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Development of Student Activity Sheets Based on The Realistic Mathematics Education (RME) Approach for Elementary School Students

Pengembangan Lembar Kegiatan Siswa Berbasis Pendekatan Realistic Mathematics Education (RME) untuk Siswa Sekolah Dasar

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Abstract

This study aims to develop student worksheets with the RME approach in the mathematics subject matter of determining speed and discharge in grade V SD as well as knowing the validity of the product that has been developed. This research is a development research carried out using a procedural model, with development procedures according to the Ministry of National Education adapted from the Borg and Gall development procedures. The steps in the development procedure are: (1) analyzing the product being developed; (2) developing the initial product; (3) expert validation and revision; (4) small-scale field trials and product revisions; (5) large-scale field trials and final products. The instruments used included interview guide sheets, LKPD assessment sheets, test questions sheets, and student response scale sheets. Based on the assessment of the developed RME-based LKPD product, it is suitable for learning mathematics for class V SD/MI with speed and discharge material. This research product has been validated by material experts, media experts. The material expert validation score was 88.16, and the media expert validation score was 88. The developed RME-based LKPD product is effective in improving problem-solving skills. This is evidenced by the difference in n-gain acquisition between what students obtained through the pretest and posttest before and after the learning process using RME-based LKPD products. An increase in learning outcomes can be shown from the results of the pretest with an average value of 45.4, an increase after the posttest with an average value of 77.8 with an n-gain obtained of 0.63 normalized in the medium classification so that the level of effectiveness is effective. Therefore, mathematics LKPD with the RME approach on the subject matter of speed for class V SD is said to be of high quality and can facilitate problem solving skills based on valid, effective, and practical achievement criteria.

Keywords: LKPD, Problem Solving Ability, RME

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Abstrak

Penelitian ini bertujuan untuk mengembangkan LKPD dengan pendekatan RME pada mata pelajaran matematika materi menentukan kecepatan dan debit di kelas V SD serta mengetahui validitas produk yang telah dikembangkan. Penelitian ini merupakan penelitian pengembangan yang dilaksanakan dengan menggunakan model menggunakan model prosedural, dengan prosedur pengembangan menurut Depdiknas yang diadaptasi dari prosedur pengembangan Borg dan Gall. Langkah-langkah prosedur pengembangan tersebut yaitu: (1) melakukan analisis produk yang dikembangkan; (2) mengembangkan produk awal; (3) validasi ahli dan revisi; (4) uji coba lapangan skala kecil dan revisi produk; (5) uji coba lapangan skala besar dan produk akhir. Instrumen yang digunakan meliputi lembar pedoman wawancara, lembar penilaian LKPD, lembar soal *test*, dan lembar skala respon peserta didik. Berdasarkan penilaian produk LKPD berbasis RME yang dikembangkan layak digunakan untuk pembelajaran matematika kelas V SD/MI dengan materi kecepatan dan debit. Produk penelitian ini telah divalidasi oleh ahli materi, ahli media. Perolehan skor hasil validasi ahli materi sebesar 88,16, dan skor hasil validasi ahli media sebesar 88. Produk LKPD berbasis RME yang dikembangkan efektif dalam meningkatkan kemampuan pemecahan masalah . Hal ini dibuktikan dengan adanya perbedaan perolehan *n-gain* antara ang diperoleh peserta didik melalui *pretest* dan *posttest* sebelum dan sesudah proses pembelajaran menggunakan produk LKPD berbasis RME. Peningkatan hasil belajar dapat ditunjukkan dari hasil *pretest* dengan nilai rata-rata 45,4 meningkat setelah *posttest* dengan nilai rata-rata 77,8 dengan *n-gain* yang diperoleh sebesar 0,63 ternormalisasi pada klasifikasi sedang sehingga tingkat keefektivitasannya adalah efektif. Oleh karena itu, LKPD matematika dengan pendekatan RME pada materi pokok kecepatan kelas V SD dikatakan berkualitas dan dapat memfasilitasi kemampuan pemecahan masalah berdasarkan kriteria ketercapaian valid, efektif, dan praktis.

Kata kunci: Kemampuan Pemecahan Masalah, LKPD, RME

INTRODUCTION

According to Utari, et.al ((Riyah & Seruni, 2015), mathematics is a subject that has an important role, both in everyday life and to help students study something logically, creatively and systematically. In line with that, according to (Dodik & Atika, 2020) mathematics is one of the subjects that is important for students to master in schools and higher education because of its use in everyday life, because mathematics is a basic science for the development of other sciences. As a field of study that continues to develop from time to time, mathematics become more theoretical and abstract. This is what makes students feel that mathematics is a boring and difficult subject and students do not know and experience the benefits of mathematics itself (Atika & MZ, 2016).

Therefore, learning mathematics must prioritize systematic, critical thinking and problem solving skills. The important role of mathematics makes

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mathematics taught at every level of education, from kindergarten to university. So that each student is equipped with problem solving abilities. However, in reality mathematics is considered a difficult and frightening subject for most students, especially for elementary school students. It can be seen that elementary school students are in the concrete operational stage. Where students have not formal enough to understand the lesson he will learn (Ananda, 2018). According to (Nugrahanta et al., 2016) students consider mathematics difficult because the basis of learning mathematics is weak, so that before learning students feel that they cannot do mathematics. In addition, mathematics is a subject that is feared and even disliked because it is difficult for students to understand.

According to (Sari & Yuniati, 2018) In the learning process, the teacher also needs to facilitate a series of activities that provide space for students to occur social interaction. Students are directly involved actively in building the meaning of mathematics for him, both individually and in groups. Thus process learning that is done in class is expected to provide encouragement or motivation in developing activities in class. Mathematical problems that can be solved can be in the form of routine, non-routine, applied routine, non-applied routine, applied non-routine, and non-applied non-routine problems in mathematics. Non-routine problems are problems whose solution procedures require a settlement plan, not just using formulas, theorems, or propositions (Lestari, 2015).

(Andani et al., 2021) In learning mathematics to determine the success of learning, it can be seen from the objectives learning mathematics itself. According to the Ministry of Education and Culture in (Fuadi et al., 2013) objectives of mathematics subjects including (1) increasing ability cognitive learners, (2) help participants educate in solving problems, (3) improve student learning outcomes (4) improve students in communicate an idea (5) as well develop the character of students. But in fact the purpose of learning mathematics is still not fully achieved, including in cognitive abilities, problem solving and the low learning outcomes of participants educate. Problem solving is a process for overcoming difficulties faced to achieve that goal expected (Sumartini, 2016). Problem solving is a process that requires logic in order to find a solution to a problem. By solving problems students will learn to devise appropriate strategies to solve the problems they face. (Shodiqin & Utomo, 2020) defines problem solving as an attempt to find a way out of a difficulty in order to achieve a goal that is not immediately achievable. So, the ability to solve is one of the competencies that must be possessed by students. The ability of students to solve problems can be seen from the extent to which students are able to take the knowledge and skills taught at school as useful provisions for later life in society and the extent to which students are able to continue learning throughout their lives.

(Sembiring & Siregar, 2020) the factors that influence math problem solving skills are that learning mathematics has always been a field of study that is less desirable so that students lack motivation in learning mathematics, the process of learning mathematics generally still accustoms students to doing practice questions routine and more memorizing of formulas, the tendency of the learning

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process to only be concerned with the achievement of learning materials in class and the lack of availability of teaching materials that facilitate students to be able to practice their mathematical problem solving skills. Many problems arise regarding learning mathematics namely low problem solving ability because students consider learning math is scary and hard to learn. If students have the ability to solve mathematical problems is still lacking, so as a result students find it difficult to solve these problems. This is the reason why students cannot solve questions and determine the answers. Problem solving ability can be seen as one of the learning processes and outcomes. Problem solving is part of a very important requirement because in the learning process so it is possible for students to gain experience in using the knowledge and skills possessed to be applied in solving daily problems and non-routine problems (Davita & Pujiastuti, 2020). Based on the results of a preliminary study in class V SD Negeri 02 Sukamaju, North Lampung. Based on the results of interviews with school principals and mathematics teachers at SD Negeri 02 Sukamaju, the achievement of students' learning competence in mathematics was not as expected. This is caused by several factors, including the attitude of students towards different mathematics subjects. Most students do not like mathematics because students consider mathematics a difficult subject to master, there are also students who think mathematics is easy when explained but difficult in working on problems. In addition, in the process of learning mathematics the teacher often delivers material in front of the class and writes it on the blackboard. Almost all of the information comes from the teacher so that the opportunity for students to develop independently in their thinking processes is still lacking.

The results of the needs analysis during the pre-research in the form of a questionnaire on mathematics subject, it was found that so far learning was still teacher-centered because the learning resource was in the form of Student Activity Sheets (LKPD) used in the learning process only using LKPD purchased from publishers without being developed. In addition, the aspect of student learning attractiveness is still relatively low. This is because during passive learning students only listen, read, and do exercises. Learning by the teacher is still monotonous and does not use a variety of appropriate approaches which is also one of the factors for the lack of effectiveness in learning mathematics.

Therefore, it is necessary to increase learning to achieve better and maximum problem solving abilities from previous results. In order to change students' mindsets, teachers need an approach to learning that can improve students' ability to solve problems in mathematics. The approach in question is a learning approach within the scope of teaching and learning activities as a general view of the learning process. This statement is supported by (Maulana, 2018) that the learning approach is the method taken by educators in implementing learning so that the concepts presented can adapt to students. Innovative learning that can be applied is the Realistic approach. Realistic refers to asking questions to students and then they solve Mathematical problems in order to be able to improve logical, critical, and creative thinking (Laurens et al., 2018).

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According to Gravemijer's opinion (seri ningsih, 2014), realistic does not refer to reality but to something students can imagine. In connection with this statement, a realistic mathematical approach must have a relationship with real situations that are easily understood and imagined by students. This is supported by the opinion that mathematics had to be connected to reality, stay close to children's experiences and be relevant to society (Sumirattana et al., 2017). The main focus of RME is ideas that are formed from the results of human activities and mathematical reality processes. The RME approach according to (Shoimin, 2017) steps: 1) Understand contextual problems, 2) Solve contextual problems, 3) Compare answers and discuss these answers, 4) Draw a conclusion in the form of material. This approach starts from everyday experience or mathematical reality, so that students can solve mathematical problem solving.

In addition to the approach, in order to support the effectiveness of learning in the classroom LKPD as teaching materials can also be used by teachers and students in learning activities. Through LKPD the activity and creativity of students in learning can be increased and the delivery of learning material can be made easier. LKPD is a learning tool as a complement/supporting facility as well as supporting the implementation of the lesson plan. According to Prastowo (2015) LKPD is a printed teaching material in the form of sheets of paper containing material, summaries, and instructions for carrying out learning tasks that must be done by students, which refers to the basic competencies that must be achieved. LKPD contains a set of basic activities that must be carried out by students to maximize understanding in an effort to form basic abilities according to indicators of achievement of learning outcomes that must be taken (Al-Tabany, 2014).

Based on the results of interviews with educators, information was obtained that there was a lack of learning resources that support the learning process, because the learning resources used were still limited and did not attract the attention of students. This research wants to develop teaching materials in the form of LKPD as a support for students' books so that learning is carried out more contextually in accordance with local environmental conditions. The LKPD will be integrated with an approach so that it is appropriate to be used as an alternative learning resource for students. One approach that facilitates students in learning is. RME brings students to the real world of everyday experiences, so that the lessons learned in mathematics class are not separated from the real world. This is related to Jean Piaget's theory where elementary school age students, namely seven to eleven years, are at the level of concrete operational cognitive development (Suherman, et al., 2003). The RME approach according to (Shoimin, 2017) steps: 1) Understand contextual problems, 2) Solve contextual problems, 3) Compare answers and discuss these answers, 4) Draw a conclusion in the form of material. This approach starts from everyday experience or mathematical reality, so that students can solve mathematical problem solving.

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METHODS

This type of research is research and development (research and development) according to Borg and Gall which was adapted in (Sugiyono, 2019). According to Borg and Gall, development research in education is the development and validation of a new product and procedure, which is then systematically tested in the field, evaluated and perfected until it meets certain criteria, namely effectiveness. Meanwhile, according to (Sugiyono, 2019) research and development methods are research methods used to produce certain products and test the effectiveness of these products.

It was further explained that the research steps for developing the Research and Development (R&D) model were as follows 1) research and data collection (research and information collecting), 2) planning (planning), 3) development of product drafts (develop preliminary from product , 4) design validation (desk evaluation), 5) revising the test results (main product revision), 6) field trials (main field testing), 7) product improvement field test results (operational field testing), 8) implementation tests field, 9) final product revision, and 10) dissemination and implementation. Based on the description above, it can be concluded that development research is research that is used to develop products that produce better products which are then tested for their effectiveness. The product developed in this study is an RME-based worksheet to improve problem-solving abilities in fifth grade students' mathematics learning.

Data analysis was carried out to determine the feasibility and effectiveness of the developed LKPD. The LKPD feasibility test was carried out using media expert validation sheets, material experts and teachers as users. Data obtained from the validation of material experts, media experts and teachers as users are measured using a Likert scale. The two groups that were sampled in this study, namely the experimental group and the control group, were compared with the average N-gain values. N-gain is used as a tool to measure the effectiveness of the benefits of LKPD development. The results of the pretest and posttest activities were analyzed for changes in mathematics learning outcomes obtained by students. The increase in students' problem-solving abilities can be seen from the students' ability to solve the problems contained in the questions.

After the N-gain value is obtained, a product effectiveness test is then carried out to see a significant increase in students' problem-solving abilities which is reflected in the learning outcomes of students before and after learning using LKPD. The test conducted was a paired t-test using the SPSS 24 program.

RESULTS AND DISCUSSION

Product development is carried out in accordance with the LKPD framework that has been prepared. The presentation of this LKPD is structured according to the steps of LKPD research, namely by formulating basic competencies, determining assessment tools, compiling material, and paying attention to the components of a LKPD which includes the title, KD to be achieved,

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completion time, equipment and materials, brief information, steps work, assignments and assessment / evaluation.

Product validation is carried out after the initial product creation. Furthermore, prior to the field trial process, the draft LKPD that had been developed was submitted to a team of experts to be validated and asked for advice. Aspects of the assessment items and material expert scores are stated in the following table.

Table 1. Material Expert Validation Rating Score

No	Rated aspect	Indicator	Score	Score Maximal
1	LKPD content quality	Completeness of learning materials in accordance with Basic Competency.	8	8
		The arrangement of material in a systematic LKPD.	7	8
		The suitability of the experiment with the material presented.	6	8
		Conformity of questions with problem solving indicators.	7	8
2	LKPD presentation	Activities that involve students are quite interesting.	12	12
		LKPD encourages students' curiosity.	14	16
		The content of LKPD is related to the experience of learning	7	8
		The types of activities in LKPD are directed at the discovery of concepts.	6	8
		∑	67	76
		Value	**88,16**	

Based on table 1 regarding the results of the assessment by the material experts above, a score of 88.16 is obtained with very good criteria. The validator stated that the developed RME-based LKPD product was feasible to be tested to improve students' problem-solving abilities in class V mathematics learning on speed and discharge. The validator provides input so that the instrument questions are adjusted to problems related to the lives of students and learning materials that are adjusted to indicators of competency achievement.

Furthermore, the validation of media experts in research, the assessment points and scores of media experts are stated as follows.

Table 2. Media Expert Validation Rating Score

No	Rated aspect	Indicator	Score	Score Maximal
1	Compatibility of illustrated LKPD with didactic requirements	The preparation of illustrated LKPD is universal	8	8
		LKPD emphasizes the concept discovery process	7	8
		LKPD invites students to be active in the learning process	7	8
		LKPD develops students' problem solving abilities.	14	16
2	Compatibility of LKPD with construction	Use of LKPD language	7	8
		Use of sentences in LKPD	7	8
		The attractiveness and clarity of LKPD	9	12

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	requirements			
3	Compatibility of LKPD with technical requirements	The contents of the LKPD provide experience from writing	11	12
		Picture	11	12
		LKPD appearance	7	8
		∑	88	100
		Value		**88**

Based on table 2 regarding the results of the assessment by media experts above, a score of 88 is obtained with very good criteria. The full results of the media expert validation assessment can be seen in the attachment. The validator provides input so that the developed LKPD is made more contextual according to the student's environment. In addition, there is a need for group work to solve problems and the cover is given an image towards learning material. The validator stated that the research product in the form of an RME-based LKPD was feasible to use to improve the problem solving abilities of class V students on speed and discharge.

2) Revision of Expert Validation Products

The RME-based LKPD products that have been validated are then revised according to suggestions and input from each expert. The results of the revised LKPD based on the suggestions given by material experts are as follows.

Table 3. Product Revision Results Before and After Material Expert Validation

No	Before revision	Sugessestion revision	After revisi
1	Tasks and exercises have not integrated into the daily lives of students.	The instrument questions are adapted to the daily lives of students.	The instrument questions in the LKPD have been adjusted to the daily lives of students.
2	In the material section there are those that are not in accordance with the competency achievement indicators.	Learning materials are adjusted to indicators of competency achievement.	The material has been adapted to the competency achievement indicators.

Furthermore, the results of the revised LKPD based on the suggestions given by media experts are as follows.

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Table 4. Product Revision Results Before and After Media Expert Validation

No	Before revision	Suggestion revision	After revision
1	LKPD is less contextual according to the child's environment.	LKPD is made more contextual according to the students' environment.	LKPD repaired to be more in accordance with child environment.
2	Lack of group work to solve problems.	There needs to be group work to solve the problem.	LKPD added group work to improve students' problem solving abilities.
3	Cover is not in accordance with the learning material.	The cover is given an image towards the learning material.	Cover is fixed towards learning material.

3) Product Trials

Product trials are intended to collect data that can be used as a basis for determining the attractiveness, level of feasibility, and effectiveness of RME-based LKPD. Product trials were carried out by means of one-on-one trials, small groups and field trials.

a) One-on-one Trial

The one-on-one trial was carried out with a sample of 3 math educators from each school. Class V educators from SDN 1 Sukamaju (school I), SDN 1 Way Lunik (School II), and SDN 2 Sukamaju (School III). The following is the result of the assessment recapitulation obtained.

Table 5. One-on-one Trial Recapitulation

No	Validation Aspect	Score Each Validator		
		School I	**School II**	**School III**
1	Color composition	4	3	3
2	Image use	3	4	4
3	Font size/fit	4	4	4
4	Text readability	4	4	4
5	Presentation flow / systematics	3	3	3
6	Ease of language	4	4	4
7	Ease of use of LKPD	4	3	4
8	Availability of instructions	3	3	4
9	Clarity of description of examples	3	3	4
10	Allows students to study independently and in groups	4	4	3
	Total Score	36	35	37
	Value	**90**	**87,5**	**92,5**
	average value		**90**	

Table 5 explains the total number of teacher response ratings as a whole is 90.0 with very interesting criteria. So, it can be concluded that LKPD can be used as teaching material in class without the need for revision.

b) Small Group Trial

Small group trials are intended to test product attractiveness with a smaller scale of respondents. This small group test involved 3 fifth grade students from

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each school. Small group trials were carried out by explaining about the LKPD being developed, then students were given a questionnaire or questionnaire. The results of student responses to RME-based LKPD can be seen in the following table.

Table 6. Recapitulation of Small Group Test Assessment

Aspect	Score for Each Aspect	Criteria
Attractiveness	90%	Very interesting
Convenience	92%	Very easy
Role	91%	Very instrumental
Percentage	**91%**	
Criteria	**Very interesting**	

Based on table 6, the LKPD product that has been developed reaches a percentage of 91% with very attractive criteria.

c. Field Trials

The field test was carried out after the research product developed was validated by experts through the initial trial and product revision stage. The results of the recapitulation of students' problem-solving ability scores in the field trial were seen based on the learning outcomes obtained after the mathematics learning process used RME-based LKPD products. Student learning outcomes are grouped into five categories of problem solving abilities which can be seen in the following table:

Table 7. Assess Students' Problem Solving Ability

Value	Categori	Frequency	Percentage (%)
81-100	Very Good	12	48,
61-80	Good	10	40
41-60	Enough	1	4
21-40	Not enough	2	8
0-20	Very less	0	0
∑		25	100
Average Value		**77,8**	

Based on table 7 above, it can be seen that the percentage of students who have problem solving abilities in the very good category is 48%. Furthermore, 40% of students have good problem-solving abilities, 4% of students have sufficient problem-solving skills, and 8% of students have poor problem-solving skills.

The results of the n-gain analysis obtained based on the results of the pretest-posttest conducted in this study can be seen in the following table.

Table 8. Pretest-Posttest N-gain Results

No	Class	*N-Gain*	effectiveness level
1	Class V	0,63	Effective

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The results of the n-gain analysis were obtained based on the results of the pretest-posttest conducted in this study, obtained n-gain of 0.63 normalized in the medium classification. The level of effectiveness is in the effective category. The n-gain calculation data can be seen in the attachment. The next analysis, namely the effectiveness test of LKPD, was carried out using a paired t-test. Based on the t-count results obtained at -34,000 with a significance of 0.000 <0.05, H0 is rejected and H1 is accepted. So it can be concluded that the RME-based LKPD product is effective for increasing students' problem-solving abilities in learning mathematics on speed and discharge material for class V SD/MI.

The effectiveness of RME-based LKPD products to improve students' problem-solving skills in this study is supported by several previous studies. Several relevant studies related to the development of LKPD based on the RME approach to research (Yanti et al., 2022). The results showed that the developed Realistic Mathematical Education (RME)-based mathematics LKPD was valid and practically used in learning. further research that is (Hidayat & Irawan, 2017), Based on the validity test results, the RME based LKS with the problem solving approach included in the category is very valid with the percentage of 81%. While the test results of practicality during large group trials, LKS based on RME with problem solving approach including very practical. Based on the result of postes, students' math problem solving ability has been classified as good.(Gustin et al., 2020), The results showed that the student worksheets based on RME had met the valid and practical criteria. The results of this study indicate that: 1) the development of mathematical student worksheets (LKPD) based on a realistic mathematics education model in grade V can be used as teaching materials as a supplementary mathematics teaching materials in the elementary school, 2) teachers' assessment on the of worksheet obtained a score of 95%, with the criteria of "Very Good", 3) response of students to the mathematical worksheet obtained an average score of 93%, with the criteria of "StronglyAgree", 4) the worksheets affected students' learning achievement. The worksheets can be functioned to complete mathematics teaching materials, which can be used in the learning process in elementary school (Septian et al., 2019). Based on the test results, it was found that the resulting LKPD met the practical requirements with an average final practicality of 91.25% in the "very practical" category. Based on these findings, it can be stated that the LKPD with a realistic mathematical approach to facilitation the mathematical understanding skills of class seven SMP/MTs pupils on comparative material is valid and practically applied in class (Desi Fitriyani, Nahor Murani Hutapea, 2023).

Relevant research that supports is (Zulfan Hanif Rahman, 2022), (Taufik Qurohman, 2017), (Gee, 2019), (Elwijaya et al., 2021), (Sintawati et al., 2020), (Mulyati, 2017) in this research study proves that the RME approach is effective for improving students' mathematical problem solving abilities.

The difference between previous research and research conducted is the research subject, the focus is to see the effectiveness of LKPD in improving

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students' mathematical problem solving abilities and the last is the material presented.

CONCLUSION

Based on the results of the research and development that has been carried out with the title "Development of RME-based LKPD to Improve Problem Solving Ability in Mathematics Learning Class V SD/MI" it can be concluded that: The developed RME-based LKPD product is suitable for learning mathematics in class V SD/MI with material velocity and discharge. The product of this research has been validated by material experts, media experts, and linguists. The material expert validation score was 88.16, and the media expert validation score was 88. Furthermore, the developed RME-based LKPD product is effective in improving problem-solving skills. This is evidenced by the difference in n-gain acquisition between what students obtained through the pretest and posttest before and after the learning process using RME-based LKPD products. An increase in learning outcomes can be shown from the results of the pretest with an average value of 45.4, an increase after the posttest with an average value of 77.8 with an n-gain obtained of 0.63 normalized in the medium classification so that the level of effectiveness is effective.

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