PARADIKMA JURNAL PENDIDIKAN MATEMATIKA
ISSN: 1978-8002 (Print)
ISSN: 2502-7204 (Online)

Development of Learning Devices Based on Realistic Mathematical Learning Models to Improve Mathematical Literary Ability

Nazri Maulana Khani Selian[1*], **Mulyono**[2], **Mariani**[3]

[1,2,3]Departement of Mathematics Education, State University of Medan, Indonesia
*Corresponding Author: maulananazri21@gmail.com

Article History:
Received : 21-06-2023
Revised : 14-07-2023
Accepted : 26-01-2024
Online : 26-01-2024

Keywords:
Development of Learning Devices;
Thiagaradjan 4-D Model;
Realistic Mathematical Education (RME);
Mathematical Literacy

ABSTRACT

The limited usage and repurposing of media in education served as the driving force behind this study. Student Textbooks and Student Worksheets (LKPD) are designed to support instruction. Additionally, Systems of Two Variable Linear Equations (SPLDV) implicit graphical problem solutions are made possible with the use of GeoGebra media. In this inquiry, interactive learning tools for the SPLDV curriculum will be made using GeoGebra. The 4-D Thiagaradjan model serves as a model in this study on development. Define, design, develop, and deploy are the four stages. This experiment involved eighth-graders aged 14 and two eighth-grade math teachers. Utilizing a requirements analysis, interviews, and questionnaires, observational data was gathered. An study of the data collection process's demands, as well as interviews and surveys, are all included. Validity, practicability, and efficacy were three essential development conditions that had to be met before a study could be put into action. Proportion scores were validated by two qualified validators to support the study's conclusions. For learning device formats, graphics, language, and content validation, the average score is 3.78. (Applicable classifications). The effective category, which received an average score of 74.3 on the pretest and 87 on the posttest, the complete category, which served as a gauge of the teacher's capacity to manage learning and received an average score of 4.4 in the very good category, and the practical category, which also received an average score of 4.4 in the very good category, served as the foundation for the research findings. As a result, improving student performance can be accomplished through the development of learning tools based on realistic learning models.

A. INTRODUCTION

The limited usage and repurposing of media in education served as the driving force behind this study. Student Textbooks and Student Worksheets (LKPD) are designed to support instruction. Additionally, Systems of Two Variable Linear Equations (SPLDV) implicit graphical problem solutions are made possible with the use of GeoGebra media. In this inquiry, interactive learning tools for the SPLDV curriculum will be made using GeoGebra. The 4-D Thiagaradjan model serves as a model in this study on development. Define, design, develop, and deploy are the four stages. This experiment involved eighth-graders aged 14 and two eighth-grade math teachers. Utilizing a requirements analysis, interviews, and questionnaires, observational data was gathered. An study of the data collection process's demands, as well as interviews and surveys, are all included. Validity, practicability, and efficacy were three essential development conditions that had to be met before a study could be put into action. Proportion scores were validated by two qualified validators to support the study's conclusions. For learning device formats, graphics, language, and content validation, the average score is 3.78. (Applicable classifications). The effective category, which received an average score of 74.3 on the pretest and 87 on the posttest, the complete category, which served as a gauge of the teacher's capacity to manage learning and received an average score of 4.4 in the very good category, and the practical category, which also received an average

score of 4.4 in the very good category, served as the foundation for the research findings. As a result, improving student performance can be accomplished through the development of learning tools based on realistic learning models.

Strong literacy abilities will make it easier for students to solve math problems. Therefore, mathematical competency is required for solving common problems. Mansur (2014) in Setiawan et al.

Nonetheless, global comparative studies such as PISA (Program for the International Assessment of Students) indicate that mathematical literacy among Indonesian students remains deficient. Indonesia ranks among the bottom ten of the 79 nations that participated in the 2018 PISA. The average level of literacy among Indonesian students is 80 points below the OECD average. In terms of intelligence, Indonesian pupils continue to outperform ASEAN students. In literacy, mathematics, and science, Indonesian students are 42, 52, and 37 points below the average student in ASEAN, respectively. (Pusat Pendidikan Balitbang Kemendikbud, 2019:2)

Additionally, on the ground, particularly in the eighth grade of An-Nizam Private Middle School, truths were discovered. Based on their observations from the previous day, the researchers administered a diagnostic test to eighth-grade students at An-Nizam Private Middle School on 15 June 2022 to evaluate their mathematical literacy abilities. As evidenced by their inability to document what they knew and what was requested, students lacked literacy skills. Students who asked questions instead of writing "unknown" exemplified this point. Students are unable to respond to the remaining queries. Consequently, this demonstrates students' absence of mathematical literacy. This is evidenced by the students' average test scores, which were below the Minimum Completion Criteria (KKM) standard value of 75.

One of the queries used to assess students' mathematical literacy is the following: A woman enters an apparel store. Then he purchased two blouses and three trousers for Rp 340,000. Then, he spent a total of Rp 210,000 on an additional blouse and two pairs of trousers. Consequently, how much do a shirt and trousers cost?

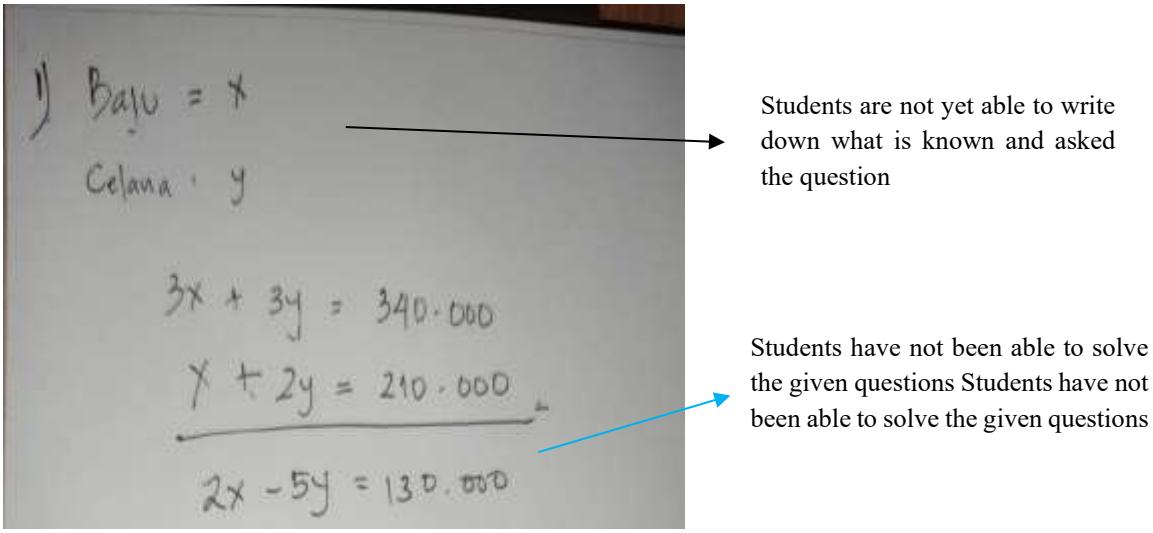

Figure 1. Student Answers

In addition to the importance of students' mathematical literacy abilities, the importance of their attitudes toward mathematics learning, such as their interest in learning, is highlighted. This reading ability is also associated with students' moral responsibility in terms of enhancing their learning motivation. Interest is a crucial component of reading skills because it encourages students to want to learn more in class. Interest in learning is a psychological factor that significantly influences a student's ability to accurately complete assignments and inquiries.

According to Rahmat (2018: 161), interest is the desire to know, possess, research, and exhibit something. After learning about an object or purpose, the surrounding environment generates interest, followed by the participation of emotions directed toward a particular action object.

To enhance academic achievement, Daniyati and Sugiman (2015: 53) argued that a more enthusiastic approach to mathematical learning is required. To engage students, educators must first identify factors that can contribute to a decline or loss of interest in learning. The perceptions of students can affect their enthusiasm for mathematics.

Based on preliminary school observations, it was determined that a number of variables, such as the teacher-centered mathematics learning process and the use of inactive traditional tactics, contributed to low mathematical literacy skills and low student interest in learning.

Consequently, the use of learning aids is one method for enhancing mathematical literacy and study motivation among students.To improve students' mathematical literacy and learning motivation, it is necessary to implement appropriate learning activities, such as the use of learning aides. It is impossible to exaggerate the importance of learning aids in teaching and learning activities. Using learning tools, which can be used to establish an effective learning environment, it is possible to increase the motivation of students to learn. A teacher must create something to increase students' interest in learning, such as learning aides that can attract students' attention and stimulate their desire to learn, because the desire to learn is the foundation of learning.

Moreover, Lubis, Wilda Indah, et al. (2020:55) emphasized the significance of device development. The instructional tool acts as a guide, leading the instructor through the systematic learning procedure.

The importance of creating learning tools is also emphasized by Permendiknas Number 41 of 2007, which governs process standards and mandates that educators in educational units create thorough and systematic learning tools in order to meet educational objectives.

Initial observations with mathematics teachers at An-Nizam Private Middle School revealed that the school's instructional materials do not meet current requirements. Resources for learning consist of lesson plans, workbooks, student booklets, and assessment instruments. This is illustrated in one of the lesson plans maintained by the An-Nizam Private Middle School mathematics teacher.:

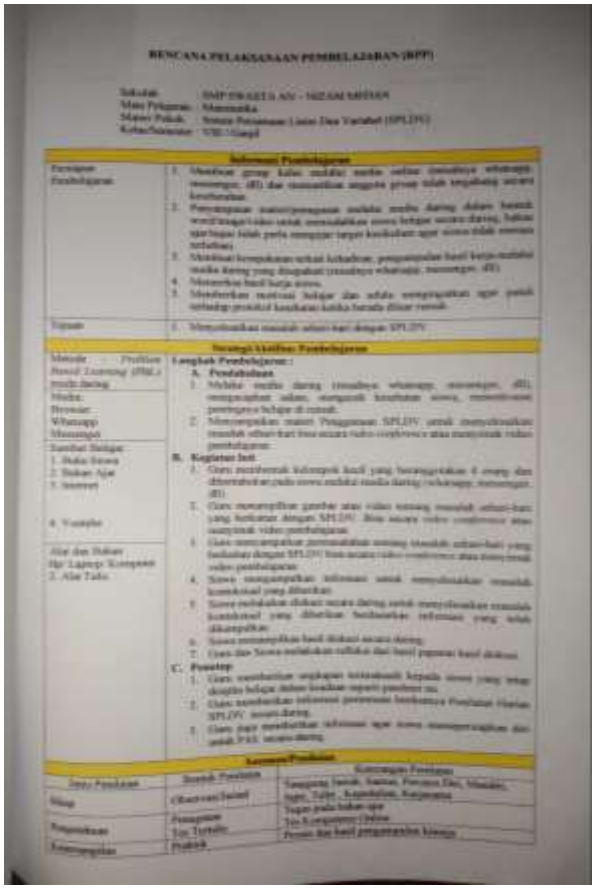

Figure 2. Form of RPP

There are still a number of flaws in the lesson plan, including the absence of fundamental competencies, indicators of competency attainment, and components for producing the lesson plan in accordance with Permendikbud Number 22 of 2016, which addresses primary and secondary school procedure standards. Therefore, learning aides must be improved. Consequently, the learning goals will be readily attained.

Learning models must be incorporated into the creation of educational instruments. As there are now numerous learning models, an appropriate learning aid is required to improve students' mathematical literacy and learning motivation. Although learning aids play an important role in teaching and studying, they are not required. It is possible to increase students' motivation to learn by using learning tools, which can then be used to establish an effective learning environment.

Learning models like RME aim to improve students' mathematical literacy and keep them interested in their studies. Sugiarni (2019) argues that a more effective and efficient way to learn mathematics and achieve the aims of mathematics education is to take a realistic approach, which involves using reality and the participants' familiar environment to speed up the learning process.

Thus, Astuti et al. (2018: 52) describe Realistic Mathematics Education as the utilization of student-comprehensible environmental reality to improve the learning process and educational outcomes. Students are given the opportunity to construct their own understanding of mathematical topics and principles through the solution of problems drawn from the actual world in Realistic Mathematics.

Researchers have found that the RME model helps students visualize the difficulties they encounter and possible solutions by having them analyze their own knowledge and use contextual artifacts to stimulate their thoughts (Seri, 2014: 75, Simanullang, 2018).

To better mathematical literacy, the researcher is interested in the "Development of Learning Devices Based on Realistic Mathematical Learning Models."

B. RESEARCH METHODS

The R&D process is a part of this investigation. Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (1974) proposed the 4-D development model used in this study. Phases include "Define," "Design," "Develop," and "Disseminate" in this approach.

The stages in the evolution of the 4-D teaching tool are as follows:

1. Set the scene

This stage aims to define and specify learning requirements by assessing the material's goals and constraints. Analysis of students, analysis of the job at hand, and the creation of learning goals all fall under this category.

2. Phase of Design

In this stage, we will work on designing learning gadgets in order to create prototypes. This phase begins once a foundation of targeted instruction has been laid. Preliminary design, test preparation, and device/format selection all fall under this category.

3. Growth Phase

Experts will now validate the equipment before doing any field evaluations. Draft 1 is a reference to the instruments prior to their specialized validation. These tools must be fixed or updated before moving on to the next phase if they have been validated by experts and there is a revision by experts; otherwise, this is considered draft 2.

Once student workbooks have been developed, tested, and received good feedback from subject matter experts, they enter the transmission phase. The device is then ready to be packed, released, and set up for wider distribution.

The research's conceptual framework is shown in Figure 1 below:

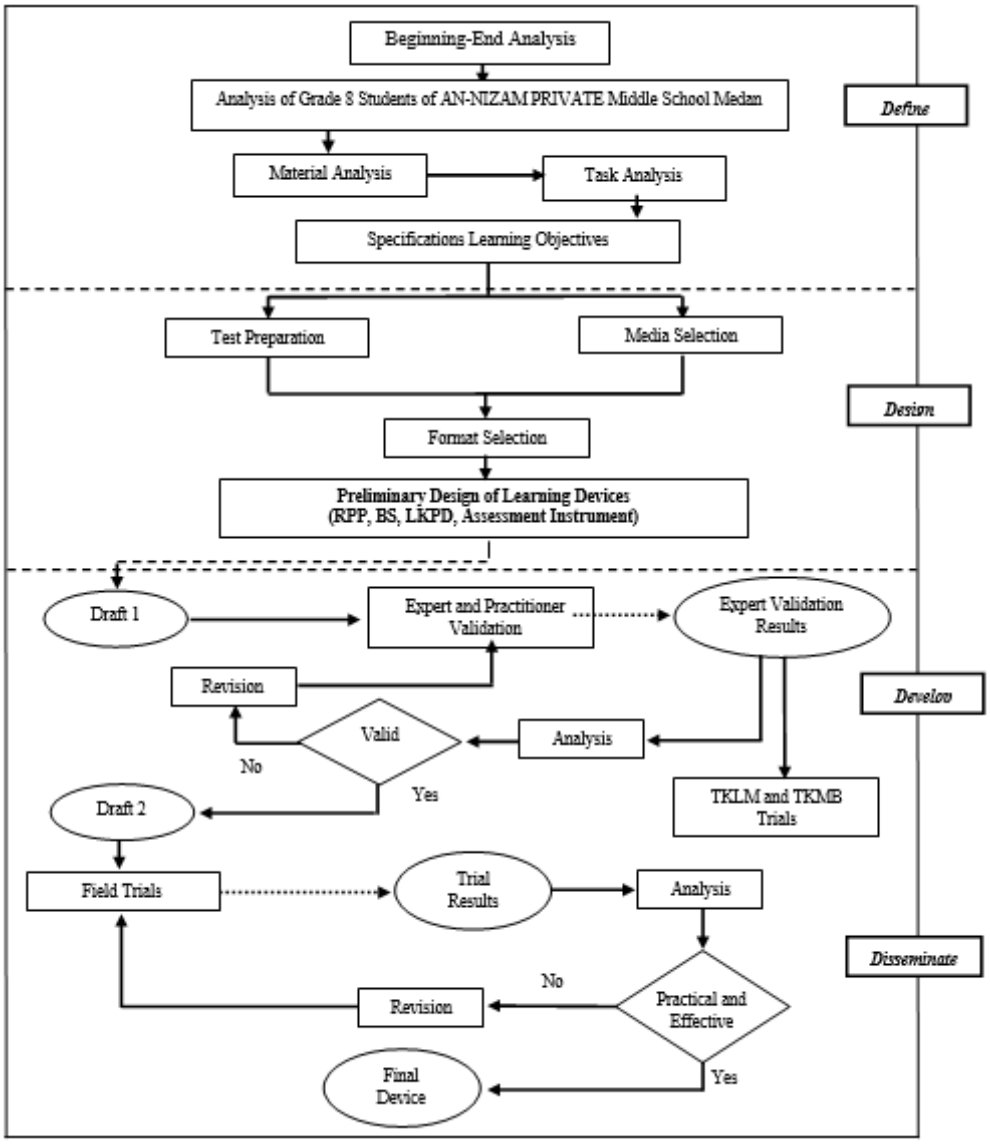

Figure 3. 4-D Model Learning Device Development Chart

This inquiry was executed at Medan's SMP AN- NIZAM during the spring 2022 semester of the academic year 2022-2023. Students from SMP AN NIZAM's eighth grade took part in the study. This study used a pre-post test design with a single experimental group. Before receiving therapy, participants take a pre-test, and after receiving treatment, participants take a post-test (Lestari & Yudhanegara, 123). This study followed the Pre-test and Post-test Group research design, with the following pattern:

Table 1. Trial Design

O1	**X**	**O2**

Information:

O1: Learning results and a patient's drive to learn are evaluated with a preliminary test (pre-test) before any treatment is given.

X : Learning therapy employs the RME paradigm, which was developed.

O2 : The final exam (post-test) was designed to gauge how much the goods, processes, and performance evaluations had influenced the students' mathematical literacy and their desire to continue studying. Following the post-test, students were given a questionnaire to complete in order to reflect on their educational experience.

Nieven's criteria are used to evaluate learning devices (Romlah et al., 2018: 8). These criteria evaluate the quality of learning aids based on three factors: (1) validity, (2) usability, and (3) efficacy.

C. RESULT AND DISCUSSION

This study is an example of applied research in which educational tools are developed. (2) to describe how learning tools based on realistic mathematical learning models are used to improve mathematical literacy skills at SMP AN NIZAM Medan. The goals of this study are (1) to obtain valid, practical, and effective learning tools based on a realistic mathematical learning model for improving mathematical literacy skills at SMP AN NIZAM Medan. At each level of development, we share the data analysis and research results that have followed:

1. Define

Observation and study of learning aids at SMP AN-Nizam Medan revealed that teachers have lacked access to materials that foster students' proficiency in mathematics. In addition, pupils are not involved in the process of information discovery; rather, the teacher hands it to them. Children's lack of proficiency in mathematics is often attributed to this.

2. Design

The objective of this phase is to design learning aides in order to obtain prototypes (examples of learning devices) for SPLDV content. The following actions are taken at this stage:

(a) Test Compilation Results

Ink's end productThe task analysis and concept analysis make up the test configuration in accordance with the learning objectives specification. The test in question is a combination of an SPLDV content test and a student survey. There are five evaluative questions included in the learning outcomes assessment tool. The time limit for this test is 60 minutes.

(b) Format Selection Results

The results of the format selection study were revised to fit the requirements of the 2013 syllabus. The following are the parts of the lesson plan: Identifying information, such as the school's name; Semester or academic year identity, theme, or subtheme of the subject matter; topic of conversation; The researchers' approach to learning serves as a paradigm for allocating time and defining learning objectives that are consistent with the curriculum's expectations for KD.Education in Applied Math; Learning resources include books, instructional films, printed and electronic gadgets, and other items. Assessment of learning outcomes occurs after the initiation, development, and consolidation phases of instruction.

(c) Preliminary Design Results

The First Design Outcomes Two field trials and meetings to measure student learning results were planned during the early design phase.

3. Develop

Primary Document Experts have verified the findings. All of the tools developed were validated by specialists in their fields. Validation of the created learning aids (Initial Draft) was conducted by three mathematics education instructors from UNIMED, one teacher from SMP AN-Nizam in Medan, and one teacher from SMP Negeri 21 Medan. Results from validation calculations performed by five experts on the preliminary assessment of student learning outcomes are included in the appendix. Overall, the average grade is 3.71. The validity criteria provide a basis for concluding that the instruments created for use in educational settings are valid.in the table that follows, with an emphasis on the "Valid" column:

Table 2. Recapitulation of Learning Device Validation Results by Experts

No	Appraised object	The average value of the total validation	Validation Level
1.	RPP Learning Implementation Plan	3.59	Valid
2.	Student Book (BS)	3.71	Valid
3.	Student Worksheets (LKPD)	3.65	Valid
4.	Mathematical Literacy Ability Test	3.83	Valid

Based on these standards, it can be determined that the created educational tools are legitimate examples of their type. Using the product moment correlation technique, we correlated the item score with the overall score to establish the questions' validity. The data from the spatial ability test are summarized in the table below:

Table 3. Pre-test 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

The statistics in the table above indicate that the interpretations of both the pretest and posttest items are extremely valid.

Once the constructed learning device (Draft 1) passes the validity criteria, it will be tested in Trial I at the SMP AN-Nizam Medan research site. The first test included twenty students in eighth grade. The Trial I was conducted over the course of two sessions, per the prescribed instructional blueprint (RPP).

Analysis of trial I's data shows that the developed learning tools have not fully met the established success criteria, namely the results of observations of the implementation of learning and the results of the trial's final test of students' mathematical literacy abilities. I. During the assessment phase, the researcher will make adjustments to the created learning aids and/or gadgets in light of the findings from experiment I. In this part, we'll go over all the areas that need fixing.

Trial I data analysis revealed a number of flaws that need to be fixed before the researcher can develop learning tools and devices that are valid, practical, and successful. The second trial used the revised teaching aid (draft 2), which was also introduced to the same classroom. The second test was done to see if the educational tools and equipment were up to snuff in terms of being legitimate, useful, and efficient. The study of the data from the second experiment shows that the educational tools created are, on the whole, valid, usable, and effective. More information about the reliability, efficiency, and usefulness of various learning tools is provided under "Description."

4. **Disseminate**

In trial two, a final draft of the learning instrument is obtained after the requirements for validity, practicability, and efficacy have been satisfied. Finally, we will deliver the learning devices to the MGMP forum at SMP AN-Nizam Medan and distribute the final draft to the forum's members in the hopes that the forum's mathematics teachers will use them to further their own education and professional development.

Description of the Validity of Mathematics Learning Devices Developed

Whether or if the expert's or practitioner's evaluation of the constructed learning device satisfies the valid criteria is what establishes the validity of the learning device. An authoritative assessment of the developed learning tools' credibility in the perspective of experts in educational technology. Experts' validation results were described before development began, and they suggest the learning tools produced have validity, with an average value of 3.71 (falling into the "valid" category). The results of this study provide strong evidence that the designed pedagogical tools are effective and valid.

Description of the Practicality of the Developed Mathematical Learning Devices

Validation documentation for the device were provided, and comments from experts/validators and practitioners/teachers were used to conduct a practicality study, all of which led to the device's success in Trial I. In conclusion, the first condition for utility has been met because the product can be put to use after some adaptation.

With a 3.40, the observation of the use of custom learning aids places it firmly in the "High" bracket. All of the learning tools that made it through Trial Phase I met or exceeded the previously defined practicality criterion for learning aids.

Description of the Effectiveness of Mathematics Learning Devices Developed

The developed learning tool is considered effective if it satisfies the following criteria: (1) the minimum test score for mathematical literacy is 70 (the "good" category), and at least 80% of students fulfill the learning completion requirement classically; (2) the teacher's ability to manage learning by using learning tools developed with a good minimum category; (3) the average results of the ideal time for student activities meet the set ideal percentage of time; and (4) the average results of the ideal time for teacher-led instruction meet the set ideal percentage of time" ($3 \leq R_s < 4$).

Analysis of Students' Mathematical Literacy Ability Test Results

The table below displays the outcomes of students' traditional mastery of mathematical literacy abilities in trial I:

Table 5. Levels of Ability Classical CompletenessMathematical Literacy Uji Try I

Category	Mathematical LiteracyStudent (Posttest)	
	The number of	Percentage
Complete	6	30 %
Not Completed	14	70 %
Amount	20	100%

According to the standards for classical education, at least 30% of test-takers will achieve a score of 70 or above on the mathematics literacy exam. There has not been a conventional compilation of the results of the students' mathematical literacy ability test because only 30% of students acquire the required score. To sum up, the trial I implementation of the designed learning tools did not achieve the required level of classical mastery. Below is a table displaying data from the second trial on pupils' level of classical mathematical literacy:

Table 6. Ability Classical Completeness Level Mathematical Literacy Try II

Category	Students' Visual Thinking Ability (Posttest)	
	The number of	Percentage
Complete	17	85 %
Not Completed	3	15%
Amount	16	100%

According to the criteria for classical student learning completion, at least 80% of students who take the exam of mathematical literacy are able to get a score of at least 70. Since 87.5% of students are able to meet the minimum requirement, the results of the students' mathematical literacy test were calculated in the usual way. As a result, it may be determined that the conditions for gaining classical mastery were met in the second trial of the designed learning aids.

Results Analysis Teacher Ability to Manage Learning

In order to better monitor student learning, a single observer attends each meeting and conducts teacher observation. Here are some notes on how teachers handle their students' education:

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

No.	Aspect	Activity	Average Observer Score I	Average Value Aspect
		Offer pleasantries	4.7	
1.	**Introduction**	Encourage students to study	4.3	4.4
		Communicating educational goals	4.3	
		issue orientation	3.3	
2.	**Core activities**	Organizing students' study efforts	3.6	
		directing individual and collective investigations	4.3	

No.	Aspect	Activity	Average Observer Score I	Average Value Aspect
		Create and display the work	3.3	3.6
		Analyze and evaluate the process of problem solving	3.6	
3.	Closing	Reaffirms the material's conclusion	3.6	3.8
		Give some queries as independent assignments	4	
4.	Learning Time Management		3.6	3.6
5.	Class situation	Enthusiastic students are engaged in their studies.	3.3	3.4
		Enthusiastic educators facilitate learning.	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	Offer pleasantries	5	4.6
		Encourage students to study	5	
		Communicating educational goals	4	
		issue orientation	5	
2.	Core activities	Organizing students' study efforts	3.6	4.1
		directing individual and collective investigations	4.3	
		Create and display the work	4	
		Analyze and evaluate the process of problem solving	4	
3.	Closing	Reaffirms the material's conclusion	4.3	4.3
		Give some queries as independent assignments	4.3	
4.	Learning Time Management		4.1	4.1
5.	Class situation	Enthusiastic students are engaged in their studies.	4	4
		Enthusiastic educators facilitate learning.	4	
		Average Value		4.4

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

Following is a brief description of the percentage of optimal time for student activities achieved.

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	25.0	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**

In trial I, the optimal time for student activities was met in 24.3%, 29.2%, 25.7%, 10.42%, 6.25 %, and 3.5% of meetings, respectively, as shown in table 8. In addition, the results of the time period are compared to predetermined success criteria. Student activity has attained the ideal time achievement percentage, as the six observed factors indicate that student activity is still within the 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	25.0	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**

Table 9 shows that the optimal time for student activities was met in 22.2%, 26.87%, 26.87%, 13.9%, 7.87%, and 2.2% of Trial II's three meetings, respectively. In addition, the results of the time period are compared to predetermined success criteria. The results presented above indicate that the optimal time achievement percentage for pupil activity has been reached.

Response Student Trial

A At the conclusion of the trial, student response questionnaires were distributed to respondents. The accompanying table describes the outcomes of the student response questionnaire.

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

No	Responded aspect	Frequency		Percentage	
		Like	**No**	**Like**	**No**
1	How do you feel about the following educational components!				
	a. Content	12	8	60 %	40 %
	b. Instructional Media	13	7	65 %	35 %
	c. Student Worksheets (LKPD)	12	8	60 %	40 %
	d. Classroom learning environment	11	9	55 %	45%
	e. The manner in which the instructor instructs	12	8	60 %	40 %
		New	**No**	**New**	**No**
2	Are the following components of learning novel to you?				
	a. Content	13	7	65%	35%
	b. Instructional Media	13	7	65%	35%
	c. Student Worksheets (LKPD)	12	8	60%	40%
	d. Classroom learning environment	11	9	55%	45%
	e. The manner in which the instructor instructs	12	8	60%	40%
		Interested	**No**	**Interested**	**No**
3	Are you interesting in participating in the next lesson similar to the one you just completed?	14	6	70%	30%
		Clear	**No**	**Clear**	**No**
4	Can you clearly comprehend the language used in this passage?:				
	a. Educational Materials				
	b. Worksheets for Students (LKPD)	12	8	60%	40%
	c. Test of Student Learning Outcomes	11	9	55%	45%
		13	7	65%	35%
		Interested	**No**	**Interested**	**No**
5	How do you feel about the appearance (writing, illustrations/pictures, and image placement) of this document?:				
		13	7	65%	35%
	a. Instructional Media	12	8	60%	40%
	b. Student Worksheets (LKPD)				

Table 10 from the pilot study shows that 61.3% of student feedback is related to instructional materials such textbooks, worksheets, and examinations of student knowledge.

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

No	Responded aspect	Frequency		Percentage	
		Like	**No**	**Like**	**No**
1	How do you feel about the following educational components !				
	a. Content	16	4	80%	20 %
	b. Instructional Media	20	0	100 %	0
	c. Student Worksheets (LKPD)	17	3	85 %	15 %
	d. Classroom learning environment	17	3	85 %	15%

No	Responded aspect	Frequency		Percentage	
		Like	**No**	**Like**	**No**
	e. The manner in which the instructor instructs	18	2	90%	10%
		New	**No**	**New**	**No**
2	Are the following components of learning novel to you?				
	a. Content	16	4	80%	20%
	b. Instructional Media	17	3	85%	15%
	c. Student Worksheets (LKPD)	18	2	90%	10%
	d. Classroom learning environment	15	5	75%	25%
	e. The manner in which the instructor instructs	16	4	80%	20%
		Interested	**No**	**Interested**	**No**
3	Are you interesting in participating in the next lesson similar to the one you just completed?	18	2	90%	10%
		Clear	**No**	**Clear**	**No**
4	Can you clearly comprehend the language used in this passage :				
	a. Educational Materials				
	b. Worksheets for Students (LKPD)	16	4	80%	20%
	c. Test of Student Learning Outcomes	17	3	85%	15%
		15	5	75%	25%
		Interested	**No**	**Interested**	**No**
5	How do you feel about the appearance (writing, illustrations/pictures, and image placement) of this document?:				
	a. Educational Materials	20	0	100%	0
	b. Worksheets for Students (LKPD)	19	1	95%	5%

Table 11 from the initial test indicates that, on average, 86% of student responses to all aspects, particularly to learning tools, i.e. student opinions on learning components such as student books, student worksheets, and student learning achievement tests, place them in the "Interested" category.

Improving Mathematical Literacy Ability Using Developed Mathematical Learning Tools

Based on an analysis of the test results from trials I and II, it was determined that the mathematical literacy skills of the students improved. On the basis of the average normalized gain, it was determined that in trial I, students' mathematical literacy skills with the "low" criterion improved, as measured by an average score of.5 points 0.27 (N-gain <0.3) In the second trial, "moderate" criteria and a score of 0.5 led to an increase in value (0.3 < N-gain < 0.7). Therefore, it can be concluded that the created learning aides can enhance students' mathematical literacy.

D. CONCLUSION AND SUGGESTIONS

The following conclusions were derived from the analysis and discussion presented in this study:

1. According to this study, the GeoGebra Applet can be used as an interactive online learning aid for probability-related content. This investigation employed the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) methodology. Observation in the form of a requirements analysis, interviews, and surveys were used to collect data. The material expert validator's media validation results are highly credible, and media experts are credible. Three math instructors and twenty-nine students were given questionnaires to complete, and it was determined that the results of the media experiments were highly pertinent.

2. On the basis of the research's findings, instruments for enhancing students' mathematical literacy and learning motivation have been developed. As a model, the 4-D Thiagaradjan model is utilized. The four stages consist of define, design, manufacture, and deploy. Observation in the form of a requirements analysis, interviews, and surveys were used to collect data. Validity, usability, and usability enhancement criteria have all been satisfied. By validating the proportion score, two seasoned validators confirmed the investigation's findings. The average validation score for format, illustration, language,

and content learning devices is 3.78 (Valid category). The study's conclusions are founded on the category where the average pre- and post-test scores for students were 74.3 and 87, respectively.

ACKNOWLEDGEMENT

The authors would like to express their sincere appreciation and reverence to everyone who played a role in the creation of this work. Before anything else, I'd like to express my gratitude to everyone who has helped me get to where I am today: SMP SWASTA AN-NIZAM's Principal, Teachers, and Administrative Staff; my brothers; my parents; Dr. Mulyono, M.Si., First Supervisor and Head of the Mathematics Education Study Program; Dr. Mariani, M. Pd., Second Supervisor; and Mr. Mangaratua M. Simanjorang, M. Pd., Secretary of the.

REFERENCES

Asmin, M. (2012). Pengukuran dan Penilaian Hasil Belajar. Medan: Larispa Indonesia.

Astuti. (2018). Penerapan Realistic Mathematic Education (RME) Meningkatkan Hasil Belajar Matematika Siswa Kelas VI SD. Journal Cendekia: Jurnal Pendidikan Matematika. https://media.neliti.com/media/publications/269821-penerapan-realistic-mathematic-education-bf7883d5.pdf

Daniyati, Nadzifah Ajeng, Sugiman. (2015). Hubungan Antara Kemampuan Verbal, Kemampuan Interpersonal, dan Minat Belajar dengan Prestasi Belajar Matematika. PYTHAGORAS: Jurnal Pendidikan Matematika, 10(1). https://journal.uny.ac.id/index.php/pythagoras/article/view/9109/pdf

Hasanah, (2015). Peningkatan Kemampuan Literasi dan Disposisi Matematis Siswa SMP Melalui Pendekatan Pembelajaran Model Elicting Activities (MEAS), Yogyakarta: UIN Sunan Kalijaga, 2015.

Lestari, K. E., dan Yudhanegara, M. R. (2015). Penelitian Pendidikan Matematika. Refika Aditama

Lubis, Wilda Indah Yonalia, dkk. (2020). pengembangan perangkat pembelajaran matematika untuk meningkatkan kemampuan berpikir kritis dan self efficacy siswa dengan menggunakan model problem based learning di sma sultan iskandar muda t.a 2017/2018. paradikma jurnal pendidikan matematika. https://jurnal.unimed.ac.id/2012/index.php/paradikma/article/download/22917/15067

Mansur, N. (2018). Melatih Literasi Matematika Siswa dengan Soal PISA. Prisma, 1, 140–144.

Ningsih, Seri. (2014). Realistic Mathematics Education: Model Alternatif Pembelajaran Matematika Sekolah. JPM IAIN Antasari. https://media.neliti.com/media/publications/121158-ID-none.pdf

Nasution, Zulaini Masruro, dkk. (2017). Perbedaan Kemampuan Pemecahan Masalah Matematik dan Motivasi Belajar Siswa yang diberi Pendekatan Pembelajaran Berbasis Masalah dengan Pendidikan Matematika Realistik di SMP Negeri 3 Tebing Tinggi. Universitas Negeri Medan: Paradikma Jurnal Pendidikan Matematika. Vol. 10, No. 1. https://jurnal.unimed.ac.id/2012/index.php/paradikma/article/view/8688

Permendikbud No. 65 Tahun (2013) Tentang Standar Proses Pendidikan Dasar dan menengah. Jakarta: Permendikbud.

Pusat Penilaian Pendidikan Balitbang Kemendikbud. (2019). Pendidikan di Indonesia Belajar dari Hasil PISA Programme For International Student Assessment.https://repositori.kemdikbud.go.id/16742/1/Laporan%20Nasional%20PISA%202018%20Indonesia.pdf

Rahmat , Psikologi Pendidikan. Jakarta Timur: PT Bumi Aksara, 2018.

Romlah, dkk. (2018). Melatihkan Keterampilan Berpikir Kreatif Siswa SD Melalui Permainan. Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian. https://journal.unesa.ac.id/index.php/PD/article/download/4249/2348.

Simanullang, M. C. (2018). Pengembangan Model Pembelajaran Pendidikan Matematika Realistik (PMR) untuk Meningkatkan Kecerdasan Triarkis dan Kemandirian Belajar Siswa Kelas VII SMP Sutomo 1 Medan. Tesis. Medan: PPs UNIMED.

Sinaga, Bornok dkk., (2016), Pengembangan Model Pembelajaran Matematika Berdasarkan Masalah Berbasis Budaya Batak (PBM-B3), Pendidikan Matematika.

Sugiarni, R. & Kurniawati, N. (2019). Penerapan Media Ajar Digital Berbasis 4c (Communication, Collaboration, Critical Thinking And Problem Solving, dan Creativity and Innovation) Dalam Menghadapi Revolusi Industri 4.0 Di Kalangan Guru Yayasan Mandiri Bersemi. Jurnal Qardhul Hasan; Media Pengabdian kepada Masyarakat p-ISSN 2442-3726 e-ISSN 2550- 1143 Volume 5 Nomor 2, Oktober 2019