

The development of e-module based on learning models of self directed learning in welding subject

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Abstract—This study aimed to produce an e-module based on a self-directed learning model that was valid, practical and effective and was able to help students learn independently and understand SMAW manual arc welding theory. This study is a Reset and Development (R&D) study which refers to the ADDIE instructional development model. ADDIE development procedures namely Analysis, Design, Develop, Implementation and Evaluation. The results of this Research and Development produced a valid learning e-module based on the evaluation of material expert validators who declared valid and the material expert validators who declared valid. The practicality of using e-module was known from the use of e-module that going well and the results of students and teachers responses from questionnaire statements were high practicality. The results of the effectiveness were known from the increase in the students' understanding of subject and the test results of the difference between pre-test and post-test results of the application of this e-module were quite effective category. Based on this study, a learning e-module for SMAW Manual Arc Welding based on the Self Directed Learning model had produced. this was valid, practical and effective for use in learning and can improve the theoretical understanding of SMAW Manual Arc Welding subject.

Keywords: *E-Module, Validity, Practical, Effectiveness, Self Directed Learning*

I. INTRODUCTION

There are activities in education, namely learning and teaching activities, Learning is an activity of observing the environment and consisting of actions and behaviors based on the results of these observations which aim to benefit ourselves (Dimiyati, 2013). The learning process is a process of interaction between teachers and students (Sudjana, 2013). The process in learning activities is an affect thing in learning outcomes. In order to realize good learning outcomes, it must have components, namely: students, material, objectives, learning methods and learning media, evaluation facilities and infrastructure (Sofyan, 2010). These components are interrelated and influence among them. (Djeamar and Aeswan Zeain, in (Uno and Mohamad, 2011).

Vocational high schools are required to create graduates who are ready and have skills to compete in the world of work. By the skills they have, students

are expected to be able to implementation in the world of work. Teachers have play an important role as educators to improve the education quality. The education quality can be realized if the learning process is conducted effectively, the teaching and learning process can run well, directed and in accordance with the learning objectives. However, in achieving maximum results there are still many problems that become obstacles.

Currently, the learning process in Vocational high schools is still using the teacher centered learning model, the teacher who is the main character of the driving force in learning by transferring knowledge directly to students (lectures) (Harsono, 2008). However, in essence, learning in this century is no longer teacher-centered learning, but the learning is conducted with a willingness by the students to Self Directed Learning (SDL). The learning process can be stated to be maximum if they conducted learning according to their own way and

then can be actively involved in the learning (Uno in Manggala, 2012). Self Directed Learning can make students become independent and will create a sense of responsibility towards their learning (Harsono, 2006).

In addition, in the technology era, learning must be able to actively utilize technology. In this era the educators must be able to utilize and combine various kinds of media to support the learning process (BNSP 2010). One of the teaching media that can be utilized is the use of modules but in the form of electronic applications commonly known as E-Modules.

Furthermore, the results of observations with direct observations conducted by researcher at Vocational High Schools State 1 West Sumatra. This school has 5 expertise competencies, namely Mechanical Engineering, Electrical Engineering, Electronic Engineering, Building Engineering and Automotive Engineering. At the time of direct field observations the researcher focused on a problem in the Mechanical Engineering Department, the Welding expertise field of the SMAW Welding Engineering subject. Based on the observations and interviews with the SMAW Welding Engineering subject teacher that there were no learning modules or E-Modules used to support their learning but only used printed books about welding. Based on direct observations the teacher stated that during the learning process, students were more interested in practicum learning than theoretical learning. The teacher's assessment is assessed from direct observation of students' learning attitudes, the students are more able to conduct practicum for longer than theoretical learning. In addition, they have more mastery of practicum skills than the concept of the material theory. Based on the results of student test values in SMAW Welding subject, it indicated that only a few students have completed values. The results of student examinations in SMAW Welding subject can be seen in the table below.

Table 1. The data of mid-semester test values

Complete Values	Uncomplete Values	Averages
8 students	17 students	48,16

Based on the problems above, it is possible to change and use appropriate learning methods to overcome these problems. The learning methods use E-Module with self-directed learning model can be a solution to these problems. Like previous research that has been conducted regarding the effectiveness of using E-modules based on self-directed learning models in understanding the concept of dynamic fluid material by Dian and A Asyhari (2020), it has resulted

in an increase in student understanding of the conceptual understanding of dynamic fluid material using the e-module developed. compared to learning using a print module. Learning model of Self-Directed Learning is the process of students can learn independently and through the help of others based on their own interests and motivations (Uno in Manggala, 2012). Meanwhile, Sunarto (in Beratha, 2009) this method is considered as a method to make students aware of the importance of responsibility in learning and to generate their own motivation so that the learning process can be student-centered. The purpose of this SDL learning process, they can be more active, innovative and creative in developing their knowledge. Therefore, the researcher conduct the study as an effort in solving the problems that have been described.

II. METHODS

A. Development model

This study was R&D study by using development models ADIIE (Analysis, Design, Development, Implementaton, Evaluation). This model was developed by Raiser and Molenda Semsel (1974: 5). This model is used because it uses a procedure that is considered simple and has a systematic procedure stage according to the study stages of Daryanto and Rachman (2014). The development was conducted, and evaluation was involved in this development, before the E-Module was deployed, it was tested first then it revised according to suggestions and input from the application results. The development used in this study namely the ADIIE development model. According to Raiser, this model has 5 stages, namely Analysis, Design, Development, Implementation, Evaluation.

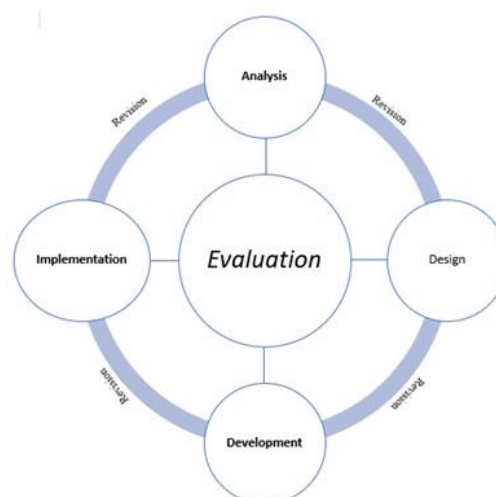


Figure 1. The Procedure of ADDIE development

The e-module development based on the self-directed learning model is developed at the development stage until the product trial stage. Product trial was conducted at five meetings. At each meeting, the students' understanding of the subject was evaluated to determine the effectiveness of using the e-module manual arc welding with the self-directed learning model. The results of this trial aimed to determine the effectiveness and produced an e-module that was effective for learning so that it can improve students' understanding the subject. The product trial model that is used namely the One Group Pretest-Posttest by using a learning group and comparing the result before and after e-module is applied (Sugiyono 2017).

Table 2. Product trial model

Pre-Test	Treatment	Post-Test
O ₁	X	O ₂

III. RESULTS

This study aimed to produce e-module based on a self-directed learning model that was valid, practical and also effective for use in manual arc welding (SMAW) subjects in the Mechanical Engineering Department of Welding Skills, Vocational High School State 1 West Sumatra. This e-module was created by using the Flip Builder PDF Pro computer application which can be accessed by using computers and smartphones through online and offline.

A. Product

The e-module that is produced namely a module in the form of an electronic application consisting of learning media such as sound, animation, video and sound as well as has an independent learning evaluation that can be accessed online which can be used in the self-directed learning model.

B. The expert validation test

Validation is conducted by six validators who have expert backgrounds in the field of welding and experts in the field of learning media. The validator filled the questionnaires that consisting of assessment instruments for several aspects of each question to the validation instrument questionnaire. The data obtained was calculated by using Aikes's V formula and the results obtained were as follows.

Table 3. The results of material validation

Aspects	Averages	Categories
Learning	0,79	Valid
Material	0,77	Valid
Self Directed Learning	0,77	Valid

Table 4. The results of media validation

Aspects	Averages	Categories
Design	0,82	Valid
Language	0,79	Valid

C. Practicality test

The practicality test was conducted on this study. The subjects of this study were 25 students of 11th grade of Welding Engineering, and two teachers in the SMAW Manual Arc Welding subject. The study subjects were respondents who filled out a practical test instrument questionnaire. The practicality test used 5-category Likert scale questionnaires. The results in this test were as follows.

Table 5. The results of practicality test

Respondents	Averages	Categories
Students	84%	High Praticalilty
Teachers	83%	High Praticalilty

D. The results of effectiveness test

Based on the results of testing the Welding e-module product based on Self Directed Learning learning model that was developed, there was an increase in the results of students 'understanding of the material based on the results of the material evaluation which was conducted five times at the end of each meeting. In addition, the effectiveness was known from the difference in the mean value of pre-test and post-test values based on the product trials developed by conducting the N-Gain value test Harsono, rahayu (2016). The results in this test were as follows.

Table 6. The Results of evaluation questions

Meetings	Average values	Max values
1 st meeting	52	66
2 nd meeting	60	73
3 rd meeting	67	79
4 th meeting	75	86
5 th meeting	81	100

It was seen based on the the application of the developed e-module, it resulted a significant increase from the first meeting to the fifth meeting so that the e-module was effective in improving students' theoretical understanding of the SMAW Manual Arc Welding subject by using e-module based on the self-directed learning model. Based on the results of the calculation of N-Gain Value, it was obtained an average value of 0.63 in Medium category and the average percentage value of the N-Gain Value was 63% and it included in the Moderately Effective category. So it can be concluded that the e-module is effective enough to be used in learning to improve the understanding of the theory in SMAW Manual Arc Welding subject by using e-module based on self-directed learning model.

IV. DISCUSSION

The development of learning e-modul was designed according to the students' needs and the problems which found by researcher. The problems are consisting of all components and looking for solutions that were considered to solve these. In this case the researcher determined the development of learning media that is considered to be able to solve the existing problems, namely developing a welding e-module in SMAW manual arc welding subject with self-directed learning model. The development of this e-module uses the ADDIE development method. This development model has several stages, namely *Analysis, Design, Development, Implementation and Evaluation*.

A. Analysis

At this stage there are 5 actions that need to be conducted namely: Needs analysis, Curriculum analysis and student analysis. The needs analysis aims to find out the first problems that can be raised in this study, the constraints, problems, and phenomena that occur and are found at the classroom in Welding subject. This analysis is conducted to select materials that will be used and as content in e-module. The curriculum analysis process will be adjusted to the existing curriculum in the study. The syllabus of SMAW Welding subject in the Welding Expertise of the Mechanical Engineering Department is used in the syllabus analysis. Students character analysis aim to determine the character of students such as background, attention, motivation, abilities, and skills that they already have.

B. Design

At this stage, it has 3 activities, namely, making the initial design, formulating learning models,

making learning models. Selection of e-module materials, namely teaching materials in the form of material on developed subjects and exercise questions that can help students in learning. Making the initial e-module design is conducted after the initial design (prototype) is completed. Making E-Module follows the existing prototype design. In this section the researcher must formulate a learning model that will be conducted in SMAW Welding subject. This is conducted in able to the purpose of developing e-module doesn't deviate from the learning model that is used.

C. Development

The validation stage of the prototype instruments that are produced is to determine the product feasibility from the point of view of the content of the material and learning media. In this activity, the validation was conducted by 3 material experts and 4 media experts as validators. This process is obtained input from the validator who was used to revise the e-module media that is developed in terms of material and media revisions. The inputs from validators are used as a guideline in making improvements and revisions to the applicable product before the trial. Revision activities include improvements and adjustments with suggestions from the expert validators and practitioners in accordance with their field of study. In addition to input suggestions, the validators are also asked to fill out the validity questionnaires to measure the validity of the material and media from e-module.

The questionnaires that are given to the validator becomes the guideline data for the validity level of the developed module. Based on the data obtained from validation activities with media expert validators and material experts that processed by using Microsoft Excel with Aiken's V formula, the calculation results data were obtained which indicated the average results with a value by 0.77 for validating material with valid category and with a value by 0.81 for the validation value of media in valid category based on the results of the average calculation of Aiken's V coefficient. After the product was declared valid in terms of material and media, it was continued with product trials with self directed learning models on the study subject.

The process was conducted to obtain practicality data. The practicality was obtained from the results of the questionnaires that are filled out by students and teachers to find out their assessment of e-module that was developed. Based on the data obtained by distributing questionnaires that given to students and teachers, so that the practicality data were obtained. Then the data were processed by using Microsoft

Excel with the results obtained by the average value based on students responses by 84.4 with high category and 83.1 based on teacher responses with high category based on calculation of the percentage interval category.

D. Implementation

Furthermore, the stage of product trial implementation is conducted to determine the effectiveness of learning on e-module. The product implementation results are used to collect data that determined whether e-module is effective. The effectiveness of e-module is known by looking at the increase in students' understanding of the learning material and comparing the results between pretest and posttest. E-module product trial is obtained by using one-group pre-test and post-test model. After the pre-test and post-test data are obtained, the data normality test is conducted to determine whether the data obtained is normally distributed or not and determine whether the data is able to be analyzed by using parametric or non-parametric statistical calculations. This normality test is conducted on two data that are obtained, namely pre-test data and post-test data.

The normality test uses the calculation which assisted by SPSS application. Based on the results of Shapiro-Wilk normality test, the pre-test indicated a significance value by 0.170, was higher than the significance value by 0.05 ($0.170 > 0.05$), the data was declared a normal distribution. While the post-test data indicated a significance value by 0.130 and was higher than the significance value by 0.05 ($0.130 > 0.05$), then the data was declared a normal distribution. Based on these results it can be concluded that the two data are normal distribution and the study can be continued with parametric analysis.

Determining whether there is a difference in learning outcomes from the pretest and posttest, it is necessary to do t-test. Based on the type of data obtained, namely data from one sample but there are 2 data variables, the T test can be continued with the paired sample T test because it fulfills the requirements in the test. Paired Sample T-Test is conducted by using SPSS application and the results were 2 outputs. In the first output obtained a correlation between the pre-test and the post-test values. Based on the test results obtained a significance value by 0.00 and less than 0.05 ($0.00 < 0.05$), it is stated that there is a correlation between the pre-test and post-test values. The second output indicates whether or not there is a mean difference between the pre-test and post-test values. In this output, the Paired Sample T-Test significance value

by 0.00. Based on the basis of decision making, Paired Sample T-Test If sig. (2-tailed) < 0.05 , then there is a significant difference between the pre-test and post-test learning outcomes. However, if sig. (2-tailed) value > 0.05 , there is no significant difference between the pre-test and post-test learning outcomes. It is known that the significance value obtained is 0.00 and less than 0.05, so there is a significant difference between the pre-test and post-test learning outcomes. After it is known that the pre-test and post-test learning outcomes data have differences in the average, a Gain Value test is conducted to determine the level of effectiveness of learning outcomes by using the developed e-module. Looking at the increase in students learning outcomes and processing the pretest and posttest data by using N-Gain value formula for the effectiveness test. The N-Gain Value test is conducted by using the Microsoft Excel application. Based on these calculations, the average value of N-Gain Value by 0.63 in the Medium category and the average percentage value of the N-Gain Value by 63% in Moderately Effective category. So it can be concluded that the e-module is quite effective in increasing students' understanding about the learning theory materials.

E. Evaluation

At this stage, the data analysis that have been obtained is conducted based on the data calculation theory and then it revises the learning tools based on input from the response questionnaires.

V. CONCLUSION

Based on the discovery of study about developed e-module learning that has been conducted, it can be concluded that SMAW manual arc welding e-module based on self directed learning model can improve students learning outcomes in understanding the theory of learning materials. The SMAW manual arc welding e-module based on self directed learning model that is produced is valid on the learning media aspect by 81% and the content/material aspect of the e-module by 77%. So the study results indicated that Welding E-Module Validation with self directed learning model is a valid aspect of the content in the material and media. E-module regarding SMAW manual arc welding based on self directed learning model produced practically according to teachers and students responses. According to students responses by 84% with high practicality category and 83% based on teachers responses with high practicality category so that the developed e-module is practical and can be used independently. The E-Module of SMAW manual arc welding based on self directed

learning model that is produced a quite effective in improving students' understanding regarding the theory of SMAW Manual Arc Welding subject with the result of N-Gain Value test by 63% in the quite Effective category and it is proven by the increase students' understanding regarding the theory, so that the developed e-module can be used in the learning process.

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