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Development of Interactive Game-Based Learning Media Using a Realistic Approach to Improve Students' Mathematical Problem-Solving in Social Arithmetic Materials for Grade VII

Alisya Qotrunada[1]✉, Syamsul Furqon[2]

[1]*Uniersitas Islam Negeri Profesor Kiai Haji Saifuddin Zuhri Purwokerto, Indonesia*
[2]*MTs Ma'arif NU 1 Pekuncen, Indonesia*

✉ *Corresponding email: alisyaqn1@gmail.com*

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Abstract: Mathematical problem-solving is a fundamental skill in mathematics education for every student. The low level of mathematical problem-solving ability among Grade VII students at MTs Ma'arif NU 1 Pekuncen urged the development of this learning media. This study aimed to develop game-based interactive learning media using a realistic approach that was both valid and effective in enhancing students' mathematical problem-solving skills in social arithmetic materials for Grade VII. The research employed the Research and Development (R&D) method. The results of this study indicated that the game-based interactive learning media was valid, as evidenced by validation coefficients from the first and second experts of 3.79 and 3.4, respectively. The practicality test conducted by teachers yielded a validity coefficient of 3.8, and student response testing resulted in a score of 88.3. Furthermore, this learning media effectively improved students' mathematical problem-solving abilities, demonstrated by the experimental class's average post-test score of 75, which surpassed the control class average of 59. A post-test t-test yielded a significance level of 0.000, indicating that the developed learning media significantly enhanced students' mathematical problem-solving in social arithmetic materials for Grade VII at MTs Ma'arif NU 1 Pekuncen.

Keywords: interactive game-based learning; mathematical problem-solving; realistic approach

A. Introduction

The rapid development of the times requires preparing students who are able to face global challenges. One of the efforts that can be made is through education. In Law of the Republic of Indonesia Number 20 of 2003 concerning National Education, in article 1 paragraph 1 it is explained that Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, nation and state (Triwiyanto, 2021).

One of the important components in education is learning. Learning is a process of cooperation between teachers and students in utilizing all the potentials and resources that exist in order to achieve learning goals (Chaerunisa, 2019). Learning objectives can be achieved by optimizing students' potential through effective learning. In his vision, effective learning is a teaching and learning process that is not only focused on the results achieved by students, but

also how the learning process is able to provide good understanding, perseverance, intelligence, quality, opportunity and can provide behavior change and apply it in life (Panggabean et al., 2021). So that effective learning is learning that requires quality learning because the learning carried out will affect student learning outcomes.

Mathematics is one of the materials taught to students to actively empower students. The National Council of the Teacher of Mathematics (NCTM), a professional organization in the United States that focuses on the development and improvement of mathematics teaching, states that the goals of mathematics learning are (1) learning to communicate (math communication), (2) thinking about mathematics, and (3) solving problems (solving math problems), (4) learning to associate ideas (mathematical relationships), (5) developing a positive attitude towards mathematics mathematics (positive attitude towards mathematics). One of the goals of learning mathematics is the ability to solve mathematical problems (Joung & Byun, 2021).

Mathematical problem-solving according to Layali and Masri (2020) is a skill in students to be able to use mathematical activities to solve problems in mathematics, other sciences, and in daily life. According to Polya (in Astutiani, 2019) there are four indicators in solving mathematical problems, namely: Understanding the problem, Planning strategies for problem solving, Implement problem-solving strategies and Double-check troubleshooting completeness.Mathematical problem-solving are an ability that is often encountered in real life because of the ability to understand problems and solve problems (Purnamasari & Setiawan, 2019). Based on research conducted by Ompusunggu (2022) said that the mathematical problem-solvingability of 8th grade students of Adhyaksa Medan Junior High School in Social Artimatics material is still relatively low.

In addition, Duroh and Irena (2021) stated that mathematical problem-solvingare very important for students to have. In line with that, according to Sumartini (2016) Mathematical problem-solving are very important as a basic skill in learning mathematics. There are 5 basic skills in learning mathematics, one of which is the ability to solve mathematical problems (Ulva et al., 2020). Mathematical problem-solving are the ability to identify, analyze, and solve problems involving mathematical concepts (Heldawati et al., 2023). Research conducted by Krisnawati and Iyam (2022) explained that students still have difficulties in improving their problem-solving.

Therefore, the researcher made observations at MTs Ma'arif NU 1 Pekuncen. Observations made to the 8th grade mathematics teacher, namely Mr. Syamsul Furqon, S.Pd., obtained information that mathematics learning in social arithmetic material is still conventional. In addition, the mathematical problem-solving ability of grade VII students at MTs Ma'arif NU 1 Pekuncen is also still very low. The reason is boring learning without any innovation in learning, besides that the assumption of difficult mathematics material is also one of the reasons.

Learning media is a learning resource that can help teachers in enriching students' insights, with various types of learning media by teachers can be materials in providing knowledge to students (Hasan et al., 2021). The use of computer in teaching and learning have contributed immensely to alleviate the problem of understanding and mastery (Etukudo, 2023).

According to Nasution (2022), teaching media is a teaching aid, namely supporting the use of teaching methods used by teachers. Learning must be interactive to attract students and students to play an active role in learning. Interactive is an adjective that means mutual action; inter-relationship; each other (Ariansyah et al., 2022). Game-based Learning is a method that combines learning or educational materials into a game that aims to make people who play interested in learning through learning media such as the Frameworks of Thinking game (Wijaya et al., 2021). So, interactive learning media is a learning medium that allows users to actively interact with learning content by combining learning with games

According to Soedjadi (in Afsari et al., 2021), the realistic approach is the use of reality and the environment understood by students to facilitate the mathematics learning process so that they can achieve better mathematics education goals. The application of realistic reinforcement is carried out by integrating it with practical context and experience (Hidayat & Novikasari, 2023). Some characteristics of the realistic approach according to Suryanto (in Ahmad et al., 2020) are as follows: Realistic contextual problems are used to introduce mathematical ideas and concepts to students. Students rediscover ideas, concepts, and principles, or mathematical models through realistic contextual problem-solving with the help of their teacher or friend. Students learn mathematics in a way that is meaningful and relevant to everyday life. Students reflect on themselves what has been completed. Mathematics is considered an activity not as a finished product or ready-to-use result.

Mathematical problem-solving skills are one of the abilities that can be used to solve various problems both outside and in the context of mathematics. In mathematics subjects, especially social arithmetic materials, most students have low mathematical problem-solving skills. One of the factors that causes the lack of problem-solving skills is learning that is still conventional in today's technological era. So that interesting learning media is needed and in accordance with the times. As for the framework of thinking in this study, the researcher described it in the form of a chart, namely:

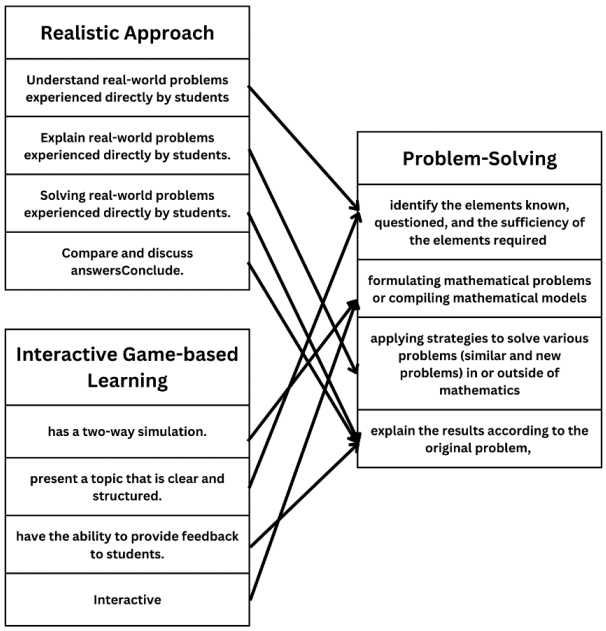

Figure 1 Framework of Thinking

Based on all these problems, an innovation is needed in the form of educational games using a realistic approach. The game is a learning medium in the form of an android application (.apk) that associates games with mathematical materials. The use of a realistic approach is becoming more and more interesting because it is based on the student's experience. The material that needs to be updated is Social Arithmetic Class VII material. This is based on the review of previous research and also the results of observations that result that many students are still difficult in solving Social Arithmetic problems.

One of the solutions to these problems is to hold learning using Game-Based Learning media. A game is a form of art in which the participant, called the player, makes the decision to manage the resources he or she has through objects in the game in order to achieve a goal (Nurcholis et al., 2021). Game-based learning is the use of games with serious goals, as a tool that significantly supports the learning process (Winatha & Setiawan, 2020).

The researcher is interested in developing a mathematical game with the research title "Development of Game-Based Learning Interactive Media Using a Realistic Approach to Improve Students' Mathematical Problem Solving Ability in Class VIII Social Arithmetic Material.

B. Methods

1. Type of Research

This research the type of Research and Development (R&D). Research and Development is a type of research by developing and testing products that will later be used and developed in the world of education (Maydiantoro, 2021).

2. Research Procedure

The researcher will develop a digital product, namely an interactive android application. In its development. The researcher uses the ADDIE development model. This study has 5 stages that refer to the ADDIE model (Analysis, Design, Development, Impelemtatuin, Evalution) (Rayanto & Sugianti, 2020)

3. Place and Time of Research

This research was conducted at MTs Ma'Arif NU 1 Pekuncen which focused on grade VII students. This research was carried out from May 1 to May 30, 2024.

4. Research Population and Sample

A population is a group of individuals who share the same characteristics (W. Creswell, 2012). For example, all teachers will be the teacher population, and all high school administrators in the school district will be the administrator population. As these examples illustrate, populations can be small or large. This makes it possible to study in more detail. The researcher took a population of 158 students who were all grade VII students and divided into 4 study groups.

In practice, quantitative research takes samples from available lists and people. A target population (or sampling framework) is a group of individuals (or groups of organizations) with some common characteristics that researchers can identify and study. In this target population, the researcher then selects a sample to study. The sample is a subgroup of the target population

that the researcher plans to study for generalizations about the target population (W. Creswell & Creswell, 2013). Researchers use simple random sampling techniques in determining samples from a population. Simple random sampling is a sampling technique that is carried out in a simple way such as using a random number approach or drawing (Sumargo, 2020). In this case, the researcher conducted a draw using a small piece of paper containing the class name and obtained 2 classes, namely the first draw got class VII A with 31 students as the experimental class and the second draw got VII B with 31 students as the control class.

5. Data Collection Techniques

Data collection techniques are one of the important steps in research because they aim to obtain data (Hartono, 2018). In this study, several data collection techniques were used. First, interviews, which were conducted during preliminary observations with the object of a grade VII mathematics teacher and several grade VII students. Second, questionnaires, Questionnaires are commonly used data collection techniques that allow the collection of information in the form of questions to several respondents (Pradana, 2022) The researcher used a validation sheet questionnaire. Third, tests, Tests are procedures used to find out or measure something in an atmosphere in a predetermined way and rules (Umami et al., 2021). In this study, the test was carried out by students twice. First Pre-test, before conducting product trials. Second post-test, carried out after conducting product trials.

6. Research Instruments

The data instrument to be used must first go through a validity and reliability test to find out whether the instrument is valid and reliable or not. The instruments contained in this study are test instruments in the form of pre-test and post-test. The validity of this instrument is used to know the extent of the accuracy of the measurement, while reliability is used to measure the extent to which the measurement is trustworthy due to its persistence. The instrument needs to be retested every time it will be used and the test instrument must meet the criteria of content validity, item validity and reality.

a. Content Validity Test

The content validity test is a process of testing the feasibility of research instruments that aims to ensure that the instruments measure concepts that are appropriate and relevant to educational objectives (Siyoto & Sodik, 2015). After the expert validates the instrument, the next step is to make improvements based on the suggestions that have been given by the validators until the valid instrument is used for research. The criteria for content validity tests are as follows:

Table 1 Content Validity Criteria

Validity Coefficient	Criterion
$3{,}25 \leq x \leq 4{,}00$	Highly Valid
$2{,}50 \leq x < 3.25$	Valid
$1{,}75 \leq x < 2{,}50$	Invalid
$1{,}00 \leq x < 1{,}75$	Highly Invalid

Before the pre-test and post-test instruments of mathematical problem-solvingability are given to students, the instruments have been validated by the validator first. There are two validators, namely Muhammad 'Azmi Buha, M.Pd. as a Mathematics Lecturer at UIN Prof.

K.H. Saifuddin Zuhri Purwokerto and Syamsul Furqon, S.Pd. as a Mathematics Teacher at MTs Ma'arif NU 1 Pekuncen. The following are the results of the validation of the pre-test and post-test instruments:

Table 2 Pre-test Expert Validation Results
Mathematical Problem-solvingAbility

No.	Validators	Total Score	Score Average
1.	Muhammad 'Azmi Nuha, M.Pd.	47	3,92
2.	Syamsul Furqon, S.Pd.	46	3,83
	Total	93	7,75
	Average	46,50	3,88

Table 3 Post-test Expert Validation Results
Mathematical Problem-solvingAbility

No.	Validators	Total Score	Score Average
1.	Muhammad 'Azmi Nuha, M.Pd.	45	3,75
2.	Syamsul Furqon, S.Pd.	46	3,83
	Total	92	7,58
	Average	45,5	3,79

Based on the table above, the average pre-test validation score by the first validator, Muhammad 'Azmi Nuha, M.Pd., was 3.92 and the average post-test score was 3.75, both of which were included in the very valid category. Meanwhile, the second validator, Syamsul Furqon, S.Pd., obtained the same average pre-test and post-test validation scores, which is 3.83 so that it can be categorized as very valid. So it can be concluded if the pre-test and post-test instruments are valid for use in research.

b. Item Validity Test

The item validity test serves to measure the extent to which a question item or test measures the component to be measured (Siyoto & Sodik, 2015). The validity of this item is used to determine the number of valid and invalid instrument items. Item validity tests can be searched using the correlation formula Pearson Product Moment. The correlation formula Pearson Product Moment as follows (Siyoto & Sodik, 2015):

$$r_{xy} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

Information:

r_{xy} : correlation coefficients of X and Y variables
n : Number of respondents
X : Question item score
Y : Total score
XY : The multiplication of the question item score by the total score
$\sum X$: Number of Question Item Scores
$\sum Y$: Total score
$\sum X^2$: Number of squares of question item scores

$\sum Y^2$: Sum of squares of total score

The decision making on the criteria for question items is carried out by comparing $r_{hitung}(r_{xy})$ with a significant level of If a comparison is obtained, the question can be said to be valid, but if then the question is said to be invalid.$r_{tabel}(\text{product moment})\alpha = 5\%. r_{xy} \geq r_{tabel} r_{xy} < r_{tabel}$.

Decision making on question item criteria was carried out by comparing $r_{hitung}(r_{xy})$ with $r_{tabel}(product\ moment)$ with a significant level of $\alpha = 5\%$. If a $r_{xy} \geq r_{tabel}$ comparison is obtained, the question can be said to be valid, but if it is $r_{xy} < r_{tabel}$, the question is said to be invalid.

Valid and reliable is a mandatory requirement for test item instruments before being tested to students. Validity tests and reliability tests are carried out using pre-test and post-test answers of respondents who are not part of the predetermined research sample.

The validity test in this study uses the help of IBM SPSS Statistics 25, with a total number of question items of 4 items and the subject selected for the trial is class VIII A with a total of 29 students. Based on the number of samples as much as. With a level of 5%, it was obtained at 0.367. The results of the validity test that have been carried out are as follows:

Table 4 Results of the Validity Test of Pre-test Questions

Question Number	r_{count}	$r_{\text{pearson table}}$	Information
1	0,748	0,367	Valid
2	0,818	0,367	Valid
3	0,852	0,367	Valid
4	0,895	0,367	Valid

Based on the table above, the results of the calculation of the pre-test validity test using the help of IBM SPSS Statistics 25, obtained if the 4 questions that have been tested are categorized as valid. So, all pre-test items can be used in this study.

Furthermore, a validity test was carried out on the post-test questions, the following are the results of the validity test of the post-test questions:

Table 5 Results of the Post-test Validity Test

Question Number	r_{count}	$r_{\text{pearson table}}$	Information
1	0,664	0,367	Valid
2	0,836	0,367	Valid
3	0,784	0,367	Valid
4	0,821	0,367	Valid

The table above shows the results of post-test calculations with the help of IBM SPSS Statistics 25 where all post-test questions, totaling 4, are included in the valid category after the validity test is carried out. So, the 4 post-test questions can be used in this study.

c. Reliability Test

Azwar (in Siyoto & Sodik, 2015) said that reliability is related to the accuracy of the instrument in measuring what is measured, the accuracy of the measurement results and the accuracy if re-measurement is carried out. An instrument can be said to have a high level of

confidence if the results of the instrument test show good results. A test can be said to be reliable if the test can be used repeatedly by students with relatively similar measurement results. The reliability test in this study uses the Cornbach Alpha with the formula (Darma, 2021):

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

With

$$S_i^2 = \frac{\sum x_i^2 - \frac{(\sum x_i)^2}{k}}{k} \text{ dan } S_t^2 = \frac{\sum x_t^2 - \frac{(\sum x_t)^2}{k}}{k}$$

Information:

r_{11} : Reliability coefficient of the test or instrument
k : The number of questions or the number of questions
$\sum s_i^2$: Number of variants per question item
s_t^2 : Total variants
x_1 : Respondent's earned item score
$\bar{x}$: Average score on each question

The question can be said to be reliable if it obtains a score Cornbach Alpha $\geq 0{,}6$. On the other hand, it is said to be unreliable if the value obtained in the test, the researcher used the help of the IBM Statistics 25 application to calculate the reliability test. The following are the results of the reliability test obtained in the Cornbach Alpha $< 0{,}6$. pre-test questions:

Table 6 Reliability Test Results of Pre-test Questions

Reliability Statistics

Cronbach's Alpha	N of Items
.833	4

The output results of the IBM SPSS Statistics 25 software above, show that the value of Cronbach's Alpha Pre-test is 0.833 which means that the reliability value is more than 0.6. So, it can be concluded that this pre-test question is reliable.

Furthermore, the results of the reliability test of post-test questions using Cronbach's Alpha scores were obtained:

Table 7 Results of the Reliability Test of Post-test Questions

Reliability Statistics

Cronbach's Alpha	N of Items
.777	4

Based on the output results of IBM SPSS Statistics 25 above, Cornbsch's Alpha Post-test score is 0.777, which shows a reliability value of more than 0.6. Thus, it can be said that the post-test question is reliable.

7. Data Analysis Techniques

Data analysis is carried out by researchers using the entire data acquisition process from the beginning to the end of the data collection process to see the quality of the media products that have been developed. The tests that will be carried out are as follows:

a. Prerequisite Test

1) Normality Test

The results of the data obtained and used in the hypothesis test must be distributed normally, therefore the data obtained must be tested for normality. This study used the Kolmogorov Smirnov test from both sample classes. In the test, the researcher used the IBM SPSS Statistics 25 application. The data will be distributed normally if after testing it gets a sig. ≥ 0.05. Meanwhile, the data is said to be not normally distributed, and the significance value is less than 0.05. With the formulation of the hypothesis, namely:

H_0: Normally distributed data
H_1: Data is not normally distributed

2) Homogeneity Test

Homogeneity test is a method in statistics to find out whether samples from different poopulations have the same variance distribution or characteristics (Ananda & Fadhli, 2018). The homogeneity test was carried out by comparing the two variants in order to find out the difference between the two population variants. This test uses the IBM SPSS Statistics 25 Application using F-test. The formulas used in this homogeneity test are:

$$\mathrm{F_{count}} = \frac{\text{largest variant}}{\text{smallest variant}}$$

While the hypothesis is:
H0: Homogeneous data
H1: Non-homogeneous data

The F value of the calculation of the homogeneity test analysis is called F_{count}. Whose value will be compared to the F_{table}. with a significance level of 5%. The criteria for hypothesis testing decisions are:

If $F_{count} \geq F_{table}$, then H_0 rejected and H_1 Accepted and vice versa

Both variances are not homogeneous if H_0 rejected and H_1 accepted. On the contrary, both variances are homogeneous if then H_0 accepted and H_1 rejected.

3) Hypothesis Test

Hypothesis testing is a statistical analysis technique used to test the correctness of a hypothesis or conjecture proposed in research (Nursalam, 2015). In this study, hypothesis testing was carried out using the t-test. After the data was distributed normally, the t-test of two free samples played a role in determining the influence of learning media Game-based learning using a realistic approach to improve students' mathematical problem-solving by comparing scores post-test Experimental class with control class. In the test, the researcher used the IBM SPSS Statistics 25 application.

Meanwhile, the limit of the significance level is 5% assuming that if the test results show < 5% or 0.05, it will be H_0 rejected and H_1 accepted. The t-test formula is as follows (Sugiyono, 2013):

$$t_{count} = \frac{\overline{x_1} - \overline{x_2}}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

With

$$S_p = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

Information:

t : Desired value
$\bar{x}_1$: Average score of the experimental class
$\bar{x}_2$: Average control class score
S_p : Standard deviation or combined variance
s_1^2 : Experimental class variance
s_2^2 : Control class variance
n_1 : Many students in the experimental class
n_2 : Many students in the control class

Decision making in the t-test is based on the score $(2 - tailed) < 0{,}05$, then it is H_0 rejected and H_1 accepted. If the value $(2 - tailed) \geq 0{,}05$ is H_0 accepted,H_1 rejected. The hypothesis used is:

$H_0: \mu_1 = \mu_2$ There was no difference in average scores between the experimental class and the control class
$H_1: \mu_1 \neq \mu_2$ There was a difference in average scores between the experimental class and the control class

Information:

μ_1 : Average score of mathematical problem-solvingability of arithmetic material in the experimental class
μ_2 : Average score of mathematical problem-solvingability of arithmetic material control class.

C. Results and Discussion

1. Validity of Game-Based Leaning Interactive Learning Media Using a Realistic Approach to Social Arithmetic Materials

The purpose of this study is to determine the validity of the product that has been developed by researchers in an effort to improve the ability to solve mathematical problems in social arithmetic materials. In its development, the researcher uses the ADDIE model, namely:

a. Analysis

At this earliest stage, the first thing to do was to interview the Grade VII Mathematics Teacher, Mr. Syamsyul Furqon, S.Pd., and also several students of MTs Ma'arif NU 1 Pekuncen on October 25, 2023. The results obtained are:

1) Class VII has 4 groups with a total of 158 students.
2) In grade VII, the independent learning curriculum has been used in learning.
3) Still using conventional learning methods, namely lectures.
4) The main learning resource used is LKS.
5) Students' mathematical problem-solving are still relatively low.
6) The lack of learning media is one of the difficulties experienced by teachers.
7) Innovative learning media, especially related to technology, is needed today.
8) The use of smartphones, laptops, and other devices is allowed to support education.
9) Students' interest in the use of learning media that has an attractive appearance.
10) Using a realistic approach is one way to increase students' sense of interest because it is related to daily activities or based on experience.
11) This learning media in the form of an application can be used anytime and anywhere, making it easier for students to learn.

Then interviews were also conducted with several students, the following are the results of student interviews:

1) The learning carried out is very monotonous and boring because it still uses a lecture system with the teacher as the center so that there is a lack of active role of students in the learning process.
2) It is difficult to understand the meaning of math problems, especially in the form of story problems, so that students have difficulty solving the problems in question.
3) Students are more interested in using smartphones than reading books.

Based on the results of the preliminary observations, it can be concluded that the students' mathematical problem-solvingability is relatively low. Especially related to social arithmetic material which is mostly related to problems in life.

One of the difficulties in solving problems in social arithmetic material is because most of the social arithmetic presented is in the form of story questions. Story problems are considered difficult to solve because students find it difficult to understand the meaning of the problem so that mistakes and mistakes often occur in solving them.

One way to overcome these problems is to use interactive learning media with a realistic approach that aims to attract students' interest in learning, creating learning where students play an active role in the process. This realistic approach is used because this approach connects the learning material with the real situation experienced by the students so that it is expected to facilitate the learning process because it is oriented to the experience or activity of the students.

One of the innovations in this learning media is the use of technology, namely androids, laptops, and other devices. The use of this technology is based on the fact that currently the use of these devices is familiar and even one of the essential items that must be owned. With the use of these devices, it is hoped that it will be able to attract students' interest in learning and make it easier for students because it can be accessed anytime and anywhere.

Learning media is developed in the form of android applications and web pages. This media was created using the Microsoft Powerpoint application with the help of Ispring which will later be extracted into an android application with Web2Apk Builder. The developed media can be accessed anywhere and anytime, does not require a lot of storage space and does not require an internet connection.

b. Design

At this design stage, the researcher focuses on making the design of media products to be developed. There are several steps taken in this stage, namely: The first step is to determine the flow of learning media so that the media is structured and collapsed. The second step after determining the flow, what must be done is to design the concept of the learning media and the parts to be added. This story includes design, menus presented, animations, characters, and backsounds that are in accordance with the predetermined concept flow. The third step is to find sources of material that will be included in the learning media. The fourth step is to detail more deeply the menus displayed on the home screen. The main menu in this media is the core material, namely buying and selling, discounts, taxes, single interest, gross, net, value, and finally quizzes. Then the additional menus on this learning media include instructions for use, learning objectives, and developer profiles. In this third stage, it also determines the flow of each menu and also the material to be delivered. The last step is the preparation of storyboards that function to make it easier to prepare learning media. The preparation of this storyboard uses the help of Microsoft PowerPoint and Canva in finding interesting animations.

c. Development

At this stage, the media will be developed using Microsoft Powerpoint. Everything that has been arranged on the storyboard will be developed including all the features in it. There are 3 features in the media, including the main material feature, the information feature and finally the quiz feature. The first and main feature is the material feature which contains 5 main materials, namely buying and selling, discounts, taxes, single interest, gross, net, and tare each of which has a different flow. There are also mini quizzes on the sidelines of the material. The second feature is the information feature. The information menu in this learning media is a menu of instructions for using media, learning objectives and developer information. This feature is designed to help students in operating learning media. The last feature is quizzes. This menu contains questions that can be used to evaluate students' learning outcomes during the learning process.

d. Implementation

There are three trials at the implementation stage, namely a trial of learning media experts, a practicality test by teachers and a student response test in small groups. The following is a trial at the implementation stage, namely:

1) Learning Media Expert Test

The validity and feasibility test of the learning media in this study is shown based on the analysis that has been validated by expert validators, namely Muhammad 'Azmi Nuha, M.Pd. and Dr. Hj. Ifada Novikasari, M.Pd. as a lecturer in Mathematics at UIN

Prof. K.H, Saifuddin Zuhri Purwokerto. This examination is carried out by providing a media validation sheet to the validator. The validation sheet consists of three aspects, namely the realistic approach aspect, the game-based learning interactive media aspect and the language aspect with a total of 18 questions:

The following are the results of the recapitulation of the first media expert test, Muhammad 'Azmi Nuha, M.Pd., as well as a lecturer in Mathematics of UIN Prof. K.H. Saifuddin Zuhri Purwokerto:

Table 8 Results of the Validation Test of Learning Media Experts 1

No.	Assessed aspects	Score	Percentage (%)	Validity criteria	Category
1.	Realistic Approach	19	95	3,8	Highly Valid
2.	Interactive Media Game-based Learning	39	97,5	3,9	Highly Valid
3.	Language	11	91,67	3,7	Highly Valid
	Average Total		94,7	3,79	Highly Valid

The table above shows the score obtained from the results of the analysis of the validator Muhammad 'Azmi Nuha, M.Pd., which is the first aspect of the category is very valid with a value of 3.8. In the second aspect, it is in the very valid category with a score of 3.9. Just like the first and second aspects, the third aspect is categorized as very valid with a score of 3.7. So that the three categories have an average score of 94.5% which is classified as a very valid category.

The results of the recapitulation of the second expert test by Dr. Hj. Ifada Novikasar, M.Pd. who is also a lecturer in Mathematics of UIN Prof. K.H. Saifuddin Zuhri Purwokerto on the learning media developed are as follows:

Table 9 Results of the Validation Test of Learning Media Experts 2

No.	Assessed aspects	Score	Validity criteria	Category
1.	Realistic Approach	18	3,6	Highly Valid
2.	Interactive Media Game-based Learning	36	3,6	Highly Valid
3.	Language	9	3	Valid
	Average Total		3,4	Highly Valid

From the table above, it is known that the score obtained from the results of the analysis of the validator Dr. Hj. Ifada Novikasari, M.Pd., is the first aspect that is included in the valid category with a score of 3.6 or 90%. The second aspect is categorized as very valid with a score of 3.6. There is also a third aspect that is also categorized as valid with a value of 3. So that the average score of the three aspects was 3.4 with a very valid category.

2) Practicality Test by Teachers

This trial is used to test the learning media developed for media teachers as experienced mathematics teachers in dealing with grade VII students. The following are the results of the recapitulation of the practicality test by teachers on the practicality of learning media:

Table 10 Results of Practicality Test by Teachers

No.	Assessed aspects	Score	Validity criteria	Category
1.	Realistic Approach	18	3,6	Highly Valid
2.	Interactive Media Game-based Learning	38	3,8	Highly Valid
3.	Language	12	4	Highly Valid
	Average Total		3,8	Highly Valid

The results of the recapitulation by the validator Syamsul Furqon, S.Pd. listed in the table above the first aspect obtained a value of 3.6 which is included in the very valid category. The second aspect obtained a score of 3.8 which is classified as a very valid category. Likewise, the third aspect is categorized as very valid with a value of 4. So that the average percentage of these three aspects is 3.8 with a very valid category.

Based on the results of the assessment by the mathematics teacher of MTs Ma'Arif NU 1 Pekuncen, it was found that the learning media developed was feasible and could be tested on grade VII students with very valid criteria.

3) Student Response Test in Small Groups

In this study, student response tests in small groups were carried out in class VII A with a total of 15 respondents. This questionnaire was given after the class was given social arithmetic learning using interactive learning media that has been developed.

The response test was carried out to determine the attractiveness of the product developed. The existing aspects include the aspect of realistic approach, interactive media aspect of game-based learning, and language aspect with a total of 18 questions. The criteria for taking content validity are seen in the following table:

Table 11 Criteria for the Attractiveness of Learning Media

Attractiveness Score	Attractiveness Level
$80 < skor \leq 100$	Very Interesting
$60 < skor \leq 80$	Interesting
$40 < skor \leq 60$	Less Interesting
$20 < skor \leq 40$	Not Interesting
$0 < skor \leq 20$	Very uninteresting

The results of the recapitulation test of the response test of small group students in class VII A to the interactive learning media of game-based leaning are as follows:

Table 12 Results of Student Response Test in Small Groups

No.	Assessed aspects	Score	(%)	Category
1.	Realistic Approach	268	89,3	Very interesting
2.	Interactive Media Game-based Learning	524	87	Very interesting
3.	Language	159	88,3	Very interesting
	Average Total	317	88,3	Very interesting

Based on the student response test table in the small group above, the first aspect is in the very interesting category with a percentage of 89.3%. The second aspect is in the very attractive category with a percentage of 87%. Then the last aspect has a percentage of 88.3% which is included in the very attractive category.

It can be concluded that the game-based interactive learning media developed is very interesting, used in learning mathematics, social arithmetic material in grade VII with an average percentage of student response tests in small groups is 88.3% with a very interesting category.

Based on the discussion above, it is concluded that game-based interactive learning media using a realistic, valid and interesting approach is used to improve students' mathematical problem-solving in grade VII social arithtic material at MTs Ma'arif NU 1 Pekuncen.

2. The Effectiveness of Game-Based Leaning Interactive Learning Media Using a Realistic Approach to Social Arithmetic Materials

This discussion aims to determine the effectiveness of the products that have been developed by researchers in improving students' mathematical problem-solvingabilities in social arithmetic. The effectiveness of learning media can be known by conducting pre-test and post-test tests conducted on experimental and control classes. There are two stages used in data analysis in this study, namely the prerequisite test and the hypothesis test. This data analysis is included in the Evaluation stage of the ADDIE development model.

a. Pre-test Data Analysis

The results of the pre-test scores of the experimental class and the control class before being given treatment. Both are treated equally by researchers on social arithmetic material. The following are the results of the pre-test of mathematical problem-solving in the social arithmetic material of the experimental and control classes.

Table 13 Pre-test Score Data for Experimental Class and Control Class

No.	Name	Experiment Value	Name	Control Value
1	A1	48	B1	23
2	A2	43	B2	41
3	A3	14	B3	77
4	A4	34	B4	52
5	A5	57	B5	20
6	A6	25	B6	30
7	A7	25	B7	30
8	A8	32	B8	18
9	A9	38	B9	43
10	A10	68	B10	46

11	A11	79	B11	20
12	A12	21	B12	45
13	A13	61	B13	88
14	A14	71	B14	16
15	A15	13	B15	29
16	A16	64	B16	39
17	A17	45	B17	25
18	A18	27	B18	23
19	A19	41	B19	36
20	A20	23	B20	43
21	A21	55	B21	66
22	A22	29	B22	43
23	A23	29	B23	32
24	A24	46	B24	29
25	A25	23	B25	30
26	A26	61	B26	20
27	A27	63	B27	34
28	A28	39	B28	25
29	A29	34	B29	32
30	A30	34	B30	61
31	A31	21	B31	43
Sum		1263		1157
Average		41		37
Minimum Value		13		16
Maximum Value		79		88
Median		38		32
Mood		34		43
Standard Junction		320,931		294,378

Based on the data from the table above, it shows that the highest pre-test score in the experimental class is 79 and the lowest is 13 with an average of 41. Meanwhile, the pre-test in the control class had the lowest score of 16 and the highest score of 88 with an average score of 37.

1) Normality Test

The normality test is used to find out whether the data is normally distributed or not, which can be interpreted as whether the sample used is representative of the population. In this study, the researcher used the Kolmogorof Smirnov method in testing normality assuming that the data is normally distributed if H_1 rejected and H_0 accepted. The data is said to be normally distributed if the normality value obtained is greater than the significance level of 0.05. The following are the results of the normality test of the pre-test data of the experimental and control classes:

Table 14 Pre-test Normality Test Results

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Pretest Eksperimen	.131	31	.192	.953	31	.191
	Pretest Kontrol	.147	31	.088	.886	31	.003

a. Lilliefors Significance Correction

Based on the results of the above test, the significance value of Kolmogortof Smirnov's test in the pre-test results of the experimental class $0{,}192 > 0{,}05$ and the pre-test results of the control class were obtained $0{,}088 > 0{,}05$. Based on the decision-making criteria in the Kolmogortof Smirnov test, the significance value of both is above the significance level of 0.05. This means being H_1 rejected and H_0 accepted. It can be concluded that the pre-test data of the experimental class and the control class are at a normal distribution.

2) Homogeneity Test

The homogeneity test is one of the prerequisite tests that must be proven to be true whether two or more groups of sample data come from populations with the same variance or not. The basis for the homogeneity decision is that if the data is homogeneous if the data processing results are above the level of 0.05.

Table 15 Pre-test Homogeneity Test Results

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	.575	1	60	.451
	Based on Median	.591	1	60	.445
	Based on Median and with adjusted df	.591	1	57	.445
	Based on trimmed mean	.658	1	60	.421

In the table above, it is known that the significance value is 0.451. Where $0{,}451 > 0{,}05$ so that it is H_1 rejected and H_0 accepted. This means that the data from the pre-test results of the two classes, the experimental class and the control class, meet the homogeneity assumption which means that the two classes are homogeneous or the same in terms of students' mathematical problem-solving before learning is carried out,

3) t-test

The t-test can be done after knowing whether the data taken is normally distributed or not. The basis for making a t-test decision, that is $(2 - tailed) < 0{,}05$, if the score is H_0 rejected and H_1 rejected. The t-test was carried out by combining the results of the pre-test scores of the experimental class and the control class. The following are the results obtained:

Table 16 Pre-test t-test results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	.575	.451	.753	60	.454	3.355	4.455	-5.557	12.267
	Equal variances not assumed			.753	59.888	.454	3.355	4.455	-5.557	12.267

Based on the table above, there is a significance value (2-tailed) of 0.454 which $0{,}454 \geq 0{,}05$ is H_1 rejected and otherwise H_0 accepted. This shows that both sample classes have the same initial ability in mathematical problem-solvingability in social arithmetic material.

$H_0: \mu_1 = \mu_2$ which means that the results of the experimental class and the control class are not significantly different. Therefore, it can be said that the experimental class and the control class have the same initial mathematical problem-solvingability. So that learning using learning media can be used in experimental classes, namely class VII A and class VII B as a control class using conventional learning.

b. Post-test Data Analysis

After the researcher carried out the research and provided treatment, post-test data was taken from the experimental and control classes. This post-test is used to measure the level of students' mathematical problem-solving after being given learning with different treatment between the experimental class and the control class. The results of the scores obtained during the post-test in the experimental class and control class are as follows:

Table 17 Post-test Score Data for Experimental Class and Control Class

No.	Name	Experiment Value	Name	Control Value
1	A1	30	B1	52
2	A2	82	B2	70
3	A3	82	B3	77
4	A4	68	B4	79
5	A5	84	B5	32
6	A6	70	B6	86
7	A7	88	B7	71
8	A8	88	B8	45
9	A9	66	B9	55
10	A10	66	B10	63
11	A11	64	B11	45
12	A12	77	B12	71
13	A13	91	B13	45
14	A14	86	B14	36
15	A15	71	B15	32
16	A16	96	B16	63
17	A17	71	B17	86
18	A18	86	B18	64
19	A19	84	B19	45
20	A20	75	B20	75
21	A21	75	B21	79
22	A22	80	B22	39
23	A23	71	B23	38
24	A24	80	B24	63
25	A25	77	B25	48
26	A26	66	B26	82
27	A27	70	B27	45
28	A28	86	B28	59
29	A29	39	B29	48
30	A30	86	B30	63
31	A31	63	B31	64
Sum		2318		1816

No.	Name	Experiment Value	Name	Control Value
Average		75		59
Minimum Value		30		32
Maximum Value		96		86
Median		77		63
Mood		86		45
Standard Junction		193,714		266,746

The data from the table above shows that if the highest score obtained in the experimental class is 96, the lowest score is 30 with an average gain of 75. Meanwhile, in the control class, the highest post-test score was 86, the lowest score obtained was 32 and the average was 59.

1) Normality Test

The normality test was carried out using data from the post-test results of the experimental class and the control class. Similar to the normality test in the pre-test class, the post-test normality test also uses the Kolmogorof Smirnov method assuming that if it is H_1 rejected, H_0 it will be accepted. The data will be distributed normally if the normality obtained is greater than the significance level of 5%. The following are the results of the normality test of mathematical problem-solvingability in the post-test data of the experimental class and control class obtained with the help of IBM SPSS Statistics 25 software:

Table 18 Post-test Normality Test Results

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Posttest Eksperimen	.135	31	.158	.873	31	.002
	Posttest Kontrol	.131	31	.188	.950	31	.157

a. Lilliefors Significance Correction

The above results show that if the significance value of the Kolmogorov Smirnov test in the post-test results obtained in the experimental class is $0{,}158 > 0{,}05$, while in the control class the significance value obtained $0{,}188 > 0{,}05$. If based on the decision-making criteria of the Kolmogorov Smirnov test, then the significance value of the two classes, the experiment and the control, is above the significance level of 5% which means that H_1it is rejected and H_0 accepted. Thus, it can be concluded that the post-test data obtained in the experimental class and control class are normally distributed data

2) Homogeneity Test

The homogeneity test on the post-test data was carried out using the data on the mathematical problem-solving ability of post-test students in the experimental class and control class. The homogeneity test was carried out with the help of IBM SPSS Statistics 25 software with a significance limit of 0.05. The data will be said to be homogeneous if the yield is above the level of 0.05. The results of the homogeneity test of post-test data for the experimental class and control class are as follows:

Table 19 Post-test Homogeneity Test Results

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	3.044	1	60	.086
	Based on Median	2.458	1	60	.122
	Based on Median and with adjusted df	2.458	1	60	.122
	Based on trimmed mean	3.099	1	60	.083

The table above shows that the significance value obtained is as high as 0.086 so that it is H_0accepted and H_1 rejected. This means that the data of the post-test results meet the assumption of homogeneity, where the post-test data of the experimental class and the control class are homogeneous or the same in the students' mathematical problem-solvingability on social arithmetic material.

3) t-test

The t-test test was carried out to determine the effectiveness of game-based learning interactive learning media in improving students' mathematical problem-solving by comparing the results of the post-test of the experimental class (teaching using media) with the control class (conventional teaching). In the t-test, if the value is obtained $(2 - tailed) < 0{,}05$ then it is H_0 rejected and H_1 accepted. Meanwhile, if the value is significant $(2 - tailed) \geq 0{,}05$, it is H_0 accepted and H_1 rejected. The results of the t-test were obtained as follows:

Table 20 Post-test t-test results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	3.044	.086	4.168	60	.000	16.065	3.854	8.355	23.774
	Equal variances not assumed			4.168	58.528	.000	16.065	3.854	8.351	23.778

Based on the table above, the significance (2-tailed) obtained 0,000 is where $0{,}000 < 0{,}05$ this shows if it is H_0 rejected and H_1 accepted. $H_1: \mu_1 \neq \mu_2$This means that there is a difference between the experimental class that uses game-based learning interactive learning media and the control class that uses conventional learning. Based on this, it can be concluded that learning carried out using game-based learning interactive learning media using a realistic approach can improve students' mathematical problem-solving in social arithmetic material in grade VII at MTs Ma'arif NU 1 Pekuncen.

The effectiveness of this game-based learning interactive learning media can be known by conducting pre-test and post test tests on two sample classes. The results of the pre-test and post-test scores that have been carried out in the experimental class as well as the kpntrol class are the basis for comparing the average scores on social

arithmetic material to determine the effectiveness of learning media on students' mathematical problem-solving. The average post-test score obtained in the experimental class was 75 which was greater than the average post-test score of the control class of 59. Thus, it can be concluded that game-based interactive learning media is effectively used in improving students' mathematical problem-solving in social arithmetic material in interactive class VII at MTs Ma'arif NU 1 Pekuncen.

Then, the average post-test results obtained from the experimental class and the control class were compared using the t-test, to find out whether learning using game-based interactive learning media in the experimental class was more effective than conventional learning in the control class in improving students' mathematical problem-solving in social arithmetic material in grade VII. Based on the results of calculations using IBM SPSS Statistics 25, it is obtained if, the test result listed in the significance section (2-tailed) is 0.000, where $0{,}000 < 0{,}05$this indicates if it is H_0 rejected and H_1 accepted. Therefore, it can be concluded that the use of game-based interactive learning media using a realistic approach is more effective than conventional learning in order to improve students' mathematical problem-solving in social arithmetic material in class VII si MTs Ma'arif NU 1 Pekuncen.

3. Discussion

The researcher developed an interactive learning media Game-based Learning using a realistic approach to improve students' mathematical problem-solving in social arithmetic material in grade VII which was carried out at MTs Ma'arif NU 1 Pekuncen. In this development, the researcher uses the ADDIE development model which has 5 steps in this model, including Analysis (analysis stage), Design (design stage), Develompent (development stage), Implementation (implementation stage) and Evaluation (assessment stage).

In the analysis stage, the researcher conducts preliminary observations and interviews with teachers and students to find out the problems experienced by teachers and students. The result obtained is that the learning process carried out still uses conventional methods which are generally carried out by the lecture method. In addition, learning is still carried out with a teacher center, which results in a lack of active role of students in learning. Thus, resulting in a lack of interest in mathematics learning due to monotonous learning and lack of understanding of the teacher's explanations. Students also revealed their difficulties in understanding mathematical problems related to daily life, this resulted in students being lazy in working on mathematical problems. Because of all of this, researchers are interested in developing interactive learning media Game-based Learning using a realistic approach to improve students' mathematical problem-solving. The interactive learning media game-based learning using a realistic approach developed by researchers has several advantages:

First, the media developed is interactive. This allows two-way learning or increases the active involvement of students in learning so that it is expected to be able to attract students' interest in learning. In line with John Dewey's learning theory (in Muflich & Nursikin, 2023) which states that students' activeness in learning is able to improve student understanding and can also improve students' critical thinking skills.

Second, this media uses a realistic approach that is packaged using a lot of animations, elements, images, audio and others that aim to attract students' interest and based on students' life experiences so that it is hoped that this media will be able to improve problem-solving and formulate problem solving because the animation used is expected to be able to trigger the emergence of strategies in solving problems. In line with Piaget's learning theory (in Sugrah, 2019) where this theory focuses on the learning process as a process of self-discovery. Finding problem-solvingtrategies that allow each student to occur.

Third, the learning media is equipped with practice questions or quizzes about arithmetic problems in daily life. This practice is used to measure the extent of students' mathematical problem-solving in class VII social arithmetic material. This practice question is also equipped with a discussion so that it makes it easier for students to cross-check. In line with research conducted by Viorika (2019) which states that the application of quizzes in learning is able to trigger students' enthusiasm in solving problems.

To determine the validity and attractiveness of the learning media developed, namely the learning media expert test, the practicality test by the teacher and the student response test in small groups. The learning media expert test was carried out by two expert validators. The first validator, in the aspect of realistic approach, obtained a validity criterion of 3.8 so that it was categorized as very valid, the aspect of Game-based Learning interactive media obtained a validity criterion of 3.9 with a very valid category, and the discussion aspect obtained a criterion of 3.7 with a very valid category. Thus, these three aspects get an average of 3.79 which is categorized as very valid. The second validator in the realistic approach and interactive media of Game-based Learning obtained the same criteria, namely 3.6 with a very valid category and the language aspect obtained a criterion of 3 with a valid category. The average obtained by the second validator is 3.4 which is included in the very valid category. Then, a practicality test was also carried out by teachers by obtaining a realistic approach aspect of 3.6 with a very valid category, an interactive media aspect of Game-based Learning of 3.8 with a very valid category, and also a language aspect of 4 with a very valid category. The average obtained is 3.8 with a very valid category. Then, a student response test was carried out in small groups. This test was carried out by 15 students in a small group with a score of 89.3 on the realistic approach which was included in the very interesting category, the interactive media aspect of Game-based Learning of 87 with the very interesting category and the language aspect obtained 88.3 with the very interesting category.

Furthermore, an effectiveness test is carried out to determine the effectiveness of the product that has been developed. This trial was carried out in two classes, namely the experimental class and the control class, both of which were equally given pre-test and post-test. Based on the results of the pre-test and post-test in the experimental and control classes, researchers can compare the average scores obtained to determine the effectiveness of Game-based Learning interactive learning media using a realistic approach to improve students' mathematical problem-solving. The average post-test score obtained in the experimental class was 75 which was greater than the average post-test score of the control class of 59. This can be concluded if the interactive learning media Game-based Learning is effectively used to

improve students' mathematical problem-solving in social arithmetic material in grade VII MTs Ma'arif NU 1 Pekuncen.

Then the results of the t-test with the help of SPSS significance (2-tailed) were obtained 0.000, which means $0{,}000 < 0{,}05$ that this indicates if it is H_0 rejected and H_1 accepted. It can be concluded that learning using interactive learning media game-based learning is effectively used to improve students' mathematical problem-solving in social arithmetic material in grade VII MTs Ma'arif NU 1 Pekuncen.

Based on the above research, it can be concluded that game-based learning interactive learning media is valid and effective to improve students' mathematical problem-solving in social arithmetic material in grade VII MTs Ma'arif NU 1 Pekuncen.

D. Conclusion

Based on the research that has been carried out, the formulation of the problems in this study has been answered, namely the interactive learning media game-based learning using a realistic, valid and effective approach used in improving students' mathematical problem-solving in social arithmetic material class VII at MTs Ma'arif NU 1 Pekuncen.

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