Development of Analog-Based Online Electronic Learning Models in Improving Students Learning Outcomes in Informatics Engineering Study Programs

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Abstract **– This study aims at developing an online based learning model in analogue electronics subjects. Respondents in this study were limited to students at STMIK Dipanegara Makassar who took analogue electronics courses. The research method used was research and development method which referred to Borg & Gall, Dick and Carry and Hannafin and Peck Models. To see the feasibility of the model that has been developed, researchers conducted expert tests, 1-1 tests, small group tests, and field trials in which the indicator is student learning outcomes of informatics engineering study programs. The results of this study indicate that this model is a potential design that is effective to be used during learning. It is proven by the increase of the completeness value of learning outcomes reached by the students. The average score of the learning outcome is 79.05 after using the learning model. The average score before using this learning model is only 55.05. Therefore, it can be concluded that the model developed has been effective in improving student learning outcomes in analogue electronics courses.**

Keywords **– Development, Learning Model, Online, Analogue Electronics**

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1. Introduction

Analogue electronics learning aims at helping students in thinking about solving problems regarding passive components and active components. In learning analogue electronics, students must pay attention to how lecturers solve problems related to analogue electronics, so that students can understand how to solve them and make it easier for students to complete analogue electronics exercises and apply them in everyday life. Students easier understand the material with the help of the media.

The development of information and communication technology (ICT) in the last few years is growing rapidly. This changes the paradigm of the community in seeking information that is not only limited to newspapers, radio, and television but also from virtual sources. One of the impacts of ICT development in the world of education is as a communication media and educational information between teachers and students. In addition, ICT is also a means of presenting ideas in delivering educational material. The media means middle, intermediary or introduction, namely the intermediary or the introduction of the message source with the recipient of the message. Therefore, media is a tool that has the function of conveying messages [1].

As a learning developer, researchers intend to develop online-based learning models in analogue electronics lessons that can invite the active and constructive involvement of students in their learning process towards the media. Therefore, the expected learning process is fun, creative, and not boring.

The model is an abstraction of reality. It is a simplified representation of some real-world phenomenon. It means that the model is a representation of several phenomena that exist in the real world [2]. In addition, the model is a process of

mindset and the components contained in it which are represented in graphic and narrative form.

In developing online-based learning models, it is necessary to consider learning needs, namely (1) student-centered; (2) learning by doing; (3) lifelong learning; (4) collaboration; (5) problem solving; (6) creativity; and (7) independence [3]. At present, it can be easy to find online learning methods that are carried out in the classroom. Almost every campus has a Wi-Fi network so that students can access the information they need. Therefore, the role of textbooks will decrease as it is replaced by accessing knowledge and information from a computer or mobile devices such as tablets and smartphones.

Besides that, various features of mobile devices provide their own opportunities for application developers. Several learning applications can be utilized in the world of education. One of them is the application of e-learning on mobile devices which are usually referred to as m-learning.

Based on the description above, the problem of this research is how is the level of effectiveness of online-based learning models developed in the Informatics Engineering study program. The purpose of this study is to describe the level of effectiveness of online analogue based electronic learning models in the Informatics Engineering study program.

Based on the above description and identification of the problem, it seems that the analogue electronic lecture process needs to be optimized in this study through the development of online-based learning models. In this model, students have the initiative, with or without the help of others to analyze their own learning needs, formulate their own learning goals, identify learning resources, choose and implement appropriate learning strategies and evaluate their learning outcomes [4]. Through the application of this model, students are given autonomy in managing their learning which will lead to learning independence. This model awakens and empowers students as adult learners in which learning is their own responsibility so that the learning process that is carried out is also optimal which has an impact on improving learning outcomes. This is in line with the opinion which states that if a person has the opportunity to develop their learning independence maximally, then he will be able to manage his learning well so that the results that will be obtained will be optimal [5].

Some research results are relevant to this research plan. The first is the study entitled “Comparing the Effectiveness of Classroom and Online Learning: Teaching Research Methods.” It was concluded that student learning outcomes measured based on learning activities in the classroom did not only depend on the teaching method but also to improve the quality and quantity of interaction needed to improve learning outcomes [6].

The research entitled "Graduate students' perceptions of online learning.” The result of this research shows that interaction, between students and instructors or lecturers, has a significant impact on their satisfaction. Other challenges identified are sufficient student support related to campus resources, and the need for various instructional designs and delivery to facilitate students' desire for independent learning. Instead, students are very satisfied with the clarity and organization of instruction using online resources [7].

Third is the research entitled "Creating an Online Tutorial to Support Information Literacy and Academic Skills Development." It can be concluded that the purpose of this online tutorial is to provide student resources that can be used to improve and develop their information and academic literacy, in handling the process of written assignments, from planning to selection of search tools and techniques, to critical reading [8].

Fourth, an interactive online listening task learning model for ELF learners in China was developed by [9]. Fifth, there are several reasons for using online learning. It can increase student motivation and attitudes to gain knowledge. There is the learning experience through understanding nil products. It provides opportunities for students to explore through the use of actual technology. It encourages active participation and strengthens student interaction [10]. The results of the five studies show that learning via the internet (online) requires not only the skills of students operating computers, reading and writing but also demands personal behavior that is open, disciplined and independent.

2. Research Methods

This study aims at developing something new that is expected to improve the quality of student learning outcomes. The skills that were developed in this study were the ability to organize online-based learning models in analogue electronics lessons. The research method used in the study with consideration of compatibility with the nature of the research carried out was the Research and Development (R & D) method. This study combines Borg and Gall's research model and Dick and Carey development model [11], [12].

This research was conducted at STMIK Dipanegara Makassar in Informatics Engineering Study Program which already has the facilities and infrastructure to support the implementation of research needs. The researchers implemented lecturer needs analysis, implemented student needs analysis, designed, and implemented research products for the

development of analogue electronics learning models carried out in the odd semester 2017/2018.

Data Collection

Data needed in this study were collected through some techniques, namely, interviews, questionnaires, and learning outcomes tests on student responses on online analogue-based electronic learning model products. Learning outcomes test was conducted by setting the control class and experimental class in which the number of respondents in each class was 38 students.

Data Analysis Techniques

To test the effectiveness of the developed model, an analysis was performed by comparing the pre-test and post-test to the control class (not using development products) and the experimental class (using development products). The pre-test and post-test test results were analyzed using SPSS Version 23 software and the Normality Test with Kolmogorov-Smirnov non-parametric Statistical method. The homogeneous test was also performed to determine the homogeneity of respondents. Moreover, T-test with T-paired different test methods was also applied.

3. Results and Discussion

As stated in the research problem, a description of the results and discussion will be presented as the proposed research question. The question is how is the effectiveness of online analogue-based electronic learning models developed in the Informatics Engineering Study Program? The learning model that was developed used a systematic approach. Therefore, it is assumed that a system that processes inputs in the form of learners who do not have the competency become the outputs in the form of learners who have the expected competencies. The system approach steps refer to Dick and Carey development model. This model consists of three stages, namely: (1) identification stage; (2) development stage; and (3) evaluation and revision stage.

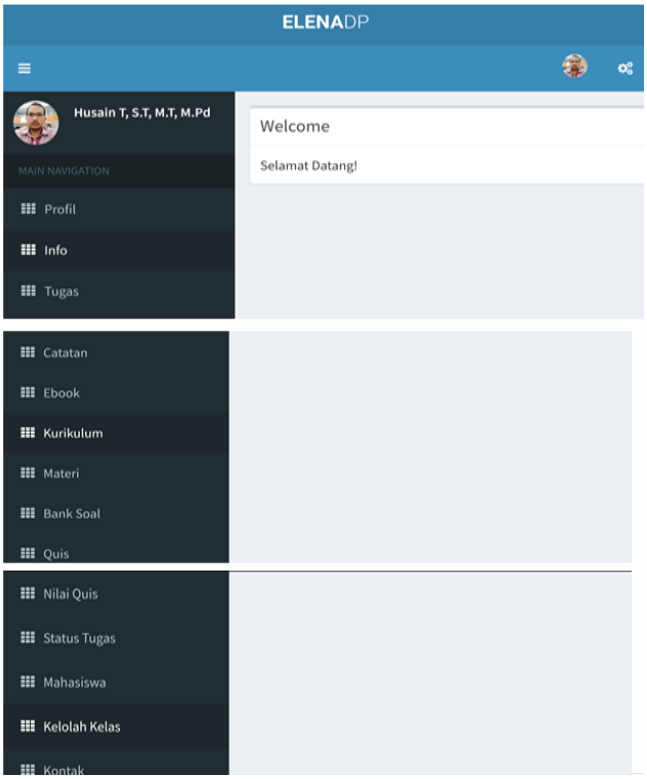

Figure 1. Display of online-based learning applications

Normality Test for Analogue Electronics Course Test Results

The data that are suitable for use in research is the data that have a normal distribution. Normality test aims at determining whether the data distribution of respondents is normal or not. The normality test will affect the use of statistical test tools in the effectiveness test of the model. A proper data model is normally distributed or near normal. Several ways can be used in the Normality test. One of them is the Kolmogorov-Smirnov (KS) method. Kolmogorov-Smirnov test is a test of normality that is widely used, especially after the existence of many statistical programs circulating in which the criteria are that if the significance value (Asym Sig)> 0.05, then the data is normally distributed. If the significant value is (Asym Sig) <0.05, then the data is not normally distributed.

Testing student learning outcomes before and after using e-learning in which the total respondents were 38 students, can be seen in Table 1. The results of testing using the Kolmogorov-Smirnov (KS) method using SPSS Version 23 can be seen in the following table.

Table 1. One-Sample Kolmogorov-Smirnov Test

Learning Outcome		Before Using E2LENA	After Using E2LENA
N		38	38
Normal Parameters [a,b]	Mean	55.0526	79.0526
	Std. Deviation	19.91190	9,19150
Most Extreme Differences	Absolute	.137	,126
	Positive	.073	,086
	Negative	-.137	-,126
Test Statistic		.137	,126
Asymp. Sig. (2-tailed)		.070[c]	,135[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The SPSS Outputs of Kolmogorov Smirnov (KS) by using the level of significant (α) 5% above show that before using e-learning it can be seen that the significance value of Asym Sig> 0.05 is (0.07> 0.05) in which the average value is 55.05 and after using e-learning the significance value of Asym Sig> 0.05 is (0.135> 0.05) and the average value is 79.05. Thus, it can be concluded that the learning outcomes data are normally distributed. The advantages of this test are simple and do not cause differences in perceptions between one observer and another observer, which often occurs in normality tests using graphical methods.

The Results of Homogeneity Test for the Analog Electronic Course

As with other statistical tests, the homogeneity test is used as reference material to determine the decision of statistical tests. The basis of decision making in the homogeneity test is as follows.

1. If the significance value is <0.05, then it is stated that a variant of two or more data of population groups are not equal.
2. If the significance value is> 0.05, then it is stated that a variant of two or more data of population groups is equal.

Table 2. Homogeneity Test

Learning Outcome

Levene Statistic	df1	df2	Sig.
,214	1	74	,645

Based on the results of the above analysis, it can be seen in the output test of homogeneity of variance. From the output, it can be seen that the significance value (sig) is 0.645. Because the significance is greater than α (0.05), it can be concluded that both learning outcomes have the same (homogeneous) variant.

T-Test for the Results of the Analogue Electronics Course Test

Parametric statistics for testing the effectiveness of the model using SPSS is through the t-test using the Paired-Samples T-Test formula. Based on the data from the pretest and posttest above, the T-test processing data is obtained as shown in Table 3.

Table 3. T-test Analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Before using E2LENA	55.0526	38	19.91190	3.23014
	After Using E2LENA	79.0526	38	9.19150	1.49106

Paired Samples Test

		Paired Differences				
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference	
						Lower
Pair 1	Before Using E2LENA After Using E2LENA	-24.00000	18.89373	3.06497	-30.21021	

Paired Samples Test

		Paired Differences				
		95% Confidence Interval of the Difference				
		Upper	t	df	Sig. (2-tailed)	
Pair 1	Before using E2LENA – After using E2LENA	-17.78979	-7.830	37	.000	

The average learning outcomes data before using e-learning and after using e-learning is different. It can be seen in the SPSS output in the t-paired sample test table above. The output can be seen that there are 38 valid data at pretest, 38 at post-test and no data missing. For the second output, the paired samples test which has been tested for levenes (homogeneity) means that if the variant is the same, the t-test uses the equal variances assumed. However, if the variant is different, it uses equal variances not assumed. The above conclusions are taken through the acceptance and rejection of the proposed hypothesis if the references are as follows.

There are two independent samples t-tests with hypotheses. Ha: There are differences in student

learning outcomes before and after using E-learning in analogue electronics courses. Ho: There is no difference in student learning outcomes before and after using E-learning in analogue electronics courses. From the test results using α = 5% two-tailed above, the equal variances assumed can be found that is (absolute value +/) 7.830. The t distribution table is searched in α = 5 %: 2 = 2.5% (2-sided test) in which the degree of freedom (df) is n-1 or 38-1 = 37, by testing 2 sides (significance = 0.000) so that t table is 2.02.

Decision-Making Criteria

1. If t counts ≥ t table, then H0 is rejected, and it means that there is a difference.
2. If t count < t table, then H0 is accepted and it means that there is no difference.

In addition to the criteria above, the probability number or Asymp.sig can also be used in making decisions with the following provisions.

1. If probability or Asymp. Sig> 0.05 then H0 is accepted
2. If the probability or Asymp.sig <0.05 then H1 is accepted

The Decision of the T-Test Analysis Results

Based on the results of the above analysis, it is found that t count value is 7.830 while the t table value is 2.02. The value of t count is greater t table (7.830> 2.02). Therefore, it can be concluded that H1 is accepted. If it is based on significance, the value is 0.000, in this case, the significance value is smaller than α = 0.05 which has been determined. Because of the significance value (0.000 <0.05), H1 is accepted, and it means that there are differences in student learning outcomes before and after using e-learning in analogue electronics course.

Theoretically and empirically online analogue based electronic learning models meet practical criteria. Theoretically, the results of the assessment of experts and practitioners stated that online analogue based electronic learning models could be applied in analogue electronics courses. Whereas, empirically the results of the trials showed that online analogue based electronic learning models met the functional criteria in terms of the implementation indicators and the ability of educators to manage online learning based on analogue learning electronic models. These results are in accordance with the opinion of [13] which states that practicality is associated with two things, namely: (1) whether experts and practitioners state that the learning material developed can be applied; and (2) significantly in the field, the developed learning material can be applied.

There are some obstacles in the process of developing online-based learning models in analogue electronics course. First, in the form of the procedural model, the development steps are only until formative evaluation. It is not until summative evaluation. It is because, in order to carry out the summative evaluation, the development model must first be implemented and disseminated. The obstacles faced are the problem of large funds and the long time in implementation and dissemination. Second, high costs are needed to be able to produce online-based learning models in analogue electronics courses. To produce a useful and accountable online application, a reliable programmer to be able to apply the conceptual model that has been made is required. In addition, it requires paid domains so that online-based learning models in analogue electronics courses can continue to be accessed and used in the learning process by lecturers and students. Third, learning resource such as online-based learning models in analogue electronics courses requires particular expertise in designing learning. This expertise is mastery of ICT literacy, especially online media.

3. Conclusion

The online analogue based electronic learning model was developed using research and development (R & D). This online-based learning model in this analogue electronics course can improve the mastery of competency in STMIK Dipanegara at informatics engineering students in Makassar. It shows that the model developed has the potential to be effective in improving student learning outcomes. This study implies that the model developed is effective in improving student learning outcomes. It was shown, before using the online-based learning model in the analogue electronics course, the average score of learning outcomes obtained was 55.05 from 38 students, and the average score of learning outcomes obtained after using the online learning model was 79.05 from 38 students. Online-based learning model in analogue electronics courses proved to be a useful and exciting model. It was suggested that the team of lecturers of analogue electronics courses should have collaborated with a clear division of tasks between lecturers, and cooperate with other relevant institutions in order to prepare online learning material, provide training and tasks that encourage students to learn actively, interactively, collaboratively, and independently. To further strengthen this online-based learning model, it is recommended that this learning model can be used for other classes and courses.

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