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The Design of Student Worksheet based on RME to Improve Student' Mathematical Communication Skills

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ABSTRACT

Mathematical communication is one of the abilities that must be possessed by students in the 21st century. Worksheets Students who have not integrated mathematical communication skills will inhibit the achievement of learning objectives. RME is one approach that teachers can use to develop mathematical communication skills. This study aims to design Worksheets Mathematical students with RME approach to improve mathematical communication skills. This research is ADDIE type development research. The procedure of this study includes analysis, design, development, implementation, and evaluation. This research is limited to the design stage. The subject of this study consisted of teachers and students of the Muhammadiyah Kalasan Yogyakarta Middle School in Indonesia. The instrument of data collection includes observation guidelines, interview guidelines, and documentation sheets. Observation guidelines are used to look at the mathematical communication characteristics of students. The interview guide is used to determine the need for teaching materials from the teacher. A documentation sheet is used to obtain curriculum implementation data that apply in the school. Qualitative-quantitative techniques analyzed data. This study resulted in the design of Student Worksheets with an approach to RME that suited students' needs. This student worksheet is designed to improve students' mathematical communication skills. The validation results of the Student Worksheet design obtain an average value of 4.3 so that it is declared valid and can proceed to the next stage.

Keywords:
Students worksheet, mathematical communication skills, RME

1.Introduction

In the 21st century, mathematical communication skills must be mastered in mathematics learning. Because mathematical communication is a way of sharing ideas and clarifying understanding so students can organize their mathematical thinking and students can explore mathematical concepts [1]. The mathematical discussion is the ability to communicate which includes the use of writing skills, listening, studying, interpreting, and evaluating ideas, symbols, terms, and

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mathematical information observed through the process of listening presentation, and discussion [2].

Mathematical communication is important for mathematics education [3] as one of the goals of education in Indonesia according to the National Standards of the Ministry of National Education No. 22 of 2006 namely communicating ideas with symbols, tables, diagrams, or other media to clarify the situation or problem. This is in line with the aim of learning mathematics formulated by NCTM (National Council of Teachers of Mathematics) known as mathematical abilities, namely: 1) Problem-solving skills, 2) reasoning abilities, 3) communication skills, 4) ability to make connections, 5) Representative ability.

However, the fact is that students' communication skills are still low, this is reflected in the International level TIMMS report (Trends of the International Mathematics Science Study) in 2015, Indonesia ranks 44th out of 49 countries [4] and the results of the study explain that the ability of school communication Secondary students included as research subjects are still of concern, so it is necessary to re-examine [5]. Therefore, mathematical communication skills need to be developed in mathematics teaching and learning in school [6]. Development of mathematical communication skills is required so that students can better interpret mathematics not only as a symbol without meaning but as a language that is useful to help facilitate solving problems in everyday life [7]. The teacher is very instrumental in encouraging the optimal learning process through the models, methods, and approaches that are applied [8].

Improving students' mathematical communication skills needs to be supported by an appropriate learning approach or model [9] so that learning objectives can be achieved then students will be able to interpret mathematics not only as symbols without meaning but as a useful language to help facilitate problem-solving in everyday life [10].

One approach in mathematics learning is realistic mathematics learning [11]. The term realistic mathematics first appeared in mathematics learning in the Netherlands, known as the Realistic Mathematics Education (RME), Freudenthal as the first figure to develop a realistic mathematical approach in the Netherlands in 1973, saying "mathematics is a human activity ", meaning mathematics is a human activity [12]. RME was later adapted by Indonesia, which was later named as Indonesian Realistic Mathematics Education.

RME has characteristics, namely: 1. Using contextual problems; 2. Using a model or bridge as a vertical instrument; 3. Using student contributions; 4. Interactivity; 5. Integrated with other learning topics. The principle of RME is: mathematics is transmitted as a human activity, giving students the opportunity to rediscover (reinvention) through practice (doing it) [13].

Many revealed that realistic mathematical learning could affect mathematical abilities, research says realistic mathematical learning can improve thematic communication skills [14], [15]. Realistic mathematics learning is suitable to be applied to junior high school students through the teaching materials provided [16]. One of the teaching materials in the school is the Student Worksheet. Student Worksheets are a guide for students in understanding process skills and material concepts that are being and will be learned [17]. Observation results at Muhammadiyah 1 Kalasan Middle School Student Worksheets used by teachers have not facilitated mathematical communication skills.

Based on the background, the results of the research, observations on students and interviews with mathematics subject teachers arise the problem that the geometric mathematics books of flat-wiring material currently circulating are still in abstract form. Students are given flat waking material with formulas and sample questions, which are then trained by students so that they are skilled at completing the problem so that students' mathematical communication is difficult to develop. So it requires contextual issues that are appropriate for the students themselves so that students can construct themselves. Therefore the authors aim to design Student Worksheets with a realistic

mathematical approach and oriented to mathematical communication skills in Muhammadiyah 1 Kalasan Middle School Yogyakarta.

2. Methodology

This research is research and development. This study uses the ADDIE model which stands for Analysis, Design, Development, Implementation, and Evaluations [18] and is limited to the Design stage. The ADDIE model can be seen in figure 1.

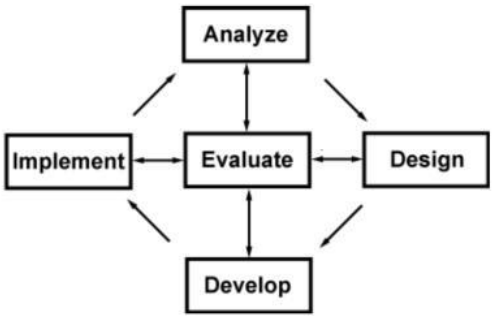

Fig. 1. ADDIE model inside [18]

The subject chosen is to get up flat. The researcher conducts a curriculum review to see the existing student worksheets, then observes the ability of students to communicate in learning and build up flat teaching material. Then, interview the teacher and students about what is needed to support students' mathematical communication.

The subjects in this study were 10 VII grade students and one math teacher at Muhammadiyah Middle School 1 Kalasan Yogyakarta. The object of this study is about understanding concepts, the ability of student communication, curriculum and learning material about flat building in the instruments in this study in the form of questionnaires, observation sheets, interview sheets, and documentation. Questionnaires are given to students to gain an understanding of students' communication skills. The observation sheet is used during the learning process. The interview sheet is used to interview students and teachers as research subjects. Then the researcher designed the student worksheet which was then validated by the expert team.

In this study validity data obtained from the results of the validator's assessment. The following is an explanation of data analysis techniques from the validity of student worksheets.

a. Turning qualitative data into quantitative data with the provisions of the Likert scale
b. Calculate the average score with the following formula

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} \quad (1)$$

Information:
$\bar{X}$: average instrument score
x_i : score on statement item to -i
n : many statements

a. Convert the average score to a qualitative value according to the assessment aspect. In the following table

Table 1
Conversion Score for Student Valuation and Worksheet

Score Range	Classification
$\bar{X} > 4{,}2$	Very Good
$3{,}4 < \bar{X}\ 4{,}2$	Good
$2{,}6 < \bar{X} \leq 3{,}4$	Enough
$1{,}8 < \bar{X} \leq 2{,}6$	Less
$\bar{X} \leq 1{,}8$	Very less

In this assessment, the learning device is said to be valid if it meets the classification of the minimum learning device assessment either.

3. Results

3.1 Analysis

Based on the results of observations, the Design of Learning Devices that are still made in general, have not been detailed in each activity. One example is in the Design of Learning Devices only written by the teacher to motivate students by providing examples of material applications in daily life. The teacher does not write examples of the application of the material in the motivational activities on the Learning Tools Plan.

In addition, most students still have difficulty in solving story problems. Learning resources used are in the form of Student Worksheets which only contain material summaries, finished formulas, examples of story problems and their solutions, and problem training. Student Worksheets are not constructive. Therefore, a learning device is needed, in the form of Learning Device Plans and Student Worksheets, which are detailed in each activity and use realistic mathematical approaches that can facilitate students in building their knowledge by using everyday life problems and solving everyday life problems in a way change it to mathematical problems.

Based on the results of the analysis of student characteristics, it was found that most students still had difficulty in applying the formulas that had been studied to solve a story problem. The Student Worksheet that the teacher uses to facilitate students' mathematical communication skills is not yet available. The same thing was conveyed by the Teachers and Students at the interview, that there is a need for more contextual teaching material for everyday life so that teachers more easily convey to students in the classroom, as well as students more easily understand the material when associated with real conditions in their daily lives so that they can improve their mathematical communication.

Therefore the development of Student Worksheets with a realistic mathematical approach and oriented to mathematical communication skills are considered acutely following the characteristics of the students of Muhammadiyah 1 Kalasan Middle School Yogyakarta.

3.2 Design

The Design Stage is to design Student Worksheets, which are carried out at the design stage: At this stage design activities are carried out in the form of drafting in developing problem-based learning-based worksheets. This stage is done by designing the student worksheet product according to the results of the analysis at the define stage. The draft worksheet consists of:

a. Opening section: Cover; Introduction; Table of contents; Indicator; Material Concept.
b. Content section: chapter titles, material summaries, practice questions, and evaluations.

c. Closing section: glossary, bibliography, and answer key.

Fig. 2. Cover

Fig. 3. Indicator

The cover is made as a front display of Student Worksheets containing titles and pictures that tell the material.

Indicators describe Core Competencies, Basic Competencies, and competencies that must be achieved by students.

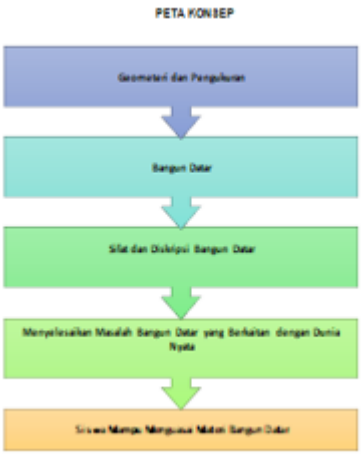

Fig. 4. Concept Map

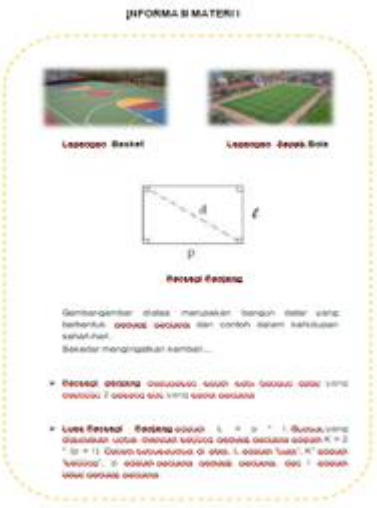

Fig. 5. Material Concept

Concept maps display the material flow that students will pass. The real concept contains information about the material students will learn.

In this section, it describes the competencies, objectives, and instructions for working students. This section describes the stages of student activities to understand the material using the RME approach.

Next is the expert validation stage, an assessment is carried out to determine the validity of the draft Student Worksheet developed. The design of Student Worksheets that have been approved by the supervisor is validated by the validator, the material expert lecturer as well as the media, and a material and language mathematics expert. Validation of the design of Student Worksheets using instruments that have been reviewed by lecturers, Dr. Suparman, DEA. Two validators validate the

Student Worksheet design. The first validator was Mr. Anggit Prabowo, M.Pd. As a lecturer in the mathematics education study program at Ahmad Dahlan University, Yogyakarta. The second validator is Mr. Avi Pudiarto, S.Pd. as a math teacher at the Depok 3 State Middle School in Yogyakarta.

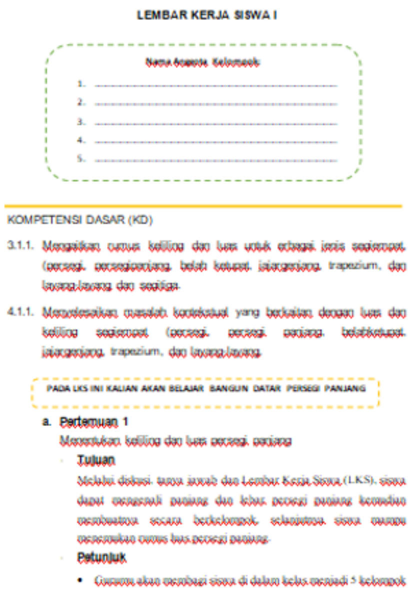

Fig. 6. Worksheet

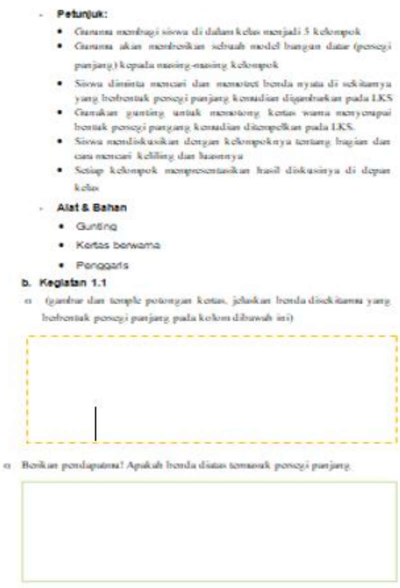

Fig.7. Concept of Activities

Following are some of the input and suggestions from the material experts summarized in Table 1.

Table 1
Inputs and Suggestions from expert validators

Suggestions and Comments	Follow-up
On the cover, it is necessary to adjust the material	Revised
There is no “Kelas VII SMP” on cover	Cover added “Kelas VII SMP”
The rectangular image is not clear	Image has been replaced
Fonts that are used differently on Lembar Kerja Siswa I	Fonts have been likened
The third point in Student Worksheet 1 is not needed	Point has been deleted
The word "temple" was changed to "tempel"	Has been replaced
The word "LKS" is described as "Lembar Kerja Siswa"	Has been replaced

Furthermore, the results of the validation of the LKS design by the validator are shown in Table 2.

Table 2
Results of Expert Validation on Student Worksheet Draft

Assessment Aspect	Maximum score	Average Score	Information
Fill in the LKS design	5,00	4,33	Very good
LKS design language	5,00	4,33	Very good
Technical aspects	5,00	4,25	Very good
Average		**4,30**	**Very good**

4. Conclusions

The results of expert validation on the design of Student Worksheets get an average value of 4.3 and are declared valid and can be continued later on. With realistic mathematical approaches, it is expected to be able to improve students' mathematical communication skills in flat-up material.

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