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The Influence of the Realistic Mathematics Learning Approach Assisted by the Mathcitymap (Mcm) Application on the Mathematical Problem Solving Ability and Learning Interest of Class V Students

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Abstrak

Tujuan penelitian adalah untuk mengetahui dan mendeskripsikan pengaruh pendekatan pembelajaran matematika realistik berbantuan aplikasi *Mathcitymap* terhadap kemampuan pemecahan masalah matematis dan minat belajar siswa Kelas V UPT SPF SDN Kompleks IKIP I. Jenis penelitian ini adalah *quasi experiment* dengan desain model *posttest only control group design*. Jumlah sampel dalam penelitian ini adalah 76 siswa yang terdiri dari 38 siswa dari kelas eksperimen dan 38 siswa dari kelas kontrol. Kelas eksperimen diberi perlakuan berupa penerapan pendekatan pembelajaran matematika realistik berbantuan aplikasi *Mathcitymap* sedangkan kelas kontrol diterapkan pendekatan pembelajaran konvensional. Metode pengumpulan data yang digunakan yakni tes, angket, dan dokumentasi. Teknik analisis data yang digunakan yaitu teknik analisis statistik deskriptif dan uji manova. Hasil penelitian menunjukkan bahwa nilai hasil uji manova menunjukkan nilai signifikansi sebesar 0,000 < 0,05 yang berarti terdapat perbedaan secara simultan kemampuan pemecahan masalah matematis dan minat belajar siswa pada kelas eksperimen dengan kelas kontrol. Dengan demikian dapat disimpulkan bahwa terdapat pengaruh signifikan pendekatan pembelajaran matematika realistik berbantuan aplikasi *Mathcitymap* terhadap kemampuan pemecahan masalah matematis, minat belajar, dan secara simultan terhadap kemampuan pemecahan masalah matematis dan minat belajar siswa kelas V UPT SPF SDN Kompleks IKIP

Kata Kunci: *pembelajaran matematika realistik, aplikasi mathcitymap, pemecahan masalah, dan minat belajar*

Abstract

The aim of the research is to determine and describe the effect of a realistic mathematics learning approach assisted by the Mathcitymap application on the mathematical problem solving abilities and interest in learning of Class V UPT SPF SDN IKIP I Complex students. This type of research is a quasi experiment with a posttest only control group design model. The number of samples in this study was 76 students consisting of 38 students from the experimental class and 38 students from the control class. The experimental class was given treatment in the form of applying a realistic mathematics learning approach assisted by the Mathcitymap application, while the control class applied a conventional learning approach. The data collection methods used are tests, questionnaires and documentation. The data analysis techniques used are descriptive statistical analysis techniques and the MANOVA test. The research results showed that the MANOVA test results showed a significance value of 0.000 <0.05, which means that there was a simultaneous difference in mathematical problem solving abilities and students' interest in learning in the experimental class and the control class. Thus, it can be concluded that there is a significant influence of the realistic mathematics learning approach assisted by the Mathcitymap application on mathematical problem solving abilities, interest in learning, and simultaneously on the mathematical problem solving abilities and interest in learning of class V UPT SPF SDN Complex IKIP I students.

***Keywords**: realistic mathematics learning, mathcitymap application, problem solving, and interest in learning*

Introduction

Mathematics is a field of study that is very effective in training and improving students' thinking abilities, including the ability to think in solving problems. Problem solving ability is one of the goals of learning mathematics. According to the Ministry of Education and Culture (Kemdikbud, 2021), mathematics learning aims to ensure that students have the following abilities: (1) Understanding mathematics learning material in the form of facts, concepts, principles, operations and mathematical relations and applying them flexibly, accurately, efficiently and precisely in solving problems mathematical (mathematical understanding and procedural skills). (2) Using reasoning on patterns and properties, carrying out mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements (mathematical reasoning and proof). (3) Solving problems which includes the ability to understand problems, design mathematical models, complete models or interpret the solutions obtained (mathematical problem solving). (4) Communicating ideas using symbols, tables, diagrams, or other media to clarify situations or problems, as well as presenting a situation in symbols or mathematical models (mathematical communication and representation). (5) Linking mathematics learning material in the form of facts, concepts, principles, operations and mathematical relationships in a field of study, across fields of study, across fields of science, and with life (mathematical connections). (6) Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention and interest in studying mathematics, as well as a creative, patient, independent, diligent, open, tough, tenacious and confident attitude in solving problems (mathematical disposition). Based on the mathematics learning objectives above, mathematical problem solving ability is mentioned in the third point and is a competency that must be achieved by students through mathematics learning organized by the teacher.

Problem solving abilities are also emphasized in the main standards in mathematics learning contained in the National Council of Teachers of Mathematics (NCTM) standards. The main

standards for mathematics learning in NCTM include problem solving abilities, communication abilities, connection abilities, reasoning abilities and representation abilities (Siregar, 2018). These five ability standards have an important role in the mathematics curriculum and are of serious concern to teachers in designing and implementing mathematics learning.

Problem solving abilities are very important in learning mathematics. According to (Krulik, S. & Rudnick, 1995), problem solving has an important position in mathematics learning. Mathematics has an important role in providing various abilities to students for the purposes of structuring thinking abilities and the ability to solve problems in everyday life, especially problems that are in direct contact with their environment (Hidayah & Sariningsih, 2018). Apart from that, the importance of mathematical problem solving abilities was also emphasized by (Ramellan, P., Musdi, E., 2012) such as the ability to solve problems is a general goal of teaching mathematics, problem solving which includes methods and strategies is the main process in the mathematics curriculum and problem solving is a basic ability in learning mathematics. Therefore, mathematics learning should be designed with the main aim of equipping students to be skilled in solving problems.

Not only do they have good mathematical problem solving skills, but students are also required to have a good attitude towards mathematics, namely having interest and interest in mathematics lessons which is shown through great curiosity, especially in solving mathematical problems. This is included in the objectives of mathematics learning according to the Ministry of Education and Culture dkk., 2019) in the sixth point, namely having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention and interest in studying mathematics, as well as an attitude of being creative, patient, independent, diligent, open, tough, tenacious, and confident in problem solving (mathematical disposition). Therefore, it is important for teachers to design and implement mathematics learning with the aim of increasing their students' interest in learning mathematics.

The hope that Indonesian students will have good mathematical problem solving skills does not seem to have materialized. We can see this in the 2018 PISA results in terms of numeracy. The test results show that Indonesia's mathematical literacy ranks 73rd out of 79 participating countries with a score of 379 (OECD, 2018). If we look back at the previous PISA mathematics literacy results, in 2015, Indonesia ranked 65th out of 70 participating countries with a score of 386 (OECD, 2016). Judging from the achievement of scores, of course the results in 2018 were lower than in 2015, meaning there was a decline in ability. Problem solving ability is one of the assessments in PISA (OECD, 2013), so that the PISA test can provide information about students' mathematical problem solving abilities.

The low ability of students to solve mathematical problems can also be seen from the 2021 ANBK results in the education report card from the Ministry of (Hery, 2015). The national student numeracy ability index value was obtained at 1.57. This shows that students' numeracy abilities nationally are still below the minimum competency (less than 50% of students have reached the minimum competency limit). The minimum competency index value is 1.80. The numeracy index value for South Sulawesi Province and Makassar City is also below the minimum competency index value. The average numeracy index value for South

Sulawesi Province is 1.54 and 1.6 for the city of Makassar.

ANBK results in terms of numeracy can be used to see students' abilities in solving mathematical problems, because the numeracy questions in AKM are problem solving questions which aim to measure and train students' abilities in solving mathematical problems in various contexts. This is in accordance with what is contained in the AKM Framework, that through AKM numeracy students practice improving their numeracy skills by solving problems in various contexts (Kemdikbud, 2021).

Regarding problem-solving abilities, researchers measured these abilities on 38 students in class IVB UPT SPF SDN IKIP Complex I on Thursday, April 12 2023. Researchers gave 2 numbers of descriptive questions related to the topic of area and perimeter of a square. The first question was to find the overall area of a shape formed from several squares and the result was that 13 students answered correctly out of 38 students. The second question calculated the distance traveled by an ant from point A to point B by passing through the circumference of a shape formed from several squares and the result was that no students answered correctly.

Not only giving questions, researchers also observed the ongoing learning process and interviewed several students. It was found that learning was carried out by presenting the material first, then giving students the opportunity to ask questions about things they did not understand (Ruseffendi, 1998). After that, students individually work on the practice questions in the textbook. Generally it happens like that, when the researcher confirms it with several students. The learning activities carried out by teachers are still less interactive and students tend to be less enthusiastic about learning. Researchers also asked about students' interest in learning about subjects and the result was that 4 out of 38 students who raised their hands chose to like studying mathematics subjects.

The learning carried out by the teacher in question tends to be conventional. (Arief S. Sadiman, 2011), say that the conventional approach is a learning approach that is widely implemented in schools today, which uses a sequence of activities providing descriptions, examples and exercises. (Yulianti & Ramdhan, 2020) stated that the learning method used is a conventional approach in the form of lecture methods, giving assignments, and questions and answers. The teacher concerned predominantly uses lecture methods and giving assignments when teaching mathematics subjects.

From the above data obtained, the researcher feels the need to increase the mathematical problem solving abilities of Indonesian students, especially class IV students at UPT SPF SDN IKIP I Complex including an increase in interest in learning mathematics. One effort that can be made to improve students' mathematical problem solving abilities and interest in learning mathematics is to apply a realistic mathematics learning approach assisted by the Mathcitymap application.

The realistic mathematics learning approach is a learning approach that refers to the Freudental view of mathematics which says that mathematics must be connected to reality (mathematics must be connected to reality) and mathematics is a human activity (mathematics as human activity) (Abidin, 2017). A realistic mathematics learning approach can improve students' mathematical problem solving abilities because it uses the real world as a starting point in developing mathematical ideas and concepts. The real world can be used as a starting point for mathematical problems for students to

understand and then design strategies for solving them. Research conducted by (Hidayah & Sariningsih, 2018) shows that a realistic mathematics learning approach contributes to increasing students' mathematical problem solving abilities.

Mathcitymap is an Android/iOS application based on GPS (Ismaya, Cahyono, & Mariani, 2018). Mathcitymap provides locations via GPS where each location contains mathematical problems solved by students. The main aim of the Mathcitymap application is to bring students to the point of the problem and solve the problem given by making direct observations, as well as including in the application the assistance needed to solve the problem (Ismaya et al., 2018). This application can train students to solve contextual problems from the problem location created by the teacher so that the Mathcitymap application is expected to improve students' mathematical problem solving abilities.

Applying a realistic mathematics learning approach assisted by the Mathcitymap application will certainly be more effective in improving students' mathematical problem solving abilities because both of these focus on training problem solving abilities from problems presented contextually. Apart from that, it can also increase students' interest in learning. Using gadgets to utilize the Mathcitymap application in learning will certainly make learning more interesting and fun. This is in accordance with (Bunga, 2018), that using the Mathcitymap application makes learning Mathematics more enjoyable.

The implementation of a realistic mathematics learning approach assisted by the Mathcitymap application meets quality learning standards. Quality learning according to the Ministry of (Hudojo, 2015) is carried out by (1) providing opportunities to apply material to real problems or situations, (2) encouraging interaction and active participation of students, (3) optimizing the use of resources available in the school environment or surrounding community , and (4) using information and communication technology devices. The implementation of realistic mathematics learning assisted by the Mathcitymap application fulfills all the components of quality learning, namely using contextual problems as a basis for developing mathematical concepts and ideas as well as challenging tasks that must be completed by students, encouraging interaction and active participation of students through collaborative problem-solving discussions, using the school environment. or the surrounding community as points of location for mathematical problems through the Mathcitymap application, and of course integrating information and communication technology by using gadget devices, mobile applications (Mathcitymap), MAPS, and the internet.

As quality learning, the application of a realistic mathematics learning approach assisted by the Mathcitymap application is expected to be able to improve students' mathematical problem solving abilities and interest in learning mathematics. Therefore, researchers will conduct research entitled the influence of a realistic mathematics learning approach assisted by the Mathcitymap application on the mathematical problem solving abilities and interest in learning of Class V UPT SPF SDN Complex IKIP I students

Method

Research Design and Type

The type of research used in this research is a quasi experiment with a posttest only control group design model. The model looks like in the table below!

Table 1 Posttest Design Only Control Group Design

	Class	*Treatment*	*Posttest*
R	Eksperimen	X	T_2
R	control	_	T_2

Source: (Payadnya & Jayantika, 2018)

The researcher chose 2 homogeneous classes as the experimental class and the control class (Sukmawati, Sudarmin, 2023). Then the experimental class was given treatment in the form of learning with a realistic mathematics learning approach assisted by the Mathcitymap application. Meanwhile, the control class is taught using a conventional learning approach. After learning, the researcher gave a posttest and questionnaire to obtain quantitative data in the form of data on students' mathematical problem solving abilities and interest in learning.

Population and Sample

1. Population

The population in this study were all class V students at UPT SPF SDN IKIP Complex, totaling 76 students consisting of 38 class VA students and 38 class VB students. The population is homogeneous based on summative test results data obtained from the class teacher concerned. The average summative test score for class VA is 73.06 while class VB is 74.09.

The average results of these classes are not much different and after carrying out the Levene statistical homogeneity test via SPSS, a significance value of 0.229 (≥ 0.05) was obtained, which means that the data from the population is homogeneous so that the researcher concludes that the class V population of UPT SPF SDN IKIP I Complex is homogeneous.

2. Sample

The researcher determined that the sample for this study was all members of the population from 2 different classes using a saturated sampling technique (Sukmawati, Salmia, 2023). The two classes were homogeneous, so the researcher determined the 38 students in class VA, totaling 38 students, as the control class who were not given treatment or taught using a conventional learning approach and the class VB students, totaling 38 students, as the experimental class who were given treatment or taught with a realistic mathematics approach assisted by Mathcitymap application.

Method of collecting data

The type of data used in this research is quantitative data, namely data on students' mathematical problem solving abilities obtained from student test results and data on students' learning interest obtained from filling out a learning interest questionnaire.

Data analysis technique

The quantitative data obtained was in the form of mathematical problem solving ability test results and data from filling out interest questionnaires. The data was analyzed using descriptive statistical analysis and inferential statistical analysis.

1. Descriptive Statistical Analysis

   Descriptive statistical data analysis presents data in the form of average or mean, lowest and highest scores, standard deviation, etc. related to mathematical problem solving ability scores and learning interest scores obtained from experimental class and control class students.

2. Inferential Statistical Analysis

   The inferential statistical analysis used to test the research hypothesis is Manova analysis. However, before testing the hypothesis, the analysis prerequisite tests for Manova are first carried out in the form of: Multivariate Normality Test, Homogeneity Test of the variance-covariance matrix / box - M, and Manova Hypothesis Test.

Result and Discussion

Research result

1. Description of Research Results

This research was carried out on class V students of UPT SPF SDN IKIP Complex I. The sample used was 76 students consisting of 38 students in class

VA and 38 students in VB. In this research, class VA as a control class was taught using a conventional learning approach and class VB as an experimental class was taught using a realistic mathematics learning approach assisted by the Mathcitymap application.

This research was conducted in 4 meetings. The learning was carried out in 3 meetings and post test activities were carried out at the last meeting to obtain data on problem solving abilities and students' interest in learning in the control class and experimental class. The data obtained was then analyzed descriptively to determine the highest and lowest values, median, mode, mean and standard deviation for each class. The following are the results of data analysis on students' problem solving abilities and interest in learning:

a. Mathematical Problem Solving Ability

The results of the post test on problem solving abilities of the control class and experimental class, if distributed into categories of achievement of mathematical problem solving abilities, are obtained as follows.

Table 2 Frequency Distribution of Post Test Results of Mathematical Problem Solving Ability for Control Class and Experimental Class

Interval Value	Category	Control		Experiment	
		Frekuensi	Persentasi (%)	Frekuensi	Persentasi (%)
x ≤ 55	Very low	5	13%	0	0%
55 < x ≤ 65	Rendah	8	21%	2	5%
65 < x ≤ 75	Enough	9	24%	5	13%
75 < x ≤ 85	Tall	14	37%	27	71%
x > 85	Very high	2	5%	4	11%
Amount		38	100	38	100

Ket. x = Problem solving ability score

Based on the table above, the mathematical problem solving abilities of students in the control class are more varied than the mathematical problem solving abilities of students in the experimental class. In the control class the students' abilities filled all ability categories from very low to very high, whereas in the experimental class there were no students with very low abilities.

The category of problem solving ability that students in the control class and experimental class mostly obtain is the same, namely they are both in the high category but with different percentages. High ability in the control class has a frequency of 14 students with a percentage of 37%, while in the experimental class there has a frequency of 27 students with a percentage of 71%.

The category of problem solving abilities that students in the control class and experimental class mostly obtain is the same, that is, they are both in the high category but with different percentages. High ability in the control class has a frequency of 14 students with a percentage of 37%, while in the experimental class there has a frequency of 27 students with a percentage of 71%.

b. Student Learning Interests

If the results of the control class and experimental class learning interest questionnaires are distributed into categories of learning interest achievement, they are obtained as follows.

Table 3 Frequency Distribution of Results of the Study Interest Questionnaire for Control Class and Experimental Class

Interval Value	Category	Control		Experiment	
		Frekuensi	Persentasi (%)	Frekuensi	Persentasi (%)

x ≤ 55	Very low	10	26%	0	0%
55 < x ≤ 65	Rendah	23	61%	1	3%
65 < x ≤ 75	Enough	2	5%	9	24%
75 < x ≤ 85	Tall	2	5%	19	50%
x > 85	Very high	1	3%	9	24%
Jumlah		38	100	38	100

Based on the table above, students' interest in learning mathematics in the control class is more varied than students' interest in learning in the experimental class. In the control class, students' interest in learning filled all categories of learning interest from very low to very high, whereas in the experimental class there were no students with very low interest in learning mathematics.

In the control class, there were 23 students in the low category with a percentage of 61%, while in the experimental class there were 19 students in the high category, with a percentage of 50%.

The category of interest in learning that students get the least is, in the control class it is in the high category, namely 1 student with a percentage of 3%, while in the experimental class it is in the low category, namely 1 student with a percentage of 3% and in the very low category, namely 0 students with a percentage of 0 %.

2. Prerequisite Test

a. Multivariate Normality Test

The normality test is carried out to determine whether the data used is normally distributed or not. Data normality analysis using SPSS 25.0 for windows at a significance level of 95% or alpha (α) 5%; provided that if the probability or sig value (2-tailed) ≥ 0.05, then the data is normally distributed; and if ≤ 0.05, then the data is not normally distributed. The following is the Multivariate Normality test data.

Table 4 Multivariate Normality Test

Correlations

		Mahalanobis Distance	Qs
Mahalanobis Distance	Pearson Correlation	1	.985**
	Sig. (2-tailed)		.000
	N	76	76
Qi	Pearson Correlation	.985**	1
	Sig. (2-tailed)	.000	
	N	76	76

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the multivariate normality correlation test above, it can be seen that the correlation between Mahalanobis Distance and qi is 0.985, proving that the data distribution for the two dependent variables, namely mathematical problem solving and interest in learning, is normally distributed.

b. Homogeneity test of the variance-covariance matrix / box – M

The homogeneity test is carried out to test that the data for the two dependent variables have the same variance - covariance matrix as against the independent variables. If the sig value. If the value obtained is more than 0.05, it means that the dependent variable has the same variance - covariance as the independent variable. On the other hand, if the sig value. less than 0.05 means the dependent variable has variances that are not the same as the independent variables. The homogeneity test results can be seen in the following table:

Table 5 Covariance Matrix Homogeneity Test

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Solution to problem	4,424	1	76	,117
Interest to learn	2,599	1	76	,101

Based on the table above, it was found that the significance value for problem solving was 0.117 and the significance value for interest in learning

was 0.101. The significance value of problem solving is 0.117 greater than 0.05 or 0.117 > 0.05 so that the problem solving data is declared homogeneous. Likewise, the significance value of learning interest obtained was 0.101 which was greater than 0.05 or 0.101 > 0.05 so that the student learning interest data could be declared homogeneous. These two variables have a significance value greater than 0.05, so the group can be declared homogeneous.

3. Hypothesis test

After fulfilling the requirements of the normality test with normally distributed data results and the homogeneity test with homogeneous data results, the next step is to test the data via the MANOVA test. The Manova test is carried out to test the first, second and third hypotheses, provided that if the significance value obtained is less than 0.05 then Ho is rejected and Ha is accepted, conversely if the significance value obtained is more than 0.05 then Ho is accepted and Ha is rejected. The following is the hypothesis test data:

Table 6 Hypothesis test

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.988	3078.673[b]	2.000	73.000	.000
	Wilks' Lambda	.012	3078.673[b]	2.000	73.000	.000
	Hotelling's Trace	84.347	3078.673[b]	2.000	73.000	.000
	Roy's Largest Root	84.347	3078.673[b]	2.000	73.000	.000
Approach	Pillai's Trace	.684	79.030[b]	2.000	73.000	.000
	Wilks' Lambda	.316	79.030[b]	2.000	73.000	.000
	Hotelling's Trace	2.165	79.030[b]	2.000	73.000	.000
	Roy's Largest Root	2.165	79.030[b]	2.000	73.000	.000

a. Design: Intercept + Approach
b. Exact statistic

Based on the table above, a significance value of 0.000 is obtained, meaning the significance value is smaller than 0.05 or 0.000 < 0.05, which means that Ho is rejected and Ha is accepted. This shows that there are simultaneous differences in mathematical problem solving abilities and interest in learning between students who are taught using a realistic mathematics learning approach assisted by the Mathcitymap application and students who are taught with a conventional approach.

Discussion

Based on the results of data analysis using the MANOVA (Multivariate Analysis of Variance) test, a significance value of 0.000 was obtained. That means the significance value is smaller than 0.05 or 0.000 < 0.05, which means that Ho is rejected and Ha is accepted. This shows that there are simultaneous differences in mathematical problem solving abilities and interest in learning between students who are taught using a realistic mathematics learning approach assisted by the Mathcitymap application and students who are taught with a conventional approach.

The realistic mathematics learning approach assisted by the Mathcitymap application has an effect on mathematical problem solving abilities because in this learning there are real problems faced by students as challenges that must be resolved. According to (Ismaya et al., 2018) the main aim of the Mathcitymap application is to bring students to the point of the problem and solve the problem given by making direct observations, as well as including in the application the assistance needed to solve the problem. Through the Mathcitymap application, students in groups will be directed to stopping points for mathematical problems, then in groups discuss understanding the problem, planning a solution strategy, carrying out calculations, and checking the answers again.

The realistic mathematics learning approach assisted by the Mathcitymap application can also increase students' interest in learning because students learn to use gadgets by following the instructions, go on adventures to find location points, and collaborate with other

students to solve real problems, like playing games and of course it feels like more fun and makes students interested in learning. This is in accordance with Kusmayanti's (2022) statement that using the Mathcitymap application makes learning mathematics more enjoyable.

Based on the explanation above, it can be concluded that the realistic mathematics learning approach assisted by the Mathcitymap application has a significant effect on the mathematical problem solving abilities and interest in learning of class V UPT SPF SDN IKIP IKIP Complex.

Conclusion

Based on the results of the research above, it can be concluded that the realistic mathematics learning approach assisted by the Mathcitymap application has a significant effect on the mathematical problem solving abilities and interest in learning of class V UPT SPF SDN IKIP Complex I. Teachers are expected to be able to apply the realistic mathematics learning approach assisted by the Mathcitymap application in their classes, especially in high classes, in order to improve their students' mathematical problem solving abilities and interest in learning. For future researchers, it is hoped that they will develop a realistic mathematics learning approach assisted by the Mathcitymap application with different material in the next research.

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