Volume 6, Nomor 1, Juni 2022
Numerical: Jurnal Matematika dan Pendidikan Matematika
http://journal.iaimnumetrolampung.ac.id/index.php/numerical
DOI:https://doi.org/10.25217/numerical.v6i1.

Development of Local Wisdom Realistic Mathematics Education Based Students Activity Sheet on Students' Mathematics Problem Solving Ability

Elvin Ervi Ladona[1]*, Caswita[2], Alben Ambrita[3]

[1, 2, 3] Lampung University, Indonesia
Correspondence: ✉ elvinladona.90@gmail.com

Article Info

Article History
Received: 27-04-2022
Revised: 10-05-2022
Accepted: 07-05-2022

Keywords:

DAM Raman and Capit Urang; Problem Solving Ability; Realistic Mathematics Education; Student Activity Sheets (LKPD)

Abstract

The selection of Student Activity Sheets (LKPD) is carried out to direct students' independent learning to help them understand the material. With local wisdom RME-based LKPD, students have a relatively firm understanding of mathematical problems. This study aims to develop LKPD products based on Realistic Mathematical Education (RME) with local wisdom of DAM Raman and Capit Urang Metro tourism objects on KPK and FPB materials that are suitable for use and are effective in mathematical problem-solving abilities. This type of research is research and development research and development (RnD) Borg and Gall. The population of this study was fourth-grade elementary/MI students in the Madrasah Working Group (KKM) 2 Metro City. The sampling technique used the class IV purposive sample technique at MINU Metro. The results of this study indicate that the development of RME-based LKPD products with local wisdom is declared feasible based on the results of validation from experts and is practical to use in terms of attractiveness, convenience, and usefulness. RME-based worksheets are effectively used in students' mathematical problem-solving abilities.

INTRODUCTION

The fact is that students think mathematics is a complicated subject to solve, based on the learning mathematics objectives [1]–[3]. It can be seen that mathematics learning activities can develop students' various abilities. One of these abilities is problem-solving ability. On the other hand, the students' ability to solve problems can be started by building confidence in students' abilities to learn mathematics (Pisa Result in Focus, 2018).

Based on observations in three Madrasah Ibtidaiyah (Islamic Elementary School) Metro City Lampung. MINU Purwosari Metro Utara, MIN 2 Metro, and MIS Al Kairiyah, mathematics learning lacks personal readiness, infrastructure, and not the optimal implementation of education. The facts show that the learning outcomes of the performance of mathematics learning are mostly still low, namely, as many as 60% of students at MINU Purwosari Metro have incomplete learning outcomes. Meanwhile, at MIN 2 Metro, 60% of students have not completed their learning, and MIS Al Kairiyah, 50% have not completed education.

The analysis states that it is necessary to develop different product designs to support learning. Educators also note that the LKPD used is not self-made, or the Student Activity Sheet (LKPD) has not been developed through the RME learning model linked to local wisdom at MINU Metro Utara, so educators agree if developed teaching materials in the form of RME-based worksheets to make it easier for students to learn mathematics.

The following results were obtained from the observations: 1) the school has implemented the 2013 curriculum to make it easier for researchers to conduct research, 2) the class facilities for

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discussion are adequate. In addition to observations, interviews with educators and principals of MINU Metro Utara obtained information that: 1) educators already understand the implementation of the 2013 curriculum, 2) educators have used LKPD but have not developed it, 3) educators have experience in teaching as elementary school teachers, 4) educators agree that teaching materials in local wisdom RME-based LKPD are developed to make it easier for students to learn mathematics, 4) the principal supports research at the school, 5) the principal allows the use of facilities and infrastructure to support research.

The research that has been carried out and supports this RME-based LKPD development research are as follows: [4]–[13]. Several previous studies have developed and implemented RME-based learning to improve the mathematical problem solving that students must achieve. However, this study provides a gap by including the local wisdom of the North Metro community, namely Raman and Capit Urang DAM nature tourism, as educational tours for elementary school students so that learning can provide more invasion and interest.

Figure 1 & 2. DAM Raman and Capit Urang Resort

METHOD

This study combines research and development models and quantitative methods. The development model used is the ADDIE model and uses a quantitative methodology with pre-test and post-test control group designs [14]. The development of LKPD uses the RME approach by linking the local wisdom of the Metro community, namely DAM Raman and Capit Urang resort. The sample used a purposive sample technique by taking fourth-grade students at MINU Metro City who represents KKM 2 Metro City students. Data collection techniques include observation, questionnaires, tests, and documentation—analysis of field research data using the Independent Sample t-test.

RESULT AND DISCUSSION

Development of Qur'an and Hadith-Based Mathematics Module

1. Analisis

Development research has been carried out at Madrasah Ibtidaiyah Nahdlatul Ulama (MINU) Metro City by producing LKPD based on Realistic Mathematical Education in the fourth-grade mathematics subjects of SD/MI. This stage begins with filling out a questionnaire addressed to subject teachers and fourth-grade students at MINU Metro. The development examines how learning activities are carried out by teachers and the learning media used to support learning activities.

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Based on observations of the problems in learning activities already have LKPD. However, the LKPD that has been owned so far has not been able to maximize student learning outcomes and cannot be used by students as a medium for independent learning because the materials and learning models are less attractive. In addition, students are not required to seek and find their concept of the material being studied but only receive an explanation of the material from the teacher. Teachers and students also stated that the use of the existing LKPD was not enough to be used as a learning medium, so other learning media were needed, namely LKPD, which presented more interesting dialogue images or stories with creative learning models so that it could encourage students' interest in learning activities in the classroom.

Furthermore, a questionnaire was distributed on student needs for the LKPD used by students, requiring the LKPD physical patch to be made more attractive by presenting attractive pictures and using language that is easy to understand, not only containing homework requiring LKPD that provides clear usage guidelines. It can be used as discussion material with friends. The need for LKPD can increase cooperation. Students need LKPD to offer clear examples before doing the evaluation. Students need LKPD that can encourage the learning objectives to be achieved. Students need LKPD, which has sub-theme evaluation. Students need LKPD, which presents a broader range of material to improve learning outcomes.

2. Design

Based on the results of the analysis of student and teacher needs, the development of LKPD based on the Realistic Mathematical Education Framework of the LKPD is carried out as follows:

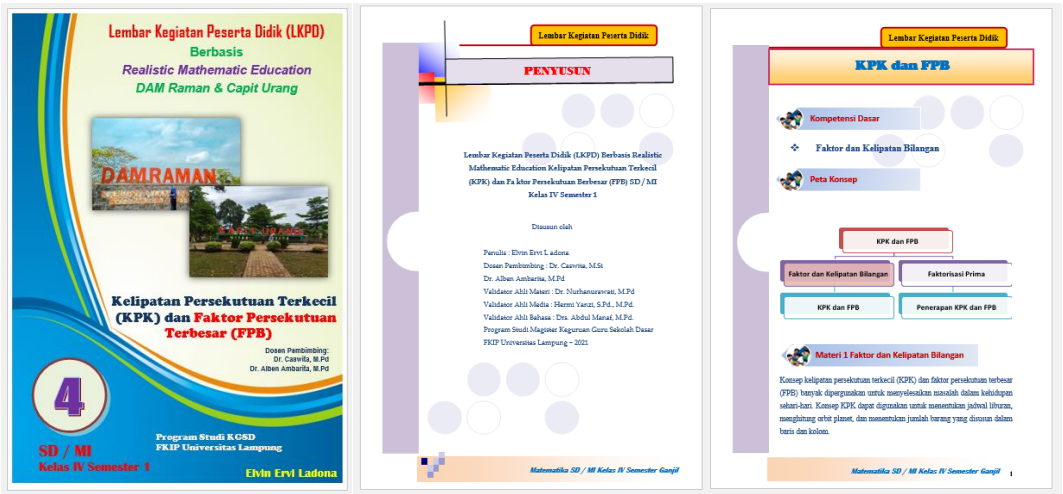

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Figure 3. DAM Raman and Capit Urang Local Wisdom RME based LKPD

The product development design is carried out based on a needs analysis of the teachers and students who state that the existing LKPD is not enough to be used as a learning media. So other learning media are needed in the form of LKPD, which presents pictures of dialogue or more interesting stories with creative learning models to encourage student interest in learning activities in the classroom. Furthermore, product development begins with limited trials to get comments and minimize errors from teachers and students.

3. Development

The product development was carried out based on a needs analysis of teachers and students who stated that the existing LKPD so far was not sufficient to be used as a learning medium, so other learning media were needed in the form of LKPD. It presented pictures of dialogue or more interesting stories with creative learning models to encourage student interest in learning activities in the classroom. Furthermore, product development begins with limited trials to get comments and minimize errors from teachers and students.

a. Expert Test

1. Media Expert Assessment Results

Based on the media expert test results, the LKPD media needs to be improved to make the layout section more attractive. The choice of contextual images or close to students, the chart is made more beautiful, the selection of pictures or illustrations reduces the description that is too long, remember LKPD is a design to achieve learning objectives or indicators. Based on the expert test, improvements were made by the suggestions for improvement given by media experts. The recapitulation of media expert test results can be seen in table 1.

Table 1. Validator Assessment Score

Aspect Assessment Quantity	Score	Maximum Score
Attractiveness	10	12
Integration	7	8
Convenience	10	12
Total Score	27	34
Value	79%	

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2. Content Expert's Assessment Results

The material test results suggest that the introduction of each material is adjusted, and the sentences in the problem must be clear and complete. Based on the expert test of the material, improvements were made by the suggestions for improvement given by the expert. The recapitulation of the content/material expert test results can be seen in table 2.

Table 2. Validator Assessment Score

Aspect Assessment Quantity	Score	Maximum Score
LKPD accuracy with learning materials	35	40
LKPD content quality	15	20
Total Score	50	60
Value	**83%**	

3. Linguist Expert Assessment Results

The linguist test results, the writing of the typeface on the LKPD, and the core and essential competencies should be adjusted to the others. Standardizing terms, capital letters, and language names using a period afterward need to be improved. Based on the test of the linguist, improvements were made by the suggestions for improvement given by the expert. The recapitulation of the results of the linguist test can be seen in table 3.

Table 3. Validator Assessment Score

Aspect Assessment Quantity	Score	Maximum Score
Straightforward	12	12
Communicative	11	12
Font	8	8
Use of terms, symbols or pictures	10	12
Total Score	41	44
Value	**93%**	

b. Initial Product Revision

After the use trial was carried out, the developer made no revisions because the product did not have weaknesses and shortcomings, so the product could be said to be feasible to produce. Modification of the final product is carried out based on the results of usage trials. The revision was adapted to comments and suggestions from teachers and students. The results in the trial users are not too many revisions. The data obtained also shows satisfactory results, so that at this stage, no product revision is carried out. The next activity is to produce LKPD based on Realistic Mathematical Education. Limited production is only done for research purposes.

The results of material expert validation data, media expert validation, and linguist analysis of teacher assessment data and field trial data or student assessments can be seen in the feasibility of the LKPD. It can be seen that all aspects of the evaluation are from material experts, media experts, linguists, and students. All of them ranged in the mean in the good-very good category. The average score from the validation results has good criteria. Thus, the development of LKPD based on Realistic Mathematical Education at MINU Metro that has been developed is declared feasible to use.

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c. Initial Product Trial

Initial product trials were carried out to correct the feasibility of the developed product, namely in the form of KPD based on Realistic Mathematical Education, to measure the effectiveness of the product in terms of student learning outcomes based on student responses in class IV Madrasah Working Group (KKM) 2 Metro City. Small groups conducted initial trials involving nine students in the Madrasah Working Group (KKM) 2 Metro City class IV. This trial distributed questionnaires to students to find out the responses of the LKPD developed. This trial aims to determine whether the development of LKPD based on Realistic Mathematical Education is appropriate for use in the following learning process. The responses of class IV students of the Madrasah Working Group (KKM) 2 Metro City are as follows:

Table 4. Student Assessment Responses in the initial product use test

No	Type of test	Mean Score	Qualitative
1	The attractiveness of LKPD	3.70	Good
2	Ease of LKPD	3.60	Good
3	The benefits of LKPD	3.50	Good

It is known that the percentage of attractiveness obtained is 3.70 good category, the ease of getting is 3.60 good category, and the rate of usefulness is 3.50 good.

d***. Final Product Revision***

After the initial product design is carried out to determine whether there are still discrepancies or errors in the product design so that they are corrected and product improvements are developed, at this stage, the researcher then corrects or revises the LKPD validated based on suggestions for improvement and design validation.

These tests or trials can be carried out through individuals, small groups, or field tests in the actual learning process using the developed media. In comparison, revision is an activity to improve things that are considered necessary to improve the test results. If all these steps have been carried out and it is deemed that nothing else needs to be revised, then the next step is that the media is ready to be produced.

4. Effectiveness Local Wisdom RME based LKPD

The results of the pre-test scores can be seen in Table 5 below:

Table 5. Homogeneity Test Average Pretest Value

		Levene Statistic	**df_1**	**df_2**	**Sig.**
Pre-test	Based on Mean	0.263	1	56	0.610
	Based on Median	0.256	1	56	0.615
	Based on Median and with adjusted df	0.256	1	43.17	0.615
	Based on trimmed mean	0.273	1	56	0.603

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The homogeneity test of the average pre-test value of the experimental class and the control class shows that the significance level (sig.) based on the mean is more significant than 0.05, which is 0.610. Likewise, if the measurement basis is the median data (based on median), the significance number (sig.) of 0.615 is still greater than 0.05. So it can be concluded that the data come from populations with the same variance (homogeneous).

Table 6. Homogeneity of the Average Posttest Data on Learning Outcomes

		Levene Statistic	**df_1**	**df_2**	**Sig.**
Post-tes	Based on Mean	0.221	1	56	0.640
	Based on Median	0.051	1	56	0.822
	Based on Median and with adjusted df	0.051	1	54.701	0.822
	Based on trimmed mean	0.129	1	56	0.721

The homogeneity test results of the average post-test data on learning outcomes in the experimental and control classes show that the significance level (sig.) based on the mean is more significant than 0.05, which is 0.640. Likewise, if the measurement basis is the median data (based on median), the significance number (sig.) of 0.822 is still greater than 0.05. So it can be concluded that the data come from populations with the same variance (homogeneous).

Knowing the effectiveness of using LKPD based on Realistic Mathematical Education with those who do not use it at MINU Metro, students are given a pre-test to see their initial abilities before being given action or learning by using LKPD. Students are given a post-test to determine the goals that can be achieved and see the effectiveness of LKPD.

The gain score data can be seen in the table below:

Table 7. Data Gain Score Experiment and Control Class

Data/ Source	N	Tes	Average -Rata	Gain Score
Experimental class	29	Pretest	68	0.47
		Post-test	83	
Control class	29	Pretest	62	0.42
		Post-test	78	

The pre-test and post-test gain results were analyzed using Normalized Gain calculations. The calculations obtained that the average gain for the experimental class was 0.47. The score has reached an average of $0.47<g<0.7$, which is included in the medium Normalized Gain classification. Based on the test results, the Independent Sample T-Test obtained a significant (sig) $0.000 < 0.05$. Thus, it can be concluded that there is a difference in the gain index of the students' mathematical problem-solving ability test results using RME-Based LKPD with students who use teaching materials at school.

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Discussion

1. Development of LKPD based on Realistic Mathematical Education of Local Wisdom

The development of local wisdom RME-based LKPD is presented with a study of the revised development product covering the suitability of the product produced for growth and the advantages and disadvantages. This development research aims to create local wisdom RME-based LKPD of DAM Raman and Capit Urang for fourth-grade students of MINU Metro Utara, which is developed in an attractive, accessible, practical, and effective way as a learning medium. It can be used independently, containing material, examples of practice questions and competency tests, and answer keys that facilitate students to find a concept based on a problem. The availability of learning media in local wisdom RME-based LKPD can help students understand the idea of the material more easily.

The material presented in the LKPD is adjusted to learning indicators with RME steps that link tourist objects in DAM Raman and Capit Urang with student life. Students are directed to formulate problems related to game activities, swimming, and material related to the concept of numbers. The teacher guides the students to analyze the situation from various student points of view. So that students can determine solutions to solve these problems. From the problem-solving results, students conclude solving these problems.

The study results are by the theory of Dhari and Haryono (2013: 22). What is meant by LKPD is a sheet containing guidelines for students to carry out programmed activities. Trianto (2009: 222) defines LKPD as a student guide used to carry out investigations and problem-solving actions. The LKPD developed has the potential to stimulate the involvement of students in the activity of finding the concept of competency and the involvement of solving problems arranged in the form of exercises. Manurung et al. (2020) mention that realistic mathematics-based learning tools effectively improve mathematical problem-solving ability and effectiveness.

Sepriyanti & Putri (2018) explain that one of the learning resources developed by teachers can motivate students to understand the meaning of learning material by connecting it with the context of their daily life lives. A good LKPD includes learning objectives and indicators that students must achieve, instructions for using learning on the LKPD, learning materials, summaries or outlines of learning materials, assignments and exercises as learning evaluations, questions to evaluate the level of mastery of learning materials, and keys. Answers so that students can directly prove the answers to the questions that have been done. Based on some of the understandings of the LKPD above, it can be concluded that the LKPD is a teaching material arranged systematically and attractively, including material content, methods, and evaluations that can be used independently to achieve the indicators that have been set.

The preparation of LKPD has specific requirements. According to [16], a good LKPD must meet various requirements. These requirements include didactic requirements, construction requirements, and technical requirements. Didactic requirements regulate universal LKPD, which can be appropriately used for slow or intelligent students. As a form of means for the teaching and learning process to occur, it must meet didactic requirements, meaning that an LKPD must follow the principles of effective teaching and learning. Construction requirements are requirements relating to the use of language, sentence structure, vocabulary, level of difficulty, and clarity, which must be appropriate so that students can understand it.

Based on the calculation of the validator's assessment of media experts and student respondent questionnaires, the percentage of eligibility for using LKPD in class IV MINU is

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obtained. The calculation results got the rate of eligibility for RME-based LKPD. Media experts 80 (very decent category), the average assessment of material experts 90 (the suitable type) and linguistic experts 93 (very proper category), student response questionnaires on the attractiveness aspect of respondents obtained an average of 79 with good categories, data obtained from Field operational trials received the percentage of the attractiveness aspect of the respondents got 79% in the excellent class, the portion of the convenience aspect obtained by 78% in the outstanding category, and the usefulness aspect by 78% in the excellent category, with an average percentage of 78% in the superb category used in learning.

2. LKPD is based on Realistic Mathematical Education for solving mathematical problems

Problem-solving in mathematics is not just solving a given problem. The problem-solving process makes students able to cope with the complexities of life. The ability of students to solve problems has the potential to provide successful experiences for students, both individually and in groups. Based on the principles and characteristics of Realistic Mathematics Education, it has enormous potential to play a role in growing students' problem-solving abilities.

The effectiveness level of using LKPD is feasible to be applied to class IV students of MINU Metro Utara. Students are given a pre-test to see the initial abilities before being given action or learning by using LKPD. Students are given a post-test to determine the goals that can be achieved and see the effectiveness of LKPD. The pre-test and post-test results were analyzed by calculating the Normalized Gain. Based on the results of the Gain calculation, the average gain for the experimental class was 0.47. The score has reached an average of $0.47 < g < 0.7$, included in the medium normalized gain classification. The Student Worksheet is feasible and effective as a learning medium. This learning worksheet can be used as an engaging, easy-to-use, practical, and effective learning medium to teach understanding about RME.

The influence factors of mathematical problem-solving skills are that learning has always been a less desirable study, so students lack the motivation to learn mathematics [17]–[19]. The mathematics learning process generally still familiarizes students with doing exercises on routine questions and memorizing formulas more, the tendency of the learning process to only focus on 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.

The study results are supported by [20] on the Development of Learning Tools Based on Realistic Mathematics Education Approaches to Improve the Mathematical Problem Solving Skills at X Grade in High School. The results of data analysis show that students' mathematical problem-solving skills are still low because learning tools do not support students to improve problem-solving skills. The learning process is still focused so that there is no visible interaction between teachers and students as well as fellow students, students are less involved in the learning process.

From the opinion above, it can be concluded that the Realistic Mathematics Education method is a method that invites students to think, not just listen, but look for solutions to solve problems in the learning process. This problem-solving method is better if done individually but can also be done in groups. Students will become active and motivated to carry out an activity. In addition, this method can also be interpreted as a method for obtaining various kinds of ideas from a group of students.

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CONCLUSION

Local wisdom RME-based LKPD is valid for Class IV MINU Metro students. The LKPD product based on the RME model has been validated by three experts, namely material, media, and linguistic experts. With the acquisition of a material expert validation score of 83, then a media expert validation score of 79, and a linguistic expert validation score of 93. The RME-based worksheets developed effectively use mathematical problem-solving skills with the average N-Gain value of students in the medium category.

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Print ISSN: 2580-3573, Online ISSN: 2580-2437

Print ISSN: 2580-3573, Online ISSN: 2580-2437