

THE INFLUENCE OF CONTEXTUAL TEACHING AND LEARNING (CTL) APPROACH ON UNDERSTANDING OF MATHEMATICAL CONCEPTS

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Received: 2021-01-08; **Accepted:** 2021-02-09; **Published:** 2021-02-28

Abstract. This study aims to see the effect of using the Contextual Teaching and Learning (CTL) approach on understanding mathematical concepts in class X SMA Negeri 2 Pekanbaru in the 2019/2020 school year. This research is a Quasi Experiment with a Nonequivalent Pretest-Posttest Control Group Design. The population in this study were all students of class X SMA Negeri 2 Pekanbaru with a sample of class X IPS 2 as the experimental class, which was given treatment using the Contextual Teaching and Learning (CTL) approach and class X IPS 3 as a control class using conventional learning. Sampling technique using purposive sampling. Data collection took place from February 14, 2020, to March 4, 2020. The data collection technique in this study was carried out using a test technique. Data were analyzed using inferential analysis. In this study, the data was assumed to be normal; therefore, the inferential analysis carried out only the homogeneity test and t-test. The research results obtained are $t_{cost} > t_{table}$. This shows that there is an effect of the Contextual Teaching and Learning (CTL) approach on the ability to understand mathematical concepts in class X SMA Negeri 2 Pekanbaru.

Keywords: *Approach, Contextual Teaching, and Learning, Understanding Mathematical Concepts*

1. INTRODUCTION

Mathematics is one of the subjects that must be studied at every level of education in Indonesia, starting from the elementary, junior high, high school / vocational school levels, even in higher education. Mathematics is a tool that can equip students with the ability to think logically, analytically, systematically, critically, creatively, and work together to obtain and utilize information to survive in an ever-changing, uncertain, and competitive situation [1].

Mathematics subjects aim to make students have the ability to understand mathematical concepts, explain the interrelationships between concepts and apply concepts or algorithms flexibly, use reasoning on patterns and traits, solve problems which include problem skills, communicate ideas, and have an attitude of appreciating the usefulness of mathematics in life [1]. Based on learning mathematics, one of the main objectives of learning mathematics is to understand mathematical concepts. Understanding good mathematical concepts will help students achieve other mathematics learning goals. Because understanding the concept is one of the basic and important stages in a series of

learning mathematics. Research [2] stated that the main problem that is often faced in learning mathematics is the low ability of students to understand mathematical concepts.

According to [3] revealed that understanding mathematical concepts has a very important role because when students understand a concept, they student is able to remember the mathematics lessons he has learned in the long term. If students' understanding of concepts is good, it will bring up a critical student mindset. The importance of understanding the concept is the basic capital to obtain satisfactory learning outcomes. By learning concepts, students can understand and distinguish objects, events, or events in the surrounding environment [4].

Based on the results of interviews conducted by researchers with class X mathematics teachers at SMA Negeri 2 Pekanbaru on September 24, 2019, information was obtained that students' abilities were still low in relating the various concepts they had, when students were given questions, some students were still confused in relating the various concepts asked in the class. The low ability of students in converting story questions into mathematical models is because students only memorize formulas, so students find it difficult to implement formulas in solving given problems. Most of the students cannot explain a concept they have learned again.

Increasing students' understanding of mathematical concepts, in this case, the teacher must be able to convey mathematical concepts well. Thus, teachers must be able to use appropriate learning models and strategies in understanding these mathematical concepts. One of them is by using a Contextual Teaching and Learning approach.

According to [5], the Contextual Teaching and Learning (CTL) approach is a concept that helps teachers relate the material being taught to students' real-world situations and encourages students to make connections between their knowledge and its application in their lives. "Contextual learning is defined as an educational process that can motivate students to understand better the meaning of learning a competency and relate it to the context, both personal, social and cultural" [6].

According to [7], "through contextual learning students not only have an academic understanding, but students can gain knowledge that can be related to the real-life context they face." In contextual learning, the teacher's role is to facilitate students in finding something new that is obtained from the students themselves. With the Contextual Teaching and Learning (CTL) approach, students are more motivated to learn. Students are active in the learning process, students are easy to accept subject matter and can improve students' understanding of mathematical concepts better than before. The indicators for understanding students' mathematical concepts that the researchers used in this study were (1) the ability to restate the concepts that have been studied; (2) The ability to classify objects based on whether or not the requirements that make up the concept are met; (3) Ability to apply concepts algorithmically; (4) The ability to relate various concepts.

From the description above, the teacher needs to create a learning process that can encourage students to construct their knowledge and be directly involved in learning by linking learning with students' real lives so that students' understanding of mathematical concepts increases. Therefore, the authors are interested in conducting a study entitled the effect of Contextual Teaching and Learning approach on understanding mathematical concepts in class X SMA Negeri 2 Pekanbaru.

2. RESEARCH METHOD

This research was carried out in class X SMA Negeri 2 Pekanbaru in the even semester of the 2019/2020 academic year starting from February 14, 2020, to March 4, 2020. The sample in this study was taken using a purposive sampling technique. The experimental class was class X IPS 2, and class control was class X IPS 3. The form of research conducted is quasi-experimental. The research design used is the nonequivalent pretest-posttest control group design [8] which can be seen in Figure 1:

O ₁	X	O ₂
O ₃	-	O ₄

Figure 1. Research Design

Description:

- O₁ : Pretest experimental class to measure concept understanding
- O₂ : Posttest experimental class to measure concept understanding
- X : Application of Contextual Teaching and Learning approach
- : Using conventional learning
- O₃ : Control class pretest to measure concept understanding
- O₄ : Control class post-test to measure concept understanding

The data collection instrument used in this study was a written test in the form of a pretest and a post-test in the form of a description. The experimental class uses a Contextual Teaching and Learning approach in practice, and the control class uses conventional learning. The research instruments are the syllabus, lesson plans, and LKPD. The data analysis technique of this research used descriptive statistical analysis and inferential statistical analysis. Descriptive statistical analysis in this study uses the average and standard deviation calculation. The inferential statistical analysis used was the homogeneity test and the two-mean difference test (t-test) for the pretest data using a two-party test, while the post-test data used a one-party test.

3. RESULTS AND DISCUSSION

Research Results

Based on the results of research conducted in the experimental class and control class, pretest and post-test data were obtained, which could be analyzed descriptively as shown in Table 1 below:

Table 1. Pretest and Posttest Result Data for Experiment Class and Control Class

Descriptive Analysis	Pretest		Posttest	
	Experiment	Control	Experiment	Control
Number of Samples	36	35	36	35
The highest score	75,00	68,75	100,00	93,75
Lowest Value	25,00	18,75	50,00	43,75
Total	1656,25	1668,75	2781,26	2493,75
Average	46,01	47,68	77,26	71,25
Standard Deviation	17,43	15,39	14,26	14,63

Based on Table 1, it can be explained that the increase in the average pretest score to the average post-test score in the experimental class is 31.25, and the increase in the average pretest score to the average post-test score in the control class is 23.57. It can be seen that the average value of the experimental class and the control class both increased, but the increase was more dominant in the experimental class. The difference between the average value of the experimental class and the average value of the control class can also be seen from the difference in the average pretest of the control class which is higher than the average value of the pretest of the experimental class, with a difference of 1.67. Then after the treatment was given, the average post-test score for the experimental class was higher than the average post-test for the control class, with a difference of 6.01.

From the description above, learning with the Contextual Teaching and Learning (CTL) approach is better than conventional learning. By looking at the numerical results of the pretest and post-test, it is certainly not possible to prove that there is an effect of the Contextual Teaching and Learning (CTL) approach on the ability to understand mathematical concepts of the experimental class and control class students. Therefore, it is necessary to analyze inferential statistical data so that the results obtained are more accurate.

In inferential statistical analysis, a homogeneity test and two-means test (t-test) will be carried out. In this study, the data was considered normal because the number of samples for the experimental class was 36 samples, and the control class had 35 samples. A normality test is not needed if the sample (n) is getting bigger. For n 30, this approach has started to apply. The experimental and control classes' pretest had homogeneous variances, then continued with the two-average test (t-test). Tests were carried out on statistical hypotheses, which were formulated as follows:

$H_0: \mu_1 = \mu_2$: There is no difference between the experimental class students' average mathematical concept understanding ability and the control class students' average mathematical concept understanding ability.

$H_1: \mu_1 \neq \mu_2$: There is a difference between the experimental class students' average mathematical concept understanding ability and the control class students' average mathematical concept understanding ability.

Description:

μ_1 : The average concept understanding ability of experimental class students

μ_2 : The average concept understanding ability of control class students

The results of the calculation of the t-test values for the experimental class and the control class can be seen in Table 2 below:

Table 2. Results of t-test Data Pretest Value of Experiment Class and Control Class

Kelas	N	\bar{x}	S_{gab}	t_{count}	t_{tabel}	Status
-Count t-table Conclusion Experiment	36	46,01	16,46	-0,42	1,99	H_0 accepted
Control	35	47,68				

Based on Table 2, with a significance level of $= 0.05$, $t_{table} = 1.99$ is obtained, then the t-test criteria is to compare t_{count} with t_{table} . So we get $-t_{table} < t_{count} < t_{table}$ or $-1,99 < -0,42 < 1,99$. Thus H_0 is accepted, which means that there is no difference between the average ability to understand mathematical concepts in the experimental class and the average ability to understand mathematical concepts in the control class.

The post-test of the experimental class and the control class had a homogeneous variance, and then a statistical test was carried out on the effect of the average mathematical concept understanding ability of students after being given different treatments using the t-test. Tests were carried out on statistical hypotheses, which were formulated as follows:

$H_0 : \mu_1 \leq \mu_2$: The average between the ability to understand mathematical concepts of the experimental class students is lower or equal to the ability to understand the mathematical concepts of the control class students.

$H_1 : \mu_1 > \mu_2$: The average of the students' ability to understand mathematical concepts in the experimental class was higher than that of the control class students.

Description:

μ_1 : The average concept understanding ability of experimental class students

μ_2 : The average concept understanding ability of control class students

The results of the calculation of the t-test scores for the experimental class and the control class can be seen in Table 3 below:

Table 3. Results of t-test Data Posttest Values for Experiment and Control Class

Class	N	\bar{x}	S_{gab}	t_{count}	t_{table}	Description	Conclusion
Experiment	36	77,26	14,45	1,73	1,67	$t_{count} > t_{table}$	H_0 rejected
Control	35	71,25					

Based on the calculation results in Table 3, the average post-test value of the experimental class and control class above is obtained $t_{count} = 1,73$ dan $t_{table} = 1,67$, by $t_{count} > t_{table}$, so H_0 rejected, and H_1 accepted. Thus, the average ability to understand mathematical concepts in the experimental class using the Contextual Teaching and Learning (CTL) approach is better than understanding mathematical concepts in the

control class using conventional learning. So it can be concluded that there is an influence between students' understanding of mathematical concepts using the Contextual Teaching and Learning (CTL) approach in class X SMA Negeri 2 Pekanbaru.

Discussion

The ability to understand mathematical concepts of class X SMA Negeri 2 Pekanbaru before the research was carried out was still relatively low, and the learning activities were not student-centered. Rather, students only accept what the teacher gives without expressing or searching first. This causes students to be less active during the learning process. The learning approach used by researchers as an alternative in the learning process is the Contextual Teaching and Learning (CTL) approach.

The positive influence between Contextual Teaching and Learning approaches on students' understanding of mathematical concepts is due to the contextual learning components that influence it. The components of contextual learning are constructivism, inquiry, questioning, learning community, modeling, and reflection [9]. The components of contextual learning that have the most influence on understanding the concept are constructivism and inquiry. Constructivism is the process of building or compiling students' new knowledge based on their personal experiences. This is in line with research conducted [10], which states that using Contextual Teaching and Learning can improve students' understanding of mathematical concepts, is due to the application of the Contextual Teaching and Learning (CTL) model in the experimental class, which supports students to find and model the causes students can find their own concepts and easily remember lessons, and the learning community can also make students learn actively and compete in acquiring knowledge.

In the preliminary activity, the researcher conveys the learning materials learning objectives, provides motivation, and conveys apperception by reminding students of the material related to the material to be studied. Researchers also aroused students' interest by asking questions related to the material being studied, where students responded well to these questions. In the experimental class, the learning process uses a Contextual Teaching and Learning (CTL) approach where each student is given a Student Worksheet (LKPD) at each meeting. The worksheets can help students determine a new concept, where the new concept is applied to solve a problem. So that student are required to understand every step in the LKPD.

Based on [11], contextual learning is a learning model that provides facilities for learning activities for students to seek, process, and find learning experiences that are more concrete in nature through the involvement of students' activities in trying, doing, and experiencing for themselves. Based on the researcher's observations of student activities, it appears that students have actively participated in the learning process provided by the researcher. When working on the LKPD, students were confused and unsure of how to solve the problems given, so the researcher guided the students by going around each group.

When presenting the discussion results, students are not used to expressing their ideas or ideas. In addition, students are also not used to finding formula concepts by themselves because usually, the direct teacher provides information on the formula directly to students. But over time, students become accustomed to it, so they begin to ask questions that are not understood and interact actively with their groupmates to find new concepts.

Control class students who use conventional learning still receive knowledge in the same way as usual. In the learning process that took place, students listened and accepted what was explained by the researcher, and some students also recorded points from the material explained by the researcher. This results in students being less active and more dependent on the teacher. During the learning process, only a small number of students are willing to respond when the teacher asks if they have not understood something. Only a few are willing to go forward when given a question, and only a small number are willing to ask if they do not understand something.

Based on the test results, the average difference in the ability to understand mathematical concepts for the experimental class and the control class, it can be concluded that the research hypothesis is accepted, which states that there is an effect of the Contextual Teaching and Learning (CTL) approach on the understanding of mathematical concepts in class X SMA Negeri 2 Pekanbaru. The results of this study are also supported by the results of research on the Contextual Teaching and Learning (CTL) approach that has been carried out [12], which states that the increase in mathematical understanding abilities of students who receive learning using a contextual approach is better than students who receive conventional learning.

4. CONCLUSION

Based on the results of the research and the results of the data analysis that has been carried out, then $t_{count} > t_{table}$. It can be concluded that there is an effect of the Contextual Teaching and Learning (CTL) approach on the ability to understand mathematical concepts in class X SMA Negeri 2 Pekanbaru.

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