Achievement of Student Competence in Learning Electrical Power Installation in the Department of Electrical Engineering Education Using the Electrical Control Techniques Simulator Application

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ABSTRACT
Implementation of tertiary institutions greatly emphasizes the method or technique of an educator in innovating learning, especially in the subject of electric power installation in the Electrical Engineering education department for student competence achievements in the process of learning activities with the Electrical Control Techniques Simulator Application. The design of learning scenarios is of course very much needed, especially the availability of teaching material facilities and learning support facilities such as the Electrical Control Techniques Simulator Application which really requires experimental results to innovate and prove theoretical learning in the industrial world. The aims of the study were to determine: (1) differences in student competency in studying electric power installations using the electrical control techniques simulator application and those using the powerpoint application; (2) achieving student competence in learning about electric power installation in the electrical engineering education department by using the application of electrical control techniques simulator. The method used in this study was a quasi experiment with a pretest-posttest control group research design. The sample of this research is 4th semester students majoring in electrical engineering education. The sampling technique used was purposive sampling. Collecting data for cognitive and psychomotor competency variables using tests. The data analysis technique used is descriptive analysis, t-test, and gain scores in the final learning outcomes using the Electrical Control Techniques Simulator application or using the PowerPoint media application in the electric power installation course

Keywords: *Student competency, Electrical control techniques simulator application, PowerPoint, Electric power installation.*

1. INTRODUCTION

Advances in technology are so rapid that human resources are required to have skills, be critical and literate in knowledge of various challenges of the times in the current era of technology 4.0. Currently, various sectors of human activity, both economic, educational and social, have changed the system of human activity towards the use of digitalization technology. Therefore, especially in the education sector, it is trying to be balanced with the rate of development of information and technology which is increasing rapidly with an increase in the quality of students in learning based on digital media or applications.

The impact of the current digitalization era requires the education system in Indonesia to innovate new breakthroughs to keep up with the pace of development of the times so as to increase quality and moral human resources. An intelligent nation is very important to introduce and carry out basic education by directing activities, innovation programs and variations in order to create good human resources among students [1]. Therefore, education is an effort to create Human Resources so that they have useful knowledge to make humans more qualified and moral, one of which can be done in the higher education system.

The important role of higher education is to improve the quality of human beings who are competent, skilled, innovative, and produce superior products to create jobs

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and have a leadership spirit in taking advantage of the digitalization era. Education with contextual learning helps educators explore potential and connect analysis of one's needs with current facts in the field [2]. Therefore, the role of educators in tertiary institutions seeks to prioritize students to be more advanced and produce works that can trigger motivation and enthusiasm for learning and take advantage of current conditions to create jobs with digitalization technology.

Based on the results of initial observations made in class, improving human resources in motivating students in class still needs to be made a new breakthrough with learning patterns that are in line with the times. Furthermore, the way educators teach in the classroom is better, but accompanied by the use of digitalization technology to make it easier for students to find relevant and effective sources of knowledge. Student achievement in learning has started to improve, but educators are making more efforts to innovate various learning techniques that promote the emergence of creative ideas and the latest products to explore student competencies.

According to [3] competence is a form of someone in carrying out activities such as assignments, training by knowing the direction and definite goals to be achieved. Meanwhile, according to [4] competence is an effort to teach someone by obtaining certain achievements and on target as well. Teaching activities that are more directed, definite and on target require consideration of the following important matters: 1) Being able to master the subject matter carefully and thoroughly in carrying it out, 2) Educators are able to master the course of learning activities by liking the subjects and are optimistic that the absorption of knowledge can knowledge is transmitted to students, 3) Individual experience and potential skills, knowledge can be absorbed by these students, 4) innovating a variety of methods in an effort to develop individual potential in the learning process and believe that these individuals can definitely explore every lesson.

The characteristics of learning competencies have an impact on the achievement of definite learning targets by involving the activeness of students in class. Without active students in class, the learning process will not run well and even the achievement of learning outcomes will be in accordance with the criteria of student learning completeness. All of these criteria are strived to be in harmony with each other to complete the target according to the expectations of educators and students. This can be done in class or outside of class. According to [5], the competence of various learning activities is systematically marked by the following important criteria or characteristics: 1) being able to successfully create student learning achievements in accordance with instructional objectives in each subject or course, 2) able to contribute to a variety of active learning experiences, where by involving all students to acquire knowledge in instructional purposes, 3) having facilities that support teaching process activities and students can be facilitated by these facilities and infrastructure.

Furthermore, educators should have stepped ahead of students in utilizing the digitalization learning era because the educator's role will be to stimulate students in various ways of learning that are interesting and fun. Professional educators will be able to see the problems around them into conditions that can be utilized by new breakthroughs for students to be better and more effective. The selection of methods, strategies, approaches and learning techniques is expected to bring changes to students so that they are more active and motivated so that their learning outcomes are in accordance with predetermined criteria.

The success of students in achieving learning competencies cannot be separated from the support of adequate learning components. The role of the educator, of course, as a facilitator, is expected to be able to increase students' knowledge and skills to take part in learning. Educators are expected to be able to creatively manage the learning process in the study room, especially the use of learning media. The use of learning media has an important role in student learning motivation. Choosing the right media and tending to vary can make students more interested in participating in learning so that it can reduce the tendency of student passivity by prioritizing learning support for learning facilities such as learning media for the Electrical Control Techniques Simulator application.

The learning that educators have been doing so far still needs interesting variations, especially in theoretical subjects by combining simulation learning support from the Electrical Control Techniques Simulator application so that students' understanding is easy to absorb their knowledge and is critical in learning. Learning with the Electrical Control Techniques Simulator application emphasizes interaction and providing information that can make it easier for students to improve student competence both in soft skills and hard skills.

So far, there have been no educators doing learning, especially in the electric power installation course which combines and proves learning from the theory explained by proving the application in the form of Electrical Control Techniques Simulator as a reinforcement of students' understanding in learning. Of course, the use of the Electrical Control Techniques Simulator application during teaching and learning activities greatly encourages developing the productivity and criticality of students, besides being able to make it easier for educators to provide information and knowledge to students, it also makes it easier for students to know in depth the workflow and prove between theory and theory. practice. In addition, the features of this application make it easier for each other to improve real life in the learning process. Therefore, learning is very useful for educators and students by applying the Electrical Control Techniques Simulator learning application. Thus, this can foster a sense of curiosity in students while at the same time motivating them to learn. Such is one of the advantages of learning by simulating the Electrical Control Techniques Simulator application. Thus educators can monitor how much absorption of knowledge students gain when studying material and evaluate learning. Educators need to have the ability to take advantage of the learning around them so that learning objectives can be achieved better and more effectively. to develop understanding and appreciation of an event that is more directed towards psychomotor, the use of a simulation learning model will be very useful [6]. The simulation model is a model that asks anyone involved in the strategy to think of himself as another person whose purpose is to learn how other people act and feel.

This learning media helps students in carrying out experiments/simulations on electronic circuits and students no longer incur costs to buy components, tools needed to design electronic circuits. As well as being suitable for application to electronic circuit subjects) then the completeness of the features provided makes the electrical control techniques simulator application one of the best electronic simulation software [7]. Based on the problems and solutions for the future, it is necessary to look for other alternatives by innovating and implementing effective and interesting learning approaches to the material presented in class. So that the learning process can be active, effective, and enjoyable so that students' competence in hard skills and soft skills increases. Based on the description and background, it is necessary to carry out research on "Achievement of Student Competence in Learning Electrical Power Installation in the Department of Electrical Engineering Education by Using the Electrical Control Techniques Simulator Application".

2. RESEARCH METHOD

The type of research above as a quantitative by conducting experiments. The research design carried out is data that needs to be used in classical experiments or Classical Experiment Design, see in Table 1 below

Table 1. Classic experimental research design [8]

Groups	Pretest	Treatment	posttest
Experiment	Q1	X	Q2
control	Q3	-	Q4

Sampling for research on the population of the electrical circuit practicum course is carried out by carrying out the Purposive Random Sampling technique, namely sampling which is carried out if the list of population names already exists. This research was conducted at the Department of Electrical Engineering Education, especially in the electric power installation course. Data collection techniques that researchers do in the form of tests and questionnaires. This test is carried out to measure the extent to which students can understand the practical learning of electrical circuits using the Electrical Control Techniques Simulator application simulation. while the questionnaire is used as questions about student Electrical Control Techniques Simulator simulation learning to obtain data collection assumptions based on indicators of simulation learning with Electrical Control Techniques Simulator among students of electrical circuit practicum in the electrical engineering education department. data analysis used normality test, homogeneity and t test.

3. RESULTS AND DISCUSSION

This research was in the electrical engineering education department for the 2022/2023 academic year in the even semester of February to May 2023. The sample in this study was Student E1 (electricity 1) as the experimental class and E2 (electricity 2) as the control class. Achievement of Competency in the Cognitive

Domain carried out with multiple choice objective tests that were tested on 26 respondents in each control and experimental class. Please note that, the following is a calculation of the results of the data obtained from students before treatment to determine student competence in the cognitive aspects of each student in Table 2 below

Table 2. Distribution of Pretest score categories Control Class.

Score Range	Criteria	Total Student	Percentage
X ≤ 25	Very low	6	23.08%
25 < X ≤ 41.67	Low	15	57.69%
41.67 < X ≤ 58.33	currently	4	15.38%
58.33 < X ≤ 75	tall	1	3.85%
75 < X	Very high	0	0%
Total		26	100%

Based on the results of table 2 above, the acquisition of control class student pretest results can be it is known that as many as 23.08% of students are at very low category, as many as 57.69% of students are in the low category, as much as 15.38% students are in the medium category, as many 3.85% of students are in the high category. Based on the explanation above, you can it was concluded that the grade students' pretest scores control is in the low category. Then to find out the results of the distribution of the Pretest value categories the experimental class can be seen in Table 3 below

Table 3. Distribution of Pretest score categories experiment Class

Score Range	Criteria	Total Student	Percentage
X ⩽ 25	Very Low	8	30.77%
25 < X ⩽ 41.67	Low	13	50.0%
41.67 < X ⩽ 58.33	Currently	5	19.23%
58.33 < X ⩽ 75	Tall	0	0%
75 < X	Very High	0	0%
Total		26	100%

Based on the results of Table 3 above, results of the experimental class students' pretest got it is known that as many as 30.77% of students are in very low category, as much as 50% of students are in the low category, as much as 19.23% students are in the medium category. Based on explanation above, it can be concluded that the pretest results of experimental class students are at low category. The data obtained is then processed using a data processing program on SPSS 16. The following is the acquisition of student cognitive achievement results in Table 4 below.

Table 4. Calculation of results of cognitive aspects of student competency data before treatment (Pretest)

Groups	N	Min	Max	Mean	Std. Dev
Control	26	4.00	68.00	33.43	17.86
Experiment	26	3.00	68.00	36.29	20.48

Based on the results of table 4 above, the calculation of the results of cognitive aspect student competency data before treatment (Pretest) in table 3, it should be noted that the results of the scores achieved in both control and experimental classes have not achieved satisfactory results. This is of course evident from the pretest for the control class which obtained a minimum score of 4, a maximum of 68 with an average of 33.43. Likewise for the pretest for the experimental class, a minimum score of 3 is obtained, a maximum of 68 with an average of 36.29

Furthermore, posttest testing was carried out to find out the description of students' mastery of concepts in the control class and experimental class after the treatment. The following is the distribution of the control class posttest value categories in table 5 below

Table 5. Distribution of Posttest score categories Control Class.

Score Range	Criteria	Total Student	Percentage
X ≤ 25	Very Low	0	0%
25 < X ≤ 41.67	Low	0	0%
41.67 < X ≤ 58.33	Currentl y	7	26.92%
58.33 < X ≤ 75	Tall	14	53.85%
75 < X	Very High	5	19.23%
Total		26	100%

Based on the results of table 5 above, Control class of competency student of cognitive aspect can it is known that as many as 26.92% of students are in medium category, as many as 53.85% of students are in the high category, as many as 19.23% of students is in the very high category. Based on explanation above, it can be concluded that the posttest results of control class students are at high category. Then to find out the results of the distribution of the Posttest value categories the experimental class can be seen in table 6 below.

Table 6. Distribution of Posttest score categories experiment Class

Score Range	Criteria	Total Student	Percentage
X ⩽ 25	Very Low	0	0%
25 < X ⩽ 41.67	Low	0	0%
41.67 < X ⩽ 58.33	Currently	0	0%
58.33 < X ⩽ 75	Tall	12	46.15%
75 < X	Very High	14	53.85%
Total		26	100%

Based on the results of table 6 above, Control class of competency student of cognitive aspect can it is known that as many as as 46.15% of students are in the high category, as many as 53.85% of students is in the very high category. Based on explanation above, it can be concluded that the posttest results of experimental class students are in the very high category. Furthermore, after the treatment was carried out in each class and the post-test was carried out during the research, it turned out that the acquisition of data results for cognitive aspects of student competencies can be seen in table 7 below.

Table 7. Calculation of results of cognitive aspects of student competency data after treatment (Posttest)

Groups	N	Min	Max	Mean	Std. Dev
Control	26	28.00	95.00	72.14	20.90
Experiment	26	48.00	100.00	79.71	15.96

Based on the calculation of the results of cognitive aspect student competency data after treatment (Posttest) in table 7, it should be noted that the results of the scores achieved in both control and experimental classes achieved quite satisfactory results. This is of course evident from the Posttest for the control class which obtained a minimum score of 28, a maximum of 95 with an average of 72.14. Likewise for the Posttest for the experimental class, a minimum score of 48 was obtained, a maximum of 100 with an average of 79.71. Based on the analysis obtained, it shows that the implementation of the learning process uses simulation learning from the Electrical Control Techniques Simulator application by using powerpoint presentation media which was applied to the two classes experiencing significant differences in results.

Of course it is very important for researchers to know how big the potential benchmark is for the average value of student competence in the cognitive aspects of each class by implementing different learning methods when learning electrical installation practice. This has proven to be effective in overcoming the limitations of learning support facilities, especially in practical learning to find out the potential of students during the learning process for practical electrical installation courses by implementing simulation learning from the Electrical Control Techniques Simulator application to be more effective and on target. It is proven that when the acquisition of individual results is viewed in terms of knowledge during tests and when given practicum assignments, students are able to freely experiment with conducting experiments repeatedly by proving the theory of practicum assignments personally rather than just giving explanations in the form of simulation media on PowerPoint displays.

Furthermore, the participation and improvement of cognitive aspects of student competency outcomes is based on learning support directly applying the Electrical Control Techniques Simulator application for electrical installation practicum learning [9]. Likewise during the learning process in class, the lecturer easily explained briefly by showing a simulation of a series of experiments which later the student could imitate again to assemble the practicum assignment. Then the following is the acquisition of data results from the normality test in both groups after being given a student cognitive test using Shapiro-Wilk in table 8 below.

Table 8. Normality test

Groups	Kolmog-Smirnov[a]		Shapiro-Wilk	
	Df	Sig.	Df	Sig.

Control	26	0.134	14	0.066
Experiment	26	0.200*	14	0.392

Based on the results of the normality test in table 8, it should be noted that if the number of samples used is larger than 50 respondents, the Kolmogorov-Smirnov normality test is used, and if the sample is smaller than 50 respondents, the Shapiro-Wilk is used [10]. In obtaining the results of the data results from the normality test in both groups after being given a cognitive test of the critical thinking abilities of control class students, it showed a significance level of 0.066 and an experimental significance level of 0.392, therefore this proved that the two groups showed achievements with a normal distribution, which condition if the P value is significant > 0.05 it indicates a normal distribution. Furthermore, to get the results of the homogeneity test, it is necessary to do it with level statistics, which can be seen in the solid table 9 below.

Table 9. homogeneity test

Test of Homogeneity of Variances (Cognitive aspects of student competency			
Levene Statistic	df1	df2	Sig.
0.776	1	50	0.386

(source of research data)

Based on the achievement of the data results from the homogeneity test in both groups after being given a cognitive aspect student competency test obtained in table 9, it shows a result of 0.386 > 0.05. This means that in this case it states that the group has similarities or is homogeneous as seen in the final results of the cognitive aspects of student competency tests. Then after testing the prerequisite analysis of the normality and homogeneity tests, the research hypothesis was tested. In this study using the t-test hypothesis test. testing was carried out using a two-sample test that was not related (Independent Sample T Test) with a risk of error (significance) of 5%. Ho is accepted if ttable ≤ tcount and significance > 0.05. Hypothesis testing uses the help of the SPSS 16 program. The following hypothesis test can be seen in table 10 below.

Table 10. T-test

Groups	Mean	Table	Tcount	Sig
Control	72.14	2.10	3.23	5%
Experiment	79.71			

Based on table 10,mark tcount > ttable at 5% significance. So, indicates that the hypothesis is accepted, this means that these results indicate that there are differences between groups that are significantly influential when given treatment. Thus the treatment given using simulation learning with the application of the Electrical Control Techniques Simulator differs in the cognitive aspects of student competence achievements in the electrical installation practicum course compared to those using simulation learning in the form of PowerPoint media displays.

Of course, success in the learning process, especially practical lessons, requires facilities that can prove theory with practical results, such as learning Electrical Control Techniques Simulator simulations. Learning using the Electrical Control Techniques Simulator simulation media has increased seen in the activities of students in learning [11]. Of course, this is due to the several advantages that can be obtained in the circuit that we have simulated and worked successfully, so students can then make it possible to assemble and design motor control circuits without having to use expensive materials. There are 4 main components of the Electrical Control Techniques Simulator namely ac supply voltage (AC Power supplies), components (Components), induction motors [12].

Furthermore, it cannot be separated from the existing simulation in the Electrical Control Techniques Simulator which is equipped with a tool program that complements practicum work as a means of supporting practicum. Knowledge of learning in the application of learning media using the Electrical Control Technique simulator with an indicator achievement of 96.9%. Then the competency achievement of student learning activities in the implementation of learning has a very good presentation of 81.58%. This evidence really highlights the learning abilities of students [7]. This is also reinforced by the research results [13] and [14] who say that Electrical Control Technique simulator based learning media is effective in improving student learning outcomes and critical thingking ability in electric motor installation lessons. Therefore, there are no limitations or obstacles experienced by educators and students in the learning process in the classroom. It is necessary to utilize learning support media, one of which is using the Electrical Control Technique simulator software so that student competencies, especially cognitive aspects, can understand and analyze

the flow of work processes from each meeting. in the electrical installation course.

4. CONCLUSIONS

The conclusion in this study is that there is an increase in cognitive aspects of student competence when designing, analyzing, and simulating the assignments given. Acquisition of student learning outcomes with Electrical Control Technique simulator simulations is effective for increasing potential student competence, especially cognitive during practicum compared to learning using PowerPoint media simulations during practicum. The results of this achievement are of course proven by the data obtained on the given pretest and posttest after being given treatment with the implementation of different learning methods indicating that students' competence for cognitive seen from the aspect of knowledge experiences a significant difference. Of course, this achievement was proven by the average acquisition of cognitive aspects of student competence in the experimental group at the pretest of 36.29 while the posttest was 79.71. In contrast, in the control class, the average cognitive aspect of student competence in the pretest was 33.43 while the posttest was 72.14. Then when testing to see the differences from both sides of the group with the Independent Sample T Test obtained a tcount of 3.23 > 2.10 ttable at a significance of 5%. Based on this that. Of course, these results indicate that there are differences between groups that have a significant effect when given treatment. Thus the treatment given using simulation learning with the application of the Electrical Control Engineering Simulator is different in the cognitive aspects of achieving student competency in the electrical installation practicum course compared to those using simulation learning in the form of power point media displays.

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