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THE COOPERATIVE SCRIPT LEARNING MODEL ON THE ABILITY TO UNDERSTAND MATHEMATICAL CONCEPTS

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Abstrak

Penelitian ini bertujuan untuk mengeksplorasi pengaruh model pembelajaran Cooperative Script terhadap kemampuan siswa dalam memahami konsep-konsep matematika. Pendekatan kuantitatif digunakan dalam penelitian ini, dengan metode quasi-eksperimen dan desain penelitian pretest-posttest control group design. Populasi penelitian ini adalah seluruh siswa kelas VIII SMP Negeri 1 Toma, dengan kelas VIII-C dipilih sebagai kelompok eksperimen dan kelas VIII-D sebagai kelompok kontrol. Data dianalisis menggunakan uji Lilliefors untuk menguji normalitas, uji varians untuk memeriksa homogenitas, dan uji t untuk mengevaluasi hipotesis. Temuan penelitian ini menunjukkan bahwa: (1) penerapan model pembelajaran Cooperative Script secara signifikan meningkatkan pemahaman konseptual siswa terhadap matematika, serta mendorong fokus yang lebih besar dan partisipasi aktif dalam pembelajaran, dan (2) hasil uji hipotesis menunjukkan bahwa nilai t-hitung (2,583) lebih besar dari nilai t-tabel (2,000), yang mengarah pada penolakan terhadap hipotesis nol (H_0) dan penerimaan hipotesis alternatif (H_a). Oleh karena itu, dapat disimpulkan bahwa model pembelajaran Cooperative Script memberikan pengaruh positif terhadap pemahaman konsep matematika siswa.

Keywords: *Model: Cooperative Learning; Understanding of Mathematical Concepts*

Abstract

This study aims to examine the impact of the Cooperative Script learning model on students' ability to understand mathematical concepts. The research uses a quantitative approach with a quasi-experimental method and a pretest-posttest control group design. The study population consists of all eighth-grade students at SMP Negeri 1 Toma, with the sample being class VIII-C as the experimental group and class VIII-D as the control group. The data were analyzed using the Lilliefors test to assess normality, variance tests to check homogeneity, and a t-test to test the hypothesis. The research findings indicate that: (1) the application of the Cooperative Script learning model improves students' ability to understand mathematical concepts, as well as their focus and active participation in learning, and (2) the hypothesis test results show that the calculated t-value (2.583) is greater than the table value (2.000), leading to the rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_a). Therefore, it can be concluded that the Cooperative Script learning model has a significant effect on students' ability to understand mathematical concepts.

Keywords: *Model: Cooperative Learning; Understanding of Mathematical Concepts*

A. Introduction

Mathematics is a part of the educational field that continues to undergo changes and developments (Gaurifa, M., & Harefa, D., 2024). In its implementation in schools, mathematics plays an important role, as evidenced by the number of teaching hours dedicated to it and its inclusion as one of the subjects tested in the National Exam (UN) up to the present. Moreover, in entering the workforce, proficiency in mathematics is often a requirement that must be met (Arifin, Z. 2017). Therefore, it is not incorrect to say that mathematics is a subject that must be studied from the basic education level through to higher education (Susilana, 2017).

Considering the importance of mathematics in everyday life as well as in the development of other sciences, mathematics is made a prerequisite subject that must be studied by students. One of the fundamental skills that must be mastered in mathematics is conceptual understanding (Komalasari, Kokom, 2015). Conceptual understanding is the level of ability that expects students to be able to comprehend concepts, situations, and known facts, and to explain them in words according to the knowledge they possess, without altering their meaning. This conceptual understanding is considered as a foundational skill in mathematics because mathematics is a field that deals with examining abstract forms or structures and the relationships among them. The abstract nature of mathematics is related to how each individual understands every concept within mathematical material (Usman, 2005). Therefore, conceptual understanding is made one of the goals in mathematics education.

Conceptual understanding in learning is an idea or concept that is relatively complete and meaningful, an understanding of an object, a subjective product that comes from the way a person creates meaning from objects or things through their experiences. Mastery of concepts represents a level of student achievement where they can define or explain part of the subject matter using their own words (Harefa, D., 2022). With the ability to explain or define, the student has understood the concept or principle of a lesson, even if the explanation given is not phrased exactly the same as the provided concept, as long as the meaning is the same. Conceptual understanding is the ability of students to master a body of subject matter, where students not only know or memorize a set of concepts they have learned, but can also express them in another form that is easily understood, interpret data, and apply concepts in accordance with the cognitive structure they possess.

Based on the explanation above, the expectation of mathematics learning is that students are able to understand mathematical concepts broadly and are capable of defining mathematical material in their own words (Suprijono, Agus, 2010). Furthermore, students should be actively involved in classroom learning, where they are accustomed to learning in groups so that mathematical material becomes easier to understand and comprehend. In mathematics learning, it is not only about receiving or memorizing formulas and procedures, but also about building meaning from what is being learned. Students actively search, investigate, formulate, prove, and apply what they have learned (Heris & Utari, 2016). Moreover, students are trained to work independently or collaborate with groups, develop critical and creative thinking, think logically, respect opinions, be honest, confident, responsible, and capable of solving everyday problems with a solid understanding of mathematical concepts.

In reality, at school, some students perceive mathematics as something to be avoided and are not enthusiastic about learning it. Additionally, students view mathematics as something very intimidating, and their self-confidence in learning mathematics is low, which results in a limited understanding of mathematical concepts. The indicators of conceptual understanding that students still struggle with include presenting concepts in various mathematical representations, developing necessary or sufficient conditions for a concept, using, utilizing, and selecting specific procedures or operations, and applying the algorithmic concepts in problem-solving.

In addition, based on the results of the preliminary study test, it was found that most students were unable to solve the problems given by the researcher, especially the questions related to conceptual understanding (Rajagukguk, Waminto, 2015). As a result, the average score obtained in the test was still relatively low, at 56, which is below the Minimum Completion Criteria (KKM) of 60.

Based on the test results above, it is evident that students' conceptual understanding is still lacking, particularly on the topic of systems of linear equations with two variables (SPLDV) (Slameto, 2013). In question number 2, which is in the form of a word problem, students had difficulty presenting or expressing it in mathematical terms, as well as determining which procedures or operations to use in order to solve the problem. This indicates that students have not yet fully grasped how to classify objects according to specific properties (in line with the concept), present concepts in various mathematical representations, select and utilize appropriate procedures or operations, and apply concepts or algorithms to problem-solving. Therefore, it can be concluded that students' conceptual understanding in mathematics is still relatively low.

There are several factors that influence students' learning success, one of which is the teacher. The teacher is a key factor in the success of every learning activity and also serves as a facilitator in the learning process. This means that the success of any lesson depends on how the teacher designs and plans the learning so that students can actively engage and enjoy the process. Enjoyable learning can take place if it is designed using a teaching model that encourages students to be active and willing to participate in the learning. One such model is the Cooperative Script learning model (Gaurifa, M., 2023).

The Cooperative Script learning model is a type of cooperative learning where students work in pairs and alternately summarize parts of the material being studied verbally (Shoimin, Aris, 2014). In other words, students learn in pairs and take turns explaining the material to their partner according to their understanding. This teaching model aims to help students think systematically and focus on the lesson (Huda, 2014). With the Cooperative Script learning model, students are trained to collaborate with one another in a pleasant atmosphere, allowing them to discover key ideas from the larger concepts presented by the teacher (Harefa, D., 2023).

Furthermore, one of the advantages of the Cooperative Script model is that it fosters the generation of new ideas, critical thinking skills, and enhances students' understanding of the concepts being taught. According to Trianto (2011), the Cooperative Script model begins with the presentation of reading material or a summary of the lesson to students, who are then given a chance to read it briefly and contribute new ideas or concepts into the material provided by the teacher. Afterward, students are guided to identify incomplete key ideas in the material, taking turns with their partner to discuss and complete them (Suyono and Hariyanto, 2017).

Based on the explanation above, it piqued the researcher’s interest to try using this model in the learning process to observe its impact on students' understanding of mathematical concepts.

B. Research Method

This study employs a quantitative research design. The research method used is a quasi-experimental approach (Sugiyono, 2012), which is characterized as research that closely approximates an experimental design or a pseudo-experiment. In this study, the participants are divided into two groups: the experimental group, which applies the Cooperative Script learning model, and the control group, which uses traditional teaching methods (Sudjana, 2005). The implementation of the learning model in both groups was carried out by the researcher, who also served as the teacher, in order to minimize any potential bias in the research findings (Arifin, Zainal, 2017).

In this design, both groups receive different treatments (Halawa, S., & Harefa, D. 2024). Once the learning process is completed, a final test (post-test) is administered. The population for this study comprises all 8th-grade students at SMP Negeri 1 Toma, with the sample consisting of class VIII-D as the experimental group and class VIII-C as the control group. The research instruments include a pretest with 5 essay-type questions and a posttest with 5 essay questions. These instruments were validated by experts in the field before being used, and the posttest was pilot-tested at another school. The pretest was conducted to assess the homogeneity of the sample and population, while the posttest served for hypothesis testing to determine whether the null hypothesis (H_o) should be accepted or rejected (Harefa, D., 2023).

C. Research Results and Discussion

1. Pretest Results

a. Average Test Scores and Standard Deviation

Based on the pretest scores of both the experimental and control groups, the average score, standard deviation, and variance of the data can be calculated. This will provide an overview of the initial performance of the students in both groups before the treatment is applied. By analyzing these statistical measures, we can assess the baseline differences between the groups and determine the extent to which the cooperative script learning model may impact the students' understanding of the material.

1) Experimental Group

Average Pretest Score $\bar{x} = \frac{\Sigma xi}{n} = \frac{2016}{32} = 63$. Therefore, the average pretest score of the experimental group is 63.

Standard deviation and variance $S^2 = \frac{\mathrm{n}\Sigma x_i^2 - (\Sigma xi)^2}{32\ (32-1)} = \frac{32\ (131.402) - 4.064.256}{32\ (32-1)} = \frac{140608}{992} = 141{,}7 = 11.91$

So, the variance of the initial test results is 141.74 and the standard deviation is 11.91.

2) Control Class

The average of the initial test results for the control class can be calculated by summing all the individual test scores for that class and then dividing by the total number of students in the control group.

$$\bar{x} = \frac{\Sigma xi}{n} = \frac{1725}{30} = 57{,}5$$

So, the average of the initial test results for the control class is 57.5.

Standard deviation and variance

$$S^2 = \frac{\mathrm{n}\Sigma x_i^2 - (\Sigma xi)^2}{30\ (30-1)} = \frac{30\ (104.409) - 2.975.625}{30\ (30-1)} = \frac{156645}{870} = 180{,}052 = 13.42$$

So, the variance of the initial test results is 180.052, and the standard deviation is 13.42.

b. Test of Homogeneity

Based on the results of the initial test, the variance (S^2) for the experimental group is calculated to be 141.74, while the variance (S^2) for the control group is 180.052. To assess whether the variances of the two groups are homogeneous, the next step is to conduct a homogeneity of variance test. This involves substituting the variance values from both sample groups into the appropriate formula. The homogeneity test helps determine if the variability within the groups is sufficiently similar, which is a crucial assumption for certain statistical tests, such as the t-test. By comparing the variances, we can assess whether the assumption of equal variances holds, which will guide the interpretation of the hypothesis testing

$$F = \frac{\text{Greatest Variance}}{\text{Smallest Variance}} = \frac{180.052}{141,74} = 1,27$$

results.

From the results, it is known that The calculated F_{value} is 1.270 Then it is consulted with the F distribution table at a significance level of 0.05 and degrees of freedom (df) = (32,30), resulting in F_{value} is 2,340. This shows that Fhitung < Ftabel (1.270 < 2.340), which means that the two sample groups in the study are homogeneou.

c. Normality Test

After the initial test was conducted, a normality test was performed as the next step. This normality test is crucial, as it serves as a prerequisite for determining the appropriate type of statistical analysis to be used in hypothesis testing. In the context of the initial test, the normality of the data from both the control and experimental groups was assessed using the Lilliefors test method. This method was chosen because it is a robust approach for evaluating the normality of sample distributions, especially when sample sizes are relatively small or unknown, ensuring that subsequent analyses are based on valid assumptions.

Based on the final results of the normality test, the largest calculated value of L_0, which represents the absolute difference between the observed and expected cumulative distribution functions ($|f(z) - s(z)|$), was found to be 0.063. The corresponding table value ($L_{ta}b_{le}$) for this test, given a sample size of n = 62, is 0.112. This value of $L_{ta}b_{le}$ was determined at a significance level of 0.05. Since the calculated value of L_0 (0.063) is less than the table value (0.112), we can conclude that $L_0 < L_{ta}b_{le}$, which indicates that the sample data is consistent with a population that follows a normal distribution.

2. Final Test Results (Post-test)

a. Average Learning Results and Standard Deviation

Using the final test scores from both the experimental and control groups, the data was subsequently processed to calculate key statistical measures. These included the average (mean) student performance, the standard deviation, and the variance. The average provides an overall measure of central tendency, offering insight into the typical student performance within each group. The standard deviation and variance, on the other hand, were calculated to assess the dispersion or variability of the test scores, giving an understanding of how widely the scores spread around the mean in both the experimental and control groups.

1) Experimental Class

Average score of the final test

$$\bar{x} = \frac{\Sigma xi}{n} = \frac{2304}{32} = 72$$

Therefore, the average score of the final test in the experimental class is 72. The standard deviation is 8.80, and the variance is
77.48.

$$S^2 = \frac{n\Sigma x_i^2 - (\Sigma xi)^2}{n\,(n-1)} = \frac{30\,(168.290) - 5308416}{32\,(32-1)} = \frac{7.6864}{992} = 77{,}48 = 8{,}80$$

Therefore, the variance of the final test results is 77.48, and the standard deviation is 8.80.

2) Control class

The average score of the pre-test in the control class $\bar{x} = \frac{\Sigma xi}{n} = \frac{1.920}{30} = 64$

Therefore, the variance of the final test results is 131.03, and the standard deviation is
11.45

$$S^2 = \frac{n\Sigma x_i^2 - (\Sigma xi)^2}{n\,(n-1)} = \frac{30\,(126680) - 3686400}{30\,(30-1)} = \frac{131{,}03}{870} = 131{,}03 = 11{,}45$$

Therefore, the variance of the final test results is 131.03, and the standard deviation is 11.45

b. Hypothesis Testing

To evaluate the hypothesis of this study, hypothesis testing was performed. The data utilized for hypothesis testing consisted of the final test scores from two sample classes: the experimental class and the control class. The results obtained from the final tests of these two sample classes are as follows:

For the experimental class, the average score was 72, with a standard deviation (s) of 8.80 and a variance (s^2) of 77.48. These values suggest that the experimental group performed with a relatively moderate degree of consistency, as indicated by the standard deviation.

For the control class, the average score was 64, with a standard deviation (s) of 11.45 and a variance (s^2) of 131.03. These results indicate that the control class displayed a greater degree of variability in their test performance compared to the experimental class, as reflected by the higher standard deviation and variance.

These values are critical in assessing the effectiveness of the intervention applied to the experimental class and in comparing the performance differences between the two groups. Further statistical analysis, such as t-tests or other relevant tests, would be conducted to determine if the observed differences are statistically significant.

The combined standard deviation and combined variance of the two sample classes in the study are as follows

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

$$S^2 = \frac{(32-1)77{,}48 + (30-1)131{,}03}{32+30-2} = \frac{6201{,}75}{60}$$

$$S^2 = 103{,}3625 = S = 10{,}17$$

Next, to determine the calculated t-value (t_0), the following formula is used

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \frac{8}{10{,}17\sqrt{0{,}0645}} = \frac{8}{3{,}482} = 2{,}583$$

Based on the calculation results, the obtained t-value is 2.583. This value is then compared to the critical values from the t-distribution table at a significance level of 0.05, with degrees of freedom (df) = 60. The table value (t_{table}) is determined to be ±2.000.

Since the calculated t-value (t_0 = 2.583) lies outside the range of -2.000 ≤ t ≤ 2.000, we can conclude that the calculated t-value exceeds the critical value. As a result, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted at a significance level of 0.05. These findings indicate that there is enough statistical evidence to suggest that the Cooperative Script learning model has a significant effect on students' ability to understand mathematical concepts. Therefore, the alternative hypothesis, which posits that the learning model has an impact, is supported by the data in this study.

The findings obtained by the researcher during the study using the Cooperative Script learning model are as follows: 1) There was an improvement in students' ability to understand mathematical concepts. 2) Students became more focused and actively engaged in the learning process. 3) The Cooperative Script learning model enhanced students' memory of statistical material and helped them think systematically and concentrate on the lesson. 4) Student interaction during discussions was more evident, with increased collaboration in solving worksheets (LKS) and other group tasks (Harefa, D., & Fatolosa Hulu, 2024).

Additionally, the test results indicate that the average score of students in the experimental class is 72, while the average score in the control class is 64. Based on the hypothesis testing results, where the calculated t-value (t_0) exceeds the critical t-value from the t-distribution table ($t_0 > t_{table}$), with 2.583 > 2.000, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. As a result, we can conclude that the Cooperative Script learning model has a significant effect on students' ability to understand mathematical concepts. This finding supports the idea that the Cooperative Script model contributes positively to enhancing students' understanding in the subject.

3. **Discussion**

The use of the Cooperative Script learning model in mathematics has demonstrated a positive impact on students' learning development, especially in terms of their understanding of the concepts being taught. The data analysis results, derived from the testing conducted by the researcher, reveal that the students' ability to comprehend mathematical concepts in the experimental class was superior to that of the control class.

These findings suggest that the Cooperative Script learning model enhances students' grasp of mathematical concepts, providing them with better opportunities for understanding and applying the material compared to traditional teaching methods used in the control class. The significant improvement observed in the experimental group highlights the effectiveness of this model in fostering deeper comprehension and active engagement in learning.

Furthermore, students who are taught using the Cooperative Script learning model exhibit a higher level of focus and active engagement during classroom activities. They actively participate in group discussions, contributing their ideas and collaborating with peers to solve problems presented by the teacher. This model encourages students to take initiative in their learning and fosters a strong curiosity to understand the concepts being taught.

This aligns with Huda's (2014) perspective, which emphasizes that the Cooperative Script learning model is specifically designed to help students think systematically and maintain concentration on the lesson. With the increased attention students give to the learning process, they are better able to comprehend and retain the material being taught. The Cooperative Script model not only enhances understanding but also motivates students to become more actively involved in their own learning journey, leading to more effective educational outcomes.

The Cooperative Script learning model plays a significant role in enhancing students' memory of the statistics material being taught. It also encourages students to think more systematically and critically when responding to questions posed by the teacher, as noted by Harefa (2022). This approach fosters deeper cognitive engagement, helping students to organize their thoughts and apply concepts more effectively during problem-solving. This aligns with Slavin's (as cited in Shoimin, 2014) perspective, which highlights that the Cooperative Script learning model is particularly effective in improving students' memory retention. By engaging in collaborative activities, students are able to better link facts and concepts they have learned previously. This process not only strengthens their memory but also enables them to apply their knowledge in new contexts, leading to a more integrated understanding of the material. Therefore, the Cooperative Script model supports both the retention and application of knowledge, which is crucial for long-term learning success.

Furthermore, during group discussion activities, students actively engage with each other to solve the worksheets (LKS) provided by the teacher, as noted by Harefa, D., & I Wayan Suastra (2024). While working on the worksheets, students collaborate, exchange ideas, and work together to find solutions to the problems at hand. This collaborative environment fosters a sense of shared responsibility and encourages students to contribute their thoughts, strengthening their understanding of the material.

Through the Cooperative Script learning model, students are trained to work together in a fun and engaging atmosphere that promotes mutual support and deeper learning. This model creates an interactive environment where students can discover key ideas and broaden their understanding of concepts introduced by the teacher. As students collaborate, they are not only reinforcing their individual knowledge but also exploring the connections between ideas, which enhances their overall comprehension. According to Schank and Abelson (as cited in Shoimin, 2014:49), the Cooperative Script learning model reflects the way students socially interact with their environment, which includes interactions as individuals, within families, community groups, and society at large. This social aspect of learning helps students build meaningful connections with their peers and the material, creating an inclusive and dynamic learning experience that mirrors real-world social interactions.

The results of the test administered by the researcher demonstrated a noticeable improvement in the average scores of the students. In the experimental class, the average score in the pre-test was 63, and after the implementation of the Cooperative Script learning model, the post-test average score increased to 72, indicating a significant gain in performance. Meanwhile, in the control class, the average score in the pre-test was 58.17, and the post-test score improved to 64. Although there was an improvement in the control class as well, the increase was not as substantial as that observed in the experimental class. These results suggest that the Cooperative Script learning model had a more pronounced effect on enhancing students' understanding and performance compared to the traditional teaching methods used in the control class. The increased post-test scores in the experimental group highlight the model's effectiveness in improving students' grasp of the material.

Furthermore, based on the results of the hypothesis test, where the calculated t-value (t_0) is greater than the table t-value ($t_0 > t_{ta}b_{le}$) (2.583 > 2.000), the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This statistical evidence supports the conclusion that the Cooperative Script learning model has a significant influence on students' understanding of mathematical concepts. The rejection of the null hypothesis and acceptance of the alternative hypothesis indicates that the differences in performance between the experimental class and the control class are not due to chance but rather to the effectiveness of the learning model. Therefore, the Cooperative Script model can be considered a valuable teaching approach for enhancing students' comprehension of mathematical material.

D. Conclusion

Based on the data analysis and discussion of the research results presented in Chapter IV, it can be concluded that the Cooperative Script learning model has a positive impact on students' mathematical concept comprehension skills. The application of this model fosters a more focused and active learning environment for students. By working in groups, students are encouraged to interact with one another and share their ideas while solving worksheets. This collaborative approach enhances their understanding of the concepts being taught, as it allows them to learn from their peers and deepen their own grasp of the material.

Additionally, students are able to effectively convey the information or material presented by the teacher to their peers, reinforcing their own understanding in the process. This peer-to-peer interaction not only improves their comprehension but also develops their communication skills and promotes a more inclusive learning environment. Thus, the Cooperative Script learning model not only aids in the mastery of mathematical concepts but also cultivates valuable collaborative and interpersonal skills among students.

Suggestions

Based on the conclusion above, the researcher offers the following suggestions:

a. For Mathematics Teachers in Junior High Schools:

It is recommended that mathematics teachers apply the cooperative script learning model, as it helps students better understand the material being taught and encourages active involvement in classroom activities.

b. For Teachers Implementing the Cooperative Script Model

Teachers should carefully follow the steps outlined in the cooperative script learning model. It is important to ensure that the planned learning design is implemented effectively and that the learning objectives are successfully achieved.

c. For Students:

Students are encouraged to actively participate in lessons that apply the cooperative script model, as this has a significant impact on improving their understanding of mathematical concepts.

d. For Future Researchers:

It is hoped that this research can serve as a reference for future studies and can be further developed to explore other aspects or areas of application.

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