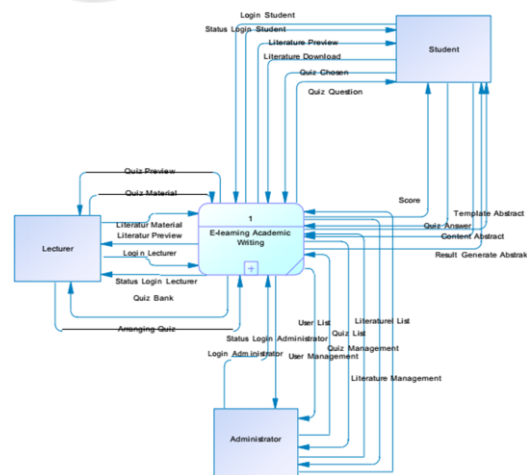

Figure 1: DFD Level 0

There are six processes that responsible by user lecturer. The description of the user activity of the lecturer is shown by DFD Level 1 in Figure 2.

a. Login Lecturer

The only users who could login this menu is the lecturers who have already been registered to e-learning system by entering their usernames and passwords.

b. Upload learning materials on academic writing

Lecturers are able to upload the main content of academic writing, particularly writing abstract serving as the learning materials.

c. Upload grammar materials

Lecturers upload grammar matters to support learning materials particularly tenses, synonyms, antonyms, paraphrase, etc.

d. Upload Quiz Academic Writing

Lecturers are allowed to upload quizzes on academic writing particularly abstract composition for final assignment.

e. Upload Quiz Grammar.

Lecturers upload the quizzes on grammar matters, such as tenses, synonyms, antonyms, paraphrase, etc.

f. Quiz Arrangement

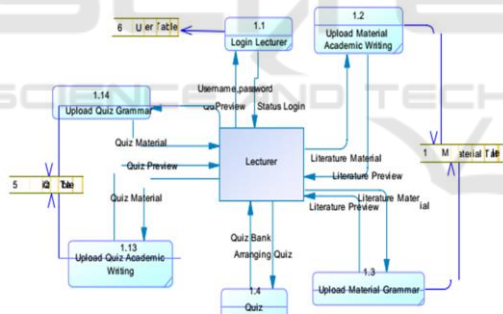Lecturers design and modify the quizzes from questions bank.

Figure 2: DFD Level 1 User Lecturer

There are four processes that can be accessed by user student. The description of the user activity of the student is shown by DFD Level 1 in Figure 3.

a. Log in Student

This activity is only accessed by students who had already been registered to e-learning system by entering the username and password.

b. Access Literature

Students are able to access e-learning materials particularly the theory on academic writing as well as grammar

c. Take Quiz

Students are allowed to take quizzes on academic writing and grammar. This system lets them know the instant score after submitting their quizzes.

d. Generate Template

Students are permitted to input the text of abstract content into abstract template and easily print and generate the text of abstract in certain format.
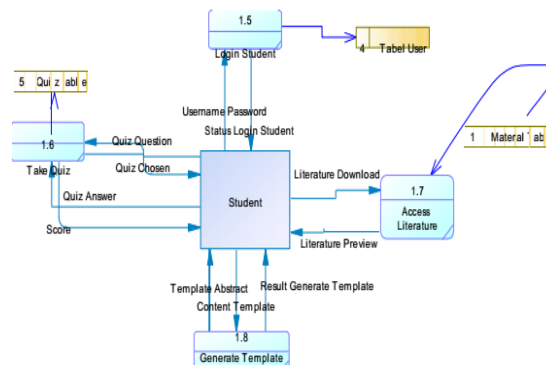

Figure 3: DFD Level 1 User Student

There are four activities which could run by user administrators. The description of the user activity of the administrator is shown by DFD Level 1 in Figure 4.

a. Login Admin

As previous activities of other two users' activities aforementioned above, this activity is only run by the user administrators by entering usernames and passwords.

b. Manage Users

User administrators have responsibility to provide permissions to other users who were successfully registered and verified.

c. Manage Literature

User administrators are able to manage and set up e-learning system.

d. Manage Quiz

These types of users have access to manage and set up data of quizzes.
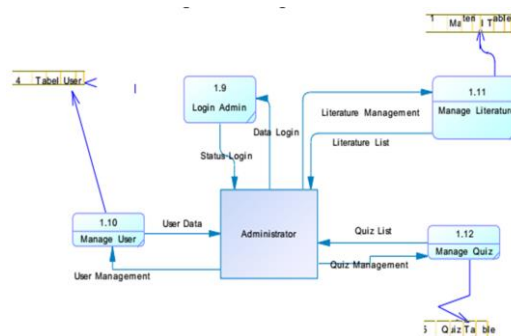

Figure 4: DFD Level 1 User Administrator

554

5 CONCLUSION

Based on the results of questionnaires and interviews, it is found that students need to improve knowledge about grammar and academic writing. Therefore the system is divided into 2 subsystems, subsystem English grammar and subsystem academic writing. Users are divided into three i.e. administrator, student and lecturer. This division is based on entire system and makes user permissions settings. Students can access materials and practice. Lecturers can upload material and questions.

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