

**DEVELOPMENT OF MATHEMATICS COMIC
MEDIA BASED ON REALISTIC MATHEMATICS
EDUCATION TO IMPROVE PROBLEM-SOLVING
ABILITY STUDENT OF SEVENTH GRADE OF
MIDDLE SCHOOL 7 PADANGSIDIMPUAN SCHOOL
YEAR 20202021**

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Abstract

This study aims to: 1) Analyse the improvement of mathematics problem-solving ability student of eventh grade of middle school 7 Padangsidimpuan school year 2020-2021. 2) Finding effectiveness of methematical Comic media based realistics mathematic education to improve mathematics problem-solning ability student of eventh grade of middle school 7 Padangsidimpuan school year 2020-2021. 3) Describe characteristics of Comic media based on realistic mathematics education to improve mathematics problem-solving ability student of eventh grade of middle school 7 Padangsidimpuan school year 2020-2021. The study was designed by as a development research 4-D method by Thiagajaran, Semmel dan Semmel. It was found that there are developments in define, design, develop, and dessiminate. The result of the study show: There are 8 (30.8%) students whose level of mathematical problem solving ability is in the low category, 16 (61.5%) students are classified as moderate, and 2 (7.7%) students

are high. The results of the second trial there were 5 (17.85%) students whose mathematical problem-solving abilities were in the low category, 21 (75%) students belonged to the medium category, and 2 (7.17%) students who were classified in the high category; 2) the mathematical comic media based on a realistic approach meets the valid and effective criteria in terms of their respective criteria; 3) The characteristics of comic media based on realistic mathematics education stated on: 1) using of the contextual problems; 2) using of the learning models; 3) using of the student contributions; 4) interactive; 5) related to other topics.

Keywords: *Mathematical Problem-Solving Skill, Mathematical Comic, Realistics Mathematic Approach,*

A. Introduction

In education, mathematics is a science that plays an important role in life. Mathematics is needed by all scientific disciplines as well as in real life because it can increase and hone the power of human thought, because the power of thought has a major contribution to the development of the character of students at school. Characters that appear in students are expected to help students instill competencies or abilities in students that are useful for the present and the future.

Then Sholihah and Mahmudi (2015:176) said that mathematics is very important because mathematics is a source for other sciences, meaning that many sciences use mathematics for discovery and development, for that, mathematics is very useful for students and becomes a basic science to be applied to other fields.

Meanwhile, Cocroft (in Huriyanti and Rosiyangti, 2017: 4) states that students need to learn mathematics because: (a) it is always used in everything in life, (b) mathematics is in accordance with other sciences (c) mathematics is concrete so that it can be used as a clear means of communication (d) mathematics solves problems in various ways (e) [380]

mathematics can hone and improve abilities (f) mathematics helps provide solutions to complex problems

National Council of Teachers of Mathematics or NCTM (in Hasratuddin 2015: 55) there are 5 standard processes that must be mastered by students through learning mathematics, namely: solving problems (problem solving), reasoning and proof (reasoning and proof), connections, communication, and representation (representation).

In line with the expression (Kushendri, 2019: 2) that students' cognitive levels can affect students' problem-solving abilities which still tend to be low. Students who can think abstractly are students whose cognitive level is high so they can understand mathematical concepts easily, while students who have low cognitive levels are students who are not accustomed to understanding mathematical concepts. At this time, when referring to the cognitive level of students who are still low, it can be concluded that students' abilities are still low.

Polya 1973 (Hasratuddin, 2015: 77) revealed that the procedures or stages of solving, namely: 1) understanding the problem (understanding the problem); (2) devising a plan (planning); (3) carrying out a problem solving plan carrying out the plan (planning a solution); (4) looking back (check back/evaluate).

But in reality, right now is the time of the COVID-19 virus pandemic, in Indonesia the covid -19 pandemic entered Indonesia in 2020. WHO has determined that covid-19 is a pandemic situation, and the Indonesian government immediately closed schools and switched to online learning (on-line). At this time people are prohibited from gathering in crowds, COVID-19 is an accumulation of viruses that attack the respiratory system (Hariman, S. S, et al 2020:4). In Indonesia, online learning is also called the transition from ordinary learning to online

learning because there is a policy from the government to carry out large-scale social restrictions or PSBB.

According to (Yaya. et al 2020:3) Online learning, also known as online, is a technology-based learning process to support distance learning. However, not all areas of technological facilities support the ongoing learning process, this is overcome by the teacher in one way, namely by using the method of giving assignments without further developing students' problem-solving abilities.

The learning process of SMP Negeri 7 Padangsidimpuan is using conventional methods or teacher-centered learning processes. During a pandemic, it is the same as the learning process in schools, teachers assign assignments to students and do them at each student's home. Due to the economic limitations of students and having different backgrounds, there are some students who do not meet the needs of distance learning. This is one of the factors that affect the continuity of the learning process and becomes an obstacle in the distance learning process.

The results of students' answers, can be taken a picture of, students' problem-solving abilities, as referring to indicators in problem solving. Based on the picture of the process of students answering the story questions given, it can be concluded that students answered the questions incorrectly as a result, students were unable to solve the problem.

From the results of the researcher's interview with several students during the observation in class VII, information was obtained that in the learning process the teacher had not taught mathematics by using mathematical Comics as a medium of learning in social Arithmetic material. The concept of this material uses a lot of story questions, so pictures are needed to deepen students' understanding.

Mathematical Comics media are one of the innovations that attract students to learn, increase creativity and effectiveness in the learning process, as a result, mathematics learning can be evaluated as a meaningful learning process. Media Mathematical Comics are needed in the learning process because Comics media can create fun and not boring learning so that students are not bored with learning.

With explanatory images which are the text being studied, it is easier to learn, understand and easy to remember. According to Septy (2015: 17) that the use of comic media is a fun thing, for it can improve students' understanding and memory. Mathematical Comics media also make students subconsciously invite and encourage students to learn mathematics from the comic stories.

Based on the description above, it can be concluded that Comics media have enormous potential as learning media. Presentations with pictures and text can make students interested in reading, consequently increasing students' understanding of the concepts being studied, meanwhile, characters in Comics can be used as role models to convey messages of character values. Therefore, the use of Comics media based on a realistic approach for class VII SMP students is expected to make the applied learning more fun and meaningful. Through teacher guidance, Comics can act as a bridge to generate interest in reading in students according to students' thinking levels, and can also increase students' understanding of the material being taught.

Then, the mathematical comic media in the process of improving problem solving abilities is an interesting print learning tool to use. In the preparation of mathematical Comics media, the material presented should be combined with a contextual learning approach so that learning becomes meaningful. One of the learning methods used is a realistic

approach.

Realistic approach aims to develop students' mathematical thinking skills optimally and in the end can increase students' confidence in mathematics through the education and learning process. Realistic approach is an approach that authorizes things that are real for students and applies them in everyday life.

B. Method

This research is a development research using a modification of the 4-D development model (Four-D Models) S. Thiagarajan, Semmel and Semmel (1974). This model was chosen because it is systematic and easy to develop mathematical comic media based on Realistic Approach. This study aims to improve students' problem solving skills.

The research was conducted at SMP Negeri 7 Padangsidempuan, Jl. Angkola Julu, Jorong Lombang, Kec. Padangsidempuan Angkola Julu, Padang Sidempuan City, North Sumatra zip code 22700. The subjects in this study were all seventh grade students of SMP Negeri 7 Padangsidempuan FY 2020-2021, but the test subjects were only taken for grades VII-1 and VII-2, all VII graders were randomly assigned, so it can be assumed that students in each class had the same abilities. homogeneous. The object of this research is the Development of Mathematical Comic Media Based on a Realistic Approach to Improve Problem Solving Ability of Class VII Students of SMP Negeri 7 Padangsidempuan FY 2020-2021 on Social Arithmetic material.

Development Research Procedure

Development steps Mathematical Comic Media in research can be seen in Figure 1.

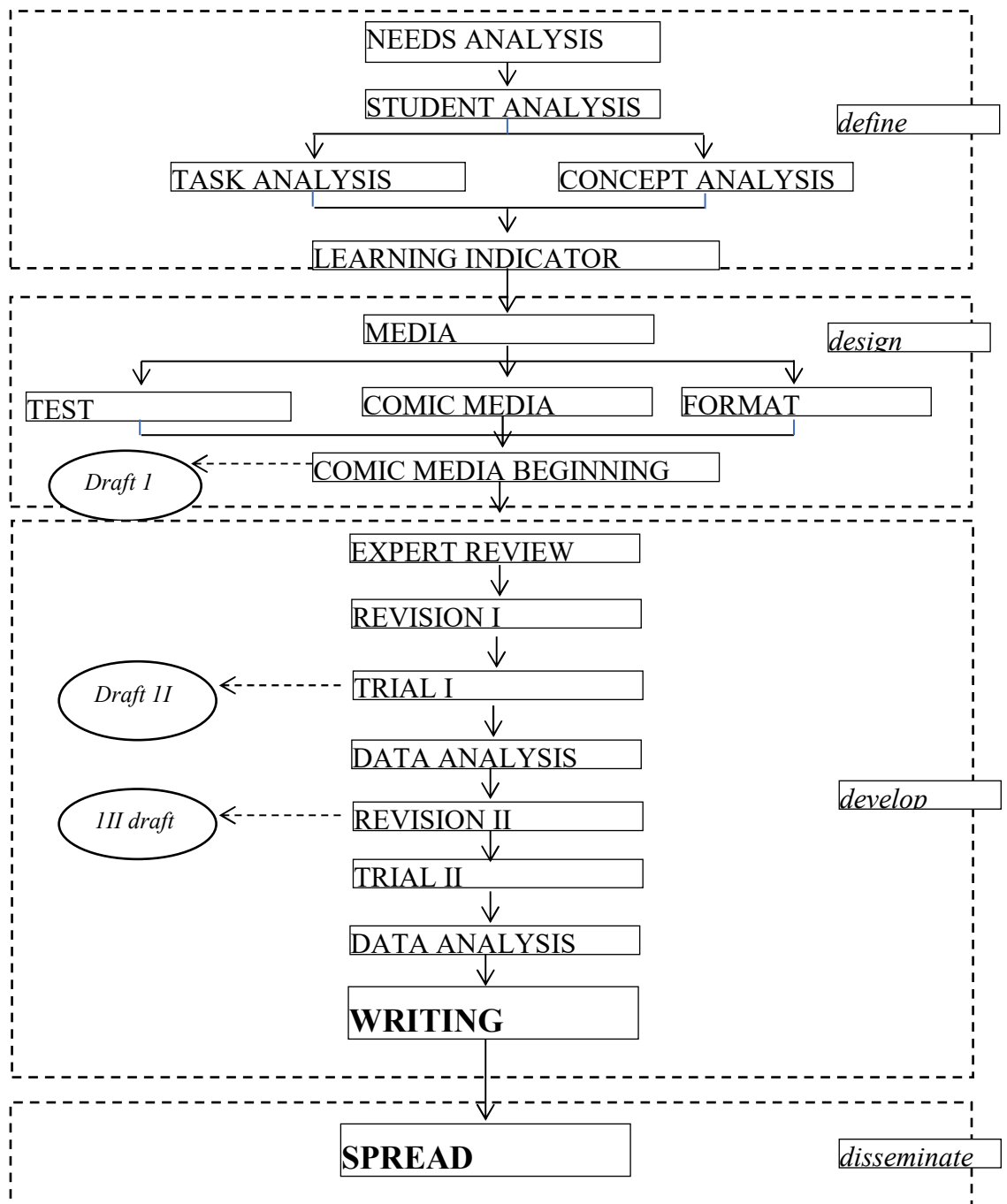


Figure 1. Development of Mathematical Comic Media

The validation sheet is used to obtain data regarding the opinions of experts/validators on mathematical Comics media consisting of material experts, linguists and media experts so that they can be used as references in revising mathematical Comics media based on a realistic approach. The following are some validation sheets used, among others: (a) Learning Implementation Plan (RPP) validation sheet, (b) Mathematical Comic Media expert validation sheet, (c) Material expert validation sheet, (d) Linguistic expert validation sheet.

Data analysis technique

Data analysis was used to answer the formulation of the problem and research questions, the validity and effectiveness of mathematical comic media based on a realistic approach. To see the validity of the mathematical comic media based on the average score of each validated mathematical comic media. The effectiveness of the mathematical Comics media is seen by the classical mastery of students during learning by using mathematical Comics media based on a realistic approach.

Analysis of the Validity of Research Instruments

Analysis of the validity of the mathematical comic media used descriptive statistical analysis techniques based on the average score of each mathematical comic media that had been validated by the validator/expert and revised based on suggestions for improvement and input from the validators/experts.

Data Analysis of the Validity and Reliability of Items.

Analysis of the validity and reliability of the items carried out with the aim of assessing the quality of the students' problem-solving ability

tests in the learning to be used, first analyzed the reliability and validity of the test.

Data Analysis of the Effectiveness of Mathematical Comics Media

To find out the effectiveness of mathematical comic media, it is necessary to conduct an effectiveness analysis that aims to make a decision whether it is necessary to carry out further trials in the development stage of mathematical comic media. The effectiveness of the mathematical comic media is determined based on the achievement of students' learning goals, students' classical mastery, student responses and ideal time.

Analysis of Measurement Improved Problem-Solving Ability

The data obtained from the test results were analyzed to determine the improvement of students' problem solving abilities. The scores obtained by students before and after using the comic media that had been developed were analyzed by comparing the student scores obtained from the test results of students before and after being treated with N-Gain Values.

Analysis of Media Characteristics of Mathematical Comics Based on Realistic Approach.

Mathematical comic media can be said to be meaningful for students if the mathematical comic media can bring out the characteristics of a realistic approach in learning activities. Traffers (in Wijaya, 2012: 12) states that there are 5 characteristics of a realistic approach

Analysis of Teacher Ability to Manage Learning.

The assessment of the ability of teachers to manage learning using mathematical comic media based on a realistic approach was analyzed using descriptive statistics by looking for categorical values from several aspects of assessors given by observers of the implementation of learning. In the learning process, a teacher uses teaching materials in the form of mathematical Comics media based on a realistic approach.

C. Finding and Discussion

1. Result

a. Description of Trial Results I

Analysis of Improving Students' Mathematical Problem Solving Ability Test I

1. N-Gain Value

Table 1. Summary of N-Gain Results of Students' Mathematical Problem-Solving Ability Test I

N-Gain	Interpretation	Total students	Percentage (%)
$g < 0,3$	Low	8	30.8%
$0,3 \leq g \leq 0,7$	Currently	16	61.5%
$g > 0,7$	Tinggi	2	7.7%

The Effectiveness of Mathematical Comic Media Based on a Realistic Approach on Trial I

- Achievement of Learning Objectives.

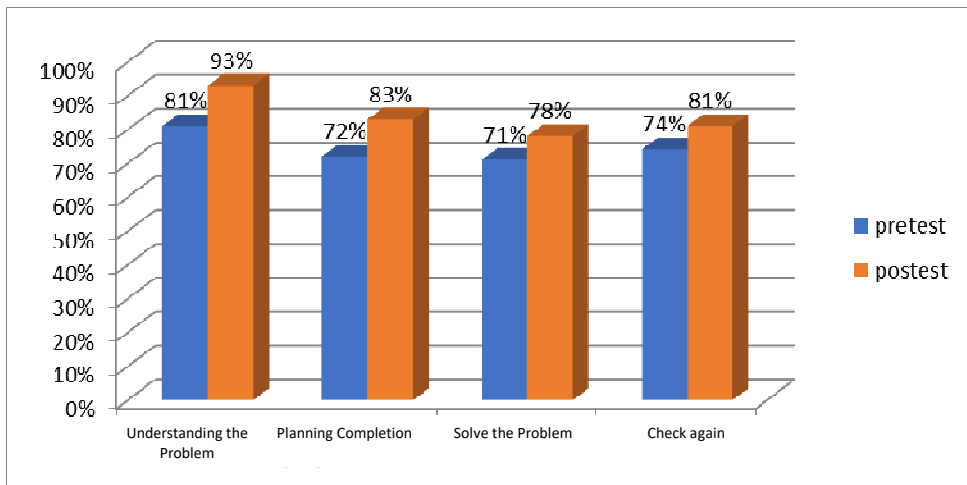


Figure 2. Graph of Increasing Students' Mathematical Problem-Solving Ability Test Indicators I

- **Classical Student Learning Completeness.**

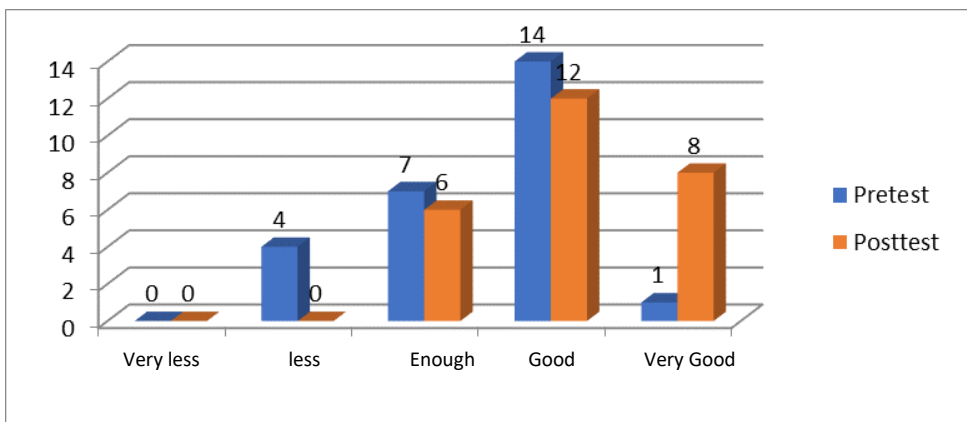


Figure 3. Graph of Pretest and Posttest Results of Students' Mathematical Problem-Solving Ability in Trial I

From Table and Figure which have been presented above, it can be concluded that the level of students' mathematical problem solving ability from the pretest results in the first trial that most dominates is the good

category, then the good category is the most dominant in the posttest results of the first trial. The following presents the results of students' classical mastery in the first trial in table 2 as follows:

Table 2. Classical Completeness Level of Students' Mathematical Problem Solving-Ability in Trial I

Category	Pretest	Classical Completeness Percentage	Posttest	Classical Completeness Percentage
	Total students		Total students	
Complete	15	57.69%	20	76.92%
Not finished	11	42.31%	6	23.08%
Amount	26		26	

The graphic image of the percentage of classical completeness criteria for solving students' mathematical problems in the first trial is presented in Figure 4 below:

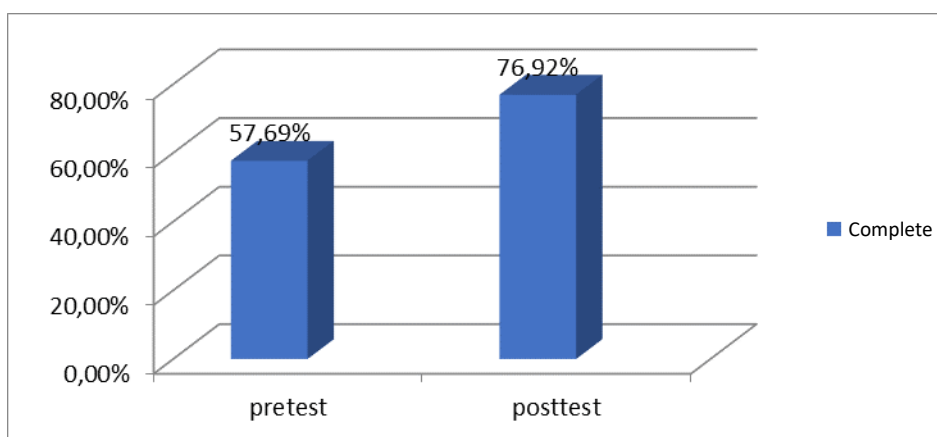


Figure 4. Percentage of Classical Completion of Students' Mathematical Problem-Solving Ability in Trial I

From the results of the pretest and posttest, it can be seen that students cannot be said to be complete, because students who complete are still less than 80%. The results of these findings, it can be concluded that in the first trial the application of mathematical Comics media based on a realistic approach have not met the criteria for classical completeness.

- Student Response to Mathematics Comic Media Learning

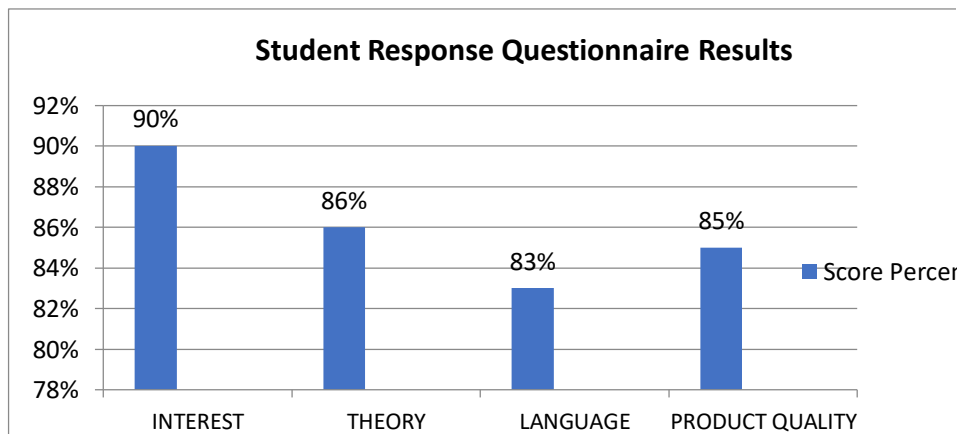


Figure 5. Graph of Student Response Questionnaire Results Test I

- Study Time

The results of the achievement of learning time in the first trial were three meetings, while the usual learning was carried out in 3 meetings.

b. Description of Trial Results II

Analysis of Improving Mathematical Problem-Solving Ability Test II.

1. N-Gain Value

Table 3. Summary of N-Gain Results of Students' Mathematical Problem-

Solving Ability Test II

N-Gain	Interpretation	Total students	Percentage (%)
$g < 0,3$	Low	5	17.85%
$0,3 \leq g \leq 0,7$	Currently	21	75%
$g > 0,7$	Tinggi	2	7.15%

The Effectiveness of Trial II Mathematics Comic Media

- Achieving the Learning Objectives of Trial II

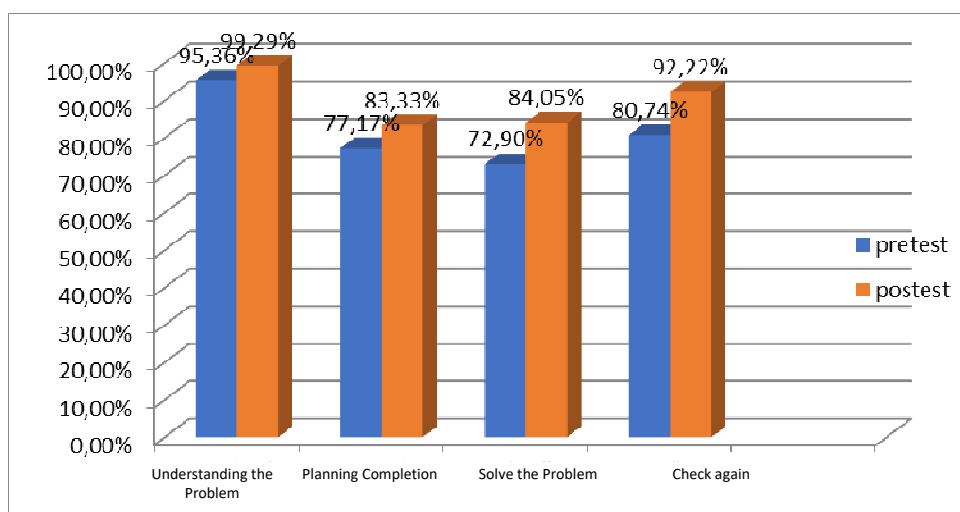


Figure 6. Graph of Increasing the Results of the Pretest and Posttest of Students' Mathematical Problem-Solving Ability in Trial II

Based on Figure 6 it is found that the students' mathematical problem-solving ability, the indicator on the Pretest results that dominates the most is at the stage of understanding the problem. While the student's systematic problem-solving ability, the indicator on the Posttest results that dominates the most is at the stage of understanding the problem.

- **Completeness Students learn classically.**

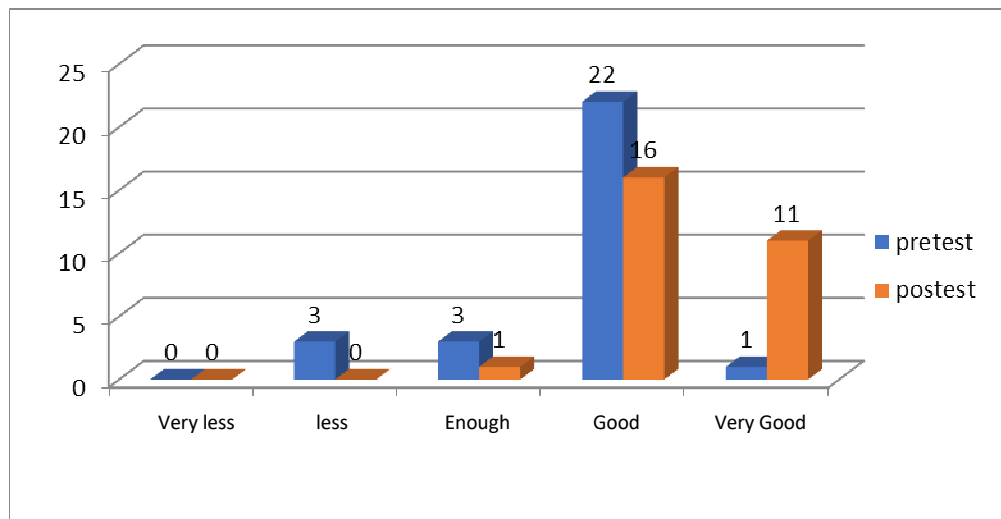


Figure 7. Graph of Pretest and Posttest Results of Students' Mathematical Problem-Solving Ability in Trial II

Table 4. Classical Completeness Level of Students' Mathematical Problem-Solving Ability in Trial II

Category	Pretest	Classical Completeness Percentage	Posttest	Classical Completeness Percentage
	Total students		Total students	
Complete	23	82.14%	27	96.42%
Not finished	5	17.85%	1	3.57%
Amount	28		28	

The graphic image of the percentage of students' classical completeness criteria for solving mathematical problems in the first trial is

presented in Figure Following.

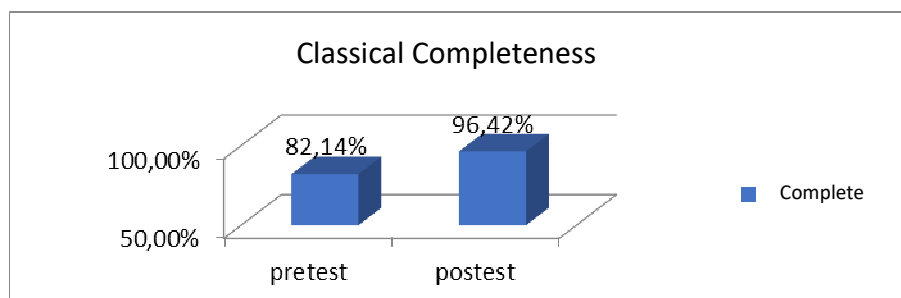


Figure 8. Percentage of Classical Completion of Students' Mathematical Problem-Solving Ability in Trial II

From the results of the pretest and posttest, it can be seen that students can be said to be complete, because more than 80% of students have completed. From these findings, it can be concluded that the use of mathematical Comics media in the second trial can be said to be effective because: has reached the level of mastery classically.

- Student Response to Mathematical Comic Media

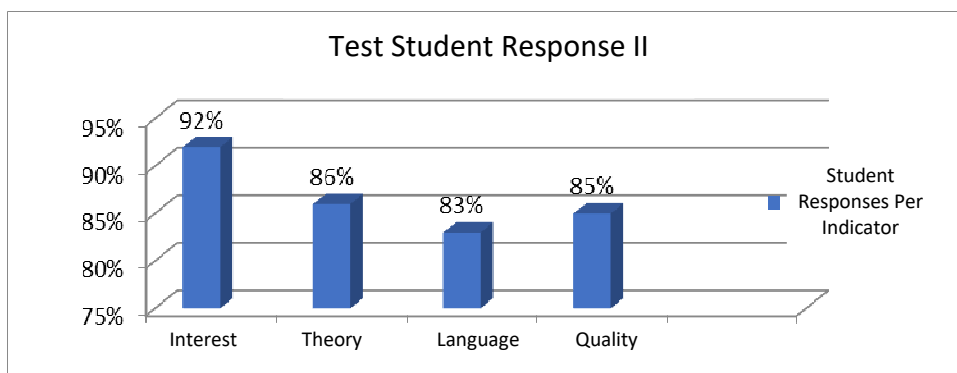


Figure 9. Graph of Student Response Questionnaire Results Test II

- **Study Time**

The results of the achievement of learning time in the second trial were three meetings, while the usual learning was carried out in 3 meetings. This shows that between trial II and ordinary learning there is no difference between the achievement of learning time using a realistic approach to mathematics Comics media with ordinary learning.

2. Discussion

The Validity of Mathematical Comic Media

Expert validation was carried out to see the shortcomings of the initial draft of mathematical comic media based on a realistic approach which was designed by taking into account the problems at SMPN 07 Padangsidempuan. The research instrument was validated by the experts/validators involved in the development of this comic media consisting of three experts. The media validity level is 3.7 with the "Valid" category, the material validity level is 3.8 with the "Valid" category, and the validity of the TKPMM test questions for all questions 1 to 5 in the "Valid" category and the KPMM test reliability value is 0.642, this value if referred to the validity criteria in chapter III, the reliability value is included in the "Valid" category. So, all mathematical comic media research instruments are "valid".

The Effectiveness of Mathematical Comic Media Trial I and Trial II

- Classical Learning Mastery

From the results of the calculation of the posttest value of the first trial and second trial, it was found that several aspects could be measured. The value of trial I did not meet the criteria for effectiveness, this was because the results of classical mastery in the first trial had not

been achieved, namely the average value of classical mastery of students in the posttest of trial I students had not reached 80% of the KKM score. ≥ 75 . Meanwhile, the posttest test scores II have met the effective criteria, because the classical mastery percentage of students reached 96.42%. This means that the criteria for the effectiveness of the mathematical comic media have been met or achieved.

The following is a picture of the increase in the classical completeness scores of the students in the first and second trials

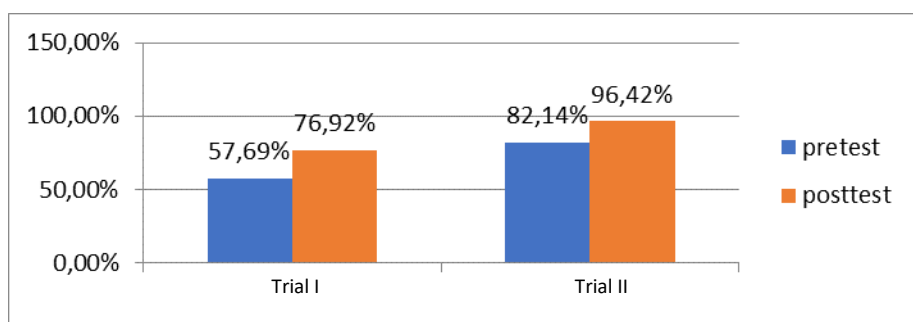


Figure 10. Graph of Increasing Classical Completeness Scores for Trial I and Trial II Students.

From Figure 10 above, it can be seen that from the scores of students' classical mastery in the first and second trials, in the first try the students' classical mastery has not been achieved while in the second try they have reached the criteria for students' classical mastery by using learning through the media of mathematical Comics based on a realistic approach.

- Student Response

Table 5. Details of Student Response Data for Trial I and Trial II
[396]

No	Aspect	Trial I	Chili test II
1	Student response	87%	90%
2	Information	Positive student response	Positive student response

For clarity, the student responses in the first and second trials are presented in graphical form as follows:

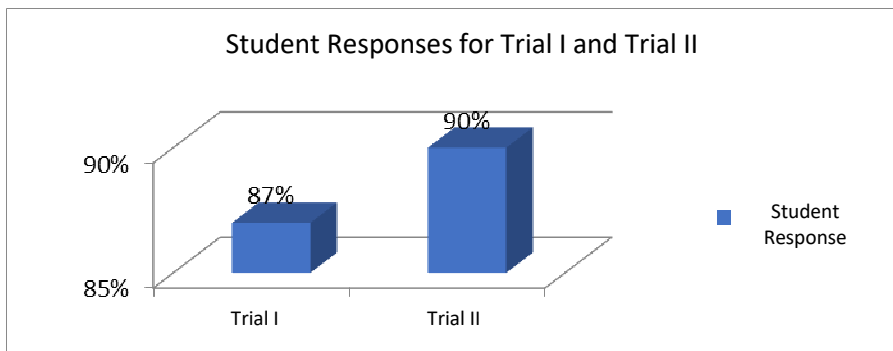


Figure 11. Graph of Student Responses for Trial I and Trial II

Based on Table and Figure above, it can be seen that the analysis of student responses by referring to the decision making described in chapter III, the results of the first trial showed a student response of 87% with a positive student response category, then in the second trial the student response was 90% with positive response category.

From the results of the student response analysis in the first and second trials, it can be concluded that the student response questionnaires given in each trial have reached the positive criteria because more than 80%. Students expressed interest and pleasure in using math during the learning process. This shows that the developed mathematical comic media has met the effective criteria.

- Study Time

Based on the achievement of learning time carried out during trial I

and trial II, the length of time for learning using mathematical Comics media with ordinary learning that has been carried out so far is 3 meetings and does not exceed ordinary learning. By referring to the basis for decision making that has been explained in chapter III, the learning time used is in accordance with the criteria for achieving the learning time used does not exceed the usual learning time, so it can be concluded that the achievement of the learning time of trial I and trial II has been achieved and meet the criteria for effectiveness.

Description of Improving Students' Mathematical Problem Solving Ability Test I and Trial II

1. N-Gain Value Results

In this study, the N-Gain value is needed to measure the improvement of students' problem-solving abilities in the first trial and trial. Here is table 4.33. Details of the N-Gain value of trial I and trial II

Table 6. Details of the N-Gain Value of Students' Mathematical Problem Solving Ability.

No	Aspects to Measure	Trial I	Percentage	Trial II	Percentage
1	Low	8	30.8%	5	17.85%
2	Currently	16	61.5%	21	75%
3	Tinggi	2	7.7%	2	7.15%

For more details, the following is a graphic image of improving students' mathematical problem solving abilities from the N-Gain value, which can be seen from Figure below:

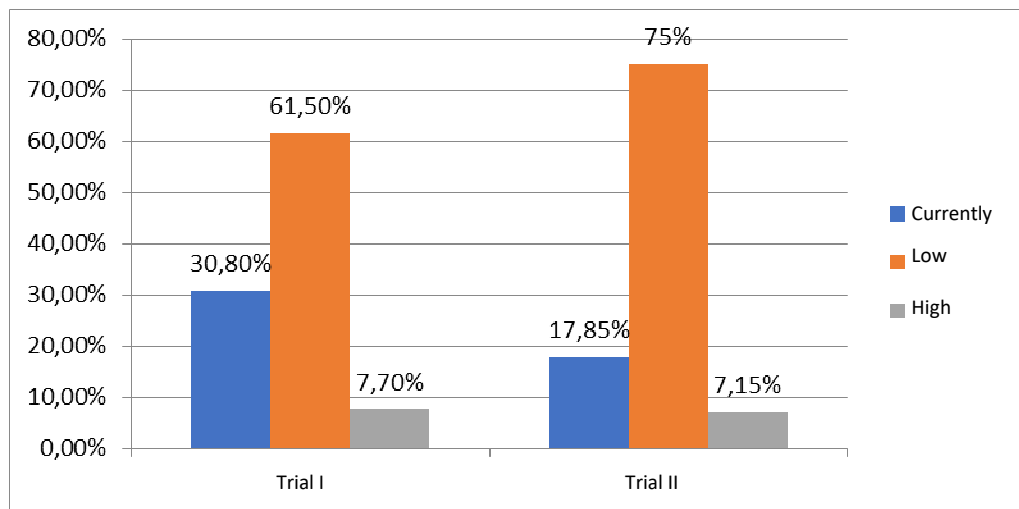


Figure 12. Graph of Increasing Student N-Gain Score

D. Conclusion

Based on the results of the analysis and discussion in this study, there are several conclusions as follows:

1. There are 8 (30.8%) students whose level of mathematical problem solving ability is in the low category, 16 (61.5%) students are classified as moderate, and 2 (7.7%) students are high. The results of the second trial there were 5 (17.85%) students whose mathematical problem-solving abilities were in the low category, 21 (75%) students were in the medium category, and 2 (7.17%) students who were in the high category.
2. The effectiveness of the mathematical comic media based on the realistic approach that has been developed has not yet reached the effective criteria where, 1) students' classical mastery has reached 80%, which is 75. Trial I of students' classical mastery has not been achieved because only 76.93% of students have grades. individual. Trial II of students' classical completeness has been achieved because

96.42% of students have achieved grades ≥ 75 ; 2) Student Responses in the first trial was 87%, in the first trial the student responses were positive while the second trial was 90%, and it can be said that the student responses in the second trial were positive; 3) Ideal Learning Time Trial I and Trial II have a time of 3x2x40 minutes, this indicates that the ideal time is because it does not exceed the usual learning time. From the three conditions for the effectiveness of the media that have been met, this shows that the mathematical comic media based on a realistic approach is effective and feasible to use.

3. The characteristics of mathematical Comics media based on a realistic approach are: a) Using Contextual Problems; b) Using models; c) Using student contributions and productions; d) Interactive; e) The interrelationships between topics

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