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DEVELOPMENT OF LEARNING INSTRUMENTS BASED ON RME MODELS TO IMPROVE STUDENTS' MATHEMATICAL LITERACY AND LEARNING INTEREST

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ABSTRACT

This study employed GeoGebra to develop interactive learning instruments for SLETV content, using the 4-D Thiagaradjan model as the framework, involving four phases: define, design, develop, and disseminate. The investigation included two eighth-grade math teachers and fourteen-year-old eighth-graders, and observational data were collected through needs analysis, interviews, and questionnaires. The data collection comprised need analysis, interviews, and surveys. Before trial implementation, three crucial development requirements had to be met: validity, practicality, and efficacy. The validation of learning instrument formats, illustrations, language, and content showed valid. The research findings indicate that the developed learning instruments were effective, with an average student score of 74.3 on the pretest and 87 on the posttest (meeting the minimum criteria of mastery learning). Teacher's ability to manage learning was rated as very good, with an average score of 4.4. The observation of learning implementation showed an average score of 4.4 in the very good category (practical). The learning instruments based on RME can be used to enhance students' mathematical literacy and learning interest.

ARTICLE INFORMATION

Keywords

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Mathematical Literacy
Interest in Learning

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INTRODUCTION

The field of education is rapidly evolving, particularly in the age of science and information technology. Education is a deliberate endeavor that involves guiding, teaching, and training students to prepare them for their future roles. It is a structured process aimed at achieving successful learning outcomes regarding personality, character, and morals while also nurturing individuals who can contribute meaningfully to their nation and state.

Mathematics is one of the subjects studied by students at school. Mathematics is an important subject in education because it is taught at all levels of education, from Elementary School to higher education. This can be seen from the number of hours studied for mathematics which is more than the number of hours studied for other subjects at school. Nasution et al. (2017) argued that mathematics is an area of knowledge studied by all students from elementary school to high school and the equivalent in tertiary institutions. This concludes that mathematics is a very important science because it acts as a basis for advancing science and technology in other fields. As a result, mathematics received the title "Queen of Knowledge."

Mathematics education itself has a vital part in one's life. Students are instructed to think rationally, critically, methodically, practically, creatively, effectively, and efficiently when solving issues by learning mathematics. Students must have high-level mathematical thinking skills to comprehend a mathematical problem. These abilities include the ability of mathematical literacy.

Literacy ability, Hasanah (2015) claimed that mathematical literacy is the ability to use contexts, including the ability to reason mathematically and use concepts, procedures, and facts to describe, explain, and forecast an event.

Having good literacy skills will facilitate students in solving math problems. Thus activating mathematical literacy is very important to solve problems encountered in everyday life (Mansur, 2018)

However, the ability of students' mathematical literacy in Indonesia is still not good; this can be seen from international comparative studies, such as PISA (Program for International Student Assessment). The results of the 2018 PISA put Indonesia in the bottom ten of the 79 participating countries. The average reading ability of Indonesian students is 80 points lower than the OECD average. The ability of Indonesian students is still lower than ASEAN students. Indonesian students' average reading, math, and science abilities are 42, 52, and 37 points lower

than the average ASEAN students (Pusat Penilaian Pendidikan Balitbang Kemendikbud, 2019).

In addition to this, facts were also found in the school studied, a Year 8 class in a private junior high school in Medan, Indonesia. From the results of the researchers' observations on June 15, 2022, to find out how students' mathematical literacy skills at the school studied were, the researchers gave a diagnostic test to Year 8 students; from the test results, it was seen that students did not use literacy skills so they were unable to write down things they knew and what was asked. This was marked by the answers of students who did not write down things that were unknown and asked. Besides that, students are not able to solve the questions given. So this shows that the ability of students' mathematical literacy is low. This can be seen from the low test results of students who only achieved an average score of 65, while the standard value of the Minimum Criteria of Mastery Learning (KKM) was 75.

The following is one of the questions given to see students' mathematical literacy skills: A woman goes to a clothing store. Then he bought two shirts and three pairs of jeans for IDR 340,000. Then he bought another shirt and two pairs of jeans for Rp. 210,000. Then how much is the price of a shirt and a pair of jeans?

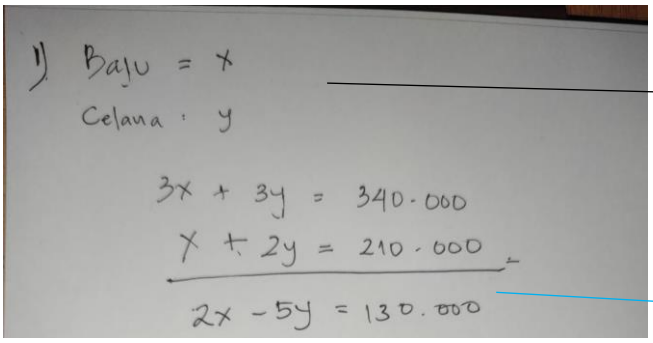


Figure 1. Student Answers

In addition to the importance of students' mathematical literacy skills, another thing that is considered important is students' attitudes toward learning mathematics, one of which is student learning interest. This literacy ability is also directly related to students' moral responsibility in increasing student interest in learning. Interest is a factor that has an important role in literacy skills because high student interest also supports the enthusiasm of these students in learning more in a lesson. Interest in learning is a psychological aspect that significantly influences student success in completing assignments and questions well.

Interest is a state in which a person gives attention to something with the desire to know, own, learn, and prove it. Interest is formed by the environment after learning about an object or

wall and is accompanied by feelings aimed at a specific action object (Rahmat, 2018).

Daniyati & Sugiman (2015) also stated that interest in learning mathematics needs to be grown to achieve better learning achievement. To foster students' interest, they must first pay attention to things that can cause a reduction or loss of interest in learning. Students' perceptions can affect students interest in mathematics.

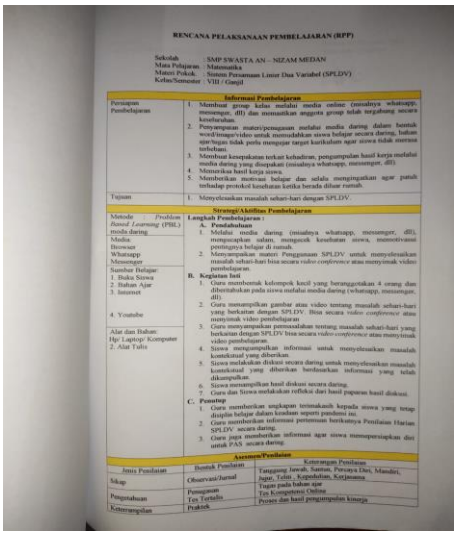
Lean on on the results of initial observations at school; it was revealed that several factors caused low mathematical literacy abilities and low student interest in learning, including the teacher-centered mathematics learning process and using conventional strategies that make students passive. Thus, using learning instruments is one method of increasing students' mathematical literacy and interest in learning.

In accordance with this, suitable learning activities, such as the use of learning instruments, are required to improve students' mathematical literacy skills and interest in learning. The importance of learning instruments in teaching and learning activities is critical. Learning instruments include acting as tools that can increase students' desire to learn, which will later be able to create an effective learning atmosphere. Because the beginning of learning is the desire to learn, a teacher must create something that can increase students' interest in learning, one of which is by developing learning instruments that are able to attract students' attention and desire to learn.

The significance of instrument development was also declared by (Lubis, Wilda Indah, et al., 2020). Learning for a teacher in which the learning instrument serves as a guide, so the learning tool directs the instructor in carrying out the systematic learning process.

Apart from that, the importance of developing learning instruments is also stated in Permendiknas Number 41 of 2007 concerning process standards, which, among other things, regulates the planning of the learning process which requires educators in educational units to be obliged to develop complete and systematic learning instruments so that educational goals can be achieved.

Based on the results of preliminary observations conducted at one of the private junior high schools in Medan, Indonesia. with teachers in the field of mathematics studies, it was revealed that the learning instruments at the school did not match the existing criteria. The learning instruments include lesson plans, worksheets, student books, and assessment instruments. This is proven by one of the lesson plans held by the mathematics subject teacher at the school as follows.



RENCANA PELAKSANAAN PEMBELAJARAN (RPP)

Sekolah : SMP SWASTA AN – NIZAM MEDAN
Mata Pelajaran : Matematika
Materi Pokok : Sistem Persamaan Linier Dua Variabel (SPLDV)
Kelas/Semester : VIII / Ganjil

Informasi Pembelajaran	
Persiapan Pembelajaran	1. Membuat group kelas melalui media online (misalnya whatsapp, messenger, dll) dan memasukkan anggota group telah tergabung secara keseluruhan. 2. Penyampaian materi/penugasan melalui media daring dalam bentuk word/image/video untuk memudahkan siswa belajar secara daring, bahan ajar/tugas tidak perlu merajuat target kurikulum agar siswa tidak merasa terbebani. 3. Membuat kesepakatan terkait kehadiran, pengumpulan hasil kerja melalui media daring yang disepakati (misalnya whatsapp, messenger, dll). 4. Memeriksa hasil kerja siswa. 5. Memberikan motivasi belajar dan selalu mengingatkan agar patuh terhadap protokol kesehatan ketika berada dirumah dan rumah.
Tujuan	1. Menyelesaikan masalah sehari-hari dengan SPLDV
Strategi/Aktifitas Pembelajaran	
Metode *Problem Based Learning* (PBL) media daring Media: Browser Whatsapp Messenger Sumber Belajar: 1. Buku Siswa 2. Bahan Ajar 3. Internet 4. Youtube Alat dan Bahan: Hp/ Laptop/ Komputer 2. Alat Tulis	**Langkah Pembelajaran :** **A. Pendahuluan** 1. Melalui media daring (misalnya whatsapp, messenger, dll), mengucapkan salam, mengecek kesehatan siswa, memotivasi pentingnya belajar di rumah. 2. Menyampaikan materi: Penggunaan SPLDV untuk menyelesaikan masalah sehari-hari bisa secara *video conference* atau menyimak video pembelajaran. **B. Kegiatan Inti** 1. Guru membentuk kelompok kecil yang beranggotakan 4 orang dan diberitahukan pada siswa melalui media daring (whatsapp, messenger, dll) 2. Guru menampilkan gambar atau video tentang masalah sehari-hari yang berkaitan dengan SPLDV. Bisa secara *video conference* atau menyimak video pembelajaran 3. Guru menyampaikan permasalahan tentang masalah sehari-hari yang berkaitan dengan SPLDV bisa secara *video conference* atau menyimak video pembelajaran. 4. Siswa mengumpulkan informasi untuk menyelesaikan masalah kontekstual yang diberikan. 5. Siswa melakukan diskusi secara daring untuk menyelesaikan masalah kontekstual yang diberikan berdasarkan informasi yang telah dikumpulkan. 6. Siswa menampilkan hasil diskusi secara daring. 7. Guru dan Siswa melakukan refleksi dari hasil paparan hasil diskusi. **C. Penutup** 1. Guru memberikan ungkapan terimakasih kepada siswa yang tetap disiplin belajar dalam keadaan seperti pandemi ini. 2. Guru memberikan informasi pertemuan berikutnya Penilaian Harian SPLDV secara daring. 3. Guru juga memberikan informasi agar siswa mempersiapkan diri untuk PAS secara daring.
Asesmen/Penilaian	
Jenis Penilaian	Bentuk Penilaian / Keterangan Penilaian
Sikap	Observasi/Jurnal / Tanggung Jawab, Santun, Percaya Diri, Mandiri, Jujur, Teliti , Kepedulian, Kerjasama
Pengetahuan	Penugasan / Tugas pada bahan ajar Tes Tertulis / Tes Kompetensi Online
Keterampilan	Praktek / Proses dan hasil pengumpulan kinerja

Figure 2. Form of Lesson Plan

The lesson plan still has several weaknesses, including that the lesson plan does not include basic competencies and indicators of competency attainment, which are part of the components for preparing the lesson plan based on Permendikbud Number 22 of 2016 relates to primary and secondary school procedure standards. As a result, the learning instruments must be improved. As a result, the learning objectives will be readily met.

Developing learning instruments must be supported by learning models. Many kinds of learning models are currently known; therefore, an appropriate learning tool is needed to improve students' mathematical literacy abilities and learning interests. The role of learning instruments is crucial in teaching and learning activities. Learning instruments include acting as tools that can increase students' desire to learn, which will later be able to create an effective learning atmosphere.

One of the learning models developed to improve mathematical literacy skills and interest in learning is the Realistic Mathematics Education (RME) learning model. Sugiarni (2019) suggests that learning mathematics with a realistic approach is utilizing reality and the environment that participants understand to expedite the process of learning mathematics so as to achieve the goals of mathematics education better than in the past.

In line with that, Astuti (2018) provide an understanding of Realistic Mathematics Education as the use of the environmental reality that students can understand in facilitating the learning process so that better educational goals are achieved. RME allows students to form their understanding of Mathematical ideas and concepts through problems found in the real

world.

Ningsih's research (2014) also explained that the importance of the RME model is that students can explore their knowledge with the help of contextual objects that can stimulate students' thinking to imagine the problems they are experiencing so that students can also imagine how to solve them.

Based on the description above, the researcher is interested in developing learning instruments based on realistic learning models to improve students' mathematical literacy skills and interest in learning.

METHOD

This research includes development research (R&D). This study uses the 4-D development model by Thiagarajan, Semmel, & Semmel (1974). This model consists of 4 stages: Define, Design, Develop and Disseminate.

The stages of developing the 4-D learning instrument are detailed as follows.

Define stage

This stage aims to determine and define learning needs by analyzing the objectives and limitations of the material. Activities in this stage are the initial and final analysis, student analysis, task analysis, and specification of learning objectives.

Design Stage

This stage aims to design learning instruments so that prototypes (examples of learning instruments) are obtained. This stage begins after specific learning is established. This stage includes test preparation, instrument selection, format selection, and initial design.

Develop stage

At this stage, Experts will validate the instrument before it is used in field trials. Draft 1 refers to the tools before they are verified by experts. If experts have validated these tools, and if there is a revision by experts, the tools must be repaired or revised before moving on to the next step; however, if there is no revision, it can be called draft 2.

Dissemination Stage

The development of student worksheets reaches the final stage if it has obtained a positive assessment from experts and has passed a development test. The instrument was designed, disseminated, and used for a wider scale.

The development model in this study is schematically depicted in Figure 1 below:

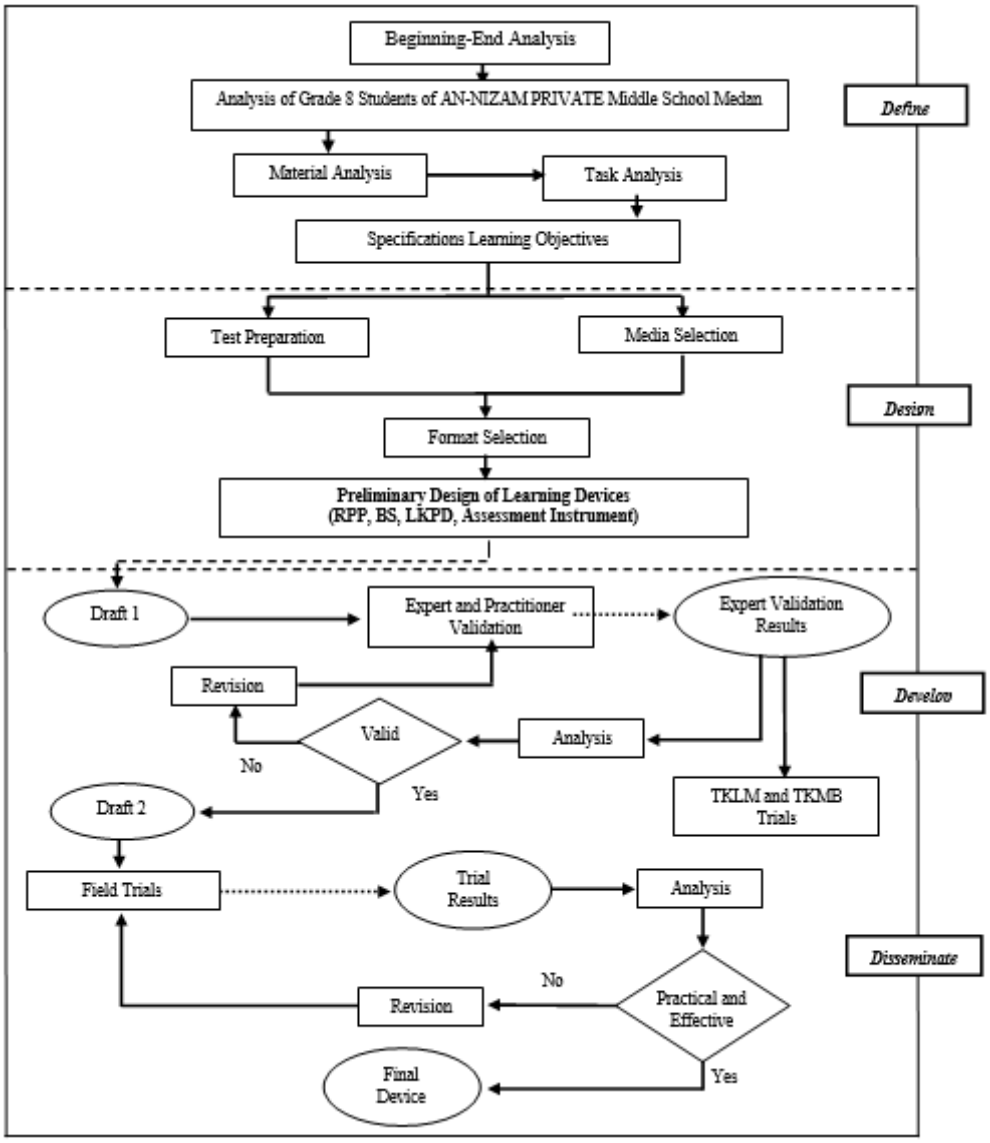


Figure 3. 4-D Model Learning Instrument Development Chart

This research was conducted at one of the private junior high schools in Medan, Indonesia, which is in the odd semester of the 2022/2023 academic year. The subjects in this study were Year 8 students. The trial design of this study used the One Group Pretest-Posttest Design. The first step is to take measurements as a pretest, then subject to treatment within a certain period, a posttest is carried out (Lestari & Yudhanegara, 2015).

The design of this research trial was based on the PretestPretest and Posttest Group research design, with the following pattern:

Table 1. Trial Design

O1	X	O2

Information:

O1 : Initial test (*pretest*) is done to determine learning outcomes and interest in learning before being given treatment

X: The learning treatment uses learning with the RME model that has been developed.

O2 : The final test (posttest) was conducted to determine the learning outcomes of products, processes, and student performance tests on students' mathematical literacy abilities and interest in learning. After the posttest was carried out, a questionnaire was given to students' responses to learning.

Learning instruments are assessed based on Nieven's criteria (Romlah et al., 2018). These criteria assess the quality of learning instruments based on three aspects, namely: (1) Validity; (2) Practically; and (3) Effectiveness.

Data Analysis of the Validity of Learning Instruments

Content validation is based on the opinions of five experts in the field of mathematics education. Based on the opinions of these experts, the level of agreement between observers (experts) will be determined, which will be analyzed using statistical tests with the formula:

$$r = \frac{RJK_b - RJK_e}{RJK_t}$$ (Asmin, 2012)

Analysis of Practicality of Learning Instruments Data

Data collection for implementing learning using the developed tools is carried out per meeting by an observer. The activity of determining the learning implementation observation score follows the following steps:

Determine the average score of observation of the implementation of learning at each meeting with the formula:

$$P_i = \frac{\sum_{j=1}^{n} O_i}{n}$$ (Sinaga, 2007)

With P_i := an average score of observation of learning implementation in each meeting

O_i = data on the observation score of the implementation of learning on the third statement *i*

n = the number of statements

Determining the average score of observation of the implementation of learning:

$O_k = \frac{\sum_{j=1}^{m} P_i}{m}$(Sinaga, 2007)

with:O_k= average score of observation of learning implementation

P_i = average score of observation of learning implementation in each meeting

m = the number of meetings

The results obtained are then written in the column in the appropriate table.

After the data is collected, the average total score is determined from the observation of the implementation of learning (O_k) with categories like Table 3.14.

The developed learning instrument is said to be practical if the average learning implementation is at least in the 'well implemented' category ($3 \leq O_k < 4$).

Data Analysis of the Effectiveness of Learning Instruments

Data analysis of the effectiveness of student learning instruments can be seen from the following various aspects:

Analysis of Student Completeness Data

The criterion states that students already have students' Mathematical Literacy abilities if there are 80% of students who take the test have at least medium students' Mathematical Literacy abilities (obtaining a score of more than one is equal to 2.85 or at least (B). To determine the percentage of each student's learning, students can use the following equation:

$$KB = \frac{T}{T_t} x100\%$$

Where: KB = Mastery learning

T = Total score obtained by students

T_t = Sum of total scores

Observation Analysis of Student Activities in Learning

Data from observations of student activities during learning activities were analyzed based on percentages.

$$\text{Percentage of ideal time} = \frac{\text{Frequency of each aspect of observation}}{\text{Sum of frequencies of all observation aspects}} \times 100\%$$

The criterion for achieving the effectiveness of student activities in learning is if the six categories of student activities are met with a tolerance of 5%.

Data Analysis of Teachers' Ability to Manage Learning

Based on observations made by observers in the implementation of learning, the Teacher's ability to manage the learning process is determined by the average score given by the observer using the rating scale as follows:

a) Determine the average observation score of the Teacher's ability to learn each meeting with the formula:

$$P_i = \frac{\sum_{j=1}^{n} K_i}{n}$$ (adaptation Sinaga, 2007)

With : P_i= the average score of observations of the Teacher's ability at each meeting

K_i= data on the Teacher's ability observation score for the i-th statement

n= the number of statements

The results obtained are then written in the column in the appropriate table.

b) Determining the average observation score of the Teacher's ability in learning:

$$K_g = \frac{\sum_{j=1}^{m} P_i}{m}$$ (adaptation Sinaga, 2007)

With : K_g= average score of observations of student activity in learning

P_i= average score of student activity observations in learning each meeting

m= the number of meetings

Analysis of Teacher and Student Response Data

Data from student response questionnaires were analyzed using descriptive qualitative by presenting positive and negative responses of students in filling out student response questionnaires calculated by the formula:

$$PRS = \frac{\sum A}{\sum B} \times 100\%$$

Note: PRS = the percentage of students who gave a positive response

$\sum A$= the proportion of students who choose

$\sum B$= number of students (respondents)

To determine the achievement of learning objectives in terms of student responses, if the number of students who give positive responses is greater than or equal to 80% of the number of subjects studied for each Trial.

RESULTS AND DISCUSSION

This research is development research, and the product of this research is learning instruments. This study aimed to describe: (1) obtain learning instruments developed based on

a Realistic Mathematics Education (RME) approach that is valid, practical, and effective for improving mathematical literacy skills in the school studied; (2) describe how the improvement of students' mathematical literacy skills at the school studied is taught with learning instruments developed based on Realistic Mathematics Education (RME) approach. Data analysis and research results obtained at each stage of development are presented as follows:

Define

The results of observation and analysis of learning instruments at the school studied showed that teachers have not had learning instruments that can improve Mathematical Literacy skills. In addition, in the learning process, students are not involved in finding their knowledge but are directly given by the Teacher. This is thought to be the cause of students' mathematical literacy skills that are still not good.

Design

This stage aims to design learning instruments to obtain prototypes (examples of learning instruments) for SLETV material. Activities at this stage are as follows:

Test Compilation Results

The result of the pretest arrangement is the task analysis and concept analysis described in the specification of learning objectives. The test is a test on SLETV material and a student questionnaire. The learning outcomes test consists of 5 questions in the form of descriptions. The time allotted to complete the test is 60 minutes.

Format Selection Results

The results of the format selection in the study were adjusted to the 2013 curriculum. The lesson plan components consist of School identity, namely the name of the educational unit; Subject identity or theme or sub-theme; Class or semester; Subject matter; Allocation of time; learning objectives that are formulated are determined according to the requirements for achieving KD available in the syllabus, the learning method used by researchers is *Realistic Mathematics Education* (RME); Learning resources, can be in the form of books, learning videos, print, and electronic instruments or other relevant learning resources; Learning steps are carried out through the preliminary, core, and closing stages; and assessment of learning outcomes.

Preliminary Design Results

From the initial design stage, a learning implementation plan was produced for two meetings

on field trials and student learning outcomes tests.

Develop

Initial Draft

The results are validated by experts. Expert validation was carried out, covering all the instruments developed. The validators who validated the learning instruments developed (Initial Draft) consisted of 5 people, including 3 UNIMED mathematics education lecturers, one Teacher from the school studied, and one Teacher from another junior high school in Medan. Based on the results of validation calculations of 5 experts in the initial test of student learning outcomes contained in the appendix. The average value of the score is 3.71. Referring to the validity criteria, it can be concluded that the learning instrument instruments developed meet the validity criteria, with the "Valid" category further can be seen in the following table:

Table 2. Recapitulation of Learning Instrument Validation Results by Experts

No	Appraised object	The average value of the total validation	Validation Level
1.	Lesson Plan	3.59	Valid
2.	Student Book	3.71	Valid
3.	Student Worksheets	3.65	Valid
4.	Mathematical Literacy Test	3.83	Valid
5.	Student Learning Interest Ability Test	3.81	Valid

With reference to these criteria, it can be concluded that the learning instruments developed meet the validity criteria with a valid category. The validity of the questions was analyzed using the product moment correlation formula, namely by correlating the item score with the total score. The results of testing the spatial ability test instrument are presented in the following table:

Table 3. Pretest-Pretest Item Validity

No.	r_{xy}	r_{tabel}	Interpretation
1	0.5102	0.4440	Valid
2	0.4831	0.4440	Valid
3	0.5222	0.4440	Valid
4	0.4982	0.4440	Valid
5	0.4748	0.4440	Valid

Table 4. Post-test Item Validity

No.	r_{xy}	r_{tabel}	Interpretation
1	0.5326	0.4440	Valid
2	0.5706	0.4440	Valid
3	0.5620	0.4440	Valid
4	0.5930	0.4440	Valid
5	0.5620	0.4440	Valid

Based on the data in the table above, the interpretation of each pretest and posttest

item is in a very valid category.

After the developed learning instrument meets the validity criteria (draft 1), then the learning instrument in the form of draft two is tested at the research location, hereinafter referred to as Trial I. Trial I was conducted in a Year 8 class with a total of 20 students. Trial I was conducted in 2 meetings in accordance with the lesson plan that had been designed.

Overall, the results of the data analysis of Trial I show that the learning instruments developed have not met all the established success criteria because there are still indicators of practicality and effectiveness that have not been achieved, namely the results of observations of the implementation of learning and the results of the final test of students' mathematical literacy abilities in the Trial. I. After the results of Trial one were obtained, an evaluation phase was carried out where the researcher revised the learning instruments and/or the instruments developed. The following will explain each component that needs to be revised.

From the analysis of the results of Trial I, the researcher found several weaknesses that must be corrected so that this research can produce learning instruments and instruments that meet all valid, practical, and effective criteria. After the revision was completed, Trial II used the learning instrument (draft 2), and the instrument was carried out in the same class as well. Trial II was conducted to measure whether the learning instruments and equipment met all the established valid, practical, and effective criteria. Overall, the results of the second trial data analysis show that the learning instruments developed have fulfilled all the established valid, practical, and effective criteria. A more complete explanation can be seen in the description section on the validity, practicality, and effectiveness of learning instruments.

Disseminate

After the valid, practical, and effective criteria have been met in Trial II, a learning tool (final draft) is obtained. The next step is to carry out limited dissemination in the form of distributing the final draft to the MGMP forum in the school studied, which is marked by the delivery of learning instruments to the MGMP forum with the hope that the mathematics teachers who are members of the forum can apply these learning instruments to further learning.

Description of the Validity of Mathematics Learning Instruments

A learning instrument is said to be valid if the expert/practitioner's assessment of the developed learning instrument meets the valid criteria. Analysis of the validity of the developed learning instruments in terms of expert judgment regarding these learning

instruments. The assessment of the experts has been previously explained at the development stage regarding the validation results of the validators, where the results show that the learning instruments developed are stated to be valid with an average value of 3.71 (category "valid"). Based on this analysis, it can be said that the learning instruments developed are valid and ready to be used in learning.

Description of the Practicality of the Developed Mathematical Learning Instruments

In the Trial, I based on the practicality analysis results obtained from the responses given to experts/validators and practitioners (teachers) as well as by providing instrument validation sheets. Thus, the first practicality criterion has been met; namely, it can be used with a little revision.

The observation of the implementation of learning with learning instruments developed is in the "High" category, with a score of 3.4. That is the average score. The learning instruments developed in Trial I have met the practicality criteria of learning instruments that were set so that they can proceed to the next stage.

Description of the Effectiveness of Mathematics Learning Instruments Developed

The developed learning instrument is said to be effective if: (1) the minimum test score for mathematical literacy is 70 (the "good" category) and classically at least 80% of students fulfill the learning completeness; (2) the Teacher's ability to manage to learn by using learning instruments developed with a good minimum category;(3) the average results of the ideal time for student activities meet the set ideal percentage of time; (4) the average student response is in the minimal category“Interested” ($3 \leq Rs < 4$).

Analysis of Students' Mathematical Literacy Ability Test Results

The results of classical mastery of students' mathematical literacy skills in Trial I can be seen in the following table:

Table 5. Levels of Mathematical Literacy in Trial I

Category	Mathematical Literacy Student (Post-test)	
	The number of student	Precentage
Meeting KKM	6	30%
Not Meeting KKM	14	70%
Total	20	100%

In accordance with the criteria of classical student learning completeness, namely, at least 30% of students who take the mathematical literacy ability test are able to achieve a

minimum score of 70. So the results of the student's mathematical literacy ability test have not been completed classically because only 30% of students are able to achieve a minimum score. So it can be concluded that in Trial I, the application of the learning instruments developed did not meet the criteria for achieving classical mastery. The results of classical mastery of students' mathematical literacy skills in Trial II can be seen in the following table:

Table 6. Levels of Mathematical Literacy in Trial II

Category	Students' Visual Thinking (Post-test)	
	The number of	Precentage
Complete	17	85%
Not Complete	3	15%
Amount	16	100%

In accordance with the criteria of classical student learning completeness, namely, at least 80% of students who take the mathematical literacy ability test are able to achieve a minimum score of 70. Then the results of the student's mathematical literacy ability test have been met the classical mastery because there are 87.5% of students were able to achieve a minimum score. So it can be concluded that in Trial II, the application of the learning instruments developed met the criteria for achieving classical mastery.

Results Analysis Teacher Ability to Manage Learning

Teacher observation in managing learning is carried out in every meeting observed by one observer. The following are teacher observation data managing learning:

Table 7. Mean Assessment of Teacher Ability to Manage Learning in Trial I

No.	Aspect	Activity	Average Observer Score I	Average Value Aspect
1.	Introduction	Say greetings	4,7	4,4
		Motivate students to learn	4,3	
		Communicating learning objectives	4,3	
		Problem orientation	3,3	
2.	Core activities	Organizing students to study	3,6	3,6
		Guiding individual and group investigations	4,3	
		Develop and present the work	3,3	
		Analyze and evaluate the problem-solving process	3,6	
3.	Closing	Reaffirms the conclusion of the material	3,6	3,8
		Give some questions as independent assignments	4	
4.	Learning Time Management		3,6	3,6
5.	Class situation	Enthusiastic students take part in learning	3,3	3,4
		Enthusiastic teachers manage to learn	3,6	
			Average Value	3,7

Table 8. Mean Assessment of Teacher Ability to Manage Learning in Trial II

No.	Aspect	Activity	Average Observer Score I	Average Value Aspect
1.	Introduction	Say greetings	5	

No.	Aspect	Activity	Average Observer Score I	Average Value Aspect
		Motivate students to learn	5	
		Communicating learning objectives	4	4,6
		Problem orientation	5	
		Organizing students to study	3,6	
2.	Core activities	Guiding individual and group investigations	4,3	4,1
		Develop and present the work	4	
		Analyze and evaluate the problem-solving process	4	
		Reaffirms the conclusion of the material	4,3	
3.	Closing	Give some questions as independent assignments	4,3	4,3
4.	Learning Time Management		4,1	4,1
5.	Class situation	Enthusiastic students take part in learning	4	
		Enthusiastic teachers manage to learn	4	4

Analysis of the Percentage of Achievement Results of Student Activity Ideal Time

The following briefly describes the percentage of achieving the ideal time for student activities.

Table 9. Results of Percentage Analysis of Achievement of Ideal Time for Student Activities in Trial I

Meeting	Percentage of Achievement of Ideal Activity Time Students Each Aspect of Observation (%)					
	1	2	3	4	5	6
I	25.00	29,2	26,4	8.33	5.56	5.56
II	23,6	29,2	25	12.5	6,94	1.39
Average Percentage	24,3	29,2	25,7	10,42	6,25	3.48

Based on the analysis results in Table 8, the average percentage of achieving the ideal time for student activities for two meetings in Trial I was 24.3%, 29.2%, 25.7%, 10.42%, 6.25%, and 3.48%. Furthermore, the results of achieving the time obtained are referred to as the predetermined success criteria. From the results above, it can be concluded that student activity has reached the ideal time achievement percentage, whereas, from the six observed aspects, the student activity percentage is still within the specified ideal time achievement tolerance interval.

Table 10. Results of Percentage Analysis of Achievement of Ideal Time for Student Activities in Trial II

Meeting	Percentage of Achievement of Ideal Activity Time Students Each Aspect of Observation (%)					
	1	2	3	4	5	6
I	20,8	27,8	25	15.3	8.33	2.78
II	23,6	26.4	27,8	12.5	6,94	2.78
III	22,2	26,4	27,8	13,9	8.33	1.39
Average Percentage	22,2	26,87	26,87	13,9	7,87	2,32

Based on the analysis results in Table 9, the average percentage of achieving the ideal time for student activities for the three meetings in Trial II was 22.2%, 26.87%, 26.87%,

13.9%, 7.87%, and 2.32%. Furthermore, the results of achieving the time obtained are referred to as the predetermined success criteria. From the results above, it can be concluded that student activity has reached the ideal time achievement percentage.

Response Student Trial

Student response questionnaires were given to the respondents at the end of the Trial. The description of the results of the student response questionnaire can be seen in the Table 11.

Table 11. Description of Student Response Questionnaire Results in Trial I

No	Responded aspect	Frequency		Percentage	
		Like	No	Like	No
1	Do you feel happy or not about the following learning components?				
	a. Subject matter	12	8	60 %	40 %
	b. Instructional Media	13	7	65 %	35 %
	c. Student Worksheets	12	8	60 %	40 %
	d. Classroom learning atmosphere	11	9	55 %	45%
	e. The way the Teacher teaches	12	8	60 %	40 %
		New	**No**	**New**	**No**
2	Are the following learning components new to you or not?				
	a. Subject matter				
	b. Instructional Media	13	7	65%	35%
	c. Student Worksheets	13	7	65%	35%
	d. Classroom learning atmosphere	12	8	60%	40%
	e. The way the Teacher teaches	11	9	55%	45%
		12	8	60%	40%
		Interested	**No**	**Interested**	**No**
3	Are you interested or not taking part in the next lesson, like the one you just took?	14	6	70%	30%
		Clear	No	Clear	No
4	Can you clearly understand or not the language used in:				
	a. Instructional Media				
	b. Student Worksheets				
	c. Student Learning Outcomes Test	12	8	60%	40%
		11	9	55%	45%
		13	7	65%	35%
		Interested	No	Interested	No
5	Are you interested or not with the appearance (writing, illustrations/pictures, and image placement) contained in:				
	a. Instructional Media				
	b. Student Worksheets	13	7	65%	35%
		12	8	60%	40%

Table 10 in Trial I shows student responses to all aspects, especially to learning instruments, namely student opinions on learning components consisting of student books, student worksheets, and student learning achievement tests, reached 61.3%.

Table 12. Description of Student Response Questionnaire Results in Trial II

No	Responded aspect	Frequency		Percentage	
		Like	No	Like	No
1	Do you feel happy or not about the following learning components?				
	a. Subject matter	16	4	80%	20 %

No	Responded aspect	Frequency		Percentage	
		Like	No	Like	No
	b. Instructional Media	20	0	100 %	0
	c. Student Worksheets	17	3	85 %	15 %
	d. Classroom learning atmosphere	17	3	85 %	15%
	e. The way the Teacher teaches	18	2	90%	10%
		New	No	New	No
2	Are the following learning components new to you or not?				
	a. Subject matter				
	b. Instructional Media	16	4	80%	20%
	c. Student Worksheets	17	3	85%	15%
	d. Classroom learning atmosphere	18	2	90%	10%
	e. The way the Teacher teaches	15	5	75%	25%
		16	4	80%	20%
		Interested	No	Interested	No
3	Are you interested or not taking part in the next lesson, like the one you just took?	18	2	90%	10%
		Clear	No	Clear	No
4	Can you clearly understand or not the language used in:				
	a. Instructional Media				
	b. Student Worksheets				
	c. Student Learning Outcomes Test	16	4	80%	20%
		17	3	85%	15%
		15	5	75%	25%
		Interested	No	Interested	No
5	Are you interested or not with the appearance (writing, illustrations/pictures, and image placement) contained in:				
	a. Instructional Media				
	b. Student Worksheets	20	0	100%	0
		19	1	95%	5%

Based on Table 11 in Trial I, it can be analyzed that student responses to all aspects of the learning instruments, namely student opinions on learning components consisting of student books, student worksheets, and test, were 86%, so it can be seen that the average -the average student response questionnaire score is in the "Interested" category.

Description of Students Interest Questionnaire Results

In this study, the distribution of questionnaires for students' interest in learning mathematics was carried out after learning. The questionnaire was given as many as 30 statement items consisting of 22 positive statements and eight negative statements from 3 indicators of student interest in learning. The description of the results of students' interest in learning in Trial I is shown in the following table.

Table 13. Description of the Results of Student Learning Interest in Trial I

Description	Results of Learning	Average
The highest score	88.33	73.75
Lowest Value	66.67	

Table 9 shows that the average student interest in learning is 73.75, with the highest score of 88.33 and the lowest score of 66.67.

Table 14. Description of the Results of Student Interests in Trial II

Description	Results of Learning	Average
The Highest Score	90.00	81.71
The Lowest Score	76,67	

Table 10. demonstrates that the average student interest in learning is 81.05, with the highest score of 90.00 and the lowest score of 76.67.

Improving Mathematical Literacy Ability Using Developed Mathematical Learning Instruments

The results of the analysis of students' mathematical literacy skills tests in trials I and II showed an increase in students' mathematical literacy skills. Based on the average normalized gain, it was found that in Trial I, there was an increase in students' mathematical literacy skills with the "low" criterion with an average score of 0.27 (N-gain <0.3), and in Trial II, there was an increase in value with criteria of "moderate" with a score of 0.5 (0.3 < N-gain < 0.7). So it can be concluded that the developed learning instruments can improve students' mathematical literacy skills.

Increasing Students' Interest in Learning Mathematics Using Learning Instruments Developed Mathematics

Based on the results of data analysis of students' interest in learning mathematics in trials I and II showed that students' interest in learning mathematics increased (better). The increase in students' motivation to learn mathematics was seen from the average results of the interest in learning mathematics questionnaire in Trial I, the average student interest in learning was 73.54, while in Trial II, the average student interest in learning increased to 81.71. There was an increase of 8.17 from Trial I to II in the average results of students' interest in learning mathematics. Based on these results, it can be concluded that the student's interest in learning mathematics after using the mathematics learning instruments based on the

Realistic Mathematics Education learning model, which was developed as a whole, increased from Trial I to II.

CONCLUSION

This research developed learning instruments based on the RME approach that could be used to improve students' mathematical literacy and learning motivation. The 4-D Thiagaradjan model is used as the model. There are four stages involved: define, design, produce, and disseminate. Three stages of data gathering were used, namely observation in the form of needs analysis, interviews, and questionnaires. This study concluded that the development requirements of validity, practicability, and practicability have been fulfilled.

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