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Physics Education in Model of Learning Cycle

Rita Destini*

Faculty of Education, Universitas Muslim Nusantara AW Medan, Indonesia
Email: ritaumnaw@gmail.com

Abstract

Physics Education needs an adapted teaching model. This paper applied a learning model which was designed to strengthen students' knowledge of Physics Education subjects at senior high school in Indonesia. Learning Cycle directs students to the materiasl they that live in and helps them to recall information related to previous information. Research Model Learning Cycle was applied to know the improvement of physics learning outcomes. This research was conducted in class X in the 2nd semester of Public Senior High School 2 Perbaungan in 2016/2017 academic year with the Dynamic Electricity as subject topic. As a tool of data collection, it is used multiple physics test result of students multiple choice as much as 20 questions. Data analysis technique in this research used t_{test} calculation with $t_{count} > t_{table}$. From this research, it is obtained: $\overline{x_1}$ = 14,15 and $\overline{x_2}$ = 12,4, s_1^2 = 166,41 and s_2^2 = 163, 84, t_{count} = 2,97 and t_{table} = 1,67. Hypothesis test of this research was $t_h > t_t$ that 2,97 > 1,67 then Ha is accepted, it means that there is significant effect from the use of Teaching Learning Cycle model to physics learning outcomes of students of class X Public Senior High School 2 Perbaungan Academic Year 2016/2017.

Keywords: Teaching Learning Cycle model; learning; improvement; achievement.

1. Introduction

Some students of the problems found in the Physics education learning process; they commonly find it is such a difficult and boring. It was found that too many formulas that make the Senior High students to remember let alone to apply. Thus, monotonous teaching methods are also the reasons why Physics lessons give the matter for most of the students; they do not understand to read the matter, and determine what formula would be used. This fact illustrates that the learning model used in the class is not right, the lesson model applied in it less varied.

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* Corresponding author.

This indicates that students only receive knowledge from the teacher alone without taking the initiative to find it themselves. In reality students are less able to link the information that has been obtained from the teacher with the information to be learned.

Furthermore, based on observations of test results conducted by teachers of physics studies, it is known that the results of students' learning about 60% dynamic electrical material has not reached the target according to the value of 70. To overcome the low learning outcomes of physics students, it needs to use a student-centered model. One alternative that can be used is using the Teaching Learning Cycle model. As a model for planning instruction, the learning cycle "can help teachers 'package' important instructional goals into a developing conceptual 'storyline' that accommodates both selection and sequencing of learning opportunities" [1].

Learning Cycle is a way to construct new knowledge from the old knowledge that students already have and takes a series of stages of activity (phase) organized in such a way to form a continuity so that learners can master the competencies to be achieved in learning by playing an active role. The use of Teaching Learning Cycle model is expected to improve student learning outcomes.

1.1. Formulation of the problem

Based on the background of this study, then the formulation of the problem in this study is: Is there any effect of Teaching Learning Cycle model on the physics learning outcomes of students of Public Senior High School 2 Perbaungan?

1.2. Hypothesis

Hypothesis in this study was: "there is a significant effect of Teaching Learning Cycle model on the results of Physics Education achievement of students in the Public Senior High School 2 Perbaungan of North Sumatra?"

2. Theoretical reviews

This part discuses the learning process. Argues Jerome Bruner [2] that the learning is an active process where students build new knowledge based on experience or knowledge they already acquired. In Sardiman [3] it was said that, according to the views of constructivist theory, the learning is an active process of the subject learning to construct the meaning of something good text, dialogue, experience and so on. Learning has the purpose to develop the knowledge, attitudes, and basic skills that learners need in life [4]. Bruner [5] suggests that the learning involves three processes simultaneously; (1) obtaining new information; (2) information transformation; and (3) examining the relevance and accuracy of knowledge.

From theories of learning above, it may conclude that the learning is a process of reconstructing new knowledge received so that a learner has more permanent learning experience. Each learning activity will end with learning outcomes. Learning outcomes are the abilities students have after receiving their learning experience [6]. Learning outcome is a description of learning achievement in following the teaching and learning process at a level that followed. Learning outcomes are the result of the interaction of learning acts in experiencing a

process; it improves a learner's ability and learning interaction within classroom and outside school. Furthermore, stresses; "Learning outcomes are the abilities that a child acquires after through learning activities, the acquisition is in the form of a relatively settled behavior as a result of knowledge, attitudes and abilities possessed learners [7]".

2.1. Teaching Learning Cycle Learning (TLC) Model

Models of learning are very complex and various. In this theory, the Teaching Learning Cycle model one of the learning approaches basically generated from the Constructivists [8]. Nuhoğlu and Yalçin [9] contends that the learning Cycle is a teaching model based on the knowledge organisation process of the mind. Additionally, Learning Cycle is a series of activity phase organized in such a way to form the continuity of education; so that learners can master the competencies to be achieved in learning by playing an active role.

The Teaching Learning Cycle (TLC) from Constructivist instructional model, as published by Akin and Karplus (1962), is an instructional model that comprises of concept discovery, concept instruction, and concept application [10]. Implementation of Learning Cycle in learning in accordance with view of constructivism that is:

1. Students learn actively. Students study the material meaningfully by working and thinking. Knowledge is in the construction of the student experience.
2. New information is associated with a scheme that students already have. The new information that students have comes from individual interpretations.
3. Learning orientation is investigation and discovery which is problem solving.

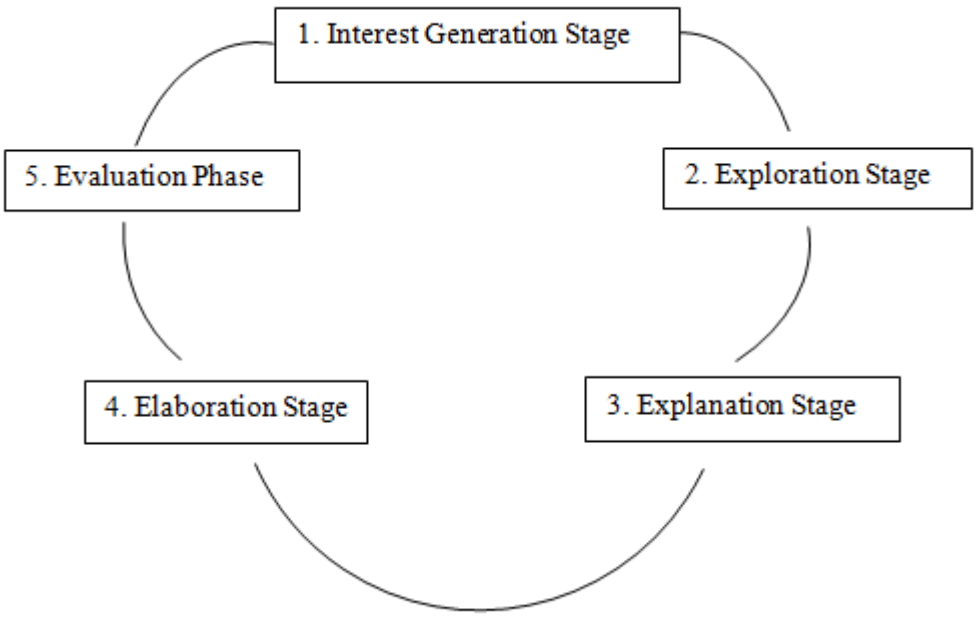


Figure 1: Learning Cycle Phases

Table 1: Learning Process Activity With Learning Cycle

NNo	Learning Cycle Stage	Teacher's Activities	Student's Activities
1 11 1	Interest generation stage (Engagement)	Awaken interest and curiosity (student curiosity)	Develop interest, curiosity on the topic
		Asking questions about factual processes in everyday life	Responding to teacher questions
		Associating the topic discussed with student experiences. Encourage students to memngat their daily experiences and show their relevance to the topic of learning being discussed	Trying to remember the day-to-day experience and relate it to the learning topics to be discussed
2	Exploration Stage	Establishing groups, providing opportunities to cooperate in small groups independently	Forming groups and work in groups
		Facilitating and motivating students	Creating a new prediction
		Encouraging students to explain concepts with their own sentences	Trying alternative solutions with group mates, recording observations, and developing new ideas
		Requesting proof and classifying students' explanations, hearing critically explanations among students	Showing evidence and clarifying new ideas
		Providing definitions and explanations using previous student descriptions as the basis for discussion	Observing and trying to understand the teacher's explanation
3	Explanation Stage	Encouraging students to explain concepts with their own sentences	Explaining the found concepts
		Requesting proof and clarification of student explanations	Using observations and notes in explaining
		Hearing critically explanations between students or teachers	Proving the concept proposed
		Guiding the discussion	Discussing
44	Elaboration Stage	Reminding students of alternate explanations and consider data / evidence as they explore new situations	Applying concepts and skills in new situations and use formal labels and definitions
		Encouraging and facilitate students applying concepts / skills in new settings / others	Asking, propose solutions, making decisions, conducting experiments and observers
55	Evaluation Stage	Observing students' knowledge or understanding in terms of concept application	Evaluating its own learning by asking open questions and searching for answers using observations, evidence, and explanations gained beforehand.
		Encouraging students to conduct self-evaluation	Taking further decisions on the learning situation undertaken
		Encouraging students to understand the shortcomings / advantages in learning activities	Viewing and analyzing shortcomings in learning activities

Here is a picture of Teaching Learning Cycle model (Learning Cycle) [8].

Based on the stages in the cyclical learning method described above, it is hoped that students will not only hear the teacher's information but can play an active role in exploring and enriching their understanding of the learned concepts.

Table 2: The Advantages and Disadvantages Teaching Learning Cycle model

No	The Advantages	The Disadvantages
11	Increasing motivation to learn because students are actively involved in the learning process.	It takes longer.
22	Students can get the experiences and understand others.	It is difficult for students who can not communicate well.
33	Students are able to develop the potential of individuals who are successful and useful, creative, responsible, actualize and optimize himself / herself to the changes that occur. Learning becomes more meaningful.	

2.2. Contextual Learning Model (CTL)

Contextual learning is a learning concept that can help teachers connect between material taught to real-world situations and encourage students to make connections between their knowledge and application in their lives as family members and society [11].

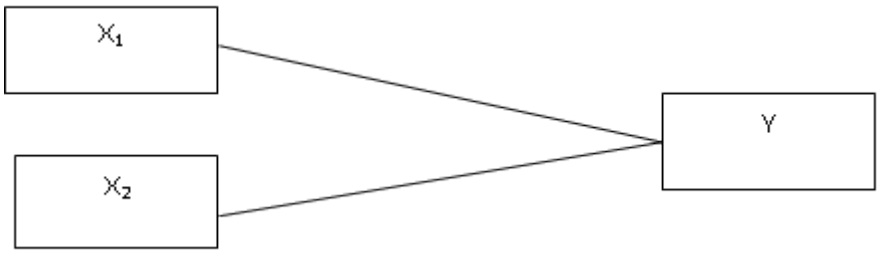
Table 3: Learning Process Activity With Contextual

No.	CTL stage	Teacher activities	Student activities
11.	Constructivism	Conditioning students in a position ready to learn and motivating students to apply their own ideas.	Answering the teacher's apperception and listening to the explanation.
22.	Inquiry	Providing a mistake and providing opportunities for students to find solutions.	Explaining, revealing facts in accordance with its content, provides a convincing argument.
33.	Asking	Motivating students by raising curiosity and asking questions.	asking about the incomprehensible things that are related to the problem.
44.	Society learns	Providing opportunities for students to learn in groups (two-way communication).	Brainstorming with group mates about the problems the teacher provides.
55.	Modeling	Presenting material is accompanied by modeling.	Paying attention and listening to teacher explanations.
66.	Reflection	Providing an opportunity for students to deduce the material they have just learned.	Answering and concluding the material being studied.
77.	The actual assessment	Providing assessment to students in various ways.	

Contextual learning is a learning model that provides facilities for student learning activities to find, process and find learning experiences that are more concrete. Thus, learning is not just seen from the product side, but the most important is the process [11]. The CTL system is an educational process that aims to help students see meaning in the academic material they learn by connecting academic subjects to the contents of everyday life, that is, to the context of personal, social and cultural life [11].From the description above, it can be concluded that the contextual learning model is the learning model that connects the subject matter with the real world state of the students. So that students easily to understand and remember the subject matter taught by the teacher. Operationally, the activities of teachers and students during the learning process can be described as follows [2].

3. Research design

A quasi experiment was applied to observe the learning result of a new treatment for subjects (students) that proved by the data found [12].



Notes: X1 = Learning with LC model

X2 = Learning with CTL model

Y = Students' Physics learning outcomes

4. Results and discussion

After the research was conducted in Public Senior High School 2 Perbaungan, it was seen the influence of Learning Cycle learning model on learning outcomes. Then the data were analyzed by hypothesis testing.

4.1. Data analysis

Learning Cycle Class

$\Sigma xi = 566$ $\Sigma(xi)^2 = 2296$ $n = 40$

1. The average

$$\overline{X}_i = \frac{\sum X_i}{n_i} = \frac{566}{40} = 14{,}15$$

2. Stardard Deviation

$$S = \sqrt{\frac{n\sum X_i{}^2 - \left(\sum X_i\right)^2}{n(n-1)}}$$

$$S = \sqrt{\frac{40\,(2296) - (566)^2}{40(40-1)}}$$

$S^2 = 166{,}41$

$S = 12{,}9$

Contextual Class

Table 4: Calculation of Average and Deviation og CL Class

No.	Value	f	Xi	Xi^2
1	9	1	9	81
2	10	3	30	100
3	11	4	44	121
4	12	4	48	144
5	13	3	39	169
6	14	6	84	196
7	15	7	105	225
8	16	4	64	256
9	17	4	68	289
10	18	3	54	324
11	19	1	19	361
Σ		40	566	2296

Table 5: Calculation of Average and Deviation of Contextual Class

No.	Value	F	Xi	Xi^2
1	7	2	14	49
2	8	3	24	64
3	9	1	9	81
4	10	3	30	100
5	11	3	33	121
6	12	5	60	144
7	13	7	91	169
8	14	6	84	196
9	15	6	90	225
10	16	3	48	256
Σ		39	483	1405

$\Sigma xi = 483$ $\Sigma(xi)^2 = 1405$ $n = 39$

1. The average

$$\overline{X}_i = \frac{\sum X_i}{n_i} = \frac{483}{39} = 12{,}4$$

2. Standard Deviation

$$S = \sqrt{\frac{n\sum X_i{}^2 - \left(\sum X_i\right)^2}{n(n-1)}}$$

$$S = \sqrt{\frac{39(1405) - (483)^2}{39(39-1)}}$$

$S^2 = 163{,}84$

$S = 12{,}8$

4.2. Hypothesis Testing

The result of data calculation postes students, it is obtained as follows:

$\overline{X}_1 = 14{,}15$ $S_1{}^2 = 166{,}41$ $n_1 = 40$

$\overline{X}_2 = 12{,}4$ $S_2{}^2 = 163{,}84$ $n_2 = 39$

Then :

$$S^2 = \frac{(n_1 - 1)S_1{}^2 + (n_2 - 1)S_2{}^2}{n_1 + n_2 - 2}$$

$$S^2 = \frac{(40-1)(166{,}41) + (39-1)(163{,}84)}{40 + 39 - 2}$$

$$S^2 = 165{,}1416$$

$$S = 12{,}85$$

Because of the data from two samples is homogeneous then to test the hypothesis used the formula:

$$t_{hit} = \frac{\overline{X}_1 - \overline{X}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$t_{hit} = \frac{14{,}15 - 12{,}4}{12{,}85\sqrt{\frac{1}{40} + \frac{1}{39}}}$$

$$t_{hit} = 2{,}97$$

By comparing t_{count} and t_{table} then $t_{count} > t_{table} = 2{,}97 > 1.67$. Based on the criteria of hypothesis test if $t_{count} > t_{table}$ then Ho was rejected but, Ha was accepted. It can be concluded that there is an effect of Teaching Learning Cycle model on student learning outcomes on the subject of dynamic electricity in class X at Public Senior High School 2 Perbaungan.

5. Discussion

From analysis of research data, it indicated that the students' learning result of class X1 (Learning Cycle) it is obtained $\overline{x}_1$ = 14,15 dan S_1^2 = 166,41 while X_2 (Contextual) it is obtained $\overline{x}_2$ = 12,4 and S_2^2 = 163,84 then S_{gab} = 12,85. In testing the hypothesis of the analysis of differences in the average calculated t_{count} = 2.97 while the value of t_{table} for significant level 1.72 and degrees of freedom 0.05 is 95%, it means $t_{count} > t_{table}$ (2.97 > 1.72). So it can be said that the hypothesis was accepted in other words the data show that the results of student physics learning from the Learning Cycle Learning Group is better than the results of contextual learning.

The above finding, it explained that the learning by using the Teaching Learning Cycle model was better and more effective for the Physics learning, in the Dynamic Electric subject topic, This model improved the students' learning outcomes. The Teaching Learning Cycle model made the students understood the material deeper and had the initial knowledge before receiving the new material presented by the researcher. In the use of Teaching Learning Cycle model students were more effective in observing learning materials and getting new things from learning materials. With the Learning Cycle Learning Model the teacher created the strategies for the material conveyed and chose; it took the right strategy in the delivery.

6. Conclusions

Based on the results obtained from the data analysis, hypothesis testing and data processing, finally it had obtained the findings with the following conclusions: The results of physics learning taught by using the Teaching Learning Cycle model has an average score of 14.15. The result of physics learning taught by using Contextual Learning Model has an average score of 12.4. The statistical calculations t test was $t_{count} > t_{table}$ or 2.97 > 1.72. So it can be concluded that there was a significant effect of learning using Teaching Learning Cycle model to the students' physics learning outcomes of the subject "Dynamic Electricity" in the X class of Public Senior High School 2 Perbaungan in 2016 / 2017 academic year.

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