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Development of Learning Materials Through RME Assisted by Geogebra Software to Improve Students Problem Solving ability

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Abstract
The aim of this study was to analyze the effectiveness of learning materials through Realistic Mathematics Education Assisted by Geogebra Software (PBRME-G), as well as improving students' mathematic problem solving ability. Learning materials developed were lesson plan, student book, student worksheet and mathematic problem solving ability test instrument. This research is a development research using the development model of Thiagarajan 4-D model. Learning materials that have met valid criteria according to experts, were tested in class X of SMK Swasta Harapan Mekar 1 Medan. The results of the analysis of the data obtained indicate that learning materials based on PBRME-G met the criteria of effectiveness and can improve mathematic problem solving ability. Based on the results of the study, it was suggested that mathematics teachers make an effort mathematic learning using learning materials based PBRME-G.
Keywords: 4-D model, development of learning materials, PBRME-G, mathematic problem solving ability
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1. INTRODUCTION

Problem solving abilities help students develop thinking skills, problem solving, and intellectual skills (Ibrahim and Nor, 2000). The ability to solve mathematical problems will be obtained by students well if in learning communication occurs between the teacher and students and between students that stimulate the creation of participation (Murniati, 2013: 115). According to Kantowski (Kolovou, 2011: 11) that the task is also a problem for an individual when his direct knowledge is not enough to solve it or when he does not have an algorithm that leads directly to his solution. Problem solving in mathematics is seen as a process where students find a combination of mathematical rules or principles that have been studied previously that are used to solve problems.

But in reality, from the results of the initial research researchers by proposing questions that measure the ability to solve mathematical problems in trigonometry material class X Vocational School Harapan Mekar 1 Medan found that students' mathematical problem solving abilities are not good, students have difficulty in solving problems related to non-problems routine or problems related to real problems (authentic).

Supporting factors that must be met apart from the mathematical problems solving ability include learning tools prepared by the teacher must meet the needs of students and in accordance with the material and character of students to be taught, here the professionalism of the teacher plays a very important role according to Prayekti's research (2015: 7). Learning is designed to be meaningful learning where the problem solving material presented has a relationship with students' daily lives. This is in line with the research of Mulbar and Zaki (2018: 8) and Fajriyah et al (2018: 7) that RME-based learning is more effective and more meaningful so students are motivated to learn seriously because students are introduced to everyday problems that are solved by applying concepts mathematics.

In addition to learning based on the RME approach the media used also play an important role in mathematics learning to improve students' problem solving ability. This is because learning that is done with the help of certain software will be the main attraction for students themselves so students will be motivated to study seriously and students' understanding is deeper, in addition students will be easier to solve problems (Jelatu et al, 2018: 10). Many computer application programs are used to help in solving mathematical problems, one of which is the Geogebra application program. Geogebra is a dynamic program that has facilities to visualize or demonstrate mathematical concepts as well as tools to construct mathematical concepts

But in reality based on the observations of researchers, mathematics learning designed by the teacher does not encourage students' mathematical problem solving ability to study seriously. The teacher only explains the material directly and gives students some sample questions and then continues with giving practice questions. Student activities only work on problems based on existing formulas and based on examples given by the teacher, students are not involved in the process of finding formulas, but formulas are directly given by the teacher. This resulted in students not actively involved in learning. This material presentation model results in students' mathematical problem solving ability to learn seriously not to grow in students.

Besides the learning tools used in the learning process are not effective, for example: First: Students do not have Student Activity Sheets (LAS) that are designed according to the character and material needs of students so that the process of developing mathematical problem solving abilities and student motivation is not well developed, Second : The problems presented in the learning support books that are used have not been able to measure mathematical problem solving abilities and student learning motivation in accordance with the expected indicators, and Third: The test of learning abilities given by the teacher is not in accordance with the indicators to measure mathematical and motivation problem solving abilities student learning.

From some of the observations that have been stated above, learning tools are the main factors in the low ability of mathematical problem solving and student motivation. To be able to foster the ability of mathematical problem solving and student learning motivation, we need a learning tool that supports. This is in accordance with Government Regulation No. 19 of 2005 concerning national education standards which states that one of the standards that must be developed is the process standard. Based on this legal basis, every teacher in the education unit is obliged to develop learning tools in a complete and systematic manner so that the learning process takes place interactively, inspiratively, fun, challenging, and motivates students to participate actively, which is then emphasized through Minister of Education Regulation Number 41 of 2007 concerning standards process. To meet these process standards, the learning process must be planned, assessed and monitored in order to be carried out effectively and efficiently.

One of the learning plans is to arrange learning tools. The learning tools are in the form of Student Books (BS), Student Activity Sheets (LAS), evaluation instruments or learning ability tests (TKB) as well as learning media. The importance of learning tools in teaching and learning activities so that development is highly demanded by every teacher and prospective teacher.

Books are devices that support learning. Akbar (2013: 33) defines textbooks as textbooks that are used as standard references in certain subjects. The development of a good textbook must meet the criteria of valid, practical and effective. According to Akbar (2013: 34) good textbooks are:

(1) accurate; (2) relevance; (3) communicative; (4) complete and systematic; (5) student centered oriented; (6) in favor of the ideology of the nation and state, (7) the rules of true language, textbooks written using the correct spelling, terms and sentence structure; (8) legible, high-legibility teaching books containing sentence lengths and sentence structures according to the reader's understanding.

Learning tools can also facilitate teachers in anticipating various possibilities that occur in the learning process, where the learning process is a complex process so that various possibilities can occur. In addition, teachers who are professional teachers are also required to have the ability to develop learning tools, because developing teacher learning tools can increase creativity in teaching.

The Realistic Mathematical Education (RME) Based Learning Model with Macromedia Flash media is one solution. This is in line with research (Rohati, 2015: 3). Learning approach that emphasizes learning material with daily problems, one of which is a realistic approach or known as RME can be used as a solution. RME is an approach to learning mathematics from the real thing for students. The RME approach is an approach developed by the Frudenthal Institute in the Netherlands and much is found about mathematics (Rohati, 2015: 3). According to the view of Frudenthal (Kurino, 2017: 41) that mathematics must be associated with the real thing for students and mathematics must be seen as a human activity. First to start from the phenomena that for students when learning students start from problems that are contextual which can ultimately be used to solve mathematical concepts. This is in line with Rusmini & Edy Surya's research (2017: 257) that the problems presented are designed from contextual problems so that learning becomes more meaningful. Second, by using frinsif quided reinvention through progressive mathematization, students are led in a dictactic and efficient manner from one level of thinking to the next level through mathematization. Both these frinsif and the self developed models of Gravemeijer in 1998 (Kurino, 2017: 41) are operationalized into five basic characteristics of the RME.

According to Soviawati (in Maryam, 2015: 68) that realistic mathematical approach is an approach that places reality and student experience as a starting point for learning where students are given the opportunity to construct their own formal mathematical knowledge through existing reality problems. According to Maryam (2015: 70) the core activities of each cycle of implementing the steps of implementing learning using the RME approach are: (1) understanding contextual problems, (2) solving problems, (3) comparing and discussing answers, (4) concluding. Furthermore, to develop learning tools that can develop mathematical skills, especially mathematical problem solving abilities and increase student motivation in learning mathematics based on the things outlined above, it is very important to develop RME-based learning tools assisted by Geogebra Software because it will be more effective to motivate students in applying knowledge, working in groups, and perceiving relationships between various subjects so that students' mathematical problem solving abilities will increase.

2. LITERATURE REVIEW

2.1 Mathematic Problem Solving Ability

The ability to solve problems is the ability to solve routine, non-routine, applied routine, non-applied routine, non-routine applied, and non-routine non-routine problems in the field of mathematics (Lestari & Yudhanegara, 2015: 84). Students are said to have good problem solving skills if the student can fulfill things according to Lestari & Yudhanegara (2015; 85) ie students are able to (1) identify the elements that are known, asked and the adequacy of the elements needed, (2) formulating the problem mathematical or mathematical modeling, (3) applying strategies to solve problems and (4) explaining or interpreting the results of problem solving.

2.2 Realistic Mathematics Education (RME)

RME or realistic mathematics education was born in the Netherlands by Frudenthal (Lestari & Yudhanegara.2015: 40) Realistic education intended in this study is school mathematics which is carried out by placing students' reality and experiences as starting points of learning. The same thing according to Jaeng (Sugiyono, 2014: 122) that RME or learning realistic mathematics is learning that starts from contextual problems, from there students discuss mathematics (translating into mathematical language) the problem, then solve it mathematically. The principles of RME according to Gravemeijer (Rohati, 2015: 3) are 1) guided discoveries and progressive death, 2) active phenomology, and 3) self-developed models.

The advantages of RME learning according to Suwarsono (Romauli, 2013: 4) are as follows,

1. RME provides students with a clear and operational understanding of the relationship between mathematics and everyday life (real world life) and the usefulness of mathematics in general for humans.
2. RME provides a clear and operational understanding to students that mathematics is a field of study that is constructed and developed by students not only by those who are called experts in the field.
3. RME gives students a clear and operational understanding that the way to solve a problem or problem does not have to be singular, and does not have to be the same between one person and another person.
4. RME gives students a clear and operational understanding that in learning mathematics, the learning process is the main thing, and to learn mathematics one must go through the process and try to find out for themselves mathematical concepts, with the help of others who already know better (for example teacher). Without the will to undergo the process by itself meaningful learning will not occur.

According to Sumarmo (Romauli, 2013: 4) there are weaknesses of the RME, namely:

1. Efforts to implement RME require very basic changes regarding some other things that are not easy to practice, for example regarding students, teachers and contextual roles.
2. The search for contextual questions that meets the requirements required by RME is not always easy for every mathematical topic that students need to learn, especially because these questions must be solved in various ways
3. Efforts to encourage students to find various ways to solve problems are also things that are not easily done by the teacher.
4. The process of developing students' thinking abilities, through contextual questions, horizontal mathematical processes, and vertical mathematical processes is also not a simple thing, because the processes and mechanisms of student thinking must be followed carefully, so that the teacher can assist students in rediscovering certain mathematical concepts.

3. Method

This research includes development research. The learning device development model that will be carried out is the Thiagarajan, Semmel, and Semmel Models, a 4-D Model consisting of four stages, namely the define, design, develop, and disseminate stages. developed in the form of Student Activity Sheets (LAS), Teacher's Manual (BPG), and Student's Book (BS). Nieveen (1999) and Akker (1999) in (Rahayu et al, 2016: 1066, Batoq et al, 2015: 120) state that to determine the quality of the development of learning tools required three assessment criteria, namely: 1) validity, 2) practicality , and 3) effectiveness assessment.

This research was conducted at Harapan Mekar 1 Medan Private Vocational School. The subjects in this study were Harapan Mekar 1 Medan Vocational School students in class X. The object in this study was a mathematics learning device based on Realistic Mathematics Education trigonometry material.

The research instrument used in this study was a test of mathematical problem solving ability. Furthermore, to see the effectiveness of the use of these learning tools is measured from: (1) Completion of student learning classically that is at least 85% of students who participate in learning get a value of ≥ 75 on the mathematic problem solving ability; (2) student activities meet established time tolerance criteria; and (3) at least 80% of students respond positively to the learning tools developed. The trial is intended to see the improvement of students 'mathematical problem solving ability through the application of the PBRME device that was developed as well as to see the process of students' answers in completing the given mathematical problem-solving ability tests.

Data obtained from the results of the pre-test and post-test students 'mathematical problem solving abilities in each trial were analyzed to determine the increase in students' mathematical problem solving abilities. Improved mathematical problem solving abilities can be obtained from normalized gain index data as follows:

Indeks Gain Ternormalisasi = (postes-Pretes)/(Skor Ideal-Pretes)(Hake, 1999)

Normalized Gains Index Criteria (g) is:

$g \quad > \quad 0,7$: High
$0,3 < g \leq 0,7$: Medium
$g \quad \leq \quad 0,3$: Low (Hake, 1999)

The process of testing the learning device is stopped when the learning device meets the criteria for good device quality. But learning tools are also able to improve students' classical problem solving ability to the medium category.

4. Result

Analysis of the data and research results obtained at each stage of development are presented as follows:

4.1 Stage-1 Design

Activities on these results consist of the preparation of tests, media selection, format selection, and initial design of learning tools. Mathematical problem solving ability tests are arranged to determine the extent of students' ability to solve a problem on the material Quadrilateral. The selection of media is adjusted to the results of the task analysis, concept analysis, and the characteristics of Harapan Mekar 1 Medan Vocational School students, namely software Geogebra. The entire set of tools (student books, LAS and mathematics problem-solving ability tests) that are designed are adjusted to the RME so that they are expected to be implemented in order to have an impact on improving the ability to solve mathematical problems and students' motivation to learn in Harapan Mekar 1 Medan Private Vocational School. The main activity in the final result of the design activity is the writing of learning tools.

4.2 Stage-2 Develop

The first phase of the results of the development is to validate the draft I to the expert / expert (expert) then conducted a field trial. The results of expert validation in the form of validation values, corrections, criticisms, and suggestions are used as a basis for making revisions and improvements to the learning tools developed. Validity test is conducted to see the shortcomings of the draft I in terms of content that contains basic competencies, material, sample questions, practice questions and evaluation at the end of each chapter. The average total value of LAS validation was 4.57; validation of BS (Student Book) of 4.23; Teacher's books are 4.64; RPP of 4.70 so that the results of expert validation in the form of content validity assessment indicate that all learning materials meet valid criteria. All items of students' mathematical problem-solving ability tests meet valid and reliable criteria. Instrument reliability is used to determine test results. After calculation, the reliability test of the mathematical problem-solving ability is 0.732 (high category).

After the learning device developed has met the validity criteria. Then, furthermore the learning device in the form of draft II was tested at the research site, namely trial I in class X TKJ-1 with 25 students. Trial I was conducted 3 times in accordance with the compiled RPP. The practicality of the PBRME-G (GeoGebra-assisted Realistic Mathematical Learning Learning) is seen from two assessments, namely the expert assessment and assessment of the implementation of the learning tools using the PBRME-G tool. The assessment of the practicality of the device based on expert judgment is done in conjunction with the validity assessment. The results of observational data analysis of the feasibility of PBM-RMEG equipment concluded that the achievement of the level of implementation of learning equipment in trial I was included in the high category, which means that PBM-RMEG equipment was said to be practical or applicable. The results of the first trial that have been carried out are used as references and input to improve the learning tools developed through PBM-RMEG. After a review, a revision process for the PBM-RMEG device is developed and the results of the revision / revision conducted on the results of the first trial are retried on the second tryout which aims to improve the quality of practical and effective teaching materials as in the criteria in trial I.

After conducting trial I on draft II, further improvements were made to produce learning tools that met all the effective criteria established. The revised results in draft II produced draft III which was then tested on students of class X TKJ 1 with a total of 25 students. Practicality The PBM-RMEG-based learning tool is said to be practical in terms of (1) the expert / practitioner's assessment of the developed learning tool can be used with little or no revision; (2) the results of observations of the feasibility of learning tools in class are included in the category of minimum height ($3 \leq \overline{(P)} < 4$). From the values obtained it was concluded that the PBM-RMEG tool developed was practical in terms of the implementation of the learning tools. Then from trial II the application of learning tools through the PBM-RMEG device has met the classical achievement criteria for completeness.

Analysis Improvement of students' mathematical problem solving abilities in the second trial will be seen through the N-Gain from the results of the pretest and posttest mathematical problem solving abilities in the second trial. Improved students' mathematical problem solving skills after applying learning using PBRME-G tools.

4.3 Stage-3 Disseminate

Development of learning material reaches the final stage if it has received positive scores from experts and through development tests. Learning material is then packaged, distributed and determined for a broader scale. Based on the results of the Spreading Results data analysis, it is known that the learning tools developed are effective. Likewise with students 'mathematical problem solving abilities, the average N-gain was 0.5 in the moderate category and there was an increase in students' mathematical problem solving abilities after applying learning using PBRME-G tools.

4.4 Result of Trial I

Based on the results of the analysis of trial I data, it appears that the classical completeness of the results of students 'mathematical problem solving abilities in the pretest I trial was 30% while the classical completeness of students' mathematical problem solving abilities in the posttest I trial was 67%. In accordance with the criteria of completeness of student learning outcomes in a classical manner, which is a minimum of 85% of students who take the math problem-solving ability tests are able to achieve a score of ≥70. Thus, the results of the posttest mathematical problem-solving skills have not met classical completeness because only 67% obtained completeness. So it can be concluded that in the first trial the application of learning tools through the PBRME-G equipment did not meet the classical achievement criteria for completeness.

Improvement of students' mathematical problem solving abilities in the first trial was seen through the N-gain from the results of the pretest and posttest mathematical problem solving abilities in the first try. Based on the data obtained there were 0 students who received N-Gain scores in the range> 0.7 or experienced improved mathematical problem solving skills with the category "High". For students who experienced an increase in mathematical problem solving abilities with the category "Medium" or got an N-Gain score of 0.3 <g ≤ 0.7 totaling 10 people and 17 people who received an N-Gain score of g ≤ 0.3 or experienced an increase in ability mathematical problem solving with the category "Low". So, the average gain in trial I was obtained 0.33 in the medium category.

4.5 Result of Trial II

Based on the results of the analysis of the trial data II, it is known that the learning device developed has been effective, this is based on the indicators of the effectiveness of the learning device that have been achieved, namely the results of the posttest of the mathematical problem solving ability in the second trial of 92% having met the criteria for achieving classical completeness, achievement of learning objectives have reached the specified criteria, achieving learning time that is at least the same as the normal learning time has been achieved, and positive student responses to the components of the PBRME-G device developed.

Based on data obtained by students who received an N-Gain score in the range 0.3 <g ≤ 0.7 or experienced an increase in the ability to solve mathematical problems in the "medium" category were 19 students. For students who have improved mathematical problem solving abilities with the category "Low" or get an N-Gain score g ≤ 0.3 amounted to 1 person and 7 people who received an N-Gain score g> 0.7 with the category "High". So, the average gain in trial II was obtained 0.56 in the medium category. So, it can be concluded that there is an increase in students' mathematical problem solving skills after applying learning using the PBRME-G tool.

5. Discussion

Validity test was conducted to see the shortcomings of the initial draft PBM-RMEG device that was designed with attention to problems in class X SMK Harapan Mekar 1 Medan related to basic competencies, material, sample questions, practice questions and evaluations at the end of each chapter. From the results of research the learning tools through PBM-RMEG that were developed have met the valid criteria. Obtaining a valid learning tool is caused by several factors, including: first, the PBM-RMEG learning device developed has fulfilled the content validity. This means that the development of learning tools through PBM-RMEG is in accordance with the demands of the existing curriculum. The above is in line with the opinion of Rajagukguk (2016), Arikunto (2013) that content validity is the accuracy of a test in terms of the contents of the test (measuring instrument).

Based on the results of the trial I, trial II and the results of the Dissemination, the PBM-RMEG tool developed has met the practical category in terms of expert / practitioner assessments which state that the developed learning device can be used with little revision or without revision and implementation of learning is within the criteria well. Indeed in trial I, some students were still unfamiliar with the use of PBRME-G learning tools that demanded student activities, but in subsequent trials students became more accustomed and happy. Thus it can be concluded that the PBRME-G tool developed is practical in terms of the practicality of learning tools. This is supported by the results of research by Ulandari, Amry, Saragih (2019) which shows that the development of learning tools with RME Problem-Based Learning developed with 4-D models produces practical learning tools. In addition, research conducted by Rusmini & Donny (2019) states that the learning tool that is said to be practical is if the observation sheet of the implementation of learning meets the practicality criteria.

Based on the results of Trial II and Dissemination Results, the PBRME-G tool developed has met the effective category in terms of: (1) completeness of student learning classically; (2) achievement of learning objectives; (3)

student responses and (4) learning time.

Based on the results of the posttest analysis of Trial II and the Spread Results it was found that the ability to solve mathematical problems had met the classical completeness criteria. This is because learning materials and contextual problems that exist in student books and LAS are developed according to the characteristics of students so that the learning process is more meaningful and students can solve problems well. The material and problems in student books and activity sheets are developed in accordance with the characteristics and environment of students so that students can use previous experiences and utilize knowledge from their everyday environment to solve mathematical problems that make the learning process more meaningful.

This is consistent with Ausubel's learning theory (in Trianto, 2011) which states that meaningful learning is a process of linking new information or material with concepts that already exist in a person's cognitive structure. Cognitive structures are facts, concepts, and generalizations that have been learned and remembered by students. This means that meaningful learning occurs when students try to connect information or new material in their knowledge structures to solve the problems they face.

With the application of realistic mathematics education based learning, students will be actively involved in the problem solving process. Students analyze and evaluate their own thinking processes and make conclusions from the knowledge that has been found with the guidance and instructions from the teacher or friend in the form of questions that lead. This is reinforced by Vygotsky's view (Rusman, 2012) that is, learning based on problems is an attempt to link new information with cognitive structures that have been acquired through learning activities in social interactions. Furthermore, Vygotsky (Arends, 2008), added that social interactions with others both teachers and peers can refer to the construction of new ideas and enhance students' intellectual development. Vygotsky (Trianto, 2009) also revealed that with the provision of assistance (scaffolding) by the teacher in the early stages of learning and reducing the assistance as long as they complete their assignments, the more active students will handle their learning tasks resulting in more effective learning done and impacting students' mastery in classical learning.

The mastery of student learning is also influenced by the learning model used in the GeoGebra-based realistic mathematics education learning process that makes students interested in learning and actively involved in the learning process. The same thing was also stated by the results of research by Wijayanti (2016) stating, "RME-based learning is a learning that begins with the delivery of mathematical problems related to existing problems in the environment around students causing students to think more realistically in connecting mathematical problems with real life.

The results of other studies regarding the problem-based learning model and students' mathematical problem solving abilities conducted by Syaiful, Yahya, Josua, Darhim (2011) stated that the results of the study showed RME (Realistic Mathematics Education) was more effective in problem solving skills than conventional teaching methods. This is also supported by the results of Murniati's research, Candiasa, Kirna (2013) which shows that the learning tools based on realistic mathematics education developed are included in the effective category in terms of classical student mastery learning.

The achievement of learning objectives by using the PBRME-G device meets the effectiveness criteria because the learning is lifted from everyday life so that the child understands it more easily because it is real, affordable by his imagination, and can be imagined, and it is easier for him to look for possible solutions by using problem solving abilities the mathematics he has. Supported by Murni's statement, Josua, Yahya (2013) that "Mathematical problem solving ability is students ability in understanding problem, devising a plan and carrying out the plan and looking back at the problem solving result. Mathematical problem solving abilities of students are shown by themselves in performing three aspects above and getting during learning.

The use of student contributions in learning is in line with constructivism understanding (Ansari, 2012), which is an understanding which states that knowledge cannot be transferred from the teacher's mind to the student's mind. This means students must actively construct their knowledge. If that knowledge or ability is not actively constructed by itself, that knowledge or ability cannot be truly mastered. This is supported by research by Ulandari, Amry, Saragih (2017) and states, "The realistic mathematics education approach provides an opportunity for students to rediscover mathematical ideas and concepts with adult guidance through exploring various situations and real world problems".

Based on the results of data analysis of the results of trial I, trial II and the results of the distribution obtained that the average percentage of student responses in each trial was positive, meaning that overall students felt helped and were pleased with the PBM-RMEG developed. Student responses given at each trial have reached predetermined criteria that is 80%. This shows that the PBM-RMEG tool developed has met the effective criteria. This is because the learning process is a complex matter, where students determine whether they will learn or not. In line with Vigotsky's theory (Trianto, 2011) that learning occurs when children work or learn to handle tasks that have not been learned but those tasks are still within their abilities and provide a large amount of assistance to a child during the initial stages of learning, then the child it takes on greater responsibility as soon as it can do it alone. Furthermore, positive responses given by students are generated because the teacher has provided a stimulus in the form of feedback and reinforcement in accordance with the characteristics of students after studying the state of the class. This statement is in line with Sagala (2014), that the learning process is a complex process, which must take into account the various possibilities that will occur, those possibilities which in turn require careful planning from each teacher. This is also supported by the results of Lestari's (2014) study which states, "Through Realistic Mathematics Education (RME) there are two mathematical functions, namely mathematics, which must be developed in reality and mathematics as human activities. As a reality, mathematics must be close to students and must be linked to everyday life situations.

Based on the acquisition of pre-test and post-test results, it can be concluded that the ability of students to solve mathematical problems using PBM-RMEG devices has increased. Improvement of students' mathematical problem solving abilities is seen from the average results of the pretest and posttest problem-solving abilities obtained by students on the Spread Results. The average pretest score of students was 67.84 and increased to 88.2 in the posttest. The results of this study are supported by the results of research by Ulandari, Amry, and Saragih (2019); Susanti (2017) said that the mathematical problem solving ability of students taught with RME was higher when compared to students who were taught with conventional learning. Then, Hidayat's research results, Irawan (2017) stated, "Realistic Mathematics Education (RME) provides an opportunity for students to learn to experience directly from the learning process provided. This implies that the GeoGebra-based RME-based learning tools are valid, practical, and effective and there is an increase in problem solving abilities.

6.Conclusion

Based on the results of the analysis and discussion in this study, it can be concluded that RME-based learning assisted by GeoGebra has met the criteria for effectiveness and the ability to solve mathematical problems of students has increased. This study shows that RME-based learning materials assisted by GeoGebra are important things to consider in an effort to maximize student mathematics learning achievement. Thus, it is expected that mathematics teachers look for mathematics learning using GeoGebra-based RME-based learning materials.

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