



The Effectiveness of the Kahoot-Assisted Socratic Question Method in Improving the Understanding Mathematical Concepts Ability

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Abstract. This study aims to determine the ability to understand mathematical concepts of students who obtain learning with the kahoot-assisted socratic question method and those who do not obtain learning with the Kahoot-assisted Socratic question method and determine the effectiveness of the Kahoot-assisted Socratic question learning method towards improving the ability to understand mathematical concepts of students in grade XI of SMA Negeri 2 Palopo. This study used a true experimental research design with pre-test and post-test control group design types. The sampling technique was carried out using cluster random sampling technique and was used as many as 2 classes with a sample of 68 students. Data are obtained through observation and tests. Then the data is analyzed using descriptive statistics and inferential statistics. The results showed that the Kahoot-assisted Socratic Question method was effective in improving students' ability to understand mathematical concepts. This is based on a hypothesis test that shows the average post-test score of the experimental class is greater than the average post-test value of the control class. Thus, the Kahoot-assisted Socratic Question method can be one of the learning methods applied in learning to improve students' understanding of mathematical concepts.

Keywords: Effectiveness, Kahoot-assisted Socratic Question Method, Concept Understanding.

1. Introduction

One of the important things for every student to master when studying mathematics is to understand concepts. Students are expected to understand concepts early in order to be able to solve problems or problems in mathematics and then be able to apply the learning in the real world. Moreover, concepts in mathematics have been systematically organized and have levels from the simplest concepts to increasingly complex concepts. Therefore, to understand mathematics deeply, it is very necessary to understand the concept thoroughly.

Students are said to have the ability to understand mathematical concepts if the student meets predetermined indicators. The indicators of understanding mathematical concepts used in this study, namely: (1) restating a concept, (2) presenting concepts in various forms of mathematical representation, (3) classifying objects based on concepts.

From an interview with one of the teachers at SMA Negeri 2 Palopo named Mrs. Naimah Makkas, S.Pd. as a grade XI mathematics teacher on Monday, August 29, 2022, she said that the ability to understand mathematical concepts is still very low because there are still many students who have not been able to restate the concepts learned, and most students do not understand the process of presenting concepts in the form of mathematical models.

To solve the problem, the method is used Socratic Questions Assisted Kahoot. Method Socratic is a learning that is carried out with a discussion process between teachers and students with the aim of

making students question the correctness of their reasoning in making conclusions about a problem. Kahoot is one of the technology-based learning media in the form of game educational. Kahoot is one of the apps for creating quizzes or test discussion survey and game which is attractively packaged. Utilization kahoot as game education that has a positive impact on the learning process is one of them to help deliver material and give a new impression on students because they can learn while playing and learning is more interesting and fun for students.

2. Literature Review

2.1 Socratic Question Learning Method

Socratic is derived from the name of Socrates, a Greek philosopher who was very influential in the field of developing critical thinking skills. Socratic method (Socrates Method) is a learning method whose implementation involves conversations or interactions carried out by two or more people who discuss each other about several questions that lead to the achievement of learning concepts and find answers or solutions to a series of these questions.

The steps of the socratic question learning method according to Johnson, D.W and Johnson.R.T (2002) are as follows:

- a. The teacher prepares a series of questions that will be asked to students according to the topic to be studied.
- b. The teacher asks the students an opening question to start the discussion process of finding answers.
- c. After asking the opening question, the teacher investigates what the student understands and looks for inaccuracies, contradictions, or conflicts from the student's explanation.
- d. The teacher asks follow-up questions related to the conflict of the student's reasoning.
- e. Continue the discussion until the student resolves the conflict and goes into a deeper level of reasoning and further adds his insight into the learning topic being studied.
- f. The teacher ends the discussion process by directing students to further discussion in reviewing the results of the discussion to understand the concept of the learning topic studied.

2.2 Kahoot App

Kahoot is an online media application used to create quizzes or tests that are presented in various types of games and packaged in the form of educational games. Using this application is quite simple, students can simply access the link provided or download the application directly and then work on the existing questions. Kahoot can be used as evaluation material in learning to see the ability and independence of students, where the grades or scores that come out on the kahoot system are calculated based on the accuracy and ability of each student.

2.3 Understanding of Mathematical Concepts

The ability to understand mathematical concepts is the forerunner or basis for deeper mastery of other mathematical concepts and encourages students' ability to find relationships between these concepts. Educators should strive to ensure that mathematics is interesting for students to learn by staying focused on important concepts in mathematics.

The indicators of understanding mathematical concepts used in this study are as follows:

- a. Restating a concept, namely the student's ability to express the information obtained again.
- b. Linking various mathematical concepts, namely the ability of students to associate every existing concept to obtain mathematical problem solving.

- c. Classify objects based on the conditions for the fulfillment of the concept, namely the ability of students to apply each concept in accordance with the classification of problem objects in solving mathematical problems.

3. Research Method

The type of research used in this study is experimental research with a quantitative approach. This study used a true-experimental research design with pre-test and post-test control group design types. True-experimental design is the testing of independent variables and dependent variables performed on samples of experimental groups and control groups.

Data collection techniques in this study are carried out by the test. Test sheets to determine the ability to understand students' mathematical concepts and carried out twice, namely before (pre-test) and after (post-test) kahoot-assisted Socratic question learning was carried out. The test instruments used are question sheets for students' ability to understand mathematical concepts, tests are used by researchers to measure students' ability to understand mathematical concepts before and after the application of the Kahoot-assisted Socratic question learning method is carried out. The questions given are in the form of essays as many as 5 questions in the experimental class and control class related to the derivative material of algebraic functions.

Table 1. Interpretation of Value Categorization Understanding of Mathematical Concepts

Interval	Interpretation
0 – 59	Very Low
60 – 69	Low
70 – 79	Enough
80 – 89	Tall
90 – 100	Very High

The formula used to measure the categorization of the results of understanding concepts and results per indicator are:

$$\text{Results} = \frac{\text{score obtained}}{\text{maximum score}} \times 100$$

Table 2. Scoring Guidelines

No.	Indicators	Criteria	Score
1	Restate a concept	Did not give an answer	0
		Gives an answer but cannot state the concept by using the rules of derived properties according to the calculated operations and algebraic forms in question.	1
		Can state part of the concept using the rules of derived properties, but the answer is not quite right, there are still many miscalculations.	2
		Can express concepts using the rules of derived properties according to calculating operations and algebraic forms, but there are still those that are not quite right.	3
		Can express concepts using the rules of derived properties according to calculating operations and their algebraic forms completely and correctly answered.	4
2		Did not give an answer	0

	Relating various mathematical concepts	Provides answers but cannot relate various definitions of concepts related to the problem of derivatives of algebraic functions.	1
		Can relate some definitions of concepts related to the problem of the derivative of algebraic functions, but the answers are not precise and there are still many miscalculations.	2
		Can relate various definitions of concepts related to the problem of derivatives of algebraic functions, but there are still lacking.	3
		Can relate various definitions of concepts related to problems derived algebraic functions and give complete and correct answers	4
3	Classify objects based on the conditions for which the concept is fulfilled	Did not give an answer	0
		Provides answers but cannot solve problems derived from algebraic functions by classifying the different variables contained in the problem	1
		Can solve problems derived from algebraic functions by classifying some of the different variables contained in the problem, but the answers are not correct, there are still many calculation errors.	2
		Can solve problems derived from algebraic functions by classifying different variables contained in the problem, but still not precise.	3
		Can solve problems derived from algebraic functions by classifying different variables contained in the problem by providing precise and complete answers	4

Before the instrument is used, a validity and reliability test is first carried out to find out whether the instrument is suitable for use.

The formula used in indicating the validity of an instrument is the following Aikens'V formula:

$$V = \frac{E s}{n (c-1)}$$

Information:

s = r-lo

r = Score provided by validator

lo = Lowest validity assessment score (in this case = 1)

n = Number of validators

c = The highest validity assessment score (in this case = 4).

As for The benchmarks for interpreting the degree of validity of the instrument obtained are according to the following table:

Table 3. Interpretation of Content Validity

Interval	Interpretation
0,00 – 0,19	Highly Invalid
0,20 – 0,39	Invalid
0,40 – 0,59	Less Valid
0,60 – 0,79	Valid
0,80 – 1,00	Highly Valid

As for the instrument reliability test based on the results of expert validity in this study using the following Cronbach Alpha formula:

$$r_{11} = \frac{k}{(k-1)} \left\{ 1 - \frac{\sum s_i^2}{s_t^2} \right\}$$

Information:

r_{11} = Instrument reliability coefficient

k = number of question items

$\sum s_i^2$ = sum of score variances per item

s_t^2 = total variance

The benchmarks for interpreting the degree of reliability of the instrument obtained are as follow:

Table 4. Interpretation of Reliability

Correlation Coefficient	Reliability Criteria
$0,80 \leq r \leq 1,00$	Very High
$0,60 \leq r < 0,80$	High
$0,40 \leq r < 0,60$	Medium
$0,20 \leq r < 0,40$	Low
$0,00 \leq r < 0,20$	Very Low

Table 5. Results of Instrument Validity and Reliability

Instruments	Validity	Reliability
Test Sheet	0,71	0,79
Observation Sheet	0,73	0,54
RPP	0,72	0,93
Total	0,72	0,75
Information	Valid	Reliable

Data analysis techniques use descriptive statistics and inferential statistics. Descriptive statistical analysis techniques are used to describe research data using data processing methods according to the quantitative nature of the data. Calculation of descriptive statistical analysis using the help of SPSS 22.

The testing process carried out on inferential statistical analysis techniques is the normality test, homogeneity test and hypothesis test. The data normality test in this study is intended to find out whether the data used is normally distributed or not. Statistically the hypothesis can be formulated as follows,

H_0 = normally distributed data

H_1 = data is not normally distributed

With decision making criteria, namely:

Accept H_0 if the value is Asymp. Sig (2-tailed) $> \alpha = 0.05$

Reject H_0 if the value is Asymp. Sig (2-tailed) $\leq \alpha = 0.05$

The variance homogeneity test is carried out to find out whether the data studied has homogeneous variance or not, if both groups have the same variance, then the group is said to be homogeneous.

Hypotheses tested:

H_0 = No difference in variance of the two classes (Homogeneous Data)

H_1 = There is a difference in variance of both classes (Inhomogeneous Data)

By decision making criteria:

If the sig value at Based on Mean > 0.05 then accept H_0 .

If the sig Based on Mean value ≤ 0.05 then reject.

After testing the normality and homogeneity of variance, calculations are then made against the T-test statistics. In this study, hypothesis testing was conducted with *an independent* T-test assisted by SPSS.

For hypothesis testing it is statistically expressed by:

$$H_0 = \mu_1 \geq \mu_2 \quad \text{oppose } H_1 = \mu_1 < \mu_2$$

Information:

H_0 : Kahoot-assisted socratic question methods are not effective in improving students' ability to understand mathematical concepts.

H_1 : Kahoot-assisted socratic question method is effective in improving students' ability to understand mathematical concepts.

μ_1 : Average post-test control class students

μ_2 : The average post-test of experimental class students.

The research hypothesis will be tested with the following test criteria:

- 1) Sig ≤ 0.05 , then H_0 rejected.
- 2) Sig > 0.05 , then H_0 accepted.

4. Results and Discussion

As for the results of the test of students' ability to understand mathematical concepts, it can be seen in the following table:

Table 6. Pre-Test and Post-Test Results Scores Ability to Understand Mathematical Concepts of Experimental and Control Class Students

No.	Experimental Class Pre-Test Scores	Experimental Class Post-Test Scores	Control Class Pre- Test Scores	Control Class Post-Test Scores
1	20	90	18	77
2	18	70	13	70
3	13	90	12	75
4	5	92	15	77
5	3	73	17	65
6	17	70	3	68
7	18	88	20	70
8	12	93	12	50
9	8	75	18	67
10	20	82	3	77
11	12	83	3	75
12	15	85	3	62
13	3	77	3	73
14	20	95	5	75
15	12	97	12	65
16	25	80	20	63
17	20	92	20	73
18	3	73	12	78
19	17	98	13	75
20	8	97	8	60
21	8	97	25	70
22	15	87	8	65

23	10	77	7	65
24	12	70	8	60
25	8	97	15	72
26	9	80	13	65
27	12	70	8	72
28	5	75	15	78
29	12	73	8	72
30	8	98	10	77
31	8	65	13	63
32	12	73	3	73
33	17	90		
34	12	72		
35	15	95		
36	9	88		
Sum	441	3.007	363	2.227

Table 7. Normality Test Results of Student Mathematical Concepts Comprehension Ability Test

Class	Statistics	Df	Sig.
Pre-test experiments	0,13	36	0,135
Post-test experiment	0,13	36	0,138
Pre-test control	0,12	32	0,200
Post-test control	0,14	32	0,100

From the table above, it can be concluded that all data are normally distributed. Because the significant value is greater than 0.05.

Table 8. Homogeneity Test Results

		Sig.
Understanding of Students' Mathematical Concepts	Based on Mean	0,483
	Based on Median	0,520
	Based on Median and with adjusted df	0,520
	Based on trimmed mean	0,452

Based on table 8, it can be seen that the value of sig. Based on Mean > 0.05 or 0.483>0.05. So it can be concluded that the variance of the pre-test data of the experimental class and the control class is homogeneous.

Table 9. Pre-Test Descriptive Statistics

Statistics	Experiment	Control
Sample	36	32
Average	12,25	11,3
Standard Deviation	5,5	6,0
Variance	30,2	36,1
Top Rated	25	25
Lowest Value	3	3

The ability to understand mathematical concepts of grade XI science students before the application of learning methods is still very low. This is because students have not been able to state a mathematical concept related to the derivative material of algebraic functions, students have not been able to solve

existing problems in order and in accordance with objects and the form of mathematical representations. It is based on three indicators of understanding mathematical concepts used in this study.

Table 10. Post-Test Descriptive Statistics

Statistics	Experiment	Control
Sample	36	32
Average	83,5	69,6
Standard Deviation	10,3	6,6
Variance	106,6	43,8
Top Rated	98	78
Lowest Value	65	50

From the post-test results of experimental class students after applying learning with the Kahoot-assisted Socratic question method, an average score of 83.5 was obtained, with the highest score of 98 and the lowest score of 65. From these results, it can be seen that the post-test scores of experimental class students are included in the "high" category.

Students have been able to fulfill 3 aspects of understanding students' mathematical concepts, although there are still some who have not mastered them. During the learning process, students are active in asking and discussing existing problems and are very involved in doing quizzes through kahoot media.

Compared to the post-test results of control class students who applied learning with conventional methods, an average score was obtained with the highest acquisition score of 78 and the lowest score of 50. From these results, it can be seen that 69,6 ≈ 70 the post-test scores of control class students are included in the "sufficient" category. This is because most students are still not precise in restating existing concepts and have not correctly classified objects and present concepts based on their mathematical representations.

Kahoot media is also quite supportive of the student learning process in experimental classes because it includes new things applied during the student learning process, and is quite interesting for students. This makes the learning process does not seem monotonous and can increase student motivation and interest in following learning.

Table 11. Independent Sample T-Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	df	Sig. (2-tailed)
Understanding of Students' Mathematical Concepts	Equal Variance Assumed	14,412	0,000	6,532	66	0,000
	Equal Variance not Assumed			6,696	60,290	0,000

Based on table 11, it can be seen that the value of sig (2-tailed) ≤ 0.05 or 0.000 ≤ 0.05 so that H₀ is rejected and H₁ is accepted, which means that the average value of the experimental class post-test is greater than the average value of the control class post-test.

By using the kahoot-assisted socratic question method, the average post-test of the experimental class was greater than the average post-test of the control class, so it was concluded that

the kahoot-assisted socratic question method was effective in increasing the understanding of mathematical concepts of students, especially students of grade XI Science 2 SMA Negeri 2 Palopo.

5. Conclusion

The ability to understand mathematical concepts of students in experimental classes who obtained learning with the kahoot-assisted socratic question method obtained a pre-test score with an average score of 12.25 and was included in the "very low" category. The post-test score of the experimental class after learning with the kahoot-assisted socratic question method obtained an average score of 83.5 and was included in the "high" category.

Students in the control class who did not learn the kahoot-assisted socratic question method obtained a pre-test score with an average score of 11.3 and fell into the "very low" category. The post-test score of the control class after learning with conventional methods obtained an average score of 70 and was included in the "sufficient" category.

The kahoot-assisted socratic question method is effective in increasing students' understanding of mathematical concepts, especially students of grade XI Science 2 SMA Negeri 2 Palopo.

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