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DEVELOPMENT OF LEARNING TOOLS BASED ON REALISTIC MATHEMATICS EDUCATION TO IMPROVE THE MATHEMATICAL PROBLEM-SOLVING ABILITY OF STUDENTS IN CLASS VII MIDDLE SCHOOL

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ABSTRACT

This research aims to describe: 1) the effectiveness of the realistic approach-based learning tools developed; 2) increasing students' mathematical problem-solving skills taught through a developed realistic approach-based learning tool; and 3) student responses to the realistic approach-based learning tools developed. This research is a development research. This research was conducted in two stages, namely the first stage of developing learning tools based on the Realistic Mathematics Education approach, and the second stage of testing learning tools based on the Realistic Mathematics Education approach developed in class VII at SMP IT Darul Ikhlas Al Islami to see their effectiveness. The results of the trial, it was obtained: 1) learning tools based on a realistic approach that were developed effectively, in terms of a) classical student learning completeness; b) achievement of learning objectives; and c) learning time; 2) The realistic approach-based learning tools developed can improve students' mathematical problem-solving abilities; and 3) students' positive response to the activities and learning tools based on the realistic approach developed.

Keywords: *learning tools, RME, problem-solving*

INTRODUCTION

Education has an important role in creating human resources. In every region, education is the main factor for advancing regional prosperity. This is explained in the preamble to the 1945 Constitution which explains the national goals of the Indonesian people, one of which is to make the nation's life intelligent. This indicates that our country upholds national education.

The basis of learning is a face-to-face process between teachers and students within the scope of education. Where the role of a teacher is a mediator in carrying out the teaching and learning process. So in this case teachers are required to be able to choose strategies in implementing learning that will be adapted to the applicable curriculum so that the face-to-face teaching and learning process in class can be carried out well and also to produce pleasant interactions for both teachers and students.

Fauzan et al. (2018) said that developing learning tools also requires the right approach or method in the teaching and learning process later. One way that teachers can do this is by using problem-based learning methods. This problem-based learning model is a learning model that is based on the many problems that require authentic investigation, that is, investigations require real solutions to real problems.

Inappropriate understanding of mathematics learning, especially by curriculum developers and teachers, results in the mathematics learning process taking place mechanistically. In mechanistic learning the learning process begins with the teacher explaining the material, then students are given exercises to do. When doing exercises, students tend to imitate what the teacher explains. So a learning process like this makes learning meaningless. Teachers are more

likely to direct students to remember the "ways" they teach in solving problems rather than stimulating them to construct knowledge. This results in students' low mathematical problem-solving abilities.

The results of Ariani et al. (2017) research show that one thing that can influence students' problem-solving abilities is learning that tends to provide material just like that and does not guide students in According to Rahman & Setyaningsih (2022), based on developmental theory, knowledge does not can be transferred from teacher to student but is constructed by the student themselves. Find the learning material yourself.

The cause of students' low problem-solving abilities is that students are less able to understand the problems they are given. Students are less able to convert the information in the problem into a mathematical model. Apart from that, students are used to working on routine questions which do not hone students' problem-solving skills.

Problem-solving ability in mathematics is an ability that students must have. This is because problem-solving abilities can help and resolve various problems related to everyday life. (Hassoubah, 2004) say that problem-solving is very important for students as a means of generating mathematical ideas and concepts that are given. According to (Putri & Suparman, 2019) problem-solving is a type of learning that is at the highest level and most complex compared to other types of learning. Therefore, the ability to solve problems requires a directed thinking process to generate ideas, ideas or develop the possibility of solving the problems encountered.

Teachers are required to explore creativity in learning models in the classroom so that students' thinking abilities are always developed, with various kinds of problem-solving strategies with a focus on problems that are not commonly encountered. "The solution to problem-solving is understanding the problem, planning a solution, resolving the problem according to plan and checking again all the steps that have been taken" Polya (Susanti & Nurfitriyanti, 2018).

Another factor that results in students' low mathematical problem-solving abilities is due to the unavailability of special learning tools used to facilitate students' mathematical problem-solving abilities. Learning tools that serve as guidelines in the learning process should be made by teachers that are adapted to the applicable curriculum and the characteristics of the students.

In improving problem-solving abilities, there needs to be innovation and alternatives. One of the keys is increasing the quality of teachers. The government carries out many programs to increase the quality of teachers, but these efforts will be in vain if teachers as important figures do not improve their own quality. Teachers must also develop effective and interesting learning tools so that students have a positive response to the learning delivered. Creativity in developing learning resources is very important. For this reason, teachers are required to prepare learning tools such as developing learning tools.

Developing learning tools is also the obligation of teachers in schools, because developing effective learning tools will produce meaningful learning activities.Amran et al. (2020) stated that learning tools are tools that are needed and used in managing the teaching and learning process. These learning tools can be in the form of student books (BS), Learning Implementation Plans (RPP), Student Activity Sheets (LAS), evaluation instruments or learning outcome tests and learning media.

The Learning Implementation Plan (RPP) according to National Education Ministerial Decree number 41 of 2007 (2007:8) is a learning plan that is developed in more detail referring to the syllabus to direct students' learning activities in an effort to achieve basic competencies. RPP serves as a guide for teachers during the learning process. RPP will help teachers organize standard material, as well as anticipate students and problems that may arise in learning. planning and preparation function as giving direction to the implementation of learning.

The RPP developed by the teacher must have high validity. The criteria for high validity of the RPP according to the RPP assessment guidelines (Mujahidah & Suparman, 2019) are: (1) there is a clear, complete, logically arranged formulation of learning objectives, encouraging students to think at a higher level. tall; (2) description of the material is clear, in accordance with learning objectives, student characteristics, and scientific development; (3) the organization of learning materials is clear in terms of material coverage, depth and breadth, systematic, coherent, and in accordance with the time allocation; (4) learning resources according to student development, teaching materials, contextual environment with students and varied; (5) there is a detailed, complete learning scenario (beginning, core, end) and the learning steps reflect the learning model used; (6) learning steps in accordance with the objectives; (7) explicit learning techniques in the learning steps, according to learning objectives, encourage students to participate actively, motivate, and think actively; (8) includes the completeness of the RPP in the form of procedures and types of assessment according to learning objectives, there are various assessment instruments (tests and non-tests), assessment rubrics.

Furthermore, the Student Worksheet (LKPD) is a guide for students to carry out investigative or problem-solving activities. This LKPD can be a guide for developing cognitive aspects as well as a guide for developing all aspects of learning (Laurens et al., 2018). LKPD is one of the learning tools used in the learning process. Meanwhile, according to Prastowo (2010: 204) LKPD is teaching material that has been packaged in such a way that students are expected to be able to study the teaching material independently.

(Prastowo, 2015) states that the purpose of using LKPD is the use of observation, observing the process of something happening, thinking critically and being able to draw conclusions. (Mujahidah & Suparman, 2019) mentions the benefits obtained by using student worksheets (LKPD), including providing convenience to students, so that they can help students in the learning process.

When conducting preliminary studies at Darul Ikhlas Al Islami IT Middle School, there were still deficiencies in learning tools, namely the learning did not use LKPD and the learning carried out tended to be teacher-centered. Students are accustomed to working on routine questions. The learning experienced by students is accustomed to memorizing formulas, so when given problem-solving questions students find it difficult to solve them.

The development of tools is a support for learning, including learning implementation plans (RPP) and Student Worksheets which refer to an approach that becomes a complementary unit and focuses on the goals to be achieved.

The Realistic Mathematics Education approach was first developed in the Netherlands by Freudenthal. RME combines views about what mathematics is, how students learn mathematics and how mathematics should be taught. Students should not be viewed as learning objects, but rather as learning subjects. RME uses real phenomena and applications for students

in starting learning. With a set of contextual questions, students are guided constructively by the teacher until they understand the mathematical concepts being studied. So that from mastering this concept, students are expected to obtain good learning achievements as well.

Within the framework of realistic Mathematics Education, Freudenthal stated that "mathematics is human activity", therefore it is suggested that learning mathematics departs from human activity. Basically, the realistic approach is not seen as "ready-to-use" knowledge, but "mathematics is a human activity". Learning is no longer just providing information in mathematics learning, but has turned into a human activity to obtain human knowledge.

The realistic mathematics learning process uses contextual problems as a starting point in learning mathematics. The contextual problems in question are real and concrete problems that are close to the students' environment and can be observed or understood by students by imagining them. Contextual problems require students to carry out mathematics.

De Lange in Wijaya (2012) divides mathematization into two, namely horizontal mathematics and vertical mathematics. Horizontal mathematics is related to the process of generalization (generalizing). The horizontal mathematization process begins with identifying mathematical concepts based on regularities and relationships discovered through visualization and problem schematization. Vertical mathematics is a form of formalization process where the mathematical model obtained in horizontal mathematics becomes the basis for the development of more formal mathematical concepts through a vertical mathematical process. So horizontal mathematization: real/context to symbols and vertical mathematization of symbols to real/context.

Gravemeijer (1994), put forward three principles related to Realistic Mathematics Education (RME), namely guided reinvention, didactical phenomenology and self-developed models.

METHOD

The type of research carried out in this research is development research. According to Sugiyono (2018) development research method is a method used to produce certain products and test the effectiveness of these products. This research is important to carry out because it still needs quality learning tools or learning resources. The quality of the device in question is valid, practical, and effectively used in learning.

The development model used is the plomp model design. The Plomp Research Design model has three phases, namely (a) the preliminary research phase; (b) the learning flow prototype development phase (development/prototyping phase); and (c) the assessment phase.

The subjects in this study were class VII students of SMP IT Darul Ikhlas Al Isalmi for the 2022/2023 academic year.

RESULTS AND DISCUSSION

This research aims to produce learning tools based on Realistic Mathematics Education (RME) that are valid, practical and effective. There are 3 phases carried out in this research, namely the initial investigation phase (preliminary research), the development or prototyping phase (development or prototyping phase), and the assessment phase (assessment phase).

Validity Aspects of RME-Based Learning Tools

Validity is carried out with the aim of seeing the suitability of products that have been developed with an RME-based learning approach. Validity in research is seen from two things, namely content validity (relevancy) and construct validity (consistency) (Nurjamaludin et al., 2021).

Validity of the Learning Implementation Plan (RPP)

What is assessed in the validity of the RPP is the identity of the RPP, indicators of competency achievement, learning objectives, teaching materials, approaches, learning methods, steps in learning activities, learning resources, assessment, language and writing.

The RPP validation stage is carried out in two stages, namely self-evaluation and expert review. For the self-evaluation stage, the researcher reviews the learning tools that have been designed with the help of colleagues. The goal is to see visible errors such as punctuation usage, typing errors, and so on.

Based on the assessment of each validator, 3 were obtained in the valid category, so this lesson plan can be used as a guide for teachers in implementing the mathematics learning process in the classroom.

Validity of Student Worksheets

For the validity of the LKPD, the aspects assessed are presentation aspects, material and content aspects, linguistic aspects and graphic or appearance aspects. Validation of the LKPD was carried out by 5 experts, namely 3 mathematics education experts, 1 language education expert, and 1 technology education expert. Mathematics education lecturers validate the LKPD from the didactic or presentation aspect, material, and content aspects. Language education lecturers validate the LKPD from the linguistic aspect. Meanwhile, technology education lecturers validate LPD from the graphic or appearance aspect.

The LKPD validation stage has the same mechanism as the RPP validation stage, namely self-evaluation, then revisions are made if there are errors, and continued with the expert review stage, namely validation with 5 validators. The validation results of the LKPD by mathematics education experts were 3.32 with valid criteria and slight revisions.

Table 1. LKPD Validation Results

No	Aspects Assessed	Validation Index	Category
1.	Presentation	3,27	Valid
2.	Content Eligibility	3,27	Valid
3.	Graphics	3,00	Valid
4.	Language	3,75	Very Valid
Average Index Validation		3,32	Valid

Based on Table 1, the results of the RME-based LKPD validation analysis are in the valid category. However, there are still some improvements. Improvements are made based on suggestions given by the validator.

In the validity process, there were several revisions to the devices produced in prototype 2. Revisions to the RPP, namely improvements to the steps in the RPP. In the steps, problem-solving indicators must be displayed. In the LKPD there are changes to the cover and revisions to several question instructions on contextual problems.

Practicality of RME-Based Learning Tools

Based on the results of the practicality test, it can be seen in table 2 below.

Table 2. Student Response Results

Aspects Assessed	Percentage of Practicality (%)	Category
Presentation	87,5%	Very Practical
Ease	83,3%	Practical
Time	91,7%	Very Practical
Readability	83,3%	Practical
Average	86,5%	Very Practical

Based on Table 2, it can be seen that the RME-based LKPD has an average practicality value of 86.5% in the very practical category. Based on the results of questionnaires and interviews, it can be concluded that RME-based mathematics learning tools at the Small Group Evaluation stage are said to be very practical. Even so, this learning tool still has some improvements. The results of improvements after the Small Group Evaluation activities are called prototype 4 which is practical for use in the next stage, namely Field Test (Sudarman, 2014).

Based on the average practicality test results, the teacher's response questionnaire gave a practicality value of 83.82%. Based on the criteria that have been made, the practicality of RME-based learning tools is declared practical.

The effectiveness of learning tools is how much learning uses tools developed by students to achieve indicators of learning effectiveness.

Cognitive learning results can be seen from the final test results which show that 20 out of 25 students got scores above the KKM. The results of student learning completeness is 76%. This shows that RME-based learning tools have been effective in achieving student competence.

CONCLUSION

The RME-based learning tool was developed for class VII of SMP IT Darul Ikhals Al Islami through a self-evaluation and validation process with 5 validators, one-to-one evaluation and small group evaluation, which is valid and practical. RME-based learning tools at the trial stage have effectively had an impact on students' mathematical problem-solving abilities. This can be seen from the achievement of students' mathematical problem-solving ability test scores in the successful category.

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