UNP JOURNAL MANAGEMENT CENTER

math.ppj.unp.ac.id
p-ISSN 2716-0726
e–ISSN 2716-0734

Indexed

Development Of Student Work Sheet Based Realistic Mathematics Education (RME) on Polyhedron Topic

Fella Megri Oktavani[1], Dewi Yuliana Fitri[2] and Lucky Heriyanti Jufri[3]

[1,2,3] Mathematichs Education Departement, Faculty of Science and Tecnology, Universitas PGRI Sumatera Barat, Padang, Indonesia

Article History
Volume 2, No. 1, 2023

Subject Areas:
Mathematics Education

Keywords:
Work Sheet Based, Realistic Mathematics Education, Polyhedron

Author for correspondence:
Dewi Yuliana Fitri
e-mail: dewiyulianafitri2@gmail.com

Abstract- The background of this research is that the teaching materials in Sijunjung 7 Public Middle School have not been able to make students active and accustom students to independent learning in solving problems given by the teacher. This study aims to develop Student Worksheets (LKPD) based on Realistic Mathematics Education (RME) in class VIII that is valid and practical. The development procedure used is the plump development model, which consists of 3 stages: preliminary research, prototyping, and assessment. Teaching materials expected by students make students active in the learning process and can guide students to learn independently. The instruments used are validity questionnaires and practicality questionnaires. The data analysis concluded that the Student worksheet developed was in very valid criteria with an average of 85.7%. The results of the practicality questionnaire analysis based on small group evaluations of 6 students obtained an average of 87.79% with efficient criteria. This research concludes to produce worksheets based on Realistic Mathematics Education that are valid and practical on flat-sided geometric material in class VIII SMP Negeri 7 Sijunjung.

1. Introduction

Teaching materials are essential in the learning process to increase the effectiveness and quality of learning so that learning objectives can be achieved (Gazali, 2016; Purmadi & Surjono, 2016).
Effective teaching materials can certainly attract students' interest in learning and will then impact increased learning outcomes (Fahrurrozi et al., 2021). Teaching materials have an essential role in

RANGKIANG MATHEMATICS JOURNAL
Journal of Mathematics and Mathematics Education

The learning process is a reference for students and teachers in carrying out learning in the classroom. One type of teaching material is Student Worksheets (LKPD).

Based on the results of observations carried out at SMPN 7 Sijunjung, it is known that the school has used the 2013 curriculum and teaching materials in the form of textbooks. However, when the learning process takes place, it can be seen that students have not been able to learn independently, so the learning process tends to occur in one direction. Learning is also still centered on the teacher. Many students are still unsure of their abilities and are even afraid to express opinions and are more likely to receive lessons only from the teacher. When material they don't like, students prefer to be silent. The reasons put forward by these students occurred in less attractive learning; so many students made this an excuse for forgetting and not wanting to take the book with them. This is always a problem for teachers in the material of flat-sided spaces because they see student learning outcomes and the learning process. As a result of the issues above, students do not like math lessons, causing objections, and do not want to carry textbooks.

The results of interviews with the class VIII mathematics teacher at SMPN 7 Sijunjung regarding existing learning tools and what is meant is learning tools from fellow teachers, the internet, and the results of the Subject Teacher Consultation (MGMP). In the previous year, the teacher had given Student Worksheets to students, but the use of the Student Worksheets had not made students motivated and active in learning. So at that time, Student Worksheets had been stopped for the teaching and learning process. In addition to problems regarding learning tools, the mathematics teacher also found that there was one subject with low learning outcomes, namely flat-sided geometric shapes. The mistake that students often experience is that it is difficult to distinguish between the surface area and volume of the geometric shape.

The interviews with class VIII students of SMPN 7 Sijunjung revealed that in the current pandemic, students must be more active in studying independently and repeating the teacher's material. The teaching materials provided to students are in the form of textbooks. Hence, students feel confused about understanding the material because the language and discussion in texts are difficult to understand and make students less interested in reading and understanding the material in the book. Using the previous Student Worksheets turned out to be almost the same as the textbooks used by students. The Student Worksheets still have many shortcomings, including their less attractive and colorless appearance, even for pictures only of certain materials. Weaknesses in textbooks are not only in appearance and language that is difficult for students to understand; however, in terms of material, it is still monotonous and does not involve the context of real life or everyday life. These deficiencies make students not interested in studying the material and discussing the problems in the Student Worksheets. Not only for reading and working on questions, for expressing opinions and asking questions, students don't dare and are afraid of being wrong. This is because students cannot understand the learning material. In the material for Flat Sided Spaces, students still do not understand the concept, and it isn't easy to distinguish between the surface area and volume of the geometric shape. Not only for reading and working on questions, for expressing opinions and asking questions, students don't dare and are afraid of being wrong. This is because students cannot understand the learning material. In the material for Flat Sided Spaces, students still do not understand the concept, and it isn't easy to distinguish between the surface area and volume of the geometric shape. Not only for reading and working on questions, for expressing opinions and asking questions, students don't dare and are afraid of being wrong. This is because students cannot understand the learning material. In the material for Flat Sided Spaces, students still do not understand the concept, and it isn't easy to distinguish between the surface area and volume of the geometric shape.

Based on the analysis carried out on the previously used Student Worksheets, it can be seen that they are still unable to facilitate students to be active in understanding, asking questions, collecting data, and communicating it. In the previous Student Worksheets, learning material was given directly without stimulating students to express their ideas and opinions. In this Student Worksheets, students are only required to memorize because students are immediately given the material. This causes students to become less active and feel afraid in the learning process.

The Student Worksheets analysis concludes that the pre-existing Student Worksheets still do not facilitate students to carry out the stages required in the 2013 curriculum. The previous Student Worksheets did not require students to express their opinions actively.

Learning from the Student Worksheets that were used previously, researchers are trying to develop Student Worksheets with the Realistic Mathematics Education (RME) model, where this learning model aims to train students to be active in arguing and expressing their own opinions based on problems in real life (Fera quality, 2021). Based on previous observations, the researcher found that out of 20 students who took part in the teaching and learning process in one class, 15 had difficulty understanding and imagining 3D objects in geometric shapes depicted on a flat plane. This causes learning mathematics to

be less meaningful. The other factor that makes learning less significant is the absence of a relationship between mathematics material and everyday life.

One way this problem can be solved is by making teaching materials, and one of them is developing Student Worksheets by making the issues more real and close to students' daily lives. Students are expected to be active again and catch on more quickly. Material during the learning process by understanding the contents of the Student Worksheets. Student Worksheets (LKPD) developed are based on Realistic Mathematics Education. The Realistic Mathematics Education learning model can train students to understand contextual problems, explain contextual problems, guide students in solving contextual problems, direct students to discuss their answers with friends' results, and help students conclude the results of the given issues.

2. Methods

This type of research is research and development (R&D). According to (Sugiono, 2012: 407), research and development methods are used to produce specific products and test the effectiveness of these products. In this study, the product developed was Student Worksheets (LKPD) based on Realistic Mathematics Education on flat-sided geometric shapes. This research was conducted in the even semester of the 2021/2022 school year at SMP 7 Sijunjung. Based on the description above, it can be said that this development research aims to produce teaching materials in the form of Student Worksheets (LKPD) based on Realistic Mathematics Education (RME). The development model used in this study is the development model proposed by (Plomp, 2013):

1) Preliminary Research Stage (Initial Investigation)

This stage is carried out to identify problems and needs in implementing learning. Data collection is carried out as follows:

a. Syllabus analysis is carried out to determine whether the material taught follows competency standards, essential competencies, and competency achievement indicators.
b. RPP analysis aims to determine whether the material being taught follows the syllabus and the learning model used.
c. Textbook Analysis aims to see the suitability of the book's contents with competency standards and essential competencies that students must achieve. Appropriate books will be used as a reference for drafting concepts and independent exercises on the Student Worksheets that will be developed.
d. Teacher and Student Interview aims to find out the problems that occur in the field related to learning mathematics.

2) Prototyping Phase (Prototyping)

The results of the initial investigation phase were used to design and develop prototype Student Worksheets based on Realistic Mathematics Education on flat-sided geometric shapes using formative information. This prototype stage can be described as follows:

a. Systematic Design of Student Worksheets Structure.
b. Making Prototypes: Draft designs compiled and used as a reference for prototypes.
c. Self-Evaluation. The prototype that has been designed beforehand is self-evaluated against the prototype. Self-evaluation guidelines are used to find out mistakes in drafting Student Worksheets drafts.
d. Expert Review. The expert review on this development is to solicit assessments and suggestions from experts (validators) regarding the feasibility aspects of the content in Student Worksheets in the form of linguistic, presentation, and graphical elements. Recommendations from experts are used to improve the developed Student Worksheets.
e. One-on-one evaluation valid Student Worksheets are then carried out a one-on-one evaluation which aims to get an assessment from the teacher as the user of the product being developed. The purpose of this one-on-one evaluation is to see the practicality.
f. Small Group Evaluation Small group evaluation involves six students. Every two people have high, medium, and low abilities.

3) Data Collection Instruments

Data collection instruments used in this study are:

a. Interview Guidelines According to (Ridwan, 2010: 74), interviews are a way of collecting data to obtain information directly from the source.
b. Self-Evaluation Guidelines. Self-evaluation is used to find out mistakes in drafting Student Worksheets drafts.
c. The validation sheet determines whether or not the Student Worksheets based on Realistic Mathematics Education are valid on flat-sided geometric material.
d. Practicality Sheet, the practicality sheet used, is a questionnaire designed to determine the practicality of using Student Worksheets.

4) Data analysis technique

Data analysis in this study consisted of three stages: interview analysis, analysis of Student Worksheets validation results, and analysis of LKPD practical results. These three things can be explained as follows:

a. Interview Analysis

Descriptive techniques describe data from student interviews regarding Student Worksheets based on Realistic Mathematics Education. According to Mires in Sugiyono (2010:246), there are three stages, namely:

1. Reducing data is selecting, focusing, abstracting, and transforming the raw data obtained through observation.
2. Presentation of data is a process of compiling data systematically so that the data obtained can explain the problem under study. Concluding is an advanced stage, and data reduction to complete the data obtained.

b. Analysis of Student Worksheets Validation Results

The validation results from the validator on all assessed aspects are presented in tabular form. The results of the Student Worksheets validation analysis based on the validity sheet are carried out in several steps:

1. Give an assessment score as in Table 1.

Table 1. Student Worksheets validity assessment score

Symbol	Information	Weight
SS	Strongly agree	4
S	Agree	3
CS	Agree	2
TS	Disagree	1
STS	Strongly Disagree	0

Source: Riduwan (2010:89)

2. Perform validation level calculations with the formula:

$$\text{Nilai Validitas (NV)} = \frac{\text{Jumlah Semua Skor}}{\text{Skor Maksimum}} \times 100\%$$

Then the validation value obtained is analyzed with the following criteria:

Table 2. Student Worksheets Validity Categories

%	Category
$80 < NV \leq 100$	Very Valid
$60 < NV \leq 80$	Valid
$40 < NV \leq 60$	Valid Enough
$20 < NV \leq 40$	Invalid
$0 \leq NV \leq 20$	Invalid

Source: Riduwan (2010:89)

c. Analysis of Student Worksheets Practical Results

The practicality of Student Worksheets based on Realistic Mathematics Education is obtained from a questionnaire on student responses to using Student Worksheets in learning. Questionnaire data were

math.ppj.unp.ac.id Rangkiang Mathematics Journal Vol 2, No 1, 2023

obtained by calculating the scores of students who answered each item in the questionnaire.

1. Provide an assessment score as in Table 3

Table 3. Student Worksheets practicality assessment score

Symbol	Information	Weight
SS	Strongly agree	4
S	Agree	3
CS	Simply Agree	2
TS	Disagree	1
STS	Strongly Disagree	0

Source: Riduwan (2010:89)

2. Perform practicality-level calculations with the formula:

$$\text{Nilai Praktikalitas (NP)} = \frac{\text{Jumlah Semua Skor}}{\text{Skor Maksimum}} \times 100\%$$

Table 4. Student Worksheets Practicality Level

Intervals (%)	Category
$81 - 100$	Very Practical
$61 - 80$	Practical
$41 - 60$	Pretty Practical
$21 - 40$	Impractical
$0 - 20$	Very Impractical

Source: Riduwan (2010:89)

3. Results and Discussion

(a) Preliminary Research stage data (Initial Investigation)

Initial investigations were carried out to identify problems and needs in implementing mathematics learning, especially those related to Realistic Mathematics Education (RME)-based Student Worksheets. Data from the initial investigation results were obtained through interviews with teachers and students, syllabus analysis, and analysis of textbooks or teaching materials used.

(b) Stage data Prototyping Phase

Creating a Realistic Mathematics Education-based Student Worksheets prototype on flat-sided geometric material begins with designing the systematics and structure of Student Worksheets. Furthermore, a prototype Student Worksheet was developed based on the systematics and structure created.

1. Systematics and Structure of Student Worksheets

The draft Student Worksheets includes a cover, instructions for using Student Worksheets, preface, table of contents, core competencies, essential competencies, indicators, learning objectives, activity 1, activity 2, assessment, and author biography. The learning activity consists of one basic competency: "Solving problems related to the surface area and volume of flat side shapes (cubes, blocks, prisms, pyramids)". The parts are in learning activity 1, regarding the concept of surface area and volume of a cube, and learning activity two, regarding the image of surface area and volume of a cube.

Based on a syllabus study, a systematic Student Worksheet was designed on flat-sided geometric material. The material discussed is the surface area and volume of flat side shapes. This material aims to familiarise students with flat side shapes, including the surface area and volume of cubes, beams, prisms, and pyramids.

A structure for discussing the material in learning activities was developed based on the results of creating the systematics of presenting material on Student Worksheets. The initial learning activity began by giving a problem (image) accompanied by statements to guide students in discovering the surface area and volume of flat side shapes. After that, students are given questions that are useful for

math.ppj.unp.ac.id Rangkiang Mathematics Journal Vol 2, No 1, 2023

students understanding.
The developed Student Worksheets contain essential information. Presentation of instructions for using Student Worksheets, preface, table of contents, core competencies, necessary competencies, indicators, learning objectives, as well as illustrations regarding the flat-sided geometric material, which is placed at the beginning of the material, after which some questions are given to determine students' abilities to understand the concept. At the same time, the assessment is placed at the end of learning.
The developer self-evaluates the development results at this stage and then analyzes and revises them based on the self-evaluation results. The following describes the design of Student Worksheets based on Realistic Mathematics Education. See figure 1

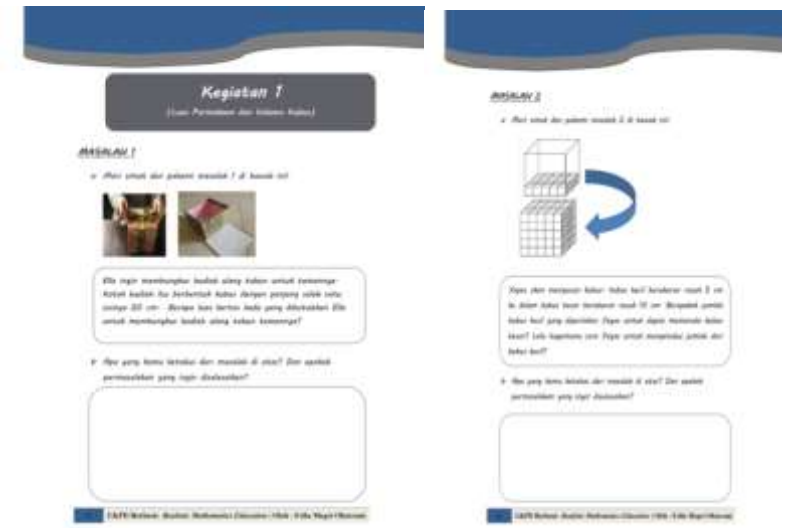

Figure 1. Display of the contents of the LKPD

2. Self-evaluation

The developer himself evaluated the results of observations at the prototyping stage, then analyzed and revised based on the self-evaluation results.
Two self-evaluations were carried out on developing Student Worksheets at the evaluation stage. Based on the results of the first self-evaluation, there were errors and deficiencies in displaying the contents of the Student Worksheets, which were unrelated to the material for building flat sides. We can see in Figure 2

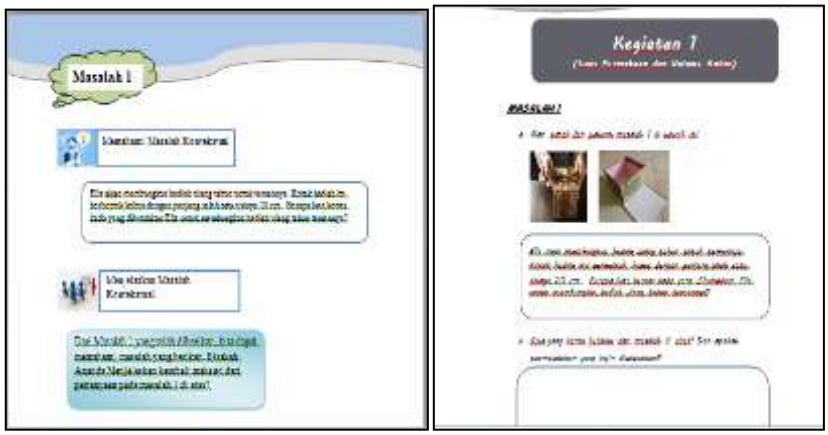

Figure 2. Revision of the contents of the Student Worksheets

3. Expert Review

At the expert review stage, the validator suggests improving the Student Worksheets. Every suggestion given is directly accompanied by analysis and revision.
a. Expert advice on the cover, preferably on the cover, the 2013 Curriculum logo should be replaced

with the Tut Wuri Handayani logo.

b. The expert suggests that in the table of contents section, preferably in the activity title, what sub-material will be discussed in the first and final activities?
c. The expert suggests that in the contents of the Student Worksheets, it is better to apply the level of difficulty to the problem section. Give a low difficulty level in the first problem until the following issues are high.
d. The expert suggested that the type of writing times new romance in the contents of the Student Worksheets be replaced with MV Boli.

4. Validity of Student Worksheets

After the material expert on the Student Worksheets gave advice, the validator was asked to fill out an expert validation questionnaire. The results of the material expert validator's assessment are as follows in Table 5 :

Table 5. Results of Student Worksheets validity assessment based on Realistic Mathematics Education

Assessment Aspects	Percentage	Category
Fill	84.3%	Very Valid
Presentation	83.3%	Very Valid
Language	91.6%	Very Valid
graphics	86.3%	Very Valid
Realistic Mathematics Education	83.3%	Very Valid
Final Score for LKPD validation	85.7%	Very Valid

The overall validation value of the Student Worksheets validation aspect is 85.7%. This shows that Student Worksheets based on Realistic Mathematics Education are very valid. The validity of this Student Worksheets is seen from 5 factors, namely content feasibility, presentation feasibility, language feasibility, graphic feasibility, and Realistic Mathematics Education. So it can be concluded that the contents of the Student Worksheets follow the competencies to be achieved, the Student Worksheets have been presented clearly, and the use of language follows the rules of the Indonesian language so that it is easy to understand. From a graphical point of view, the Student Worksheets design is attractive and follows the material, as well as at the Realistic Mathematics Education stage and following the curriculum used.

5. The Practicality of Student Worksheets

Products that material experts have validated then carried out a one-to-one evaluation of 3 students with high, medium, and low abilities. Following are the results of practicality by students.

Table 6. Practicality results of the one-to-one evaluation phase

Statement	Score	Percentage	Category
Attractiveness	63	87.50%	Very Practical
Process of Use	105	87.49%	Very Practical
Ease of Use	106	88.33%	Very Practical
Time	20	87.50%	Very Practical
RME-Based Student Worksheets Small Group Evaluation Final Value	295	87.79%	Very Practical

The table above shows that the results of the student's practical data analysis of Student Worksheets have a final score of 87.79%, which meets the convenient criteria. This indicates that Student Worksheets based on Realistic Mathematics Education on flat-sided geometric material are suitable for learning mathematics at SMPN 7 Sijunjung.

Then proceed to the small group evaluation stage of Problem-Based Learning-based Student Worksheets products in this row and series material tested on six students, each with two high, medium, and low abilities. The following are the results of practicality in small group evaluations. We can see this in Table 7.

math.ppj.unp.ac.id Rangkiang Mathematics Journal Vol 2, No 1, 2023

Table 7. Practicality results of the one-on-one evaluation phase

Rated aspect	Score	Percentage	Category
Attractiveness	10	83.33%	Very Practical
Process of Use	17	85.00%	Very Practical
Ease of Use	16	80.00%	Very Practical
Time	3	75.00%	Practical
Final Value of Student Worksheets Practicality Based on Realistic Mathematics Education	46	80.82%	Very Practical

Table 7 shows the practical value of Student Worksheets based on Realistic Mathematics Education by math teachers of class VIII SMP at Sijunjung 7 is 80.82% with convenient criteria. This shows that Student Worksheets are practical for use by teachers in the learning process.

4. Conclusion

Based on the research results and the data analysis, it can be concluded that the research produced LKPD based on Realistic Mathematics Education on the material on flat sides that are valid and practical for class VIII students of SMP Negeri 7 Sijunjung.

References

1. Ardilla, Ayu and Suryo Hartanto. (2017). Factors Affecting the Low Mathematics Learning Outcomes of MTs Iskandar Muda Batam. Journal of Electronic Pythagoras Vol. 6(2). p. 175-186.
2. Azhar, A. (2008). Learning Media; Revised edition. In National Health Research Repository.
3. Effendi, R., & Sutiarso, S. (2021). basicedu journal. 5(2), 920–929.
4. Gustin, Liza. (2020). Development of Student Worksheets (LKPD) Based on Realistic Mathematics Education (RME) on the Material of One Variable Linear Equations and Inequalities. Journal of Mathematics and Mathematics Education. Vol.5(2). pp. 111-127.
5. Hendro Darmodjo and Jenny RE Kaligis. (1992). Science Education II. Jakarta: Depdikbud.
6. Juliandita, E., Rezeki, S., & Setyawan, AA (2016).Development of Cognitive and Effective Assessment Tools on the Subject of Quadrilaterals for Grade VII Junior High Schools. Journal of Community Service and Empowerment, Islamic University of Riau, 9(2).
7. Kurniawan, DT (2017). Using the Pjbl Model to Increase Student Creativity in Making Mathematics Learning Media. Kalamatics: Journal of Mathematics Education, 2(2), 207-220.
8. Nieveen, T. P & N. (2013). Educational design research. Netherlands Institute for curriculum development.
9. Ningsih, Series. (2014). Realistic Mathematics Education Alternative Model for School Mathematics Learning. Journal of Mathematics Education. Vol.1(2). pp. 73-94.
10. Gems, Sari Putri. et al. (2019). Development of Student Worksheets (LKS) Based on Realistic Mathematics Education (RME) Learning Models on Flat Sided Space Materials. Journal for Research in Mathematics Learning. Vol.2(1). p. 269-276.
11. Prastowo, Andi. (2014). Creative Guide to Making Innovative Teaching Materials. Yogyakarta: Diva Pres.
12. Plomp, T. (2013). Educational design research : An introduction. In T. Plomp & N. Nleveen (Editors), Educational design research. Enschede: SLO Netherlands Institute for curriculum development.
13. Sanjaya, W. (2015). Learning System Planning and Design – Dr. Wina Sanjaya, M.Pd – Google Books. Kencana, Prenadamedia Group.
14. Siagian, Daut Muhammad. (2016). Mathematical Connection Ability in Mathematics Learning. Journal of Mathematics Education and Science. Vol. 2(1).
15. Sugiyono. (2014). Quantitative Research Methods, Qualitative, R & D. Bandung: Alfabeta.
16. Sugiyono. (2015). Combination Research Methods (Mix Methods). Bandung: Alphabet.
17. Ulya, Zulkardi, & Putri, RII (2010). Design of teaching materials for the addition of fractions based on Indonesian realistic mathematics education (PMRI) for fourth-grade students at Indralaya 23 public elementary school. Journal of Mathematics Education, 4(2), 86–96.

18. Vahrum, FN, & Rahaju, EB (2016). The Thinking Process of Middle School Students in Solving Contextual Mathematical Problems in Set Material Based on Impulsive and Reflective Cognitive Styles. 3(5).

19. Zulainy, F., Rusdi, R., & Marzal, J. (2021). Development of Student Worksheets Based on Realistic Mathematics Education to Improve Students' Argumentation Ability. Journal of Scholars: Journal of Mathematics Education, 5(1), 812-828.