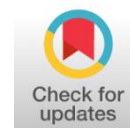


## Effectiveness of Android-Based Learning Media “Teman Ritma” to Improve Problem-Solving Skills of SMP Negeri 5 Yogyakarta



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### Abstrak

Pemecahan masalah merupakan kemampuan dasar yang harus dimiliki setiap individu serta merupakan bagian integral dalam pembelajaran matematika. Akan tetapi, masih banyak siswa di Indonesia yang membutuhkan kemampuan pemecahan masalah. Media pembelajaran berbasis *android* merupakan salah satu upaya dalam meningkatkan kemampuan pemecahan masalah siswa. Tujuan penelitian ini adalah untuk mengetahui efektivitas dari penggunaan media pembelajaran berbasis *android* yang bernama Teman Ritma. Penelitian ini berjenis penelitian eksperimen berbentuk *true-experimental* dengan desain yaitu *pretest post-test control group design*. Pengumpulan sampel dilakukan dengan menggunakan teknik *purposive sampling* dan menghasilkan sampel yaitu siswa kelas VII-G sebagai kelas kontrol dan siswa kelas VII-H sebagai kelas eksperimen dengan jumlah siswa dari masing-masing kelas adalah 30 siswa. Teknik pengumpulan data menggunakan observasi, wawancara, dan soal *pretest* dan *post-test* kemampuan pemecahan masalah yang memuat materi aritmetika sosial. Hasil penelitian menunjukkan bahwa penggunaan media pembelajaran Teman Ritma berbasis *android* efektif dalam meningkatkan kemampuan pemecahan masalah siswa. Pernyataan ini didukung oleh hasil uji Mann-Whitney yang menunjukkan bahwa nilai *Asymp. Sig. (2-tailed)* kurang dari 0,05 ( $0,027 < 0,05$ ) yang berarti pembelajaran dengan media Teman Ritma lebih efektif daripada menggunakan media pembelajaran yang guru gunakan. Kesimpulan ini diperkuat berdasarkan uji perbedaan rata-rata yang menunjukkan bahwa peningkatan rata-rata kelas eksperimen lebih tinggi daripada kelas kontrol ( $60,12 > 45$ ). Berdasarkan uji tersebut, dapat disimpulkan bahwa penggunaan media pembelajaran Teman Ritma berbasis *android* efektif meningkatkan kemampuan pemecahan masalah siswa SMP Negeri 5 Yogyakarta.

Keywords: android, efektivitas, kemampuan pemecahan masalah, teman ritma

### Abstract

*Problem-solving is an essential ability that must be achieved by each individual and problem-solving itself has become integral part of mathematics learning. However, many Indonesian students need problem-solving skills. Android-based learning media is one of the efforts in improving students' problem-solving skills. This study aims to find out the effectiveness of the use of android-based learning media called Teman Ritma. This research is kind of experimental research in the form of true-experimental with a design namely pretest post-test control group design. The sample is determined using purposive sampling techniques and produces a sample i.e., class VII-G students as a control group and class VII-H students as an experimental group with the number of students from each group is 30 students. Data collection techniques use observations, interviews, pretest questions and post-test problem-solving skills that contain social arithmetic material. The results showed that the use of android based learning media “Teman Ritma” was effective in improving students' problem-solving skills. This statement is proved by the results of the Mann-Whitney test which shows that Asymp's value. Sig. (2-tailed) less than 0.05 ( $0.027 < 0.05$ ) which means that learning with Teman Ritma media is more effective than using the learning media that teachers use. This conclusion was reinforced based on an average difference test that showed that the average increase in the experimental group was higher than that of the control group ( $60.12 > 45$ ). Based on the test, it concluded that the use of android-based learning media “Teman Ritma” is effective to improve the problem-solving skills of seventh-grade students of SMP Negeri 5 Yogyakarta.*

Keywords: android, effectiveness, problem-solving skill, teman ritma



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## INTRODUCTION

Recent science and technology advancement is achieved by humanity today cannot be separated from the role of mathematics (Krisnawati, 2012: 1). Mathematics is a universal science that accommodates modern technology and human intelligence development and has a vital role in various disciplines (Astuti, 2019: 2). Mathematics has multiple benefits in every aspect of life, so through the Law No.20 of 2003 on the National Education System, mathematics is used as a subject that must be taught and learned at all education levels, from primary education to higher education. Students learn mathematics to obtain the purpose of learning, namely having the ability to solve mathematical problems carefully, creatively, logically, and critically (Widjajanti, 2009: 1). Every student must have problem-solving skills because (a) the general purpose of mathematics learning is to have problem-solving skills, (b) the mathematics curriculum contains core processes, namely problem-solving skills that include methods, procedures, and strategies, (c) Problem solving is one of the essential abilities (Branca, 1980: 3-7). Problem-solving cannot be separated from mathematics learning because problem-solving has become an integral part of mathematics learning (NCTM, 2000).

But in reality, students' problem-solving skills are relatively low (Amam, 2017:40). According to a report entitled "Education in Indonesia Learns from PISA Results 2018" issued by the Research and Development Agency of Indonesian Education and Culture Ministry (Balitbang Kemendikbud), Indonesia scored 379 on PISA test results in mathematics (Kemendikbud, 2019: 50). A total of 71% of students have not achieved the minimum competency of mathematics level 1, i.e., students can answer questions that contain the usual context with the availability of relevant information, and students can investigate information and carry out steps based on direct instruction in obvious situations (OECD, 2017a). The PISA statement above aligns with the initial test results for student problem-solving skills held on November 12, 2021, at SMP Negeri 5 Yogyakarta (State Junior High School). The initial ability test problem consists of 3 description questions that contain indicators: (a) understanding problems, (b) making a plan, (c) implementing the plan, and (4) reviewing and concluding (Polya, 2004: 6). The results of the problem-solving skill initial test are interpreted based on the data conversion guidelines of the research results referring to Widoyoko (2012) can be seen in Table 1.

**Table 1. Result of Problem- Solving Skill Initial Test**

Indicators	Category		
	Low	Keep	Tall
Understand the problem	37,5%	28,125%	34,375%
Draw up a plan	40,625%	34,375%	25%
Carry out the plan	40,625%	28,125%	31,25%
Review and concluding	28,125%	37,5%	34,375%

Each student's ability to solve a mathematical problem is variated, starting from low, medium, and high ability (Widarti, 2013: 4). In Table 1, there are three indicators of problem-solving skills that are relatively low. However, the conclusion aspect is good enough. This is because students tend to write the final answer without being accompanied by how the steps are done. Cases like this make it a little difficult for teachers to check the math problem-solving skills of learners (Marhaeni, 2018: 2). Based on PISA results and preliminary test results of problem-solving skills above, many Indonesian students still need problem-solving skills when faced with mathematical problems.

Researchers then interviewed a teacher on November 1<sup>st</sup>, 2021, at SMP Negeri 5 Yogyakarta regarding the use of learning media. Based on the interview, the learning media used by teachers in mathematics teaching with a hybrid learning model is using PowerPoint media. The content of the PowerPoint Slide that the teacher uses only presents material text, question exercises, and assignments. In addition, the PowerPoint slides used do not contain interactive elements between teachers and students. Other results from the interview were that students were more likely to use technological devices such as laptops and smartphones to support hybrid learning. It is known that

SMP Negeri 5 Yogyakarta can only open classes with a maximum of 50% of the total students so that the remaining 50% of students are still learning from home in real-time as face-to-face schedule due to the COVID-19 pandemic. This phenomenon eventually made researchers make questionnaires about the use of gadgets in learning.

Based on a questionnaire sent on November 4<sup>th</sup>, 2021, 98,4% of students have their own smartphones, with 88,9% of them using smartphones with android operating system. Other results, because hybrid learning is still ongoing, 60% of students use smartphones for more than 3 hours in one day. The features, apps, or content that students access is dominated by access to learning content, followed by entertainment and game content. This was later confirmed when researchers also interviewed several students. The interviews with some students showed that smartphones are beneficial in their learning process. Other results from the preliminary study, as many as 39,7% of students have a very interesting assumption if the math material is packaged into an application that can be run on a smartphone device, while 55,6% have a reasonably exciting belief and the remaining 4,7% find it less attractive if the math material is packaged into an application. However, students' attention to using applications containing mathematical materials is very high. This is proved by 93,7% of students are interested in using smartphone-based math learning applications.

Learning media that use technology allows students to learn with high motivation because the learning media can display text, images, videos, sounds, and animations (Wahid 2019: 2). Android-based learning media development is one solution that teachers can use to improve students' mathematical problem-solving skills in the learning process during the COVID-19 pandemic (Nursyaidah et al., 2020:48 & Bilda et al., 2021:2648). Thus, based on the results of preliminary studies, researchers hope that the development of android-based learning media called "Teman Ritma" will be beneficial and able to facilitate learners during the mathematics learning process, especially in improving students' mathematical problem-solving skills. In addition, the use of android-based learning media is one of the learning style in the 21st-century learning era (Calimag et al., 2014: 90).

In a previous study, Ahmad Yani, Iwit Prihatin, Hodyanto, and Sumiati (2020) have conducted research on android-based learning media development with the title "*Android-Based Learning Media Design with Contextual Learning to Develop Problem-Solving Skills*". The study showed that android-based learning media mask as valid, practical, and effective in improving students' mathematical problem-solving skills. The type of research they used is Research and Development (R&D) with a 4-D development model. Furthermore, the practicality test obtained a percentage score of 85.7%, which is very practical. The effectiveness test involved 30 students where after treatment was obtained, as many as 23 students managed to get a grade above Minimal Criteria of Mastery Learning (MCML) or KKM (Kriteria Ketuntasan Minimum), and 7 students got a grade under MCML. This means that 76.67% of students managed to get grades above MCML. These results concluded that the development of android-based learning media proved valid, practical, and effective in improving students' problem-solving skills. Based on the description above, this study aims to find out the effect of the use of android-based learning media called "Teman Ritma" to improve the mathematical problem-solving skills of seventh-grade students of junior high school.

## METHOD

The type of this research is experimental research in the form of true-experimental, with the design used is a pretest-posttest control group design. This design involves two groups, namely the experimental group, which is a group that is given treatment and a control group that is not given treatment (Sugiyono, 2011: 75). The experimental group is given treatment, namely learning using android-based "Teman Ritma" learning media, while the control group are not given treatment or, in other words using the learning media that the teacher used before. The population used in this study was seventh-grade students of SMP Negeri 5 Yogyakarta. The sample was selected using purposive sampling techniques, considering the average characteristics of the result of the problem-solving skill initial ability test and mid-term test result. The sampling technique concluded that the

VII-H group gets the lowest average value set as an experimental group, while the VII-G group gets a better average score which is then set as a control group. Data collection techniques use observations, interviews, and pretest & post-test problem-solving skills with social arithmetic material. Teman Ritma's learning media is measured in effectiveness using data analysis techniques, i.e., statistical tests: (1) paired sample t-test, (2) independent sample t-test test, and (3) average difference test. The paired sample t-test and independent sample t-test require a prerequisite analysis test, i.e., the normality and homogeneity test. If the prerequisite test is not met, then the statistical test is continued with a non-parametric statistical test, namely, the Wilcoxon Ranked-Signed test, which is an alternative to the paired sample t-test and the Mann-Whitney U test, which is an alternative to the independent sample t-test (Sha'bania et al., 2020:43 & Sugiyono, 2011: 151). The level of significance used is 0.05.

## RESULTS AND DISCUSSION

The effectiveness of Teman Ritma's learning media is measured using the score from pretest and post-test problem-solving skills in social arithmetic materials. Pretest questions were given to control and experimental groups on February 3<sup>rd</sup> and 4<sup>th</sup>, 2022, while post-test questions were issued on March 16 and 17, 2022. To conclude whether android-based Teman Ritma's learning media can improve students' problem-solving skills or not, researchers analysed the results of pretest scores and post-test from control and experiments groups using IBM SPSS Statistics 26 software to obtain conclusions about the effectiveness of using android-based Teman Ritma learning media. The analysis steps are described as follows:

### 1. Prerequisite Test

The prerequisite test contains a test of normality and homogeneity. This prerequisite test aims at whether the pretest and post-test value data come from a population whose distribution is normal and has the same variance.

#### a. Normality Test

Test data normality using IBM SPSS Statistics 26 software with Shapiro-Wilk technique. The results of pretest and post-test normality tests from both experimental and control groups can be seen in Table 2.

**Table 2. Normality Test Results**

Assessment Data	Significance value (p-value)	Information
Control Group Pretest	0,065	Normal Distribution
Control Group Post-test	0,038	Not Normally Distributed
Experimental Group Pretest	0,198	Normal Distribution
Experimental Group Post-test	0,015	Not Normally Distributed

Table 2 above shows that the p-value of pretest score from control and experimental groups is greater than 0.05 ( $\geq 0.05$ ), which means that the data is normally distributed. While the p-value of post-test score from control and experimental groups is less than 0.05 ( $< 0.05$ ), which means that the data is not distributed normally.

#### b. Homogeneity Test

The data homogeneity test uses the Levene-Statistic test. Homogeneity tests are performed for pretest and post-test data from control and experiments groups. The results of the homogeneity of pretest and post-test score data are presented in Table 3.

**Table 3. Homogeneity Test Results**

Assessment Data	Significance value (p-value)	Levene Statistic	df1	df2	Information
Pretest	0,060	3,689	1	58	Homogeneous Data
Post-test	0,038	3,514	1	58	Homogeneous Data

Based on Table 3, pretest and post-test data scores have significance values of 0,060 and 0,038. The p-value is greater than 0.05 ( $\geq 0.05$ ), so it has a conclusion that the scores of pretest and post-test data have the same variance or homogeneous.

The above prerequisite test results concluded that the score of pretest data from the control group and the experimental group were normally distributed, while the post-test score data from both group were not normally distributed. As a result, prerequisite tests are not met even if pretest and post-test score data are homogeneous. Furthermore, to figure out whether the learning media of Teman Ritma can improve students' problem-solving abilities or not will be analyzed with non-parametric statistical tests and average difference tests.

## 2. Effectiveness Test

### a. Wilcoxon Signed-Rank Test

The Wilcoxon Signed-Rank Test uses IBM SPSS Statistic 26 software to find out the following:

#### 1) The Influence of Teman Ritma's Learning Media on Improving Problem-Solving Skills

This test uses the score of pretest and post-test data from the experimental group. The results of this test can be seen in Table 4.

**Table 4. Wilcoxon Signed-Rank Test Results from Experimental Group**

	N	Mean Rank	Sum of Ranks
Negative Ranks	0 <sup>a</sup>	0	0
Positive Ranks	30 <sup>b</sup>	15,5	465
Ties	0 <sup>c</sup>		
Total	30		

a. Post-Test < Pretest  
b. Post-Test > Pretest  
c. Post Test = Pretest

Based on the table above, 30 students from the experimental group experienced an increase in scores with an average increase of 15,50. To find out if there is an average difference between scores of pretest and post-test in the experimental group can be seen from the significance value (p-value) of statistical test results contained in Table 5.

**Table 5. Pretest & Post-test Statistical Test from Experimental Group**

Pretest & Post-test experimental group	
Z	-4,785
Asymp. Sig. (2-tailed)	0,000

Based on the statistical test above, the value of Asymp's significance. Sig. (2-tailed) is 0.000. The significance value is less than the significance level ( $0.000 < 0.05$ ), then  $H_0$  is rejected, and  $H_1$  is accepted. This means there is a difference in average scores between pretest and post-test in the experimental group. There is an influence on the use of android-based learning media "Teman Ritma" on students' problem-solving abilities. The average pretest score of the experimental group before treatment was 20,44, while the average post-test score after treatment was 80,56. This shows an increase from before the treatment until after the treatment, namely the use of Android-based Teman Ritma learning media, with an average difference of 60,12.

#### 2) The Influence of Direct Learning on Improving Problem-Solving Skills

This test uses the scores of pretest and post-test data from the control group. The results of this test can be seen in Table 6.

**Table 6. Wilcoxon Signed-Rank Test Results from Control Group**

	N	Mean Rank	Sum of Ranks
Negative Ranks	0 <sup>a</sup>	0	0
Positive Ranks	27 <sup>b</sup>	14	378
Ties	3 <sup>c</sup>		
Total	30		

a. Post-Test &lt; Pretest

b. Post-Test &gt; Pretest

c. Post Test = Pretest

Based on the results above, 3 students have not experienced an increase or decrease in grades (ties). In other marks, 27 students experienced an increase in scores with an average rise of 14,00. To find out if there is an average difference between the scores of pretest and post-test from control group can be seen from the significance value of Wilcoxon test results contained in Table 7.

**Table 7. Pretest & Post-test Statistical Test from Control Group**

Pretest & Post-test control group	
Z	-4,543
Asymp. Sig. (2-tailed)	0,000

The significance value of the statistical test is 0.000. The value of this significance is smaller than 0.05 (< 0.05). There is a difference between the pretest and post-test scores in the control group. The average pretest score before the treatment is 22,00, while the average post-test score after the treatment is 67,00. These results showed an increase before and after the treatment with direct learning with an average difference of 45,00.

#### b. Mann-Whitney U Test

The Mann-Whitney U test is non-parametric if the independent sample T-test cannot be performed because it does not meet the assumptions of normality and homogeneity. This test uses the median difference or middle grade of the two groups to determine which learning is more effective in improving students' problem-solving skills between learning using the Teman Ritma application and learning with the media that teachers use. This test involved post-test score data from the control and experimental groups. The results of this statistical test can be seen in Table 8.

**Table 8. Mann-Whitney U Test Results**

	Group	N	Mean Rank	Sum of Ranks
Post-Test Results	Experiment	30	35,48	1064,50
	Control	30	25,52	765,50
	Total	60		

The table above shows that the post-test results of the experimental group have an average rating of 35,48, higher than the average post-test result of the control group of 25,52. The statistical test results to find out which learning is more effective can be seen in Table 9.

**Table 9. Mann-Whitney U Test Significance Value**

Post-test Results	
Mann-Whitney U	300,500
Wilcoxon W	765,500
Z	-2,217
Asymp. Sig. (2-tailed)	0,027

From the table above, the value of Asymp is obtained. Sig. (2-tailed) is 0,027. This significance value is smaller than 0.05 (< 0.05), which results in  $H_0$  is rejected and  $H_1$  is

accepted. So, the conclusion that can be obtained is that the use of android-based learning media "Teman Ritma" is more effective in improving students' mathematical problem-solving skills than direct learning.

### c. Average Difference Test

In addition to using the Mann-Whitney U test, effectiveness tests can also be performed using a comparison of the average score from pretest and post-test in control and experiments groups. The following Table 10 presents results to see the extent of the difference in average improvement from both group.

**Table 10. Problem-Solving Test Results**

Aspects	Control Group		Experimental Group	
	Pretest	Post-Test	Pretest	Post-Test
Number of learners	30	30	30	30
Average value	22	67	20,44	80,56
Lowest value	6,67	13,33	6,67	46.67
Highest score	40	100	30	100
<b>Average increase</b>	<b>45,00</b>		<b>60,12</b>	

The table above shows that the control group test's score was increased with an average value of  $67,00 - 22,00 = 45,00$ , while the experimental group test's score also increased with an average value of  $80,56 - 20,44 = 60,12$ . These results can conclude that the use of android-based learning media "Teman Ritma" can improve students' mathematical problem-solving skills. The increase in student problem-solving skills can be seen from the results of the pretest and post-test work of one of the students in Figure 1 and Figure 2.

<p>2. a. Memahami masalah: menentukan jumlah uang yang dikembalikan setelah 2 tahun.          b. Merencanakan masalah: mencari bunga yang disetorkan (12% per tahun), lalu menambahkan dengan nominal pinjaman (Rp 20.500.000,00).          c. Melaksanakan rencana;</p>	<p><b>Problem 2</b></p> <p><b>a. Define Problem</b>          Answer:          Determine the amount of money returned to the bank after 2 years</p> <p><b>b. Make a plan</b>          Answer:          - Find out the specified interest rate (12% a year)          - From the result above, then add to the loan amount (Rp20.500.000)</p>
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**Figure 1. Pretest Results**

<p>2. a. Modal yang dibutuhkan: Rp 90.650.000,00. Suku bunga sebesar 12% per tahun. Rita harus mengembalikan pinjaman dalam waktu 2 tahun.          b. L1) Menentukan bunga selama 2 tahun.          L2) Menentukan jumlah uang yang dikembalikan dengan modal + bunga selama 2 tahun          c. L1) Bunga: <math>\frac{24}{12} \times \frac{12}{100} \times 90.650.000</math>  <math>= 2 \times 12 \times 906.500</math>  <math>= 21.756.000</math>          L2) Pinjaman akhir: <math>21.756.000 + 90.650.000</math>  <math>= 112.406.000</math>          d. Jadi, jumlah uang yang dikembalikan setelah 2 tahun adalah Rp 112.406.000.</p>	<p><b>Problem 2</b></p> <p><b>a. Define Problem</b>          Answer:          Amount of loan needed: Rp90.650.000,00. The bank gives an interest rate of 12% a year. Rita must repay the loan within 2 years</p> <p><b>b. Make a plan</b>          Answer:          - (L1) Determine the amount simple interest rate for 2 years          - (L2) Determine the amount of money returned with the loan + the amount of simple interest rate</p> <p><b>c. Execute the plan</b>          Answer:          - (L1)  <math display="block">\text{interest rate} = \frac{24}{12} \times \frac{12}{100} \times 90.650.000</math> <math display="block">= 2 \times 12 \times 906.500</math> <math display="block">= 21.756.000</math>         - (L2) The final loan  <math display="block">\text{Final loan} = 21.756.000 + 90.650.000</math> <math display="block">\text{Final loan} = 112.406.000</math></p> <p><b>d. Look back and interpreting</b>          Answer:          So, the amount of money returned after 2 years is Rp112.406.000</p>
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**Figure 2. Post-test Results**

The table above shows the difference in answers from the pretest and post-test. Students have not been able to answer according to the indicators of problem-solving ability in the pre-test. Furthermore, during learning with Teman Ritma learning media, there was an improvement in the quality of answers in the post-test. Students can solve problems with indicators of problem-solving skills. The increasing test scores of problem-solving skills

between the control group and experimental group can be seen more clearly through the graph in Figure 2.



**Figure 1. Control and Experiment Groups Test's Score Improvement Graph**

Based on the results above, research was conducted in experimental and control groups, with the number of samples in each group being 30. The number of students should be 32 students, but there were two students from the control group who did not do the pretest and post-test questions during the study. Researchers had difficulty approaching those two students from the control group. The teacher later confirmed that the two students needed a different approach than the other students. Meanwhile, in the experimental group, there was one student with similar problems, and one other student was a transferred student and began to follow learning when the research was in the final stage. Based on this problem, researchers reduced the number of samples to 30 students per group.

The experimental group uses Teman Ritma's learning media which contains quizzes, games, and materials that have indicators of problem-solving, i.e.,: (1) understanding problems, (2) making a plan, (3) implementing the plan, and (4) reviewing and concluding. Based on the results of this study, the android-based learning media called "Teman Ritma" effectively improves the problem-solving skills of seventh-grade students of junior high school.

## CONCLUSION

This study has concluded that the use of android-based learning media Teman Ritma, which contains four indicators of problem-solving skill, proved effective to improve the problem-solving ability of seventh-grade students in junior high school. This conclusion is confirmed by data analysis were based on the results of the Wilcoxon Signed Rank Test, the Mann-Whitney U test, and the average difference test. The Teman Ritma learning media is more effective than classes that do not use the Teman Ritma learning media.

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