

# Joko\_Sutopo\_Design of E-Learning Courses With Learning Simplification Method

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# DESIGN OF E-LEARNING COURSES WITH LEARNING SIMPLIFICATION METHOD

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## Abstract

*A change in the curriculum and the learning objectives has brought complex challenge for teacher in explaining material and books to learn. Teachers are faced with the challenge to find the right books and learning material for their students. This paper aims to propose a method of learning simplification to the instructional media to support learning in subjects that are considered difficult and has many various textbooks. This study is conducted to determine the suitable model for academic learning material with the e-learning design. It tested and evaluated the relationship between the design and material suitability. It used quantitative approach with Research and Development analysis for orientating product development. Furthermore, the data were analyzed using OLS (Ordinary Least Squares) method with E-views version 4.1. The results showed a significant aspects of expediency, display, operational, and ratio of quality on the student interaction with e-learning courses media.*

Keywords: e-learning, usefulness, operation, interaction

## 1. BACKGROUND

A change in the curriculum and learning objectives has shape new learning process resulted in different course material and books to learn (Kolb, 2014). Teachers are faced with the challenge to find the right books and course material for their students (Kumashiro, 2015). In addition, teachers also have to design suitable learning model which suitable with the students (Danielson, 2013). This paper aims to propose a method of learning and instructional media suitable to support learning in subjects that are considered complex.

In some departments, the college handbook sometimes contains number of pages in the range of 1500 to 3000 pages to be used within a semester of study. Considering the characteristics of diverse students and thick books, the teachers find it difficult to explain whole books (Hawkins, 2015). This is a challenge for the teacher to find suitable approach to teach the book to their students (Reece and Walker, 2016). Sometimes, overwhelmed teacher teach in the book with limited time, the teachers must simplify the books into modified course materials. This means that teachers must transfer the knowledge from the books to explain everything into new form (Laurillard, 2013).

It could lead to find practical stage and initiative of students. In the long-term, the factors lead to the risk of failure of education or slow learning which so-called failure rate (Clark and Mayer, 2016). The Learning failure is indicated by the amount of time wasted which learners do not absorb full knowledge during learning in the classroom rather than just listen and take notes (Allwright, 2014). In terms of the approach to student learning that students actively

take the initiative and practice immediately upon material obtained on the day and the same hour (Boaler, and Sengupta-Irving, 2016). This resulted in confusion for teachers in complete transfer of the thick material. If teachers replaced the books with thinner book pages, it will reduce the transferred knowledge to students and students only get smaller portion of knowledge from usual books.

According to Laurillard, (2013) stated that Learning is effective when every aspect of learning are used by teacher with less time and more knowledge is adsorbed by students. This means that teacher must transfer the knowledge with better student absorption especially from higher number of pages with less time (Cook, 2013). In addition, the activities of students during learning activities must be measured to absorb knowledge besides their activeness in class participation (Tomlinson, 2014).

Learning is interactive, communicative process between learning resources, teachers, and students to exchange information. According to Salim, et al., (2014) the learning media is anything that can be used to deliver knowledge from teacher to students so that it can stimulate thoughts, feelings, concerns and interests as well as the attention. learning media must include tools that are physically used to deliver the teaching materials such as books, tape recorders, cassettes, video cameras, video recorders, film, slide (picture frame), photos, images, graphics, television, and computers. In other words, the media is a component of learning resources or physical means of containing instructional materials in the learning environment that can stimulate students to learn faster with higher volume of knowledge (Murthy, et al., 2015).

Various attempts have been made to improve the effectiveness of the efficiency of learning and one of them with the development of e-learning approach (Hsu, et al., 2013). With e-learning system the learning process can take place anytime, anywhere, without the constraints of time and space (Ferreira, et al., 2013). Students and faculty can make the process of teaching and learning through computers connected in a network of e-learning. Implementation of e-learning in the lecture has increased the motivation and student learning outcomes, however, the students still have problems in terms of understanding the abstract material which need explanation than conventional class method (Kolb, 2014).

Based on these descriptions, the researchers considered the problem to be the focus of research by proposing a design of e-learning course for engineering courses on Universitas Teknologi Yogyakarta (UTY). It is expected that the frequency of all activity and practice in the class is started from the student initiative and their activeness through self-initiative course. Learners are instructed to try more often to the allocation of time in finding the ideal way and the answer to the problem and change initiatives with teachers and peers to learn them.

## 2. LITERATURE REVIEW

### 2.1. Learning theory

Learning activities are defined as the addition of knowledge comes with practice and discussion between students and teachers so that students become learners quickly and accurately (Klingner, et al., 2015). In fact, teachers are faced with the challenge of providing relevant knowledge and develop learning activities which burdening students (Allwright, 2014). Therefore, understanding learners and proposing better design of learning approach as milestones of teacher efforts (Bunch, 2013).

### 2.2. Characteristics of learners

A characteristic of learners is important in the design and development of media-assisted learning website (Salmon, et al., 2015). There are learners features that the teachers must considered such as their ability and experience of learners in understanding the learning goals and the course materials difficulties (Entwistle and Ramsden, 2015). Characteristics of learners can be influential in identifying, elaborating and organizing systematic concepts that are relevant and very important to understand the purpose and the adaptability of the learners in the class.

### 2.3. Design of learning approach

Design of learning is important to match the learning objectives and tasks with the learner ability (Barkley et al., 2014). In the analysis of the learning task, it is necessary to identify the tasks / skills that the students must do in their learning (Adams, 2015). It is formulating a framework of sub-skills that

contains the specifications of learning objectives (Clark et al., 2016). This stage is made to estimate the achievement of learning outcomes toward goal of learning. Design of learning is also useful to measure the students understanding on course material and suitable medium for the presentation of learning materials tailored to the characteristics of learners and existing facilities.

### 2.4. Type of textbooks

Students who participating in engineering course classes can have various task assignments from more than 5 books which burdening and seizing their time. In total, the handbook or textbook given by the teacher ranged 1500 to 3000 pages within one semester of their study. This can be a burden for students who are not active in the classroom.

### 2.5. Knowledge adsorption

The frequency of all practiced book contents is representing the knowledge which transferred to students and become student's activities as reflection of the student adsorption in the learning with self-initiatives. Determination of the effectiveness of the criteria based on the achievement of learners as ideal time of students has in class. The ideal time for student's activity is useful to measure the percentage of students in an effective way to find answers to problems and changing into a joint initiative with their teachers. Learners are said to be effective if they can try more often to the allocation of time into self-initiative.

### 2.6. Learning Simplification Method

Procedure for solving complex learning or so-called learning simplification methods has been proposed by George Dantzig in 1947 to simplify the complex learning process, particularly in the fields of engineering courses and business. The method is a procedure to simplify algebraic geometric learning process to facilitate the search for the optimal solution of a pathway problem and how to reach the goal. Teachers should help students to define each step of the learning pathway and then specify a conclusion and give an explanation in brackets. There are two steps of simplification method through the steps as below.

1. Determine two edge areas which eligible containing greater than zero.
2. Determine the limits of the constraints that are owned by the conclusion of the student capability, teacher competence, and course materials
3. Determine the intersection of the boundary set
4. Determine the area bounded by three boundary constraints of students capacity, teacher competence, and course materials
5. Determine the size of the area that are not affected by restrictions to the right edge moving along the edge to improve students capability

6. Move in the direction that has been selected in step 1 which eligible to leave the area and stop till it reached the limit or new obstacles encountered when moving in that direction.
7. Determine the equations for the limits of the learning obstacles to solve the intersection of constraints to produce the learning solution
8. When concluded that student's capability and teacher competence is matched, it is the optimal solution, then stopped and the course material is mapped and can be considered as optimal solution.

The concept is usually important in the simplification of the course material selection. This concept is useful in simplifying the procedures of course material and teacher competence (Fox, 2014). It is based on solving the intersection of constraints such as time limit versus number of book pages. Therefore, the first step in establishing the simplification method is to convert the inequality constraints to be functional equality constraints. That is, the end result cannot be a negative number, known as the concept of no negativity which remained as inequalities result because they are treated separately. Conversion is done by introducing a slack variable.

The concept can be rewritten to explain the boundaries, intersection and obstacles experienced by the teachers and students side-by-side so that it can solve the system of learning. Direction of learning movement should aim to increase no basic variable at zero by adjusting the values of a variable policy to continue to meet the edge of the system of equations to obtain the minimum of non-zero for the student capacity, teacher competence and .

At each iteration of the simplex method, the goal of Phase 1 is to choose one no basic variable increased from zero while the values of variables are adjusted to meet the basic system of equations. The increase of these variables no basic zero will turn it into a variable basis for an optimal solution to the basic variable stop but did not leave the eligible area.

District deemed worthy or not meets the requirements of any other variable that all the negative out of the optimal solution. That is, a variable policy violates constraints no negativity to variable basis.

### 3. RESEARCH METHODS

This type of research used in this research is the development of a quantitative approach-oriented product development (Creswell, 2013). Thomas et al., (2015) describes Research and Development (R & D) is a strategy or method that is powerful enough to improve learning practices. Furthermore, explained that research and development is a process or steps to develop a new product or improve existing products that can be justified. In developing the design, the researchers chose Four-D model for the development

of 4 instructional stages of Define, Design, Develop and Disseminate a model (Thomas et al., 2015). It is also modified by Richey, et al. (2014) as Definition, Design, Development, and Deployment.

In this study, it used multiple learning simplification regression modeling. The variables used in this study are the independent variables, e.g., expediency (X1), display (X2), operation (X3), web speed access (X4), knowledge adsorption (X5), and aspects of interaction (X6) , Meanwhile, the dependent variable is the quality of instructional media (Y).

Data collection techniques used were interviews, questionnaires, observation, and documentation (Miles et al., 2013), as measured by the instrument, as follows: (1) questionnaire validity; (2) student responses; (3) learning achievement test. While data analysis is conducted on three categories: (1) analysis of the results of validation data media; (2) analysis of data observation student responses on the test results is limited; (3) the analysis of the test data by using E-views version 4.1 and the students' responses to the media.

<sup>13</sup> In this case, the researchers developed learning media in the form of e-learning. The instruments used are valid instruments, practicality instrument and effectiveness instruments of the website-assisted learning media. The collected data were analyzed using regression analysis of Ordinary Least Squares method with E-views version 4.1. The research was involving students of engineering courses at faculty of Engineering, Universitas Teknologi Yogyakarta (UTY). The research was conducted within 7-19 December 2016.

Diagram model development media assisted learning website consists of several stages. Each stage is a critical component in the development of procedures of e-learning media which described as below.

1. Define phase (Definition)
 

The aim of this stage is to establish and define the needs of learning by analyzing the goals and limits of the material. Activities in this phase are consisted of three steps.

  - a. Analysis of the student vocabulary in engineering courses term. Activity analysis is performed on early step to measure a basic vocabulary that required the development of instructional method. At this stage, the basic problem in engineering courses class is set and analysis on learning theory and relevant challenges and demands of the future is mapped in order to obtain a description of the learning pattern that is considered ideal to average students. After finding a description of relevant learning approach, as well as analysis on the students about their knowledge in engineering



courses term especially in the topic of engineering courses.

- b. Analysis of the provided engineering courses and learning material. It must be paired with the observation about student characteristics. The students must be analyzed about their characteristics in learning. It has an objective to match the design and development of media-assisted learning website with the student condition and their preparation. Characteristic features include the learner capacity, the learner ability and experience in the engineering courses.
- c. Analysis of Concept. Analysis of concept is intended to identify, specify and compile systematically relevant concepts to be taught based on the analysis of early step in item (a). This analysis is the basis for the formulation of the goals of learning undertaken by teachers.
- d. Analysis of tasks. This analysis is the identification of tasks / skills given to the students during and after learning. It is a framework of sub-skills which then positioned to measure the student knowledge absorption after learning transfer is conducted.
- e. Formulation / Specifications of learning objectives. This stage is made to summarize the results of the analysis of task and concept as indicators of achieved learning outcomes. The formulation result will be the basis for drafting a learning media.

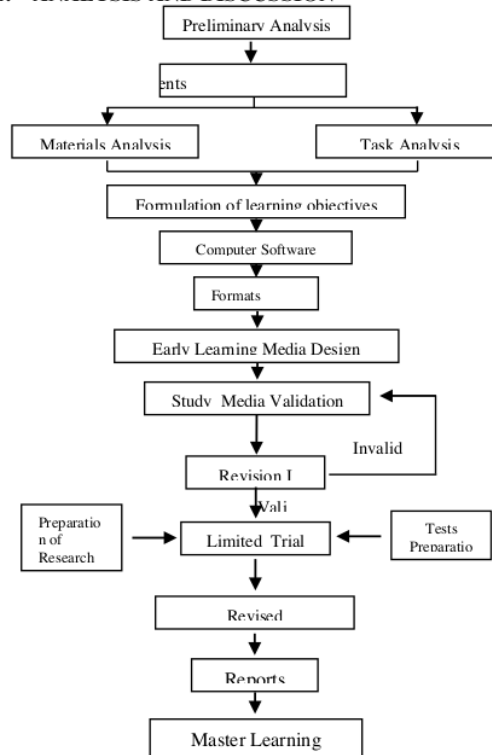
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2. Design Stage (planning). At this stage, it combines the information about students, teachers, and learning material into instructional media. There are several steps in designing the instructional media: (a) Preparation of test instrument to determine the initial understanding of students to the material. (B) Selection of the media presentation as learning materials tailored to the learner characteristics and existing facilities.

3. Develop Stage (Development) this stage has a goal to produce draft II of learning media which has been revised based on the experts input and test result. It is consisted two activities: (a) expert assessment (so-called validator) and limited testing to get direct feedback from teachers, students and observers of the instructional media.

Limited testing is carried out on the students. The data collection is based on several considerations such as academic skills and time availability. For the purposes, it is provided of instrument of validation sheets and instrument of knowledge transfer between teachers and learners in responding to questions and

cooperates in completing the task. The learning media (e.g. website-assisted learning media) is evaluated with relevant instrument to measure the student adaptability after using the media in the form of Learning Outcomes evaluation (THB).

#### 4. ANALYSIS AND DISCUSSION



#### Description:

From the data analysis, it is obtained information about the test results of the study. There were 20 students from total 24 students who completed the test with the percentage of completion 83%. From the student response, it showed that average percentage of students responding is 98%. Thus the data meet the criteria that have been previously described. It showed that the use of the simplification method and e-learning model can improve student understanding about the engineering course learning as explained above. In addition, the presented media also can be used in the process of learning as a learning media with a good quality that supported by the developed learning tools.

For the OLS regression results, it found that quality of learning media are influenced by expediency, display, operation, web speed access of access, adsorption aspects and interaction in the virtual class. The summary of the regression result is showed in Table 1 to explain the effect of

independent variable and the interaction of instructional media.

The results showed that there was a partial influence on the expediency, display, operation, web speed access of access, adsorption aspects and interaction are tested toward learning media with 0.05 significance level. All variable are jointly evidenced from F test that earned less than significance level of 0.05. The summary of the testing result is showed in table 1.

Variable	Coefficient	Std. Error	t-Statistic
Expediency	0.004115	0.051816	0.073720
Web Display	0.303660	0.050367	11.96138
Operation	0.095413	0.053725	1.775946
Web speed	0.067613	0.036930	1.693281
K.Adsorption interaction	0.186749	0.055548	2.624801
	0.072794	0.024561	2.106260
R-squared	0.770598	Mean dependent var	3.795000
Adjusted R-squared	0.764943	S.D. dependent var	1.003499
S.E. of regression	0.476062	Sum squared resid	42.96712
Durbin-Watson stat	2.063982	Second-Stage SSR	44.96712
J-statistic	194.0000	Instrument rank	8
Prob(J-statistic)	0.000000		

Source: analysis result with Eviews 4.1. (2016)

The regression analysis result showed that the expediency (X1) has a positive effect on the quality of instructional media with the probability of 0.0413 which below the  $\alpha$ -value 0.05. This shows a direct relationship between the expediency on the quality of instructional media. It means that the expediency will increase the quality of teaching media (Kolb, 2014). For aspects of quality of education, it generally showed the usefulness of learning media especially about the usefulness which bring benefits to the teachers and students. For students itself, the learning media can improve their understanding about the learning materials and really contribute to the learning outcomes. In addition, there are other aspect which can contribute to the successful of learning, e.g., student characters and learning approach. Both aspects have been included in the design of instructional media which has motivated teachers to use the media in the delivery of the learning materials (Tess, 2013).

As for the aspect of web display (X2), the regression analysis result showed that the display in the website has influential effect on the quality of media with  $\alpha$  value of 0.05. This shows a direct relationship of the display on the quality of instructional media. It means a higher quality of instructional media can be increased through better display of website. In this case, the quality can be associated with the appearance and performance of how the website can present easy-to-understood color and position. In addition, it means the media can be

used easily read and remembered by the user (Leonardi, et al., 2013). Such media also can assist the students to give responses to the question items (Brookfield, 2015). The aspect of display also measured from several sub-items such as: (a) the product can give clear instructions for use, (b) readability, (c) systematic position of learning materials, (d) quality images and animations, (e) color composition, and (f) expositional narrative which makes the content is easy-to-remember.

In the operation of learning media, the prob. quality of media is very important and has been investigated here (Greenfield, 2014). In the results of this analysis, it indicated that there are three things that are important in the compatibility of operation and learning media (Bunch, 2013; Buckingham, 2013). Firstly, as web-based website, the operation can be carried out in various places and the users can use it more easily. secondly, the operation is considered easier if the website was can give tutorial help the users to resolve technical issues in using media. Third, it is also useful to measure how quickly users become proficient in the use of the website. In this study, the regression analysis showed that operation (X3) has influenced the quality of instructional media with  $\alpha$  value of 0.05. This shows a direct relationship between the operation and quality of instructional media. In addition, a good operation means higher quality of learning media. Aspects of the operation are generally associated with the appearance and performance of instructional media and how it can be used easily by the user. In addition, it is also can assist the user to use the media quickly.

Web speed access is also important since it is related to the ability to process data and then ease in processing information (Ward and Peppard, 2016). Website as a container in the service and the quality of learning is very important to have enough web speed access since it is used by many students (George and Robinson, 2013). As an educational website, it is necessary to measure the level of the speed and make it easier for data to students and combined with monitoring and evaluation (Henrie, et al., 2015). When many users accessing in same time, there is a probability that the site becomes slow and it requires improvement in the speed access. For the web speed access, the regression analysis showed that the web speed access (X4) affect the quality of instructional media with  $\alpha$  value of 0.05. This shows there is a direct relationship between the web speed access and quality of instructional media, i.e. if the web speed access is good then the media is considered to have high quality. The web speed is important component in developing a system of teaching quality (Greenfield, 2014). Media is everything that can be used to deliver a message from the sender to the receiver since it can stimulates mind, feelings, concerns and interests as well as learner

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willingness to take place in order to achieve the learning objectives effectively (Buckingham, 2013).

For other variable, the knowledge adsorption (X5) can affect the quality of media with  $\alpha$  value of 0.05. This showed a direct relationship between knowledge adsorption on the instructional media. It is supported by the insertion of Adobe Flash in the website as animation features with Action Script in the webpages. This program can be used to develop MPI support for animation, photo, image, text, and sound (Hafner, 2014). In this case, the quality generally associated with the appearance and performance of how teacher can give easy-to-understood instruction and it means the media can be used easily by the user. Such media also can assist the students to learn faster and have more capacity to absorb the new knowledge and theory in the engineering courses.

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In a virtual classroom, it is important to measure the effect of interaction. It can be seen that the interaction are shaped by teacher activeness in providing services to the students (Simonson, et al., 2014). In addition, the teacher readiness to interact also improves the quality of student interaction and participation in the virtual classroom (Yilmaz, 2017). Teacher must actively collecting data from students to interact better and also be able to become an example of positive interaction to foster student interest (Hamid, et al., 2015). In this virtual interaction, teachers can verify the student's proposal and then approve the study material used together in a virtual classroom. However, teacher also faces the challenge of improving the quality and interaction in the classroom, especially in the engineering course.

In addition, it also found that interaction (X6) affect the quality of the media quality with  $\alpha$  value of 0.05. The quality of the interaction of media can be improved through better interaction to create a good atmosphere of learning. The classroom interaction can be happened between a person and their environment, and happen anytime and anywhere (Salim and Tiawa, 2014). One sign that a person has good interaction is their participation in the virtual classroom and have a change in the behavior after learning something. In addition, there are changes of knowledge, skills or attitudes through the interaction and participation in the virtual class (Senge, 2014).

Media-based learning approach is an important component in developing a system of teaching quality (Gikas, et al., 2013). According to Bunch, (2013) learning media in a classroom is everything that can be used to deliver a message and evaluate the quality of the message to stimulate the student mind, feeling, concern, and interest to achieve the learning goals in limited time.

## 5. CONCLUSION

Virtual classroom can handle the activity and specific issues such as the interaction and

participation in class. However, with limited time and infrastructure, online educational services it must have quality standards, processes, procedures and rules in order to have a referral service in education and consulting services with the teachers and other staff. In this case the virtual classroom management is required for the implementation of better online education website to provide the greatest benefit to students in improving their competence and provide greater access to training, seminars, and educational training activities more transparent and accountable.

Students with difficulty in applying the e-learning must consult to the operational staffs and get guidance. Even though the e-learning has provided tutorial, however, students with lack of knowledge also have difficulties to resolve the issue. Such issue is the limit of their learning and it is become teacher task to assist the students in their virtual classroom.

The website design can lead students to find the optimal solution to this problem when they were able to ask to the teachers to identify the issues that are defined not actually part of the problem. However, students also still face a trouble in catching engineering terms because it is rarely discussed in class and not given concrete examples. Therefore, it is necessary to combine the constraints formulations through the learning simplification model. However, this is not always the case.

The website design for e-learning can be a strong instrument to explain engineering concepts, especially to describe the basic engineering term and formulas that need to be understood and it can need student modification to understand the constraints. This can be a positive result to the student when they can follow the teacher guidance and have active consultation about the concept of engineering.

Activities through practice and consultation in the virtual classroom can give benefit if it is supported by the design of the website so that students can interact online with fellow teachers and their friends. In addition, since the website has been improved by the practice steadability, therefore, the knowledge adsorption is also improved as student improving in conducting activities and consultation with their teachers.

## 6. LIMITATIONS OF STUDY

The achievement of an ideal learning media is difficult to measure because of the diversity of the students, teachers and learning materials. In addition, this study measured only a limited number of the students participating in engineering course class. Therefore, the result cannot be generalized to other study. In finding answers to problems and ways to improve student practice, it needs a joint initiative of teachers and students while resolving learner barriers who are not familiar with the virtual classroom.

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