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Application of Learning Cycle Models in Industrial Electrical Installation Courses

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ABSTRACT
This research is motivated by the low active participation of students in lectures on electrical installations in the electrical engineering department, ft unp. This is due to the lack of student activity in the learning process because the learning method is centered on the lecturer. This study aims to determine whether the application of Learning Cycle can improve student learning outcomes in the Industrial Electrical Installation course. Where the method of conducting this research is in the form of an experimental application of the learning cycle model in industrial electrical installation courses in industrial electrical engineering students in the semester Juli - Desember 2022. Based on the results of data analysis, the average value of pre-test was 73.87 and the post-test average 86.94. To test the hypothesis used t test with the help of SPSS version 15.0, obtained t value 10.467 is greater than the value of t table 2.042, which means that the proposed hypothesis is accepted at the real level $\alpha = 0.05$. So it was found that there was a significant increase in learning outcomes in the lectures on industrial electrical installations by applying the learning cycle learning. Thus it can be concluded that the application of the learning cycle can increase student competence in lectures.

Keywords: *Cycle learning, Models, Competency, Industrial Electrical Instalation.*

1. INTRODUCTION

The development of science and technology (science and technology) in this day and age, the need for qualified and competent humans in their fields is increasing. In order for these demands to be met, the existing human resources must be increased so that they are more competent in their respective fields. The existence of learning resources is very important to improve human resources [1].

The role of learning resources is one of the main factors in realizing increased knowledge. Learning is not only limited to the use of learning resources in the form of printed materials, but more than that. Learning that is carried out in vocational high schools today is towards the principle of complete learning called mastery learning, where competencies that have been fulfilled by students from the realm of knowledge, skills, and attitudes can support their need to face the industry when this [2].

The principle of Mastery Learning in the teaching and learning process will impact the activities of teachers in organizing the learning process". With this principle the teacher is no longer the main resource for students but as a student's companion in learning. Student-centered teaching is a learning process based on students' needs and interests Implementation of Mastery Learning In monotonous learning makes students seen as learning objects that only accept what is given by the teacher. Such learning tends to the method of training (drill and practice) so that student activities seem to be programmed to follow the procedures made by the teacher [3], [4].

Student learning habits that are always centered on the teacher, receive lessons from the teacher, work only at the request of the teacher and according to the teacher's way. Current learning conditions make it difficult for students to develop intellectual and motor skills optimally [5] . Now students cannot remember the material provided by the teacher in other words students tend to passively accept knowledge from the teacher without the opportunity to manage the knowledge they have acquired. This happens because the information obtained by students is not further processed so it is only stored in short term memory not stored in long term memory. Every stage of intellectual development in question is equipped with certain characteristics in constructing knowledge. For example, at the motor

sensory stage the child thinks through movements or actions [6]

The learning model has an important role in determining success in learning. Therefore teachers are required to be able to apply effective and efficient learning models that can increase student participation in teaching and learning activities. The benefit of the learning model is to enhance a more conducive learning atmosphere by involving aspects of student intelligence or in other words students are directed to conduct independent learning activities with professional supervision by the teacher [7], [8].

There are several learning models to meet the above strategies one of which is the learning cycle called the Learning Cycle. This learning cycle model is based on constructivism understanding which emphasizes the importance of the learning process of the formation of knowledge by students themselves based on their own knowledge in dealing with problems, materials and new environments. Regarding children and their learning environment according to constructivism, propose the following characteristics: (1) students are not seen as passive but have goals, (2) learning to consider as optimal as possible the process of student involvement, (3) knowledge is not something that comes from outside but is constructed personally, (4) learning is not the transmission of knowledge, but it involves setting the classroom situation, (5) curriculum is not merely learned, but a set of learning, materials, and resources [9], [10], [11]

Based on the observation results of the Industrial Electrical Installation course is one of the subjects in the curriculum structure of the Industrial Electrical Engineering Study Program (PSTEI) FT UNP. This course is a course that leads students to get to know electrical installations that are developing in the industry and scientific insights related to the field of electrical installations in the industry. The course emphasizes the activity of applying a theory in limited conditions and situations, such as laboratories, workshops, workspaces and so on. The application of this course is widely used in manufacturing industries. By mastering all the skills taught in each lecture material both theory and practice are expected to be a support for graduates truly prepared to work in industry [12].

The problem that occurs in the lecture process is the lack of active student participation in lectures, perhaps due to the inadequate learning methods carried out by lecturers supporting this course, so lectures have not been maximally increased students' critical thinking competencies

Therefore, with this research, the implementation of a learning model in the Industrial Electrical Installation lecture is a learning model that is able to foster motivation and critical thinking competence of students in higher education in order to have the competencies needed in the work / industry world to maximize the learning process.

2. MATERIAL AND METHODOLOGY

5E Learning Cycle Learning Model With Cognitive Style - Learning model is a plan or a pattern that can be used to design teaching patterns face-to-face in the classroom or arrange tutorials and to determine learning materials including books, films, types types, computer peripheral programs, and curriculum (as courses for learning). Each model directs us to design learning that can help students achieve various goals. The 5E learning cycle model is a learning model that consists of activities that are organized in such a way that students can master the competencies that must be achieved in learning by playing an active role [13]

The learning cycle learning model is one of the learning models that is in accordance with the constructivist paradigm. The constructivist theory approach basically emphasizes the importance of students constructing their own knowledge through the involvement of the teaching and learning process. So that the teaching and learning process is more student centered than teacher centered. In other words learning using the learning cycle learning model is centered on students and the teacher acts as a facilitator.

According to Rusman there are several models that are based on constructivist namely 16 models of learning cycles (Learning Cycle), generative learning models, interactive learning models, CLIS (Children Learning in Science) models, and cooperative learning strategy models. The learning cycle model was first introduced by Robet Karplus in the Science Curriculum Improvement Study / SCIS. The learning cycle model is one of the learning models with a constructivist approach which initially consisted of three stages, namely: exploration, invention, and discovery. The three stages are currently developed into five stages by Anthony Worsbach, namely: engagement, exploration, explanation, elaboration, and evaluation. This 5E learning cycle model has one of the goals that gives students the opportunity to construct their own knowledge and experience by actively engaging in learning material meaningfully by working and thinking both individually and in groups, so students can master the competencies that must be achieved [14].

The following are the 5 phase learning cycles applied in the recovery process known as 5E as follows:

2.1 Engagement phase

At this stage, the teacher tries to arouse and develop interest with students' curiosity about the topic to be taught. This is done by asking questions about factual

processes in daily life (which correspond to the topics discussed). Thus, students will provide responses / answers, then the student's answers are grounded by the teacher to find out the student's initial knowledge of the subject to be discussed.

2.2. Exploration phase

In this phase, students are given activities that can involve students' activeness to test predictions and hypotheses through alternatives taken, record observations and discuss with other students. So students have the opportunity to work together in small groups without direct teaching from the teacher. In this phase the teacher is the facilitator.

2.3. Explanation phase

Activities in this phase aim to complete, perfect and develop concepts that are obtained by students. Students are required to explain the concepts being learned in their own sentences. In this phase students find terms from the concepts being studied.

2.4. Elaboration Phase

This learning activity directs students to apply the concepts they have learned, make connections between concepts and apply them to new situations through advanced practicum activities that can strengthen and broaden the concepts they have learned.

2.5. Evaluation Phase

Students are given questions to diagnose the implementation of learning activities and know students' understanding of the concepts obtained.

Engagement evaluation revolves around pre-assessment. That is, find out what students already know about the topic to be discussed by asking questions and making students respond verbally or in writing. In exploration, evaluation focuses on process. That is, in the process of data collection by students, not the product of data collection. The explain evaluation focuses on how well students can use the information they have gathered and what they already know about new ideas. Elaboration evaluation can be likened to a test at the end of a lesson to find out how far students' understanding of the concepts they have learned. The engagement, exploration, explanation, elaboration, and evaluation phases are interrelated and support each other. Each phase (phase) has a specific function and contributes to teachers and students to improve understanding of scientific knowledge and technology, attitudes, and better skills [15]

The five stages of the 5E learning cycle model can be illustrated as in Figure 1 below:

Figure 1 Stages of the 5E Learning Cycle Model (adapted from Ergin, 2012; Tuna & Kacar, 2013)

Based on the syntax of the 5E learning cycle model, the learning process undertaken is no longer merely the transfer of knowledge from teacher to student, but the process of acquiring concepts oriented towards active student involvement in the learning process. The 5E learning cycle model emphasizes the role of students as a center of learning and as knowledge self-making [16]. States that the 5E learning cycle model is able to create meaningful learning that can improve student learning achievement, student motivation, and help them to learn actively [17]. Also states that the 5E learning cycle model is effectively used to increase student understanding and learning achievement, help students enjoy science, understand material, and apply it in scientific situations [18], [19].

3. METHOD

This type of research is experimental research which is categorized into quasi-experimental research. Quasi experiments are a design not using random at the beginning of group determination and also groups are often influenced by other variables and not solely by treatment [20]. In this study, student learning outcomes will be distinguished before and after being treated in the form of learning using the 5E learning cycle learning model [21].

This research was carried out in the Department of Electrical Engineering, Padang State University, as the Research Subject was an Industrial Electrical Engineering Study Program Student who took Industrial Electrical Installation Lectures in the January-June 2020 semester. This research was conducted during semester 1 semester. from planning to compiling reports on research results. Starting from February to June 2020. the research sample consisted of 2 classes, namely 2TEIA and 2 TEIB. The research subjects were 34 students in class 2TEIA and 33 students in class 2TEIB whose learning

activities used the learning cycle type 5E learning model. The procedure in this study was experimental. The instrument used in this study was in the form of written multiple choice test questions. Test questions are arranged based on the material and objectives to be achieved in learning. In this test problem the measurement used is if the question can be answered correctly then the score is 1 and if the question is answered incorrectly then the score is 0.

Analysis of the data used is descriptive analysis and inductive analysis. Descriptive analysis aims to look at the distribution tendency of each indicator and to see in general the spread of each variable in the form of data presentation into a frequency distribution table. The general purpose of inductive analysis is to determine the significance of the Effect of Learning Cycle Learning Methods [22]

4. RESULT AND DISCUSSION

Based on the results of descriptive analysis, obtained information on the frequency distribution of pre-test and post-test results. Student learning outcomes data when the pree test is taken from the initial test given before applying the learning cycle learning method. The number of questions for this research consists of 25 questions which have been tested for validity, different power and reliability. Furthermore, this problem was given to 34 students. Based on the distribution of the lowest score of 40, the highest value of 80, to be further seen in table 1 the following pre-test analysis results.

Table 1. Pre Test Descriptive Analysis Results

N	Valid	34
	Missing	34
Mean		63,8710
Median		64,0000
Mode		80,00
Std. Deviation		11,97704
Range		40,00
Minimum		40,00
Maximum		80,00
Sum		1980,00
N		Valid

From Table 1 above we get an average value (Mean) of 63.87 median of 64, mode of 80 and standard deviation (standard deviation) of 11.97. Furthermore, the results of the post test based on the distribution of scores obtained the lowest value of 52, the highest value of 92. From the value of the data sought values for the range of data, many classes, and class length. Based on the analysis, the results obtained can be seen in the following Table 2.

Table 2. Post Test Descriptive Analysis Results

	Valid	34
	Missing	34
Mean		73,9355
Median		76,0000
Mode		80,00
Std. Deviation		11,06928
Variance		122,529
Range		40,00
Minimum		52,00
Maximum		92,00
Sum		2292,00

From Table 2 above, the mean value is 73.93, the median is 76, the mode is 80 and the standard deviation is 11.07. After a descriptive analysis is done then an inductive analysis is performed, to determine the significance of the difference in learning outcomes of the experimental class and the control class. The hypothesis test used is the t test. Before testing the hypothesis first, the analysis requirements test is performed. After all the analysis requirements are met, then proceed with the hypothesis test. From the hypothesis test using the t test, it was obtained that tcount was 10.467 while the ttable price was 2.042. it was concluded that there was a significant increase in learning outcomes in the subjects of industrial electrical installations by implementing Learning Cycle learning models in the Industrial Electrical Engineering study program

This research results that there is a difference in the average value of student learning outcomes in industrial electrical installation lectures using learning cyle modes rather than being taught by direct learning models. The average score for the experimental class with the project-based learning model was 92.6, while the mean score for the control class with the direct learning model was 81.2. The application of the cyle learning model has a significant effect on the application of the direct learning model. Where students are more active in learning in the laboratory, the student's experimental learning outcomes are higher than the control class as shown in Figure 2 below:

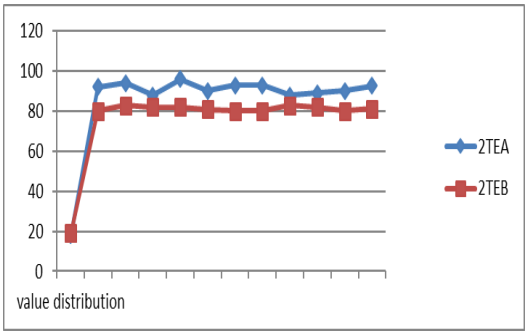

Figure 2. A figure Distribution of values and averages, experimental and control classes

Based on Figure 2, it can be interpreted that the application of the learning cycle model can improve student learning outcomes. This can be seen in the results of experiments conducted on students of the industrial electrical engineering study program majoring in electrical engineering at the Faculty of Engineering, Padang State University. There are differences in learning outcomes between students. experimental class and control class. This difference can be seen from the highest score of the experimental class 97 with an average of 92.6, while the control class is at the highest score of 89 with an average of 81.2. Thus it can be said that student learning outcomes in the experimental class are higher than student learning outcomes in the control class.

5. CONCLUSIONS

Original Based on the results of data analysis discussed, it can be concluded that student learning outcomes with the application of the learning cycle learning model are better and improved. This can be seen an increase in average learning outcomes in pre-test with post-test results. This is because the application of the learning cycle model provides advantages as being able to increase learning motivation because students (students) are actively involved in the learning process, help develop students' scientific attitudes, learning becomes more meaningful.

In connection with the research findings, the authors propose a number of suggestions, namely: It is expected that lecturers who are in charge of industrial electrical installation courses. In order to be able to apply various learning methods when teaching. One of them, with the Learning Cycle method as researchers do, because it is proven to improve learning outcomes. Students, with the learning process of the learning cycle method it is hoped that students can be more motivated in the learning process and not be bored in learning. And for further researchers, it is expected to be a reference to try to apply similar learning methods in other subjects, or add other variables that serve as helpers in the learning process.

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