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Development of Cooperative Script Model Mathematics Learning Devices with Realistic Mathematical Approach to Improve Mathematical Communication Ability for Grade VII Algebraic Materials

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Abstract

This research aims to: (1) obtain a valid mathematics learning tools model cooperative script with realistic mathematics approaches to improve mathematics communication skills; (2) a practical mathematics learning tools model cooperative script with realistic mathematics approaches to improve mathematics communication skills; (3) test the effectiveness of mathematics learning tools model cooperative script with realistic mathematics approaches to improve mathematics communication skills; The research consisted of two stages. The first stage is developing a learning device. The second stage is the implementation of learning using the learning device. The development of learning tolls in this study adapting development model proposed by Thiaragajan, Semmel, & Semmel includes define, design, develop, and disseminate. Disseminate not implemented in this study. The average value of the validation by the experts that developed the device is good. Individual mastery test results showed t calculate 7.3420296 > t table so it can exceed Minimum Criteria of Mastery Learning. Average test results the classical completeness showed z calculate 2,4495 is outside the reception area of H_0. So, it can be concluded mathematics learning model of cooperative script with realistic mathematical approaches to effectively help student achieve complete Minimum Criteria of Mastery Learning. The result test difference in average value of mathematical communication ability test showed t calculate 6.277818 > t table. This means that the average student mathematical communication ability test experimental class is better than the average test communication ability mathematical student control class. Being two different test results show the proportion of z calculate 2.30551 is outside the reception area H_0. So it can be concluded that the number of students with communication skills math test scores reached the limit of Minimum Criteria of Mastery Learning in the experimental class more than the number of students who reach the limit value Minimum Criteria of Mastery Learning completed in experimental class. Data were analyzed by SPSS 17 resulted in the regression equation $\hat{Y} = 51.652 + 6.019X_1 + 5.562X_2$, It means each additional character variable independence (X_1) of the unit will add to the value of mathematical ability test ($\hat{Y}$) of 6.019. Average each additional variable of mathematical communication skills (X_2) of the unit will occur the value addition of mathematical communication ability test ($\hat{Y}$) of 5.561.

Keywords
realistic mathematics; cooperative script; mathematical communication

I. Introduction

Almost everyone is aware of the importance of mathematics. This awareness is not enough to move students' learning motivation. The low motivation to learn mathematics for class VII students of SMP Negeri 1 Ngablak, Magelang Regency is suspected from the

low interest in continuing. Based on informal interviews, it is known that less than 30% of students plan to continue. One of the reasons for the lack of motivation to learn is that students fail to understand the benefits of mathematics. They do not appreciate the role of mathematics in life. Low motivation affects independent learning. Education is a very important human need because education has a duty to prepare Human Resources (HR) for the development of the nation and state (Pradana et al, 2020). According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong characteristics, clear identities and able to deal with current and future problems (Azhar, 2018). Education and skills are the main keys in gaining social status in community life (Lubis et al, 2019).

One of the goals of learning mathematics (BSNP, 2006) is that students have the ability to communicate ideas with symbols, tables, diagrams, or other media to clarify situations or problems. As a language (Suherman, et al. 2003), mathematics is an accurate communication tool. Shadiq (Prayitno, Suwarsono, and Siswono, 2013) shows the lack of mathematical communication skills due to the small portion of developing mathematical communication skills.

Algebra is a difficult subject (Fong, 2011: 53). Stacey (2011) notes in PISA that questions about algebra are more difficult than questions about numbers, geometry and data. Hidayati (2010) noted the difficulties of students in learning algebra. Not many algebra learning materials are available that accommodate increasing independence and mathematical communication skills to improve mathematical communication skills.

As one component in the curriculum (Kesumawati, 2011) teachers must be able to make teaching materials and develop curriculum. Likewise, Zulkardi (Putri, 2009) said that teachers are required to translate the curriculum into material that students will learn so that it is easy to understand by making their own material. It is an ideal thing when each teacher uses his own structured textbook in his work.

Based on that description, it is necessary to find a learning model that can increase independence and mathematical communication skills. With independence and increased communication skills encourage increased mathematical communication skills. Cooperative script model of mathematics learning with a realistic mathematical approach is feasible to use to improve mathematical communication skills.

As a reference, several related studies are presented. Rifa'i's research (2014) among others states that there are differences in the increase in mathematical communication of students who receive a cooperative script learning model with students who receive conventional learning. Muniroh (2010) stated that learning the cooperative script model can increase creativity in solving mathematical problems. Loviana, Nurhanurawati, and Coesamin (2013) stated that the cooperative learning model with the cooperative script method is better applied to students' understanding of mathematical concepts.

Agus (2010) stated that the mathematics learning achievement of students who were taught the RME approach with problem solving was better than the mathematics learning achievement of the students who were taught the RME approach. Budhiani (2010) stated that the PMRI approach modified with Group Discussion resulted in better mathematics learning achievement than PMRI. Pamekas (2011) states that a realistic approach to

mathematics learning can improve students' mathematics learning achievement and a realistic approach to mathematics can increase students' active involvement.

With that background, the objectives of this research are: 1) To obtain a cooperative script model learning tool with a realistic mathematical approach to improve the mathematical communication skills of valid class VII algebraic material; 2) Produce cooperative script learning tools with a realistic mathematical approach to improve practical mathematical communication skills for class VII algebra; and 3) Testing the effectiveness of the cooperative script model learning device with a realistic mathematical approach to improve the mathematical communication skills of class VII algebraic material.

II. Research Method

This research consists of two stages. The first stage is the development of cooperative script learning tools with a realistic mathematical approach. The second stage is the implementation of the developed device. The development of tools in the research adapts the development proposed by Thiaragajan, Semmel, & Semmel (Buhari, 2009) including define, design, and develop, as well as disseminate. Disseminate was not carried out due to limited time and the ability of researchers. The population in this study were all seventh-grade students of SMP Negeri 1 Ngablak, Magelang Regency in the 2015/2016 academic year. The research sample was students of class VII-c. The subject of the device testing was carried out using a random sampling cluster technique.

In this study, the instruments used were validation sheets, teacher assessment sheets, student assessment sheets, observation sheets, and mathematical communication skills learning outcomes test (TKKM). The data used in this study is the experimental class TKKM data compared to the control class TKKM data. Furthermore, the effect of effectiveness and process skills was tested on students' mathematical communication skills. The variable whose completeness is measured is the variable of Mathematical Communication Ability.

III. Result and Discussion

In the define stage, the researcher observes the low independence and communication skills of students. In addition, learning has not been supported by adequate devices. In the design stage, the researcher makes the initial product. The products designed are syllabus, lesson plans, Mathematical Communication Ability Test (TKKM), Student Activity Sheets (LKPD), and student books. The product is designed to foster independent learning of mathematics and mathematical communication skills so as to improve mathematical communication skills. The product is implemented through a cooperative script model with a realistic mathematical approach.

At the develop stage, expert assessments and trials are carried out. The validator provides input on all products. Based on that input, a revision was made. Next, the validator makes an assessment. The average score of the syllabus assessment is 4.09; RPP 4.06; TKKM 4, LKPD 4.01; and Student Book 4.00. In the normality test, the Kolmogorov-Smirnov test was used for the pretest value. The results of the calculation of the significance value of 20% > 5%. It means that H_0 is accepted. It is concluded that the values are normally distributed. With a significance level of 0.05 the homogeneity of variance test using the Barlett test, the result is _obs^2 = 1.1227 while DK = {□² ² >

3.841}, so _obs^2 DK. It means that H_0 is accepted. This means that both classes come from the same variant.

Prerequisite test is carried out based on the TKKM value. Output normality test calculation significant value 11.7% > 5%. It means that H_0 is accepted. It was concluded that the posttest scores were normally distributed. The value of posttest kurtosis in the experimental class is 0.752 which is quite close to zero. It can be said that the data tend to be homogeneous. Individual completeness testing is carried out with the average test of two parties. The calculation results produce a value of tcount = 7.340296. Medium ttable = 2.063899. Thus tcount > ttable, so H_0 is rejected. This means that the average mathematical communication ability exceeds the minimum completeness criteria (KKM).

There were 24 students who scored more than 70. With individual completeness criteria, it means = 0.75. While x = 24 and n = 24. So z 2.4495. The z number of the standard normal list with = 0.05 is 1.96. The criteria used: accept H_0 if $1.96 < z < 1.96$. The value of z count 2.4495 is outside the reception area. Thus H_0 is rejected and H is accepted. It is concluded that the cooperative script model of mathematics learning with a realistic mathematical approach meets the KKM. This means that the use of effective learning tools helps students achieve KKM.

The normality test was carried out in two classes based on the TKKM value. With the Kolomogorov-Smirnov test, the significance value for both classes was 0.056 = 5.6% > 5%. Means that H_0 is accepted, it is concluded that the population is normally distributed. Homogeneity test was conducted to determine whether the population being compared had the same variance. With a significance level of 0.05, the homogeneity test gave the result _obs^2 = 0.10099 while DK = {□² ² > 3.841}, so _obs^2 DK. This means that H_0 is accepted. Thus both classes come from the same variant.

The completeness test was conducted to determine the classical achievement of the experimental class students compared to the KKM. With a significance level of 0.05, the value of ttable = 2.069 is tcount = 7.340. Means tcount > ttable. Thus reject H_0 or accept H_1. So that the average TKKM of the experimental class is 70.

Testing the difference in the average TKKM results between the two classes was carried out to determine whether the use of the cooperative script model with a realistic mathematical approach resulted in better scores than learning that did not use the same model and approach. With a significance level of 0.05 the value of ttable = 2.069 while tcount = 6.277818. Means tcount > ttable. Thus reject H_0 or accept H_1. So it can be concluded that the average TKKM of the experimental class is more than the control class.

The average value of students who received treatment was 76.67 more than the value of students who did not receive treatment, which was 73.88. This shows that the learning outcomes of students in the experimental class are better than the control class. The TKKM value of students who received treatment was 96% reaching the KKM. In the dick class, there are 4 students whose scores have not reached the KKM.

The classical completeness difference test uses a completeness test. The result is z = 2.30551. The z number of the standard normal list with = 0.05 is 1.96. The criteria used are accept H_0 if $1.96 < z < 1.96$. In other cases H_0 is rejected. The price of zcount 2.30551 is outside the H_0 reception area. Thus H_0 is rejected and H is accepted. It was concluded that many students with scores reaching the KKM complete limit in the experimental class were more than the control class.

The results of the calculation of the Variance Inflation Factor value of 1.070; indicates that there is no multicollinearity. The results of the calculation of the Durbin-Watson coefficient = 2.539. This value is compared with the DW table at a significance of 0.05 with n = 24 and the number of independent variables = 2. The values of dL = 1.27 and

dU = 1.45 are obtained. So the value is 4 – dU = 2.55. It means that the calculated value of DW = 2,539 is between dU and 4 – dU. This means that there is no autocorrelation. Based on the output of the Scatterplot, it can be seen that the dots are spread out and do not form a certain pattern. It was concluded that there was no heteroscedastic problem.

The calculation of the effect is carried out with the help of SPSS 17. The result is a sig value. = 0.000 < 0.05. It means that H_0 is rejected. This shows a linear regression, meaning that there is a joint linear influence between the character of independence and mathematical communication skills on mathematical communication skills. The regression equation obtained is $Y = 51.652 + 6.019X_1 + 5.561X_2$, meaning that each addition of the independence character variable by one unit adds to the TKKM value of 6.019. For every addition of a mathematical communication skill variable of one unit, the TKKM value of 5.561 increases. The large influence of the character of independence and mathematical communication skills on mathematical communication skills obtained an R Square value of 0.703. This means that 70.3% of students' mathematical communication skills are influenced by the character of independence and mathematical communication skills together.

The value of the character of independence and mathematical communication skills at each meeting has increased. This is in line with the results of the value of the dominant mathematical communication ability completed by KKM. This situation is supported by the results of the mathematical communication ability gain test of 0.5069301.

From the results of observations, researchers analyzed the character of the independence of students. There were four students who from the beginning had quite high independence. They dare to take the initiative to convey the results of their thoughts. From the results of observations, researchers conducted an analysis of mathematical communication skills. There are four students with outstanding mathematical communication skills. They excel at writing clearly and systematically statements, notations, tables, diagrams, maps, illustrations, models or mathematical formulas accurately. In addition they can check or evaluate other answers appropriately.

The results of the development of learning devices, first tested in a limited class. Based on the limited trial, it was found that the developed mathematics learning tools met the practical criteria. This is based on the assessment of teachers and students who apply learning in a limited class with the resulting device. Good and positive results from this observation indicate that learning has met the criteria of practicality.

The effectiveness of the developed learning tools is evaluated based on the mastery of learning and whether or not there are differences in the learning achievements of students who receive cooperative script learning models with a realistic mathematical approach compared to the achievements of control class students. The effectiveness of learning tools is evaluated based on whether or not there is a joint influence between independence and mathematical communication skills on mathematical communication skills.

The effectiveness of learning is measured by classical and individual completeness tests. Based on the calculation, it is found that the individual and classical completeness in the research has been achieved. It can be concluded that the cooperative script model of mathematics learning with a realistic mathematical approach to improve mathematical communication skills for class VII algebra material meets the KKM 80% of students get a minimum score of 70. This means that the learning tools developed are effective in helping students achieve KKM mastery.

Another reason for this completeness is that the tools developed are arranged in a systematic and gradual manner. The depiction of clearly instilled character values also

contributes to the mathematical communication skills of students. While the learning model developed in its implementation helps students who have difficulty learning the material alone so they can have discussions with their partners.

Testing the difference in the average TKKM results will produce a better score or not. The TKKM posttest score for the experimental class was 76.67. The pretest score for the experimental class was 62.63. The gain value, g〉 0.37. It means that the gain in the experimental class is in the medium category.

In the control class, the pretest TKKM score was 62.5. The TKKM posttest score was 73,875. The gain value, g〉 0.30. It means that the gain in the control class is in the low category. This shows that the learning outcomes of students in the experimental class are better than the learning outcomes of students in the control class. It can be seen that there is a significant influence of independent character and mathematical communication skills on students' mathematical communication skills. This can be seen from the TKKM value of the experimental class which shows a positive influence between these variables.

At the beginning of the study, the level of mathematical communication ability of the first indicator was 41.67%, the second indicator was 40.63%, while the third indicator was 42.71%. At the end of the observation the percentage of the first indicator is 63.54%, the second indicator is 50%, while the third indicator is 67.71%. Overall the increase in mathematical communication skills for the first indicator is 22.91%. The second indicator is 8.17% and the third indicator is 26.04%.

The character of independence has a positive impact on mathematical communication skills. The indicators applied are realized in learning. So that the independence of students is well formed. At the beginning of the study, the independence of students for the first indicator was 63.54%. The second indicator is 52.08%, for the third indicator is 45.83%. At the end of the observation the percentage of achievement of the first indicator is 66.67%, the second indicator is 64.58%, for the third indicator is 61.46%. Overall, the increase in mathematical communication skills for the first indicator is 3.13%, the second indicator is 12.5% and the third indicator is 15.63%.

IV. Conclusion

Learning using a cooperative script model of mathematics learning with a realistic mathematical approach can improve mathematical communication skills for class VII algebraic material. This is based on: a) The learning tools developed meet the valid criteria; b) The average learning achievement of students in learning with learning tools developed thoroughly KKM; c) Classical learning achievement meets the criteria for classical completeness; d) The average learning outcomes of students with cooperative script learning with a realistic mathematical approach are better than students who study conventionally; e) Independent learning has an effect on mathematical communication skills; f) Mathematical communication skills affect mathematical communication skills; g) Independent learning and mathematical communication skills together affect mathematical communication skills.

Given the limitations of this study, other researchers are expected to conduct further similar research related to cooperative script models and realistic mathematics. It is hoped that other researchers will conduct research in a wider area, with more samples, with more complex research designs.

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