

DEVELOPMENT OF LKS BASED ON REALISTIC MATHEMATICS EDUCATION (RME) ON ONE VARIABLE LINEAR EQUALITY AND INEQUALITY

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Abstract

This study uses development research using the ADDIE model, which includes five stages: *Analysis, Design, Development, Implementation, and Evaluation*. This study aims to produce a teaching material product, namely the Realistic Mathematics Education (RME) Based Student Worksheet (LKS), feasible or valid and practical. This research has done at SMP Muhammadiyah 7 Bayat, Bayat, Kab. Klaten. The subjects of this study were experts, namely lecturers, teachers, and students of class VII SMP Muhammadiyah 7 Bayat, totaling ten people. The type of data used is in the form of quantitative and qualitative data. The data collection instrument used in this study was a questionnaire. Based on the validity test results, the Realistic Mathematics Education (RME) based Student Worksheet (LKS) stated in the very feasible or very valid category, with the percentage data from material experts being 87.5%. The results of the percentage data from teaching materials experts being 90.2% included in the very feasible or very valid category. Based on the results of the practicality test using a student response questionnaire based on the Realistic Mathematics Education (RME) Student Worksheet, this includes in the efficient category with a percentage result of 86.92%. The results show that the Realistic Mathematics Education (RME) based Student Worksheet (LKS) on the material of one-variable linear equations and the developed inequalities can employ in learning mathematics.

Keywords: student worksheet, realistic mathematics education, ADDIE model.

Abstrak

Penelitian ini menggunakan penelitian pengembangan dengan menggunakan model ADDIE yang meliputi 5 tahap yaitu : *Analysis, Design, Development, Implementation, Evaluation*. Penelitian ini bertujuan untuk menghasilkan sebuah produk bahan ajar yaitu Lembar Kerja Siswa (LKS) Berbasis Realistic Mathematics Education (RME) yang layak atau valid dan praktis. Penelitian ini dilakukan di SMP Muhammadiyah 7 Bayat, Bayat, Kab. Klaten. Subjek penelitian ini adalah para ahli yaitu dosen, guru, dan siswa kelas VII SMP Muhammadiyah 7 Bayat yang berjumlah 10 orang. Jenis data yang digunakan berupa data kuantitatif dan kualitatif. Instrumen pengumpulan data yang digunakan pada penelitian ini adalah angket. Berdasarkan hasil uji validitas, Lembar Kerja Siswa (LKS) berbasis *Realistic Mathematics Education* (RME) dinyatakan dalam kategori sangat layak atau sangat valid dengan data presentase dari ahli materi adalah 87,5% dan hasil data presentase dari ahli bahan ajar yaitu 90,2% termasuk dalam kategori sangat layak atau sangat valid. Berdasarkan hasil uji kepraktisan yang menggunakan angket respon siswa Lembar Kerja Siswa berbasis RME (*Realistic Mathematics Education*) ini masuk kedalam kategori sangat praktis dengan hasil presentase 86,92%. Dari hasil tersebut menunjukkan bahwa Lembar Kerja Siswa (LKS) berbasis *Realistic Mathematics Education* (RME) pada materi persamaan dan pertidaksamaan linear satu variabel yang telah dikembangkan ini dapat dipergunakan dalam proses pembelajaran matematika.

Kata kunci: lembar kerja siswa, realistic mathematics education, model ADDIE.

INTRODUCTION

Mathematics is a subject that is not liked by many students. In accordance with what was explained by Doli & Armiami (2020), mathematics is the topic that students despise the most since it is a theoretical discipline with numerous symbols and formulae that make it tough for pupils to grasp. In addition, according to Simanulang (2013), mathematics is one of

the methods of reasoning which is necessary logically to foster reasoning, valid, orderly, and firm reasoning. According to Helma et al. (2018), mathematics is basically a reasoning interaction that includes constructing, applying reflection, and connecting ideas and smart thinking. Based on some of the explanations above, it can be concluded that mathematics is a subject in which there are many symbols and formulas that require logical reasoning. Therefore students are expected to learn mathematics. Learning mathematics is a high mental movement, so learning mathematics must be carried out continuously and sequentially and based on the experiences students have gained (Azis et al., 2021). According to Mulyani (2021), learning mathematics does not only maintain equations, but students must contemplate how to find solutions according to the ideas and steps. Learning mathematics is not easy, and there are several things that can affect the success of learning mathematics. Factors that directly affect student learning outcomes for the need for context-oriented science progress that demonstrates the coordination of related information material and a reasonable methodology are learning styles (Helma et al., 2018). Meanwhile, the student experience is an important variable that will create factors of interest, mentality, and inspiration in concentrating on Mathematics. Teachers are expected to pay attention to the methods and teaching materials they use during the mathematics learning process when carrying out this activity. One of the things that need to be improved and developed to determine how well students learn mathematics is to use of teaching materials.

The term teaching materials can also be used to refer to all types of materials that are systematically organized that are designed according to the applicable curriculum, and allow students to learn on their own (Magdalena et al., 2020). With a view to improving the quality of the learning process, these teaching resources enable students to study the mathematics learning material in a systematic and coherent manner so that they can master the material holistically. Teaching resources through print media that can be used in class by teachers and students are LKS (Student Worksheets).

LKS is a teaching material that can help students learn (Mulyani, 2021). According to Khusna et al. (2016), worksheets are visual aids in the form of sheets containing assignments in the form of questions that can direct students to find some information that alludes to a basic skill that students must master. In LKS, students will get material, summaries, and assignments related to the material, and there are sub-materials to understand the material

given so that it will cause students to become independent (Haryonik & Bhakti, 2018).

The use of this worksheet activates the learning process in the classroom to increase student learning activities, facilitate students' understanding of the material, and encourage student independence through various assignments and questions. The preparation of an LKS requires a learning approach as a reference. Where a learning approach is needed that involves students actively so that the teacher does not always present the material. Students are also taught to think critically, taught how to analyze a problem, and encouraged to discuss and share thoughts. Therefore, students need LKS whose learning approach tends to be realistic.

RME (*Realistic Mathematics Education*) is an elective learning that expects students to construct information with their own abilities through exercises they do in learning exercises (Khusna et al., 2016). Because students build their own knowledge, this RME-based learning provides an opportunity for them to reinvent and construct mathematical concepts based on realistic problems presented by the teacher. In addition, by incorporating the realities of life, the learning process becomes more enjoyable. The RME approach makes students learn mathematics easily. Judging from the presentation of the problems above, research will be carried out entitled "Development of LKS based on RME (Realistic Mathematics Education) on the Material of One Variable Linear Equations and Inequalities."

METHODS

This research employs development research (Research and Development). The goal of this research is to create an RME-based LKS (Realistic Mathematics Education) product on one-variable linear equations and inequalities. Students will learn more about learning mathematics with the aid of this product. In this study, class VII students from SMP Muhammadiyah 7 Bayat were the participants.

The research and development model used in this research is the research *and development (R & D)* of the ADDIE model. According to Fitria et al. (2018), models an easy-to-use learning system design is the ADDIE model, which describes the basic stages of a learning system. The five stages of the ADDIE development model are referred to in this research and development model, namely 1) Stages of Analysis (*Analysis*); 2) Design Stages (*Design*); 3)

Development Stage (*Development*); 4) Implementation Stages (*Implementation*); 5) Evaluation Stage (*Evaluation*).

The research instrument used by researchers to validate worksheets is a questionnaire that will be distributed to validators and students. The validators for this research instrument consisted of two expert lecturers at the University of Muhammadiyah Surakarta and two teachers at SMP Muhammadiyah 7 Bayat. The questionnaire consists of a validity questionnaire and a practicality questionnaire. Data collection using this questionnaire technique was carried out to determine the validity and practicality of the worksheet products that had been developed. The questionnaire will be given to the validator to find out the validity of the LKS, while to find out the level of practicality, the researcher will use a questionnaire that will later be given to students. This questionnaire uses a Likert scale in assessing worksheets. The Likert scale consists of 4 assessment categories, namely (1): Not good, (2): Fair, (3): Good, and (4): Very good. The results of the questionnaire were analyzed using a validation assessment according to Sudijono (2019) from (Melianti et al., 2020), namely as follows:

Table 1. Validate Level Of Validator

Percentage	Qualification	Information
0% - 25%	Not Good Enough	Very Unworthy
26% - 50%	Enough	Not Worth It
51% - 75%	Good	Worth the Revision
76% - 100%	Excellent	Very Decent

The researcher first looks for the questionnaire's average value and relative frequency value. The formula for finding the average value is as follows:

$$M_x = \frac{\sum X}{N}$$

Where M_x is the mean (average), $\sum X$ is the sum of the entire scores, and N is the sum of the scores. Then look for the calculation of the percentage score that can be calculated using the formula:

$$\text{Percentage score (\%)} = \frac{\text{Average score}}{\text{Highest score}} \times 100\%$$

After obtaining the percentage score, it adapts to Table 1 the Validity Level of the validator. With Table 1, researchers can see whether the percentage of the assessment results is feasible based on the Likert scale of each validator and applied to the results of the LKS practicality test for class VII students of SMP Muhammadiyah 7 Bayat.

Both qualitative and quantitative data analysis approaches were employed as the data analysis method in this study. Techniques for qualitative data analysis are used to handle information coming from professional assessments of worksheets in the form of recommendations for improvement. Quantitative data analysis approaches employ descriptive techniques in which the findings will be in the form of descriptions of the outcomes of product validity and practicality tests.

RESULTS AND DISCUSSION

In this activity there are five stages to find out the practicality of the worksheet product, while the first stage is reality in this stage which presents contextual problems in students' daily lives. Then students are given contextual problems, students are given the opportunity to analyze the information contained in contextual problems. The next stage is solving contextual problems independently by filling in the gaps. After solving contextual problems, students are given the opportunity to discuss concepts and students are directed to solve other contextual problems. After students carry out all activities, students are directed to be able to conclude the concepts and definitions that have been discussed regarding contextual issues.

The findings of this study come from the use of the ADDIE paradigm in the creation of RME-based LKS on one-variable linear equations and inequalities. The ADDIE paradigm has the following stages: analysis (analysis), design (design), development (development), implementation (implementation), and evaluation (evaluation) (evaluation). It may be explained as follows using the ADDIE model's phases.

Analysis Stage

This analysis stage contains a needs analysis, including competency, material, and student character analysis. This stage begins with analyzing competencies which analyzes Basic Competence (KD) which refers to the K-13 curriculum. The material developed in this research is one-variable linear equations and inequalities, which are materials for class VII students of junior high school. The curriculum contains essential competencies for one-variable linear equations and inequalities and indicators of achievement of competence in one-variable linear equations and inequalities, as seen in Table 2.

Table 2. Essential Competencies And Indicators Of Competency Achievement

Basic Competencies	Competency Achievement Indicators
3.6 Explaining one-variable linear equations and inequalities and their solutions	3.6.1 Identifying the concept of one-variable linear equations 3.6.2 Identifying the concept of one-variable linear ordering
4.6 Solving problems related to one-variable linear equations and inequalities	4.6.1 Solving contextual problems relating to the linear equation of one variable 4.6.2 Solving contextual problems relating to one-variable linear ordering

The next stage is the stage of student character analysis. Based on the observations on mathematics learning activities for class VII students of SMP Muhammadiyah 7 Bayat, it can deduce that students need help understanding contextual problems. The learning process still uses conventional learning models where teachers are more active in explaining material to students. Students feel bored with LKS-owned students because it is less exciting and monotonous, so students rarely read the LKS.

Design Stage

At this design stage, the researcher designed an RME-based LKS (*Realistic Mathematics Education*) by compiling several components of the LKS requirements, collecting references, preparing instruments, and validating instruments. Researchers use media in the form of applications *Canva* to make cover designs, prefaces, tables of contents, instructions for using worksheets, concept maps, and material related to one-variable linear equations and inequalities.

Development Stage

The development of this LKS is carried out based on the design in the previous stage, and this LKS application uses the *Canva* application. After designing the product, the LKS that has to expand is validated by media expert validators and material experts using the questionnaires given. The questionnaire used to validate the instrument validator has agreed on it. This validation aims to see the feasibility of LKS that will examine students. Table 3 contains the findings from the material experts' validation, and Table 4 contains the findings from the instructional material experts' validation.

Table 3. Material Expert Validation Results

Assessment Indicators	Validity Value	Information
Material according to Core Competency (KI)	100%	Very Decent
Material according to the KD achieved	100%	Very Decent
Material according to the measured GPA	100%	Very Decent
Material according to the needs of the Learning Objectives	100%	Very Decent

The material is arranged in sequence	87.5%	Very Decent
The material is relevant to everyday life	75%	Worth the Revision
Image availability can assist students in understanding the material	87.5%	Very Decent
The material contained in the teaching materials supports the implementation of fun learning	75%	Worth the Revision
LKS presents problems of a contextual nature from real events in the life of students.	87.5%	Very Decent
Exercises in LKS based on the RME approach can measure the achievement of student learning outcomes.	87.5%	Very Decent
Commands in the LKS based RME approach lead learners to discover concepts.	75%	Worth the Revision
LKS directs students to be able to design, try, and solve problems.	87.5%	Very Decent
The material uses language that is in accordance with the rules of Indonesian	75%	Worth the Revision
The language used is easy to understand	87.5%	Very Decent
Text or question writing is easy to read	87.5%	Very Decent
Percentage of validity	87.5%	Very Decent

Table 4. Teaching Materials Expert Validation Results

Assessment Indicators	Validity Value	Information
LKS design packaging is attractive.	87.5%	Very Decent
The work instructions are written clearly.	75%	Worth the Revision
Accuracy of use of the typeface used in LKS.	87.5%	Very Decent
Consistent use of spaces, headings, and material typing.	87.5%	Very Decent
Accuracy of image placement.	87.5%	Very Decent
The correctness of the use of empty columns.	87.5%	Very Decent
Accuracy and consistency in the use of numbering systems.	100%	Very Decent
The text contained in this LKS can be read well	100%	Very Decent
The font size used in the LKS mathematics based on the RME approach is clear and precise.	87.5%	Very Decent
This RME-based LKS has an attractive appearance.	100%	Very Decent
The presentation of LKS is complemented by clear drawings and illustrations.	100%	Very Decent
This LKS is in accordance with the characteristics of the RME	87.5%	Very Decent
The language used is in accordance with the rules of Indonesian.	87.5%	Very Decent
The language used is easy to understand	87.5%	Very Decent
Percentage of validity	90.2%	Very Decent

Implementation Stage

After expert validators validate the LKS, this RME (Realistic Mathematics Education) based LKS examines a small group of students. Ten students became a small group to conduct the LKS trial. The results of these trials can look in Table 5.

Table 5. Practicality Test Results

Assessment Indicators	Validity Value	Information
RME-based LKS has an attractive look	85%	Very Decent
The images on the RME-based LKS are easy to understand and attract attention.	87.5%	Worth the Revision
Dapat learn independently by using this LKS	85%	Very Decent
Learn by using this LKS	85%	Very Decent
Dapat use this LKS repeatedly	87.5%	Very Decent

The use of LKS can arouse enthusiasm and learning activities in mathematics learning	85%	Very Decent
The material in LKS can relate to real contexts in everyday life	80%	Very Decent
This LKS can help in the understanding of materials and concepts	85%	Very Decent
The language used in this LKS is clear and easy to understand	97.5%	Very Decent
Text or writing on LKS is easy to read	92.5%	Very Decent
Learning with LKS does not require a long time in solving mathematical problems	85%	Very Decent
Feel easier to learn by using this LKS	90%	Very Decent
Learning with LKS makes it easier to understand the material and questions	85%	Very Decent
Percentage of validity	86.9 2%	Very Decent

Evaluation Stage

At this evaluation stage, the worksheets which will later employ in the learning process have previously been examined by expert validators and corrected according to the suggestions given by the validators. The evaluation phase brings after validating and testing the LKS on small groups of students. Researchers have evaluated the worksheets developed based on suggestions from experts and students. Offers given the advice provided by the validator in improving the worksheets, designed to be used as material for improvement and has been revised by the researcher. The suggestions given by the validator can look in Table 6.

Table 6. Validator Suggestions

Validators	Suggestion	Revision
Teaching Materials Expert 1	LKS is more adapted to the description, indicators, and characteristics of the RME itself.	It's fixed
Material Expert 1	The problems contained in the solving section have not been RME-based	It's fixed

Based on the results of data analysis conducted by material experts and teaching material experts, it shows that the RME (*Realistic Mathematics Education*) based LKS developed by researchers gets a very feasible or valid category with a percentage of 87.5% and 90.2%. The assessment results from validators show that this RME (*Realistic Mathematics Education*) based LKS is declared feasible and valid because it has a test that this LKS can employ as teaching material for the mathematics learning process. So LKS based on RME (*Realistic Mathematics Education*), developed by researchers can be used as teaching material for class VII students on one-variable linear equations and inequalities.

The results of the researchers small group practicality data analysis show that the LKS builds on RME (*Realistic Mathematics Education*), declared practical with a practicality percentage of 86.92%. These results show that the LKS based on RME (*Realistic Mathematics Education*), developed by researchers, can be used as teaching materials for class VII students on one-variable linear equations and inequalities.

CONCLUSION

Based on the results of the research that has to execute, it can deduce that the RME (*Realistic Mathematics Education*) based LKS on the material linear equations and inequalities of one variable that researchers have developed are included in the category of valid or feasible to use based on the assessment of expert validators, namely a review of 2 material expert validators, with a percentage of 87.5%, announced at a very decent level. The evaluation of 2 teaching material expert validators with a rate of 90.2 % claim at a proper level. The practicality test results tested on ten students received a percentage of 86.92%.

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