

# Development of Student Worksheets Based on RME to Improve Creative Thinking of Grade VII Middle School Students in Indonesia

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*Abstract: Creative thinking is one of the 21st century skills that students must possess in the 2013 curriculum. Learning resources that do not integrate creative thinking skills can hinder students in learning objectives. This study has three objectives. The first objective is to analyze the needs of teaching materials that are in line with student characteristics, curriculum and subject matter. The second objective is to design RME-based teaching materials that can improve creative thinking skills. The third objective is to develop and validate teaching materials that have been previously designed. The method used in this study is the 4D model which consists of defining, designing, developing and distributing. The subjects of this study were teachers and students in junior high school grade VII. Data collection instruments consisted of questionnaires, interview guidelines, and validation sheets. Data analysis techniques use Miles and Huberman. This study provides several results. First, existing student worksheets are in accordance with textbooks, students lack focus if only using textbooks, existing student worksheets are not easy to understand, teaching materials have not been able to increase students' creativity, students need teaching resources that can enhance students' creativity with examples of questions related to real life. Second, student worksheets are designed according to the RME learning model. Third, RME-based student worksheets are developed to enhance student creativity. This study concludes that the RME-based student worksheets developed are in accordance with student characteristics and curriculum. Student worksheets have been validated so they are suitable to be used to develop students' creative thinking skills.*

**Keywords:** *berpikir kreatif, Pengembangan LKS, Realistic Mathematics Education.*

## INTRODUCTION

Creativity is the result of creative thinking. Students' creative thinking ability can be seen from the way students solve a mathematical problem that includes fluent thinking skills, flexibility, authenticity (original) completion steps, detailed skills, and assessment skills (Utami, 1992; Kenedi, 2017). Creativity is a process of generating new ideas (Richardo, 2014). Student creativity is an important factor in determining the success of student learning (Kenedi, 2017).

Creativity is one of the important aspects developed in 21st century skills (Lukas, 2016). In 21st century learning students must be able to solve various problems, one of which is by creative thinking (Turiman, 2012). Not only in the 21st century learning, Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System Chapter I Article I Paragraph (1) states that the aim of the National Education System is to form creative people. Therefore in the learning process it is necessary to develop students' creativity.

But in reality, based on observations made in learning activities, students' creativity has not been maximally developed. Student creativity is not maximized in learning activities because many teachers still teach using traditional approaches, where mathematics teaching in schools is introduced in a symbolic or abstract way, and forces students to memorize (Zakaria, 2017). The traditional learning process makes students become passive learners and little talent for mathematical thinking and reasoning (Wahyu, 2015). In this case, mathematics teachers in particular, are required to always be able to create learning activities that can make creative, not monotonous, and certainly fun. Student creativity can be achieved one of them by giving

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motivation from the teacher through several methods, strategies that vary, for example through learning the work of groups, role playing, and problem solving (Laurens, 2018)

The right learning model can facilitate and support students in improving their creativity. One learning model that can be used is Realistic (Lestari, 2017). In using RME learning, mathematics is carried out by directing students to the use of variations of situations and opportunities to rediscover mathematical concepts in their own way (Dhany, 2013). Mathematics learning is in the form of human activities and must relate to reality. The important point is that mathematics must relate to reality in accordance with human activities, which means that mathematics must be close to children and relevant to everyday situations (Lestari, 2017). If the problem can be imagined or manifest in the minds of students (Maulydia, 2017).

In addition to the right learning model, the learning media must be able to facilitate and support students in enhancing their creativity. One of them is the Student Worksheet. Student Worksheets in the form of materials that contain explanations that provide guidance on activities that students will do in the learning process (Inan, 2017). Student Worksheets are a way to help and facilitate learning activities that will form an effective interaction between students and teachers and can increase student activity in improving learning achievement (Zulyadaini, 2017). Using Student Worksheets in the learning process can also help students to understand the material alone (Merdekawati, 2011). This makes students able to find new ideas, can solve problems and can find their own answers according to their creativity. Student Worksheets developed must be made clear and certainly as interesting as possible and must be related to daily life.

This article is written to analyze the curriculum used, analyze student characteristics and analyze students' needs for learning resources. The results of the analysis are used to design and develop RME-based Student Worksheets. This worksheet is expected to improve student learning outcomes and creativity. The systematic writing of articles is as follows: the first part contains the introduction, the second part describes the research method used, the third part presents the findings and the discussion, and the fourth section provides conclusions.

## **METHOD**

This type of research is development research using the 4D development model developed by Thiagarajan, Semmel and Semmel consisting of four stages, including the stages of defining, designing, developing, and disseminating (Thigarajan, 1974). Development of learning tools using the 4D development model: but the deployment stage was not carried out (Pratama, 2017). The research steps are presented in Figure 1.

The defining stage includes three analyzes: curriculum analysis, analysis of student characteristics, and analysis of student needs. Curriculum analysis in terms of alignment between syllabus, core competencies, and basic competencies in the 2013 curriculum. At the design stage to produce an initial form of product prototype. The initial product was designed based on RME. Development phase to validate the product. Product validation is done through two steps, namely: expert validation and material validation. The product was revised based on input from the validators. After that, product trials were conducted on students.

The subjects of this study were teachers and students at the junior high school level. Data collection instruments used were interview guidelines and questionnaires. Data analysis techniques used Miles and Huberman which consisted of three stages, namely: data reduction, data presentation, and conclusions (Miles, 1994).

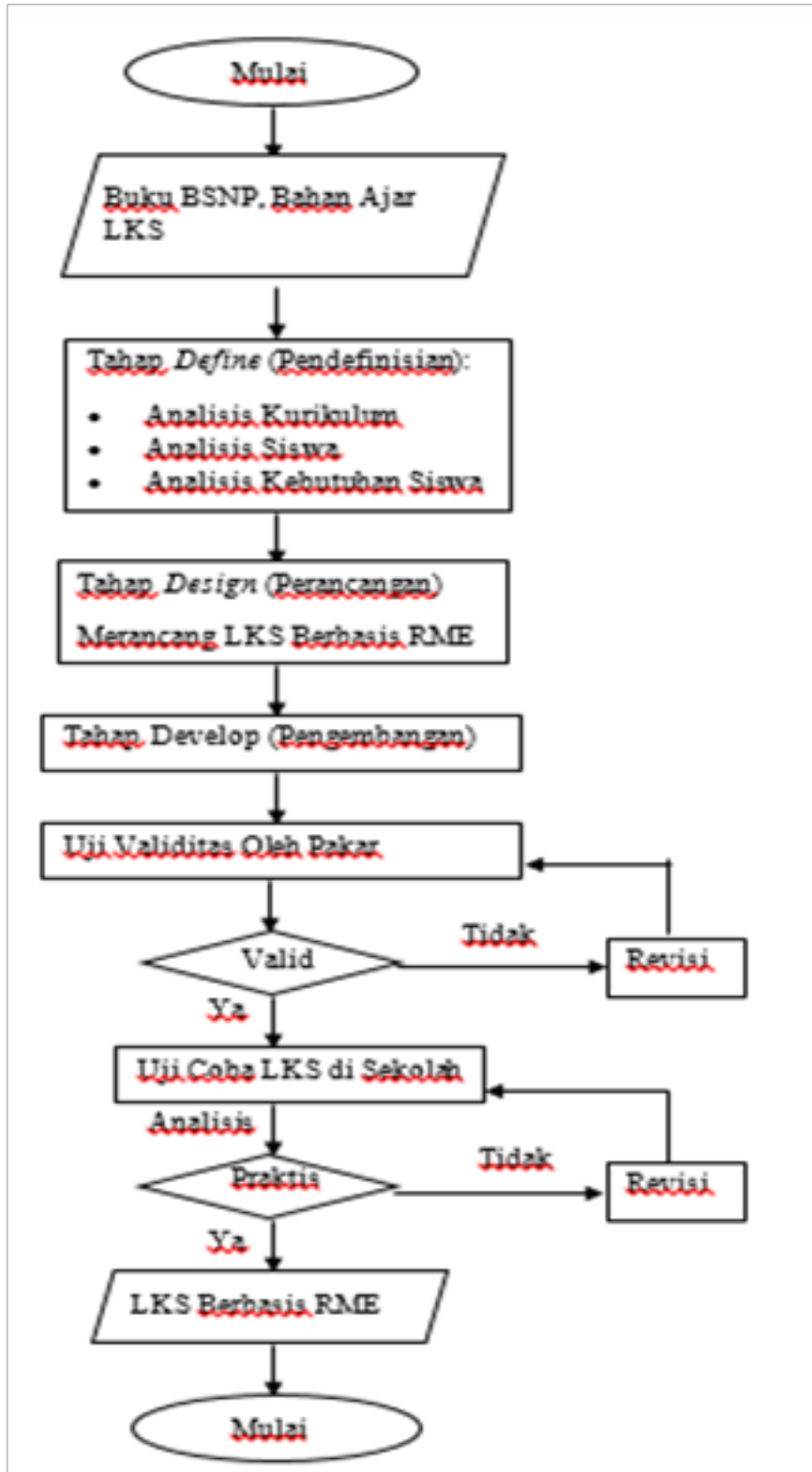


Figure 1: Research phase for developing Student Worksheets

## RESULT AND DISCUSSION

The research results from each stage in the development of RME-based worksheets are as follows:

### ***Defining Stage***

The results of the defining phase are as follows:

#### **Curriculum Analysis**

Student Worksheets that have been developed by the teacher are in accordance with the textbook instructions. Textbooks used in schools consist of teacher and student books. The textbooks used are not RME based. So that it is necessary to develop RME-based student worksheets with quadrilateral material.

#### **Student Analysis**

Based on the results of direct interviews with students obtained the following results: (a) learning using Student Worksheets makes it easy for students to understand the subject matter, (b) students lack focus in learning if only using textbooks. This is because the material in textbooks is too much. Study material can be summarized by developing LKS.

#### **Student Needs Analysis**

Based on direct interviews with students, the steps on the Student Worksheet still require teacher guidance in completing the practice questions. According to students, the instructions in the Student Worksheet are poorly understood. So, students need Student Worksheets that are easy to understand and more interesting. Learning material is easily understood by students if it is related to students' daily lives. One of the lessons that applies mathematics in everyday life is Realistic Mathematics Education (Musdi, 2016)). This can be seen when students experience problems directly given by the teacher, then students more easily understand the problem. Thus students need RME-based Student Worksheets.

### ***Designing stage***

Design of Student's Worksheet based on Realistic Mathematics Education is designed with a cover, a description of the Student Worksheet, Instructions for Using Student Worksheets, Activity Sheets, and Problem Exercises. The following are the characteristics of the Student Worksheet that have been designed:

#### **Cover**

Cover contains the title of the Student Worksheet that will be made entitled "Student Rectangles (Jajargenjang & Trapezoid) Student Worksheet". The cover design of the Student Worksheet can be seen in Figure. 2.

On the cover of the Student Worksheet is designed with an identity that describes the material to be studied. This can be seen from the title of the Student Worksheet which has mentioned the material directly. The cover of the Student Worksheet is completed with a picture of the tools and materials that will be used in the activities to be carried out on this Student Worksheet. So that students are expected to be interested and motivated in learning the Student Worksheet.

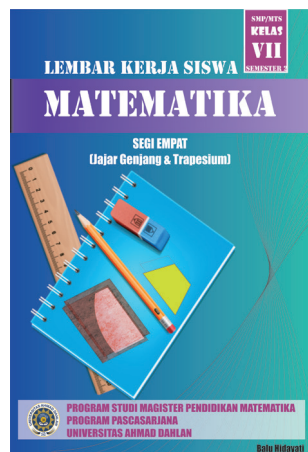


Figure 2: Cover of Student Worksheets

## Preface

Foreword expresses gratitude for the preparation of the Student Worksheet to the parties involved in the creation of the Student Worksheet. In addition to thanks, the introduction also contains hope for criticism and suggestions from the authors for the achievement of a better Student Worksheet.

## Instructions for Using Student Worksheets

Instructions for Use of Student Worksheets are designed with the aim of explaining what parts of the Student Worksheet are based on Realistic Mathematics. This guide is intended for teachers and students. Instructions for Using Student Worksheets are designed to explain parts of the Student Worksheet, so that in this guide sheet there is an explanation of the syllabus component in the Student Worksheet, Instructions on Working on Student Worksheets, Activities, Information, and Exercise questions, all of which are part of this Student Worksheet.

## Syllabus

The syllabus on the Student Worksheet is an important thing to be in the design stage. This syllabus component is used as a reference in the preparation of the material in the Student Worksheet. Syllabus of Student Worksheets based on Realistic Mathematics Education takes quadrilateral material. This material is in accordance with Basic Competencies 3.11, namely linking the perimeter and broad formulas for various types of rectangles (rectangles, rhombus, jajargenjang, trapezoid, and laying kites) and triangles. But the design of the Shiva Worksheet is only limited to Jajargenjang and Trapezoid only. Indicators of achievement of competencies and learning objectives are also written in full. One of the goals of learning is that students can solve problems in everyday life by linking rectangular material. It has to do with the definition of Realistic Mathematics Education, namely RME as contextual learning, which means students learn mathematics through real problems in a meaningful context (Searle, 2012). Same as the Student Worksheet activity based on Realistic Mathematics Education, it is designed by involving participating students to find their own concepts from the material being taught. So that the objectives of the Student Worksheet can be clearly understood, both by the teacher and students.



## Instructions on Working on Student Worksheets

Referrals in Working on Student Worksheets are designed with the aim of providing guidance to students. What things should students do in working on Student Worksheets. The Instructions on Working on Worksheets begin with the column that students must fill in their identity. This aims to help the teacher in the assessment process. This sheet also comes with study instructions. Learning objectives are given in the form of technical instructions for filling out and working on Student Worksheets. For example, students are asked to read the Worksheet carefully. In addition, the study instructions also contained 3 Realistic Mathematics Education principles, namely 1) rediscovery and progressive mathematization 2) didactic phenomenology 3) self-developed models and 5 characteristics of RME, namely 1) use of context 2) use of progressive mathematical models 3) use of results student construction 4) interactivity 5) linkages [28]. For example, students are asked to collect objects that are examples of the building they encounter in the surrounding environment. Students are asked to find a solution in the Student Worksheet by discussing with their groups in various ways according to their respective creativity. According to the third principle, for example, students are asked to conclude their own final completion according to their activities.

## Prerequisite Information

Prerequisite Information contains information about the reminder material from the material that will be submitted on this Student Worksheet. Obviously the material on this information has been submitted at a previous meeting or in elementary school. The material given is only repetition. In the form of a summary, things that have something to do with the material or activity on this Student Worksheet. The design of the Prerequisite Information sheet is in Figure.3.

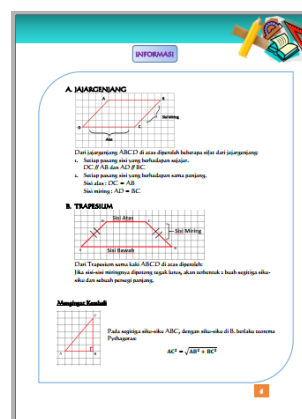


Figure 3: Prerequisite Information

The process in Realistic Mathematics Education has a mathematization process, which is a process where students are asked to build or develop mathematical models of models that have been previously formed with their knowledge [29]. Using this Prerequisite Information is expected to help students in doing all activities on the Student Worksheet which some activities in it have activities that relate to the previous material.

## Activity Sheet

The Activity Sheet contains what activities students will do in the concept discovery process. The first design is whatever tools and materials students must prepare to work on the Student

Worksheet. Furthermore, it contains the method of work, consists of providing problems, and steps to work. Design Activity sheet is in Figure. 4.

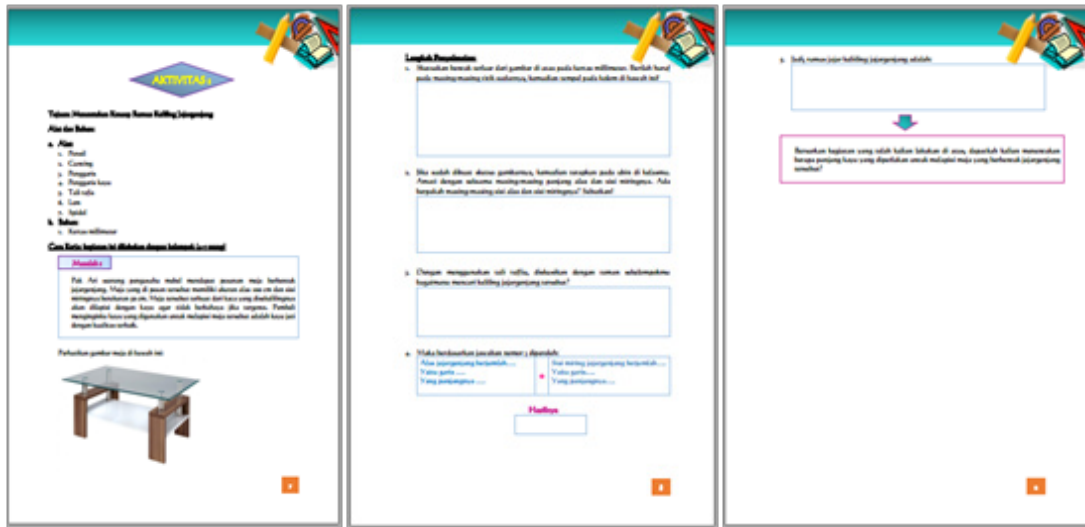


Figure 4 : Activity Sheet

The Activity Sheet begins with the provision of problems related to daily life complete with illustration pictures, because the Student Worksheet is based on RME. Furthermore, in the Activity Sheet there is a step in working on the Student Worksheet, which directs students to do learning activities. Its function, to lead students to develop their creativity in finding their own mathematical concepts according to the material in this Student Worksheet. The stages are modeling, practicing it directly, discussing with groups, linking with the previous material in the prerequisite information. All activities in this Activity Sheet are in accordance with 3 principles of RME and 5 Characteristics.

### Exercises

To find out whether students understand the material in the Activity Sheet that has been carried out, students need to be given a Problem Sheet. The design of the Problem Sheet on the RME-based Student Worksheet can be seen in Figure.5.

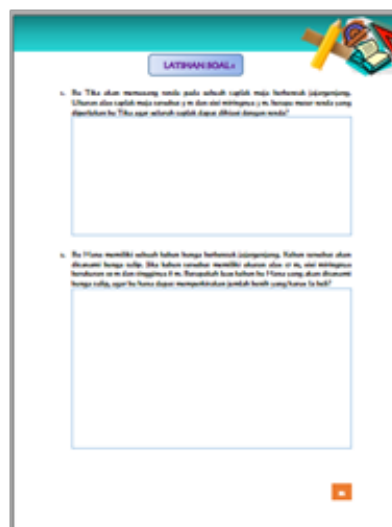


Figure 5: Exercises

There are questions in the Problem Exercise according to the activities students have done in finding mathematical concepts. The problem in this Problem Sheet is based on Realistic in accordance with problems in everyday life.

### *Development Phase*

#### **Expert Assessment**

Based on the results of the evaluation of the learning tools by experts, Table 1 presents the results of the expert evaluation of the LKS products.

Table 1. The validity test results of LKS by media expert validators

No	Aspect	Level validity	Criteria validity	Explanation
1	Aspects of language	4,00	Valid	No need to be revised
2	Aspects of serving	4,00	Valid	No need to be revised
3	Graphic Aspects	3,50	Valid	No need to be revised

Table 2. The validity test results of the LKS by the material expert validator

No	Aspect	Level validity	Criteria validity	Explanation
1	Aspects of content	4,17	Valid	No need to be revised
2	Aspects of construct	4,80	Valid	No need to be revised
3	Aspects of language	4,00	Valid	No need to be revised

Table 3. Suggestions from media experts and material experts

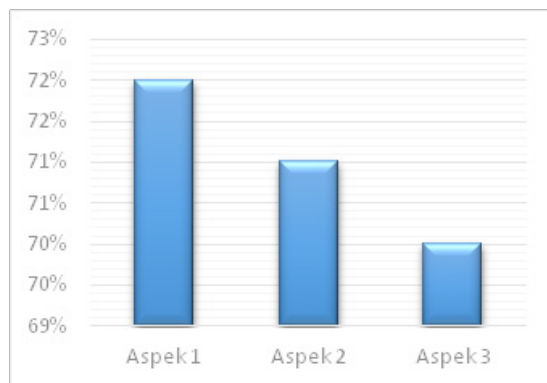
No	Aspect	Suggestions
1	Content	Some contexts are less precise and lack information on practice questions, causing ambiguity.
2	Construct	More detailed instructions are needs
3	Language	There are several writing errors and unclear sentences.

The results of the analysis can be concluded that the LKS products that have been developed meet the minimum valid criteria, so that they can be tested in schools to see other eligibility criteria in learning activities. The revision is still done by the researcher based on the comments and suggestions of the media expert validator and the material expert.

#### **Practicality of Learning Devices**

Analysis of the practicality of the learning device is done to see the results of the practicality test of LKS namely the results of filling out questionnaires by students. The questionnaire is filled after a series of LKS work is completed. Graph 1 presents the results of students' assessment of LKS products.





Graph 1. Results of testing the practicality of student worksheets (diagrams are made different)

Based on the results of filling out the questionnaire, 72% stated aspect 1 (material), namely the Student Worksheet helps in understanding the learning objectives, students easily understand learning instructions, and students easily understand the language used, then 71% state aspect 2 (graphics), which stated that the legibility of LKS titles is clear, LKS has a consistent layout on each page, the illustrations presented on LKS make it easier for students to understand the material, the images presented on LKS make it easier for students to understand the material, and the LKS display is interesting and makes learning fun using LKS based RME. Whereas 70% stated aspect 3 (benefits), including that LKS facilitated to develop understanding of concepts related to the material, assisted in developing creativity, the material presented was interrelated so as to facilitate understanding of the material, the questions presented helped in understanding the material, and with student LKS helped in understanding the material.

Overall the practicality criteria for each aspect / indicator of LKS is practical and does not need revision. This shows that the developed worksheets have been suitable for use in the learning process.

## CONCLUSION

Based on the development of student worksheets based on Realistic Mathematics Education which has been carried out in several stages, the following conclusions are obtained: at the definition stage with three analyzes, curriculum analysis states that Student Worksheets are in accordance with the taught curriculum, analysis of students states that the student worksheets are helped in understanding the material because if only using textbooks students tend to be less focused, student needs analysis requires easy-to-understand worksheets that relate to everyday life. At the design stage, the design of the cover has been obtained, foreword, instructions for using LKS, syllabus, instructions for working on LKS, prerequisite information, activity sheets, and practice questions that are in accordance with the RME. Whereas at the development stage it was said that according to the material experts and experts the RME-based LKS media was valid, although there was a need for revision. This student worksheet has the advantage of increasing students' creativity and making it easier for students to understand the subject matter. This worksheet can be used by teachers and students in learning activities.

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