J U P I T E K Jurnal Pendidikan Matematika | December 2022 | Volume 5 Number 2 | Page. 114 – 122
ISSN: 2655-2841 (Print); 2655-6464 (Electronic)
DOI https://doi.org/10.30598/jupitekvol5iss2pp114-122

THE DEVELOPMENT OF A REALISTIC MATHEMATICS APPROACHES TO SOLVE THREE-DIMENSIONAL SHAPES WITH CURVED SURFACES PROBLEMS

Wilmintjie Mataheru [1*], Novalin C Huwaa [2]

[1,2] Mathematics Education Study Program, FKIP, Universitas Pattimura
Ir M Putuhena Street, Ambon, 97233, Indonesia

e-mail: [1] wilmintjiemataheru@yahoo.co.id

Submitted: June 19,2022 *Revised: November 26, 2022* *Accepted: November 30, 2022*

*corresponding author**

Abstract

This study aims to develop a validity of learning tools for the curved side space material for grade IX students of SMP in Ambon City in the 2021/2022 academic year using a realistic mathematics approach. The learning device development model used is to modify the 4-D model, which is limited only to the development stage, namely the learning device trial. The data in this study were analyzed quantitatively. The results showed that the learning device that used a realistic mathematical approach in problem-solving the build a curved side spaces problem met the valid criteria at the end of the test.

Keywords: realistic mathematics, three-dimensional shapes with curved surfaces

1. Introduction

Today's mathematics learning is still more focused on "material" goals, which in short can be said to be goals that emphasize mathematical abilities and skills and problem-solving. In this situation, students passively accept mathematical knowledge as finished goods transferred by the teacher (Hadi, 2015).

Facts found in the field, there are still obstacles and errors encountered by students in the curved side space building material. The results of research by Nuraida (2017) and Arifin et al. (2017) show that students experience obstacles in organizing data, sorting, using symbols, mathematical manipulation, procedural understanding, and concluding. Furthermore, Rosyida et al. (2016) stated that the errors made by students in solving curved side space problems often occur during the process of understanding questions, developing strategies, implementing strategies, or re-examining their results work. According to Deviani et al. (2017), the factors that cause students' difficulties in the curved side space are: poor physical health, impaired sensory function, lack of interest, low motivation, not mastering basic knowledge, low frequency of learning mathematics.

This was proven when the researcher met a mathematics teacher who taught in several junior high schools in Ambon City. They said that the material for Constructing Curved Side Space (BRSL) is one of the materials most students in grade IX of junior high school still find challenging. Especially material related to understanding concepts and formulas for area and volume, as well as calculating the surface area and volume of BRSL around the student's environment, so one approach to learning mathematics that links students' real-life experiences with learning mathematics is learning that uses a Realistic Mathematics Approach (PMR) which is known as Realistic Mathematics Education (RME).

According to Suwarsono (2017), learning with PMR is an approach to learning mathematics that uses contextual problems as the first step in the learning process. Students are asked to organize and identify the mathematical aspects contained in the problem. Students are also given complete freedom to describe, simplify, interpret and solve contextual problems in their way, either individually or in groups, based on experience or prior knowledge they already have.

Given that the primary object of mathematics is a mental object or an object of thought, the effort to reactivate previous knowledge and thinking patterns that students have learned about mathematics is not easy. Therefore, it is expected that the involvement of individual students is active in learning.

The realistic approach is a mathematics learning approach introduced by Freudenthal (1973), which was eventually called realistic mathematics education (RME). This pragmatic approach has influenced mathematics learning in several countries. For example, the Mathematics in Context (MIC) project in America adopted what is known as RME in the Netherlands (Yuwono, 2014)

Learning mathematics with a realistic approach emphasizes how students reinvent (reinvention) concepts, properties, or procedures in mathematics through contextual problems. Students are directed to study independently or in groups to solve these contextual problems. Students are free to express and communicate their ideas to each other. The teacher acts as a facilitator and, when needed, can help students on a limited basis. Then the teacher facilitates class discussion so that students can compare the ideas and guide them to agree on which opinions are correct, efficient, and easy for them to understand.

In this study, learning mathematics with a realistic approach is a learning process that begins with giving a real problem (contextual). Students organize problems and try to identify the mathematical aspects of the problem. Then, with the teacher's guidance, students are given the ample opportunity to interpret and solve contextual problems in their way, rediscover and construct their own concepts/natures/procedures, then applied in everyday life problems.

Thus, RME is a process of building students' understanding of mathematical material by using contextual problems (contextual problems) as a starting point in learning mathematics; individual students are allowed to describe, interpret, and solve contextual problems based on their prior experience/knowledge. Then, with or without the help of the teacher, students are expected to be able to use the contextual problem as a source for the emergence of mathematical understandings or concepts. After achieving concept formation, students can apply these concepts again to contextual problems, thereby strengthening their understanding of the concept.

Hadi's (2015) realistic approach has three principles in designing mathematics learning: guided reinvention through progressive mathematization, didactical phenomenology, and self-developed models. These three principles are briefly described below.

a. Guided reinvention through progressive mathematization
Guided rediscovery through progressive mathematization. Through the contextual problems presented, students should be allowed to experience the same process of constructing and reinventing mathematical ideas and concepts

b. Didactical phenomenology
An educational phenomenon. This phenomenon can be seen when students try to focus on contextual problem situations given by the teacher and actively answer various questions posed with their thoughts.

c. Self-developed models
Self-developed models to bridge the gap between informal knowledge and formal mathematics students. Students build their models when solving contextual problems, so the following sequence of learning is expected:

"contextual problem" ⇨ "model of the contextual problem" ⇨ "model towards formal" ⇨ "formal knowledge"

At first, students will build a model of the contextual situation. Then individually or in groups, students develop mathematical models to be completed, thus obtaining formal mathematical knowledge.

The three principles above are operationalized into five characteristics of mathematics learning with a realistic approach. The five characteristics are: using contextual problems, using models, using student contributions, interactions, and linkages. The five characteristics are briefly described as follows.

a. Using contextual problems (the use of context)
Learning begins by using contextual problems (real world), not starting from the formal system. Contextual problems raised as the initial learning topic must be simple problems that are 'recognized' by students.

b. Using models (the use of models, bridging by vertical instruments)
The term model relates to situational models and mathematical models that students develop as a bridge between one level of understanding using vertical instruments such as models, schemes, diagrams, and symbols.

c. Using student contributions (student contributions)
A significant contribution to the teaching and learning process is expected to come from students. Therefore, all students' thoughts (construction and production) are considered.

d. Interactivity
Optimizing the teaching and learning process through the interaction of students with students, teachers, and students with infrastructure is essential in realistic mathematics learning so that students themselves can carry out the construction process.

e. Integrated with other topics (intertwining)
Mathematical structures and concepts are interrelated. Therefore, the interrelationships and integration between topics (lessons) must be explored to support a more meaningful learning process.

Wijaya (Yuliana, 2017) also said that, like RME, Indonesian Realistic Mathematics Education (PMRI) has the exact characteristics of mathematics learning as RME, namely (1) use of context, (2) use of models for progressive mathematization, (3) utilization of results student construction, (4) interactivity, and (5) linkage.

One of the goals in learning mathematics is for students to be able to solve problems. The problems raised are not only limited to routine difficulties but can be non-routine problems. Therefore, the problem is a challenge for students to solve. Non-routine problems become problematic because they cannot be solved using general mathematical concepts and principles.

Polya (Mataheru, 2019) divides problem-solving into four steps: (1) Understanding the problem. In this step, students must be able to show the essential parts of the problem, namely what is known, what is asked, and the conditions contained in the situation. Therefore, the teacher's question to students, namely, what is known? What was asked? what are the requirements? (2) Devising a plan. At this stage, it is necessary to think about the idea of the plan. Good statements are based on previous experience or information. Therefore, the question posed is, is this problem related to something? If it does not work, it is okay to change the shape of the problem or modify it by asking, "Can you state this problem? (3) Carry out the plan. In carrying out the plan that has been designed, the teacher should ask students to check each step by asking whether they are sure that the measure is correct?. Moreover, (4) Look back. When a solution is found, it is necessary to re-examine the results that have been obtained. Hence, the question asked, i.e., can you check the results? Can you match the argument? To provide both challenge and satisfaction in solving the problem, one can ask the question, i.e., could you get the result differently?

The accuracy of reading the questions is exceptionally influential on the mathematical problem solving of Junior High School students Lutvaidah & Hidayat (2019). Through problem-solving, it is expected to train students to understand issues, plan, apply concepts and rules, and strategies to solve mathematical problems and the complexity of the matters in life.

Based on the description of the problem, the formulation of the situation in this study, namely how to develop a valid Realistic Mathematics Approach in the Curved Side Space material for grade IX students of SMP in Ambon City?

2. Method

Research and development is a research method used to produce specific products and test their effectiveness of these products (Sugiyono, 2013). This research is development research with a 4-D model designed by Thiagarajan, Semmel, and Semmel (2019), which includes: the definition stage, the design stage, the development stage, and the dissemination stage. However, this research only reached the development stage. Therefore, the procedure for developing learning tools can briefly be explained.

a. The definition stage aims to determine and define everything needed in learning by analyzing the objectives and limitations of the subject matter. This stage consists of five activity steps, namely: (1) preliminary final analysis, (2) student analysis, (3) material analysis, (4) task analysis, and (5) specification of learning objectives.
b. The Design Phase aims to produce a realistic mathematics learning device design. The result at this stage is called draft-1. Activities at this stage consist of (1) Selection of Media, (2) Selection of Format, and (3) Initial Design, which includes: Learning Implementation Plan (RPP), Teaching Materials, and Student Worksheets (LKPD).
c. Development Phase aims to produce a final draft of valid learning tools. Activities at this stage, namely (1) Validation/Expert Assessment, (2) Readability Test of Learning Devices, and (3) Testing of Learning Devices.

The research instrument consisted of (1) Validation sheets: RPP, BA (teaching materials), LKPD, and learning outcomes tests; (2) Readability test sheets for learning devices for students and teachers; (3) Teacher activity observation sheet; (4) Teacher and student questionnaires, and (5) Student learning outcomes test instruments.

The data analysis technique was carried out on some of the data follows. The general assessment of the validator on learning tools uses the formula (Mataheru et al., 2017):

$$\bar{x} = \frac{\int \text{total rating of all validators}}{\text{number of validators}}$$

$1{,}00 \leq \bar{x} < 1{,}50$: not good
$1{,}50 \leq \bar{x} < 2{,}50$: partly good
$2{,}50 \leq \bar{x} < 3{,}50$: good
$3{,}50 \leq \bar{x} < 4{,}00$: very good

The data from the readability test for partner teachers and grade VII_1 students were analyzed against input in the form of suggestions and corrections from the students and teachers.

Experimental data: Observational data on teacher and student activities were analyzed using the formula (modification from Sudjana, (Mataheru et al., 2017):

$$y = \frac{\text{the number of observations of teacher activities carried out}}{\text{total number of observation points}} \times 100\%$$

$80\% \leq y \leq 100\%$ = Very High
$70\% \leq y < 80\%$ = Hign
$60\% \leq y < 70\%$ = Average
$50\% \leq y < 60\%$ = Low
$40\% \leq y < 50\ \%$ = Very Low
The implemented aspect is rated 1.
Aspects not implemented are rated 0.

Teacher and student response data were analyzed using the formula:

$$\text{Rg} = \frac{\text{number of questions answered}}{\text{total number of questions}} \times 100\%$$

Student learning outcomes test data were analyzed using the formula:

$$\text{Mastery} = \frac{\text{total score obtained}}{\text{total score}} \text{ x } 100$$

Then, these results were qualified according to the Minimum Completeness Criteria (KKM). The results passed KKM if reach ≥ 65. Furthermore, to determine classical completeness, the formula used is:

$$\text{Classical Completeness} = \frac{\text{the number of students who reach the KKM}}{\text{total number of students}} \times 100\%$$

Based on the data analysis technique above, it can be said that the learning device with a realistic mathematical approach to the curved-surface three-dimensional shapes for 9^{th} grade students of Junior High School in Ambon City was suitable (valid) if it met the following criteria.

a. The validator gave a minimum rating of good.
b. Teacher activity in learning was said to be implemented if the percentage of teacher activity was more than or equal to 70%.
c. Student activity in learning was said to be effective if the percentage of student activity was more than or equal to 70%.
d. The teacher's response was said to be positive if the average percentage obtained was more than 70% in the category of Strongly Agree (SS) and Agree (S)
e. Student responses were said to be positive if the average percentage obtained was more than 70% in Strongly Agree (SS) and Agree (S).
f. 65% of students got test results reaching KKM.

3. Result and Discussion

3.1 Result

Based on the stages of device development, the following results were obtained.

a. Defining Stage

This stage consists of: (1) Preliminary Final Analysis: Researchers obtained information from junior high schools in Ambon city, generally already using the 2013 Curriculum. In addition, the mathematics teacher said that the material for building space was considered difficult for grade IX students, (2) Student Analysis: characteristics Grade IX students of State Junior High Schools in Ambon city for the 2020/2021 academic year, among others, have various academic abilities, namely high, medium, and low skills, (3) Material Analysis: includes cylinder surface area, cylinder volume, cone surface area, and volume cone; Task Analysis: the task formulation obtained is to find the formula for the surface area of a cylinder, calculate the surface area of a cylinder, find the formula for the volume of a cylinder, calculate the volume of a cylinder, find the procedure for the surface area of a cone, calculate the surface area of a cone, find a formula for the volume of a cone, and calculate the volume of a cone; and (4) Results Specification Learning Objectives: writing in their own words the meaning of the tube, writing in the terms the importance of cones, finding the formula for the surface area of a tube and a cone through experimentation, finding the procedure for the volume of a cylinder and a cone through investigation, solving problems related to surface area of cylinders and cones, and solve problems related to the importance of cylinders and cones

b. Design Stage

This stage consists of (1) Format selection: adjusted to the steps and characteristics of a realistic mathematical approach. The RPP includes core competence (KI), basic competence (KD), indicators, subjects, learning methods, learning resources, and learning activities. Learning activities consist of introductions, core, and closing; (2) Preliminary Design: an initial draft consisting of RPP, BA, and LKPD is produced for 4 meetings.

The initial design systematic is shown in Table 1 below.

Table 1. Preliminary Design Systematics

RPP	BA	LKS	Meeting
RPP 01	BA 01	LKPD 01	First
RPP 02	BA 02	LKPD 02	Second
RPP 03	BA 03	LKPD 03	Third
RPP 04	BA 04	LKPD 04	Fourth

c. The Development Stage is as follows.

1) The general evaluation of the validators on learning tools. The three validators gave an average rating of 3. It means that the assessment was in a good category. In addition, the validator said that the learning tool could be used with a few revisions. Thus, the revision was carried out following the validator's suggestions and comments.
2) Results of RPP Validation and Revision: the three validators gave an average rating of 3.4. It means that the assessment was in a good category. In addition, the validator said that this RPP tool could be used with a few revisions. Thus, revisions were made according to the suggestions and comments of the validator.
3) In the BA Validation and Revision results, the three validators gave an average rating of 3.6. It means that the assessment was in a good category. In addition, the validator said that this BA device could be used with minor revisions. Thus, revisions were made according to the suggestions and comments of the validator.
4) In the LKPD Validation and Revision results, the three validators gave an

average rating of 3.7. It means that the assessment was in a good category. In addition, the validator said that this BA device could be used with minor revisions. Thus, revisions were made according to the suggestions and comments of the validator.

5) The results of the Readability Test and Revised Readability Test. Students said they could understand the sentences in the BA and LKPD, and the partner teacher said he could understand the meaning of the sentences in the RPP, BA, and LKPD. Based on the readability test results, the researchers decided not to revise the learning tools in draft II because the learning tools in draft II, which had been revised based on the validator's input, were legible and could be understood by both students and partner teachers. Thus, the draft II learning tool could be used in a trial of learning tools.

6) Learning Tool Trial Results: The trial was carried out by each Junior High School and carried out in 4 meetings following the lesson plans. In this activity, the teacher was the partner teacher. Students were arranged in groups by each junior high school in the learning process. In addition, the number of students in each group was adjusted for the total number of students who had heterogeneous academic abilities. The data obtained from the trial was in the form of data analysis to revise the learning tool draft III to draft IV (final draft) based on the results:
   a) Observations of teacher activities. The observations result of partner teachers when using realistic mathematics approach learning tools in the four meetings, namely 77.1% at the first meeting, 83.3% at the second meeting, and 100% at the third and fourth meetings, respectively. Thus, it can be concluded that teachers could carry out learning according to a realistic mathematical approach.
   b) The results of the teacher's response to the learning device. 42.2% of the teacher's responses were strongly agreed (SS), and 57.8% were in agree (S). Meanwhile, the responses with categories of undecided (RR), disagree (TS), and strongly disagree (STS) by 0%. Thus, the teacher gave a positive response of 100%, which was obtained from the sum of the SS and S categories.
   c) Students' responses to learning tools. The average student response in the category of strongly agree (SS) was 35.4%; agree (S) 63.8; undecided (RR) 0.8; and disagree (TS) and strongly disagree (STS) were 0%, respectively. Thus, it can be said that students gave a positive response of 99.2%, which was obtained from the sum of the categories strongly agree and agree.
   d) Student Learning Outcomes. 87% of students reached the KKM (≥ 65).

Based on the test results, the criteria are met, so that the results of the development of a valid Realistic Mathematics Approach on the three-dimensional shapes with curved surfaces material for grade IX students of SMP in Ambon City.

3.2 Discussion

The results based on a realistic mathematical approach can be used as an alternative in learning the three-dimensional shapes with curved surfaces material, which departs from the 4D model with the stages of defining, designing, and developing. The discussion of the results of the study is described as follows.

d. Defining Stage

At this definition stage, a preliminary analysis is carried out, and student analysis, concept analysis, task analysis, and learning objectives are carried out. Based on the final preliminary study results, the three-dimensional shapes with curved surfaces material is one of the most challenging materials for most students in class IX SMP in Ambon city.

The low quality of mathematics learning indicates this in schools. One of the low-quality education is the learning approach used in the learning process. According to Dalyana (Mataheru, 2011), one of the causes of the low quality of learning is the learning process that is still carried out conventionally and too abstractly. This contradicts the cognitive development of junior high school students. As a result, many students are not happy and have difficulty learning mathematics.

A realistic mathematics approach is a learning approach that uses contextual problems; as the first step in learning mathematics by the principles and characteristics of a realistic mathematics approach. Through a realistic mathematical approach, it is hoped that: (1) Learning activities are no longer centered on the teacher but centered on students, even centered on contextual problem-solving, (2) Will be more familiar with mathematics in the student's environment so that it is not easy to forget the mathematical concepts/principles he learns, and (3) It will make it easier for students to apply mathematical concepts or principles in solving problems and solving problems of everyday life.

Based on the results of the material analysis, it can be seen that the curved side space structure consists of several sub-materials. The researcher feels the need to research this material. Then a task analysis is carried out to make it easier to identify student skills. Furthermore, the specification of learning objectives is carried out by outlining the students' specific tasks.

e. Design Stage

At this stage, the selection of learning media, learning formats, and the design of learning devices are carried out. The selection of media needed in learning, namely RPP, BA, and LKPD. Furthermore, the selection of a format that is adapted to the syntax of a realistic mathematical approach is carried out. Finally, under the selection of media and learning formats, the initial design for the learning devices was carried out in four (4) meetings

f. Development Stage

Learning tools made in the form of a draft I were assessed by an expert assessment (validator). Based on the results of the general assessment of the three validators, they gave an average rating of 3. Therefore, this assessment was in a good category. Furthermore, it shows that the first criteria had been met, but some things still need to be revised. Thus, the researcher made a revision based on the validator's input and suggestions to obtain the second draft.

The second draft was then judged for reading by partner students and teachers. Students said they could understand the sentences contained in the BA and LKPD. The partner teacher said the same thing. They said they could understand the meaning of the sentences in the RPP, BA, and LKPD. Thus, draft II's RPP, BA, and LKPD were not revised, so draft II directly became draft III.

Furthermore, draft III was tested on 10 junior high schools in Ambon city. Before learning began, students were divided into study groups consisting of 3-4 people. The placement of students in each group with heterogeneous abilities was high, medium, and low abilities. The placement of students in this group is intended so that they can share their knowledge and experiences. Nur's opinion (Mataheru, 2011) is that a realistic mathematics approach is a learning strategy that allows students to work in small groups with different abilities to help each other learn as a team.

At the first meeting, the teacher had not carried out the learning steps thoroughly. For example, the teacher did not conclude the discussion results, did not repeat the concepts that had just been taught, and the use of time had not been as expected. It was indicated by observations of teacher activities in learning by 77.1%. In addition, it also appears that in each study group, several students had not been actively discussing. It can happen because this realistic mathematical approach is considered new to the teacher. At the end of the lesson, the researcher, the teacher, and the observer discussed several things that were considered to be shortcomings at the first meeting. They were expected to be applied to the second meeting.

At the second meeting, the teacher carried out learning according to the planned learning steps. Likewise, students in study groups ask each other, their friends, and their teachers about things they do not understand. It follows the opinion of Sanjaya (Mataheru, 2011). In the learning process, the teacher does not only act as a model or role model for students and as a learning manager.

Yusmanita, et al. (2018) also stated that the learning process is designed to create an atmosphere that allows students to carry out mathematics learning activities. Activities in groups can also allow students to conduct discussions so that student interaction can be established and the sharing of opinions occurs.

Thus, the effectiveness of the learning process lies on the shoulders of the teacher, and the success of implementing a learning strategy will depend on the teacher in using learning methods, techniques, and tactics. It is indicated by observations of teacher activities in learning starting to increase, equal to 83.3%.

At the third and fourth meetings, the learning process was getting maximized compared to the learning process at the first and second meetings. For example, each learning step could be passed, the use of time was appropriate, and students looked active in groups. In addition, if there were group friends who did not understand the material, they were invited to discuss it. It is indicated by observations of teacher activities in learning by 100%.

Teachers and students were asked to fill out a questionnaire to find out the response of teachers and students to the learning tools used. From the questionnaire results, it was found that partner teachers gave a positive response, namely with a category of strongly agree (SS) of 42.2% and agree (S) of 57.8%. Likewise, student responses responded positively to the learning tools, namely with the category of strongly agree (SS) of 35.4%; and agree (S) of 63.8. Therefore, based on the responses of teachers and students, it can be said that the response criteria had been met, so the learning tools did not need to be revised.

The learning outcome test consisted of 8 questions with Curved-surface three-dimensional shapes material. It was followed by students from 7 junior high schools in Ambon city, with 125 students. Based on the test results, 90 students had reached the KKM, and 35 had not reached the KKM. Thus, it can be concluded that the student's test results have reached the predetermined criteria, which is 72%.

Based on the discussion above, it is known that all the criteria for valid learning devices have been met. The set of realistic mathematical approaches for Curved-surface three-dimensional shapes in the 9th grade class of a junior high school in Ambon city, which the researcher developed, is valid. However, this study has a weakness. Namely, no observations were made on student activities in groups. It certainly affects the results of the analysis of student activities on the implementation of the learning device trials.

4. Conclusion

Based on the results and discussion, it can be seen that the key is the development of learning tools using a realistic mathematical approach to the curved side space construction material for class IX students of SMP in Ambon city, after being validated, tested for legibility, and tried is good (valid). The fulfillment of the following criteria indicates this: (1) The general assessment of the validator is good (score 3); (2) The implementation of learning in class at the first meeting (77.1%), the second meeting (83.3%), the third meeting (100%), and the fourth meeting (100%); (3) Positive teacher response (100%); (4) Positive student responses (92.2%) and (5) 72% of students achieved classical completeness.

Learning tools on curved side space with a realistic mathematical approach were also tested in other schools to obtain better learning tools. In addition, learning tools with a mathematical system were also developed for other mathematics materials because, based on student responses, it was found that students were interested in following further learning with a realistic mathematics approach.

References

Arifin, Yusmin, E, Hamdani. (2017). Analisis Kesulitan Belajar Siswa pada Materi Bangun Ruang Sisi Lengkung Di SMP. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, *6*(4).

Deviani, R. Ramlah, Adirakasiwi, A. G. (2017). Analisis Kesulitan Belajar Siswa Pada Materi Bangun Ruang Sisi Datar. *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika (SESIOMADIKA)*.

Freudenthal, H. (1973). *Mathematics as an educational task*. Dordrecht: Kluwer Academic Publishers

Hadi, S. (2015). Pendidikan Matematika Realistik. Banjarmasin: Penerbit Tulip.

Lutvaidah, U., & Hidayat, R. (2019). Pengaruh Ketelitian Membaca Soal Cerita terhadap Kemampuan Pemecahan Masalah Matematika. *JKPM (Jurnal Kajian Pendidikan Matematika)*, *4*(2) 79-188

Mataheru, W., dkk. (2011). Pengembangan Perangkat Pembelajaran Matematika realistik Untuk Topik Perbandingan Pada Siswa SMP Hang Tuah Ambon. Hasil Penelitian.

Mataheru, W., Huwaa N. C., Matitaputty C. (2017). Writing Material Using Inquiry Oriented Discovery Method on Learning Mathematics. Proceeding International Seminar on Educatio. Volume 1.

Mataheru, W. (2019). Proses Kognitif dalam Pemecahan Masalah: Alfabeta. Bandung.

Nuraida, I. (2017). Analisis Kesalahan Penyelesaian Soal Bangun Ruang Sisi Lengkung Siswa Kelas IX SMP Negeri 5 Kota Tasikmalaya. *Teorema: Teori dan Riset Matematika*, *1*(2), 25-30

Rosyida, E. M., Riyadi, R., dan Mardiyana, M. (2016). Analisis Kesalahan Siswa Dalam Pemecahan Masalah Berdasarkan Pendapat John W. Santrock Pada Pokok Bahasan Bangun Ruang Sisi Lengkung Ditinjau Dari Gaya Belajar Dan Gaya Berpikir Siswa. *Jurnal Pembelajaran Matematika*. *4*(1).

Sugiyono. 2013. Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D). Bandung: CV Alfabeta.

Suwarsono. (2017). Beberapa Permasalahan yang Terkait dengan Upaya Implementasi Pendidikan Matematika di Indonesia. Makalah disajikan pada seminar RME di universitas Sanata Dharma Yogyakarta.

Thiagarajan, S., Semmel, D. S. dan Semmel, M. I. (1974). *Instructional Development for Teacher of Exceptional Children*. Bloomington: Indiana University.

Yuliana, R. (2017). Pengembangan Perangkat Pembelajaran dengan Pendekatan PMRI pada Materi Bangun Ruang Sisi Lengkung untuk SMP Kelas IX. *Jurnal Pedagogi Matematika*, *6*(1), 60-67.

Yusmanita, S., Ikhsan, M., & Zubainur, C. M. (2018). Penerapan Pendekatan matematika realistik untuk meningkatkan kemampuan operasi hitung perkalian. *Jurnal Elemen*, *4*(1), 93-104.

Yuwono, I. (2014). *”RME (Realistics Mathematics Education) dan Hasil Studi awal Implementasinya di SLTP.”* Makalah Seminar disajikan pada Seminar Nasional Realistics Mathematic Education (RME) di UNESA Surabaya.