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Application of Learning Cycle Model Based on Cognitive Conflict Approach to Improve Physics Concept Understanding of Class XI D Students of SMA Negeri 2 Sentajo Raya

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ABSTRACT

The physics learning process in schools is carried out using conventional learning models which cause many students to be less active in the learning process in the classroom so that the learning process is only teacher-centered, it results in low understanding of the physics concepts of students. Understanding of concepts that tend to be low is influenced by the learning model applied by teachers in the classroom. So it needs a learning model that can be used as an alternative to improve students' concept understanding. This cognitive conflict-based learning cycle model is one of the alternative models because the learning process is no longer teacher-centered but changes to student-centered. This study aims to describe and determine the differences in students' concept understanding before and after applying the learning cycle model based on the cognitive conflict approach. Pre-experimental method, with One Group Pretest Posttest Design. The subjects of this study were students of class XI D SMAN 2 Sentajo Raya totaling 29 students. Data were obtained through pret-test and post-test, a total of 15 objective questions which were analyzed descriptively and inferentially to determine how students' critical thinking skills using the SPSS version 25 application. The results of descriptive analysis obtained the average value of the posttest is greater than the prettest. The results of inferential analysis on the t-test using SPSS version 25 with significant results of 0.000 <0.05, meaning that H_o is rejected. So that the conclusion, understanding the concept of physics students experience a significant difference between before and after being treated. This means that the learning cycle model based on cognitive conflict approach can improve the understanding of physics concepts of students of class XI D SMAN 2 Sentajo Raya.

Keywords: Learning Cycle, Cognitive Conflict, Concept Understanding, Newton's Laws

1 Introduction

Education is a process of learning knowledge, skills, and habits of a group of people that are passed on from one generation to the next through teaching, training, and research (Sebayang & Rajagukguk, 2019: 106). Education is one of the things that must be fulfilled by every human being. The role of education for humans is to raise dignity, degree, intelligence, morals and can make humans more useful for other humans. Education is a systematically designed and organized process related to the learning process (Waroka et al., 2020: 218). Educational activities include interactions between learners and educators and other educational resources that take place in an educational environment (Sagita et al., 2022 : 13). Education is also described as developing and giving birth to a whole human being (Risna et al., 2023: 3).

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Physics is the study of natural phenomena and their interactions. These natural phenomena and their interactions are studied by finding out, so that the concepts and knowledge obtained are the result of findings. The nature of science consists of three aspects, namely products, processes and attitudes process (Kristiana & Rambu, 2021: 770). As part of science, physics is also an integral product and process (Apriani et al., 2017: 3). This science product in the form of findings that include rules, laws, facts and principles of physics. This science product is obtained through a process known as the science process (Kristiana & Rambu, 2021: 770). Physics is a field of science that Physics is a field of science that studies many abstract concepts (Azhar, 2008: 8).

Physics is often considered a difficult and boring subject to learn by students. Physics is also one of the lessons that really requires a good understanding of concepts. If students do not understand the concepts of the material being studied, then they will have difficulty in solving problems related to the material they study (Sonia et al., 2023: 24). Azmi et al (2023: 3) said that some students were not interested in the use of the lecture method in explaining physics material because it made students sleepy when following the lesson.

The concept understanding that tends to be low is influenced by the learning model applied by the teacher in the classroom (Siahaan et al., 2021: 109). One alternative that can be pursued by teachers is to use creative and innovative learning models. Because the success of the learning process cannot be separated from the teacher's ability to develop learning models that are oriented towards increasing the intensity of effective student involvement in the learning process. The development of the right learning model basically aims to create learning conditions that allow students to learn actively and pleasantly so that students can achieve optimal learning outcomes and achievements. The use of the right learning model can encourage the growth of students' enjoyment of lessons, foster and increase motivation in doing tasks, make it easier to understand lessons so that students can achieve better learning outcomes (Abidin, 2019: 227).

Concept mastery is defined as the ability of students to understand scientific meaning, both theoretical concepts and their application in everyday life. Concept mastery is an understanding that not only remembers the concepts that have been learned, but is also able to re-express them in another form or in their own words so that they are easy to understand, but do not change the meaning (Syahfira et al., 2021: 17).

The Learning Cycle Model is a learning model consisting of phases or stages of activities that are organized in such a way that students can master the competencies that must be achieved in learning (Liana, 2020: 93). Cognitive conflict strategy is a strategy strategy that seeks to create conflict in the cognitive structure of students in order to be able to construct their own knowledge. Cognitive conflict strategy is based on constructivism approach (Sari et al., 2019: 67)

2 Research Methodology

The type used is Pre-Experimental, with a One Group Pretest Posttest Design, which uses 1 class that is treated before and after being seen in Table 1.

Table 1. Design one group pretest posttest design

Pretest	*Perlakuan*	*Posttest*
O_1	X	O_2

(Sugiyono, 2022: 74)

Description:

O_1 : Pretest (before being treated)

O_2 : Posttest (after being treated)

X : Treatment (Learning by using the cycle model based on Cognitive Conflict Approach.

In class XI D SMAN 2 Sentajo Raya in the 2023/2024 school year with a total of 29 students. Where, there are 12 girls and 17 boys. Data collected was about the understanding of concepts collected through pretest and posttest questions consisting of 15 multiple choice questions.

The data analysis technique used in this research is descriptive and inferential analysis. Descriptive analysis referred to in this study looks at the mastery of the concept of students seen from the difference in pretest and posttest results. To calculate the concept understanding score obtained by students, the provisions are used:

$$Concept\ Understanding\ = \frac{\sum The\ Score\ Obtained\ by\ the\ learner}{\sum Maximum\ Score} \times 100\% \quad (1)$$

The categories of students' concept understanding scores are in Table 2.

Table 2. Category of students' physics concept understanding score

Concept Understanding Score (%)	Category
$0 < 19$	Very Low
$20 \leq PK < 39$	Low
$40 \leq PK < 59$	Fair
$60 \leq PK < 79$	High
$80 \leq PK \leq 100$	Very High

(Febriyana et al., 2021: 58).

Inferential analysis in this study was conducted to determine the difference in understanding the concepts of students before and after using the learning cycle model based on the cognitive conflict approach through hypothesis testing.

3 Results and Discussion

This study has results consisting of two types of analysis, including descriptive analysis and inferential analysis. The results of the research can be explained below:

3.1. Descriptive Analysis

Data on the results of understanding the concept of students' critical thinking skills per indicator obtained through the post-test score of class XI IPA SMA N 1 Kubu Babussalam presented in table 3.

Table 3. Data on learning outcomes before and after applying the learning cycle model based on a cognitive conflict approach

Category	Concept Understanding Score	Prettest		Postest	
		Value	Percentage%	Value	Percentage %
Very Low	$0 < 19$	1	3.4 %	0	0 %
Low	$20 \leq PK < 39$	12	41.4 %	0	0 %
Fair	$40 \leq PK < 59$	12	41.4 %	1	3.5 %
High	$60 \leq PK < 79$	4	13.8 %	15	51.7 %
Very High	$80 \leq PK \leq 100$	0	0 %	13	44.8 %
Total		29	100%	29	100%

Based on table 3, it can be seen that the understanding of the concept of class XI D students before being taught by using the learning cycle model based on cognitive conflict methods is on average 40.21 with the category of understanding the concept of physics most are in the category of sufficient and low

with the number of students who reach the KKM value of 4 people, with a percentage of 13.8%. While the average value of students has a concept understanding value of 75.07 so that the description of the test results of understanding the concept of students after applying the learning cycle model based on cognitive conflict methods in physics learning in Class XI D SMA Negeri 2 Sentajo Raya increased with the most kagerogi in the high category with the number of students who reached the KKM score of 28 people, with a percentage of 56.5%.

The difference in the average value obtained between the pretest and posttest results has a significant difference, this can be seen from the category results of the pretest and posttest concept understanding test results. Based on this, the understanding of the concept of students in class XI D SMA Negeri 2 Sentajo Raya can be said to have increased.

3.2. Inferential Analysis

Before conducting hypothesis testing, it is necessary to apply prerequisite tests first, namely normality test and homogeneity test. The output of the normality test, homogeneity test, and hypothesis test can be seen in Table 4 below.

Table 4 Output of normality test, homogeneity test and hypothesis testing

Types of Inferential Analysis	Group	Test	Sig	Decision
Normality Test	*Pretest*	*Saphiro Wilk*	0.413	Data is normally distributed
	Posttest		0.274	
Homogeneity Test	*Pretest*	*Test of Homogeneity of Variances*	0.383	Homogeneous variant
	Posttest		0.696	
Hypothesis Test	*Pretest*	*Paired Samples Test*	0.000	H_0 is rejected, there is a significant difference
	Posttest			

In Table 4, the output of the Saphiro Wilk test obtained a significance result in the pretest group of 0.413 and the posttest group of 0.274. Based on these results, it states that the data is normally distributed.

In the homogeneity test to test whether or not the two data that have been normally distributed before. Table 4 shows the results of the test of homogeneity of variances output, the significance of the pretest group was 0.383 and the posttest group was 0.696. Based on these results, it states that the two groups of variants are homogeneous or have the same variance.

Hypothesis testing was carried out with the Paired Samples Test. Based on the provisions, if significant, (p) ≥ 0.05 then, H_0 is accepted and if the significance, (p) ≤ 0.05 then, H0 is rejected. In Table 4.7, the Paired Samples Test output obtained the significance result (Sig.2-tailed) which is 0.000, the data obtained (Sig.2-tailed) 0.000 <0.05, so that H0 is rejected, which means that there is a significant difference between the pretest and posttest groups, which means that the posttest group gets better results than the pretest group.

4 Conclusion

Based on the results of data analysis, the conclusions obtained are: there is a significant difference between the understanding of the physics concepts of students before and after being applied with a learning cycle model based on cognitive conflict methods, where the difference in the average value of understanding the concepts of students between before and after treatment is 34.86 and based on the category of understanding the physics concepts of students before being treated with an average value of prettest of 40.21 is in the category of sufficient and low while for understanding the physics concepts of

students after being treated with an average value of posttest of 75.07 is in the high category, so it can be concluded that the application of the learning cycle model based on cognitive conflict approach can improve the understanding of the physics concepts of students of class XI D SMAN 2 Sentajo Raya.

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