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DEVELOPMENT OF INTERACTIVE LEARNING MEDIA ASSISTED BY DESMOS BASED ON RME TO IMPROVE MATHEMATICAL REPRESENTATION ABILITIES AND RESILIENCE OF CLASS VIII STUDENTS AT SMPN 1 IDI

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ABSTRACT

The purpose of this study to describe: 1) the validity, practicality and effectiveness of the interactive learning media assisted by RME-based Desmos which was developed to increase students' mathematical representation abilities and resilience at SMP N 1 Idi; 2) increasing students' mathematical representation abilities through interactive learning media assisted by the developed RME-based Desmos; 3) increasing student resilience through interactive learning media assisted by the developed RME-based Desmos. This study is development research using the Tessmer development model, formative evaluation type. This development model consists of two development stages, namely preliminary (determination) and prototyping (design and evaluation). From the outcomes of trial I and trial II it was gotten: 1) Interactive learning media assisted by RME-based Desmos to improve students' mathematical representation abilities and resilience which was developed met the criteria of being valid, practical and effective; 2) Increasing mathematical representation abilities using interactive learning media assisted by RME-based Desmos which has been developed as seen from the N-gain value in trial I of 0.41, increasing to 0.47 in trial II, meaning it is in the "medium" category; and 3) Increasing student resilience with the RME approach that has been developed as seen from the N-gain value in trial I of 0.33, increasing to 0.51 in trial II, meaning it is in the "medium” category. Based on the study outcomes, it is recommended that teachers use interactive learning media assisted by Desmos in learning straight line equations to improve students' mathematical representation abilities and resilience.

Keywords: Interactive Learning Media, Desmos, RME, Mathematical Representation, Resilience

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PRELIMINARY

The use of media in learning activities is very important. Interesting and learning media interactive can influence the learning activities to be more efficient and effective, besides that learning media able to make it more easily for teachers to deliver lessons to students. Using learning media as a tool can facilitate the delivery of information from teachers to students with interesting stimuli, so that students will easily process the information received (Kusumaningtyas et al., 2018).

In contrast to the phenomenon that occurs at SMPN 1 Idi, it turns out that teachers rarely use technology-based media as a learning tool. This is seen from the outcomes of researchers' observations of teachers who teach mathematics at the school regarding the learning media that are often used during the mathematics learning activities.

English Version

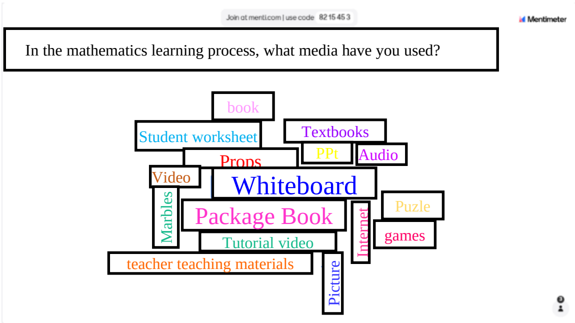


Figure 1. Results of Teacher Answers via Mentimeter

Based on Figure 1, several teachers' answers to the media used in mathematics learning can be seen, including: whiteboards, textbooks, teaching aids, puzzles, games, learning videos, pictures, student worksheets, internet, ppt, and audio. Of these media, the most dominant media used by teachers are blackboards and textbooks. This shows that teachers are less creative in choosing learning media, especially technological learning media. Of course, this is not a mistake, but if the teacher explains the material using the blackboard continuously, it will tend to make students bored and less motivated (Ishartono et al., 2019).

From the outcomes of the researcher's observations of mathematics teachers at SMPN 1 Idi, it can be seen that some teachers use computer technology (Powerpoint) when making teaching presentations in class. Of course, as a presentation medium, PowerPoint is the right medium. However, as a mathematics teacher in the current era you need more than just presentation skills, but the ability to teach using technology applications. Moreover, the school is equipped to assist the creation of technology learning resources. As an illustration, a computer laboratory with good internet connection facilities. Based on data from the manager of the computer laboratory, Mr. Abdul Rahmi, S. Pd, mathematics teachers rarely take students to the computer laboratory during lessons. The reason is because teachers lack application/software resources related to learning material and teachers do not have time to prepare learning media. This was also conveyed by Azni, et al., (2022), that many teachers are less able to realize learning through technology-based learning media. Most teachers are limited to technical issues in creating e-learning media programs, either in mastering programming techniques or visual appearance or design.

Interactive learning media with the digital Desmos application is one of the technological developments that teachers can use. According to Hafni et al (2021), The integration of digital media, like digital text, images, animated movies, and sound, into a well-structured digital space that allows users to communicate with data for the intended objectives is known as interactive media.

Desmos graphing calculator is an interactive mathematical media in the form of a graphing calculator (Solihah, 2018). By means of the web or iOS and Android applications, Desmos is a website or service that offers a variety of mathematical resources, interactive math problems, and curricula to encourage students' advanced learning. The mathematical tools provided by Desmos include graphing calculators, scientific calculators, four-function calculators, matrix calculators, and geometric tools. Desmos also provides many digital math activities that teachers can search, use, or edit through its website. In addition, teachers can develop their own interactive learning activities through the website and share them easily with other teachers or students (Kristanto, 2021).

One of the effective learning methods used to develop this media is the *Realistic Mathematic Education* (RME) learning approach. Because it requires students to build knowledge on their own through the tasks they complete in learning activities, the RME learning strategy is a suitable option for instruction. The fundamental tenet of RME learning is that pupils should be allowed to reimagine mathematical ideas under the supervision of an adult.

Naturally, using educational materials to teach mathematics will also help students become more proficient mathematicians. Between them is the ability to mathematical representation. Mathematical representation skill is one of the skills that needs to be considered because mathematical representation skill simplifies and clarifies mathematical solutions transforming abstract thoughts into concrete notions, for instance by the use of images, phrases, symbols, graphs, tables, etc (Hasratuddin, 2015). RME can help build students' mathematical representation ability by relating mathematics to the real world, improving concept recognition, practicing mathematical communication skills and mathematical problem solving skills (Rafiela & Andhany, 2023).

The field's facts show that students' proficiency with mathematical representation is still weak. Based on giving mathematical representation questions to 29 students in class VIII-1 SMPN 1 Idi on March 14 2023, the results showed that 34.5% of students who met the indicators presented data or representational information in the form of tables and graphs (10 people). Furthermore, the indicator to create mathematical equations or mathematical models from representation to another representation was 51.7% (15 people). Meanwhile, the indicator of writing down answers to problems through textual text in sentences was 41.4% (12 people).

Another fact regarding the low ability of mathematical representation is also shown by Rizki & Haerudin (2021), that schools have not been able to improve students' representation abilities. This is because teachers only deliver learning through textbooks and examples of less diverse questions as a result of which students are not prepared to put in work on independent practice questions, resulting in a lack of development of representational abilities.

To face the difficulties encountered in the mathematics learning process, resilience (flexible strength) is needed (Hutauruk & Naibaho, 2020). Mathematical resilience is something that is very important because people who have high mathematical resilience are confident in their success through hard effort in carrying out a task or work and build positive motivation related to the task or work being carried out. Naturally, it is desired that students would study with high mathematical resilience, which translates to a high degree of positivity regarding their ability to finish tasks and get beyond various lesson-related obstacles.

Because of their low levels of mathematical resilience and representation, students are less likely to be able to create concepts on their own, which means that learning is primarily focused on the teacher. Teachers also find it difficult to employ a variety of teaching strategies, and most students are accustomed to memorizing material as part of their learning activities rather than developing their mathematical representation skills. Aside from that, students who are learning mathematics in class are not resilient till they figure out a solution since they are terrified of the difficulties they may encounter.

The aim of this development is to produce RME-based Desmos-assisted interactive learning media that satisfies the requirements for validity, practicality and effective.

Additionally, this also seeks to determine the amount of students capacity for mathematical representation has increased and resilience through interactive learning media assisted by RME-based Desmos.

METHODS

Development research is a form of study that this is (Research and Development). This research uses the Tessmer development model, formative evaluation type. This development model consists of two development stages, namely preliminary (determination) and prototyping (design and evaluation). In this Preliminary Stage, researchers will conduct an analysis of the curriculum, students, materials and media. At this stage, a formulation of learning objectives and the weaknesses of the media used by the teacher will be produced. The prototyping stage has 5 (five) stages (self evaluation, expert review, one to one, small group and field test). From the self evaluation stage to the small group, a learning media design will be produced which will be evaluated at the field test stage. In the field test, practicality, effectiveness, improvement of mathematical representation abilities and student resilience will be seen.

This study was carried out at SMP Negeri 1 Idi, Kabupaten Aceh Timur in 2023/2024. The subjects in this study were students in class VIII-1 of SMP Negeri 1 Idi. In the field test, there were 29 students in all and 3 students were selected for the *one to one* stage and six students for the *small group* stage. The object of this study is interactive learning media assisted by Desmos which was developed through RME-based learning on straight line equations.

The image that follows provides a schematic representation of the development model used in this study (Jurnaidi & Zulkardi, 2013).

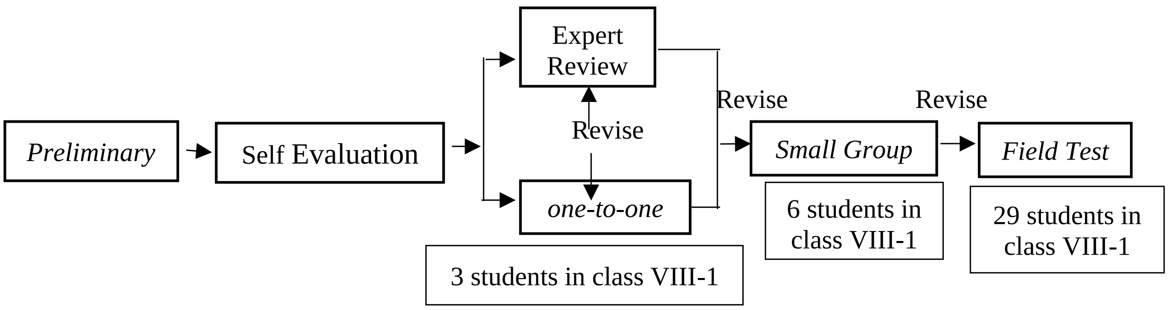


Figure 2. Tessmer 1998 Research Flow

A study instrument was constructed and developed in order to assess the validity, usefulness, and efficacy of the interactive learning medium that Desmos helped to build. The trial's tools comprised a student mathematical resilience questionnaire, an assessment of students' proficiency in mathematical representation, and interactive learning materials made possible by Desmos. The validators consisted of three mathematics education lecturers and two mathematics study teachers. The validator examines the format, language, illustrations and content of the media that has been designed by the researcher. Validator suggestions are used to revise the media being developed.

The validity of Desmos-assisted interactive learning media uses descriptive statistical analysis based on the average score of each Desmos-assisted interactive learning media which has been validated by the validator and revised based on the validator's suggestions. The formula for determining the Va Value or total average value from the average values for all aspects is as follows.

$$V_a = \frac{\sum_{i=1}^{n} A_i}{n}$$

Information:

V_a = total average value for all aspects
A_i = average for the ith aspect
n = number of aspects.

The Va value or total average value obtained can be referred to in the interval for determining the level of validity of RME-based Desmos-assisted interactive learning media on table 1 Susanto (2012).

Table 1. Validity Level Criteria

Number	**V_a or total average value**	**Validity criteria**
1	1≤ Va < 2	Invalid
2	2≤ Va < 3	Less Valid
3	3≤ Va < 4	Fairly Valid
4	4≤ Va < 5	Valid
5	Va = 5	Very Valid

The criteria state that RME-based Desmos-assisted interactive learning media has a great degree of validity, if the minimum level of validity achieved is the valid level .

The practicality of interactive learning media assisted by Desmos includes observation indicators for learning implementation which are analyzed by determining the average score for observing learning implementation using the formula:

$$O_k = \frac{\sum_{j=1}^{m} P_i}{m}$$

Information:

O_k = average score of learning implementation observations

P_i = average score of learning implementation observations at each meeting
m = number of meetings

The O_k value obtained is referred to according to the category on table 2 (Sinaga, 2007).

Table 2. Criteria for Level of Learning Implementation

Number	Level of Learning Implementation	Implementation Criteria
1.	$1 \leq O_k < 2$	Not implemented
2.	$2 \leq O_k < 3$	Poorly implemented
3.	$3 \leq O_k < 4$	Well implemented
4.	$O_k = 4$	Very well implemented

The interactive learning media assisted by Desmos that was developed is called to be practical if the average learning implementation is at least in the 'well implemented' category ($3 \leq O_k < 4$).

The effectiveness of interactive learning media assisted by Desmos is seen from (1) the completeness of students' classical learning, namely a minimum of 85% of students who take part in the learning are able to achieve a score of; (2) 80% of students responded positively to the RME-based interactive learning media assisted by Desmos that was developed.

To determine the validity calculation of the item description, the product moment correlation formula according to Arikunto (2006) is used, namely:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Information : N = number of research respondents
$\sum X$ = overall score for variable X
$\sum Y$ = overal score for variable Y
$\sum XY$ = overal score for variable X and Y
$\sum X^2$ = sum of squares of X variable scores
$\sum Y^2$ = sum of squares of Y variable scores
r_{xy} = coefficient values of variables X and Y

To compute the rise in mathematical representation skills following the use of the development of interactive learning media assisted by Desmos using learning with the RME approach, it is determined by the gain formula (Susanto, 2012), namely:

$$N - Gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Information : $N - Gain$ = normalized gain score
S_{post} = post test score
S_{pre} = pre test scores

S_{max} = maximum score

Normalized gain categories are displayed in the following table (Susanto, 2012).

Table 3. Normalized gain categories

N-Gain Scores	*N-Gain Criteria*
$0{,}00 < N - Gain \leq 0{,}30$	Low
$0{,}30 < N - Gain \leq 0{,}70$	Medium
$N - Gain > 0{,}70$	High

RESULT AND DISCUSSION

The *Preliminary* Stage

At the Preliminary stage, researchers executed an analysis of the curriculum, students, materials and media. Based on the results of observations of the mathematics learning media used by mathematics teachers at SMP Negeri 1 Idi, several weaknesses were found in the learning media used by mathematics teachers in the form of media that could not represent a concept in visual or pictorial form accurately, for example making a line from a place. the position of the two points traversed. Teachers have not yet fully created interesting learning media for students. On average, teachers still use media in the form of whiteboards and textbooks, which causes boredom and lack of understanding among students. This indirectly contributes to the low ability of mathematical representation and students' resilience towards the material.

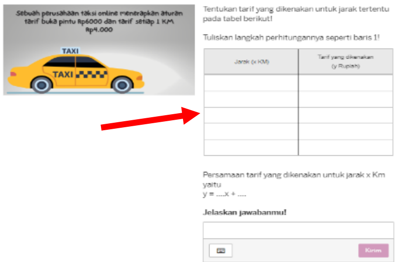
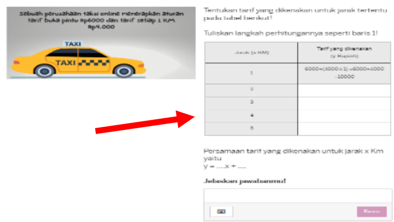
The *Prototyping* Stage

At the *Sef Evaluation* stage, the researcher designed the learning media so that a prototype (initial design of learning media) was obtained for the straight line equation material. The learning media developed comprises three pieces for three meetings. On the Custom Activities menu, researchers began to create interactive learning media including: 1) LAS 1 Straight Line Equations (Student link: https://student.desmos.com/join/pe2bhh?lang=id or student code: PE2BHH); 2) LAS 2 Straight line gradient (Student link: https://student.desmos.com/join/pe2bhh?lang=id or student code: H9YZ7E); 3) LAS 3 Straight line equations (Student link: https://student.desmos.com/join/347vnf?lang=id or student code: 347VNF); 4) Straight line equation material (Student link: https://student.desmos.com/activitybuilder/student-greeting/65617e890db8604ddcb2dbb6?lang=id).

A team consisting of three experts and two practitioners served as validators for the created learning materials (*expert review).* In the learning media developed, there are several main parts, namely: topics, basic competencies, indicators, learning objectives, instructions for using the media, and contextual problems that students must discuss together with other friends in learning.

Improvements to learning media carried out according to validator suggestions is displayed on the table 4.

Table 4. Revision of Learning Media

<table>
<tr><th>Number</th><th>Before Revision</th><th>After Revision</th></tr>
<tr><td>1</td><td>Lack of clarity in the table description
</td><td>It has entered data and/or numbers in the table
</td></tr>
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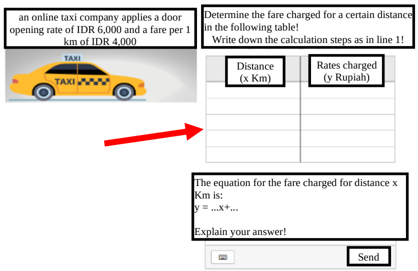
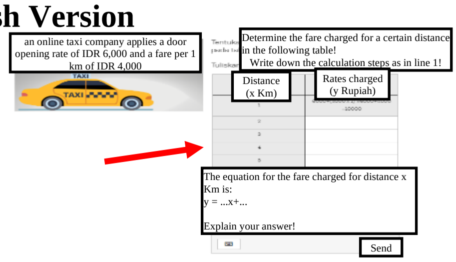
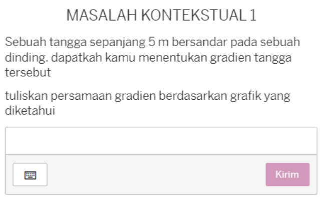
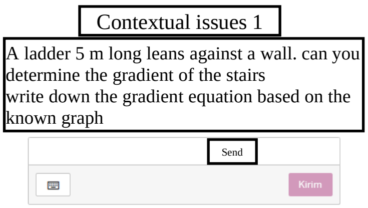
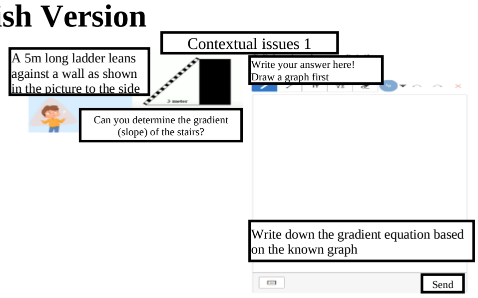
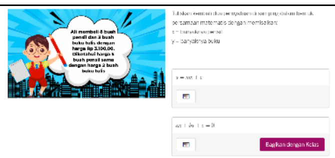
<tr><td></td><td>
</td><td>
</td></tr>
<tr><td>2</td><td>Presented with a contextual problem about a ladder leaning against a wall, students are asked to make sure the slope (gradient) of the ladder.

</td><td>Presented with a contextual problem about a ladder leaning against a wall, students are asked to make sure the slope equation (gradient) of the ladder by first presenting the problem again in graphic form.
</td></tr>
<tr><td></td><td colspan="2">English Version</td></tr>
<tr><td></td><td>
</td><td>
</td></tr>
</table>

Trial of the research instrument to test mathematical representation ability for three essay questions with a significance level of 5%, dk = 30-2=28, obtained r_{table} = 0.361. If we refer to the testing criteria, with the testing criteria being $r_{xy} > r_{table}$ then the mathematical representation ability test can be used or is valid. Likewise, in the trial the resilience questionnaire instrument for 30 statement items could be used or was valid.

Testing in small classrooms (*one-to-one*) with students in class VIII-1 of SMP Negeri 1 Idi consist of the high, medium, and low ability categories with one person for each, the first prototype has been validated by experts. The three students were asked to comment on the media that had been developed. Based on these comments, the learning media developed can be continued to the next stage by producing a second prototype whose results are then tested on *small groups*. The following revised comments given by students in the *small group* trial can be shown on the table 5.

Table 5. Display of Desmos Tektivity before and after revisions in *Small Group* Trials

Before Revision	After Revision
	
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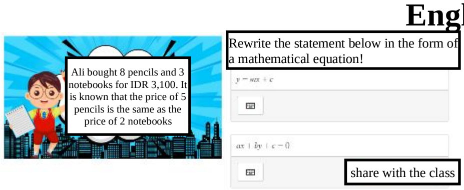
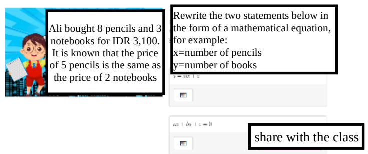
	
Command sentences are still too general, students don't get the significance of the question	The command sentence has led to the requested answer

The average mathematical representation skill of students in trial I was 57.76 in the pretest results, rising to 74.43 in the posttest, according to the study of the students' mathematical representation skills in trial I. Trial I provided an average N-Gain value of 0.41, coming into the "medium" group ($0.3 < g \leq 0.7$). An increase in mathematical representation skill was observed in 24 students who got an N-Gain score in the range of $0.3 < g \leq 0.7$ or in the "medium" category, and five students who got an N-Gain score in the range of $g \leq 0.3$ or in the "low" category. The use of interactive learning materials assisted by RME-based Desmos results in an increase in students' mathematical representation skills, it may be concluded.

Results from the investigation of the average student's mathematical resilience attitude in the pretest of trial I was 55.95, increasing to 70.92 in the posttest. The average N-Gain value obtained in trial I was 0.33 or in the "medium" category ($0.3 < g \leq 0.7$). Where one student received an N-Gain score in the range $g > 0.7$ or experienced an increase in mathematical resilience in the "high" category, then fourteen students received an N-Gain score in the range $0.3 < g \leq 0.7$ or experienced an increase in mathematical resilience with the "medium" category. Furthermore, fourteen students received N-Gain scores in the $g \leq 0.3$ range or experienced increased mathematical resilience in the "low" category. It means that students' mathematical resilience increases by using interactive learning media assisted by RME-based Desmos.

The outcomes of the analysis of the average value of observations of learning implementation in trial I were 2.90, namely in the poorly implemented category ($2 \leq O_k < 3$). This score does not get the criteria for achieving the practicality of learning media in terms of learning implementation. From these outcomes it means that the RME-based interactive learning media assisted by Desmos which was developed was not practical in trial I, so it needs to be revised and tested again.

The results of classical completion of students' mathematical representation skills in trial I can be showed on the table 6.

Table 6. Level of Classical Completeness Representation Skill Mathematics in Trial I

Category	***Pretest***	**Classical Completion Percentage**	***Posttest***	**Classical Completion Percentage**
	The number of students		**The number of students**	
Complete	5	17.24%	20	68.97%
Not Complete	24	82.76%	9	31.03%
Total	29	100%	29	100%

The completion percentage of 68.97% on the posttest of mathematical representation skill in trial I did not satisfy the criteria for achieving classical completeness, according to the criteria for classical student learning completeness, which requires that at least 85% of the participating students achieve a score of ≥75. Therefore, the initial attempt at implementing interactive learning materials with help from RME-based Desmos did not satisfy current standards for attaining completion.

The outcomes of questionnaire data analysis of student responses to the RME-based Desmos-assisted interactive learning media component developed in trial I visibled a positive response (85.13% > 80%) where the learning carried out was interesting, not boring and made it more easily for students to understand the material presented.

The outcomes of the analysis of students' mathematical representation skills in trial II visibled that the average mathematical representation skill of students in the pretest results of trial II was 62.24, increasing to 80.47 in the posttest. The average N-Gain value obtained in trial II was 0.47 or in the "medium" category ($0.3 < g \leq 0.7$). Where there were 4 students who got N-Gain scores in the range $g > 0.7$ or experienced an increase in mathematical representation skill in the "high" category, 21 students got N-Gain scores in the range $0.3 < g \leq 0.7$ or experienced an increase in ability mathematical representation with the "medium" category. Furthermore, 7 students got N-Gain scores in the range $g \leq 0.3$ or experienced an increase in mathematical representation skills in the "low" category. It means that students' mathematical representation skills increase by using interactive learning media assisted by RME-based Desmos.

The outcomes of the analysis of the average students' mathematical resilience attitude in the pretest of trial II was 57.16, increasing to 76.02 in the posttest. The average N-Gain value obtained in trial II was 0.51 or in the "medium" category ($0.3 < g \leq 0.7$). Where 8 students got N-Gain scores in the range $g > 0.7$ or experienced increased mathematical resilience in the "high" category, then 20 students got N-Gain scores in the range $0.3 < g \leq 0.7$ or experienced increased resilience mathematics in the "medium" category. Furthermore, there were 4 students who got N-Gain scores in the range $g \leq 0.3$ or experienced an increase in mathematical resilience in the "low" category. It means that students' mathematical resilience increases by using interactive learning media assisted by RME-based Desmos.

The outcomes of the analysis of the average value of observations of learning implementation in trial II were 3.78, namely in the well implemented category ($3 \leq O_k < 4$). In terms of learning implementation, this score satisfies the requirements for attaining the practicality of learning media.

The outcomes of classical completion of students' mathematical representation skills in trial II can be showed on the table 7.

Table 7. Levels of Classical Completeness Representation Skill Mathematics in Trial II

Category	*Pretest*	Classical	*Posttest*	Classical
	The number of students	Completion Percentage	The number of students	Completion Percentage

Complete	9	28.12%	29	90.62%
Not Complete	23	71.88%	3	9.38%
Total	32	100%	32	100%

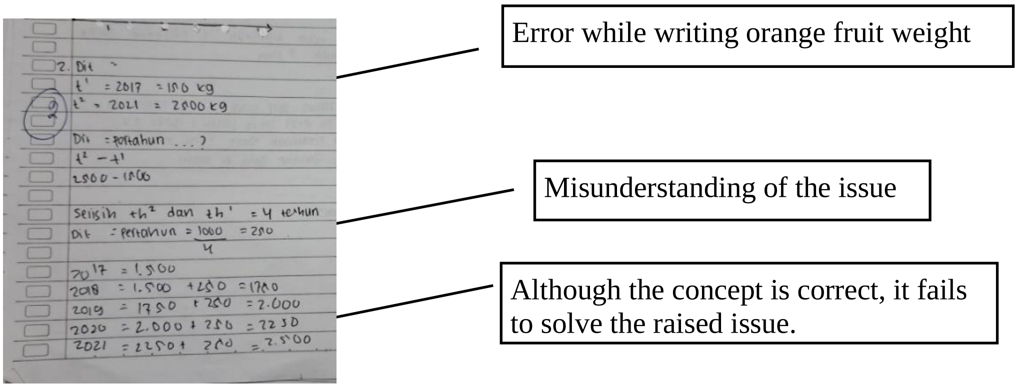
The posttest results of trial II's mathematical representation ability have satisfied the requirements for achieving classical completeness, which is 90.62%, specified that minimum 85% of the students who participated in the learning were able to achieve a score of ≥75. Thus, it namely that in trial II, the development of interactive learning materials with the help of RME-based Desmos satisfied the requirements for attaining classical completeness.

The outcomes of questionnaire data analysis of student responses to the RME-based Desmos-assisted interactive learning media component developed in trial II also showed a positive response (86.23% > 80%) where the learning carried out was interesting, not boring and made it more easily for students to understand the material presented.

Discussions

There are several signs that Desmos-assisted interactive learning media is good when viewed in the context of the review from five validators using validation questionnaires supplied by researchers and sheets of recommendations and criticism supplied by experts. These indications include: 1) clarity in the content distribution, attractiveness, deleting the numbering system, suitable spacing and organization of the layout, appropriateness between the text and illustrations, and letter type and size are all included in the format aspect; 2) grammar accuracy, encouraging reading, sentence structure simplicity, clear directions and instructions, and the communicative quality of the language employed are all included in the language substance; 3) the illustration component consists of making things visually appealing, clear, and simple to comprehend; 4) correctness of the content/material, essential material organized logically, compliance with the 2013 curricular competence standards, compliance with RME-based learning, appropriateness of the material sequencing, and clarity of the Desmos usage instructions are all included in the content element.

From the outcomes of the N-Gain test in trials I and II, it showed that students ability to improve their mathematical representation skills remains unchanged, namely it is still in the medium category. This matter that there were errors made by students when working on mathematical representation ability questions. The following are several examples of errors made by students in completing mathematical representation ability tests.



English Version

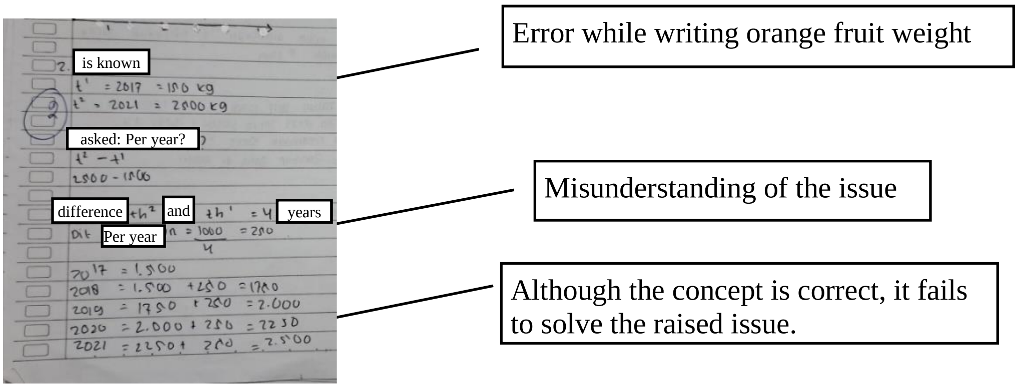


Figure 3. Error Analysis of Student Answer Results

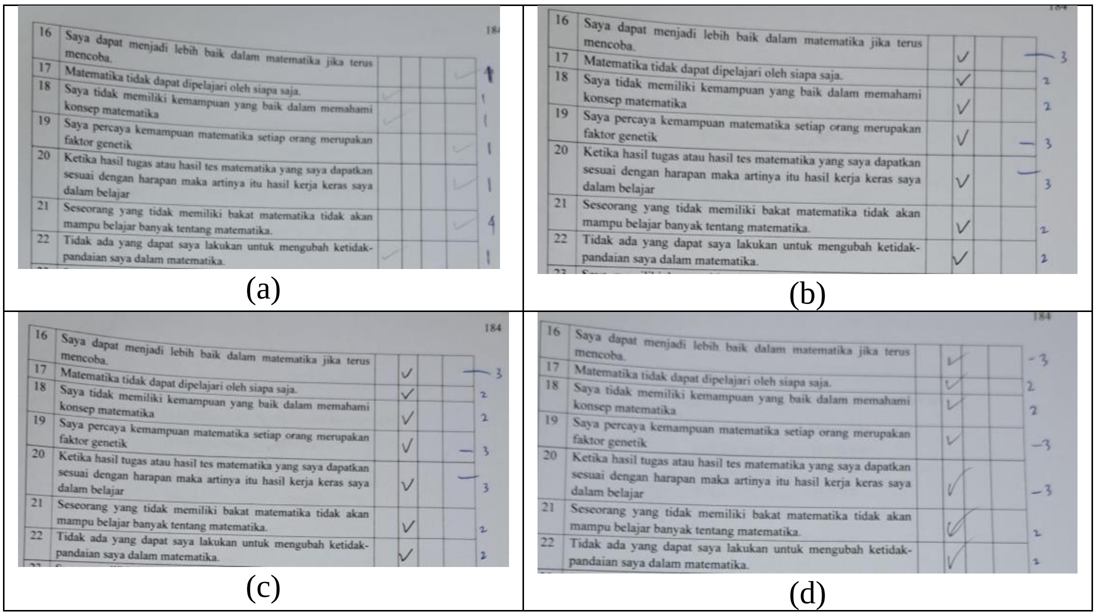
Figure 3 illustrates the many mistakes that students made when working on questions (procedures) and when applying ideas. However, if studied as a whole based on the average scores obtained by students, it means that the use of interactive learning media assisted by the RME-based Desmos developed can improve students' mathematical representation skills.

The previous research that supports this research is research by Hindarto, et al (2023) where in this research it was found that the Desmos technology has the potential to provide higher level thinking support for students in studying linear function graph material in a context that is closer to their daily lives. Desmos technology media also has the potential to give chances for students to express mathematical ideas, ideas and understanding that they already have. Mathematical representation skill is one of the higher thinking skills that students must have so that the use of Desmos-assisted learning media is able to encourage students to understand straight line equation material critically and creatively with teacher guidance. Teachers cannot be separated from the learning process. Students must be guided to prevent misinterpretation in learning. Their researchs were stated that Desmos technology can facilitate students to learn with good visual representations of linear function graphs based on the animations provided. Providing continuous problems in Desmos technology with various representational solutions makes students accustomed to conveying their ideas in the form of mathematical ideas and graphics. RME learning is also very effective in improving students' mathematical representation abilities as done by Sulastri, et al (2017) where at least students with low skills in mathematical representation have fulfilled two indicators of mathematical representation skill, namely figuring out mathematical expression problems and recording procedures. -methods for using words to solve mathematics problems.

To improve mathematical representation abilities, this cannot be separated from an important idea taken from Vigotsky's theory, namely scaffolding which is in line with one of the characteristics of RME (Realistic mathematics education) learning which emphasizes the need for continuous interaction between students and students, students and teachers and students with materials. learning so that students gain positive benefits from these interactions. The assistance provided by the teacher is only to explore students' understanding of the problem being studied. By providing assistance (*scaffolding*) by the teacher, students can better understand the problems in these activities and actively participate in learning.

Increasing students' mathematical resilience is the fulfillment of mathematical resilience indicators towards a better category according to the criteria set through the process of improving the development of learning media and reflecting on learning practices. Desmos, an app created using the RME learning strategy, provides support for interactive learning materials that have an impact on the development of mathematical resilience. Integrating learning with the RME approach can increase students' resilience towards mathematics.

From the outcomes of the N-Gain test in trials I and II, it showed that there unchanged in the category of increasing students' mathematical resilience, namely it is still in the medium category. This shows that there are shortcomings that students have from several statements given in the mathematical resilience questionnaire. The responses to statements that students frequently find weak on mathematical resilience assessments are summarized below.



English Version

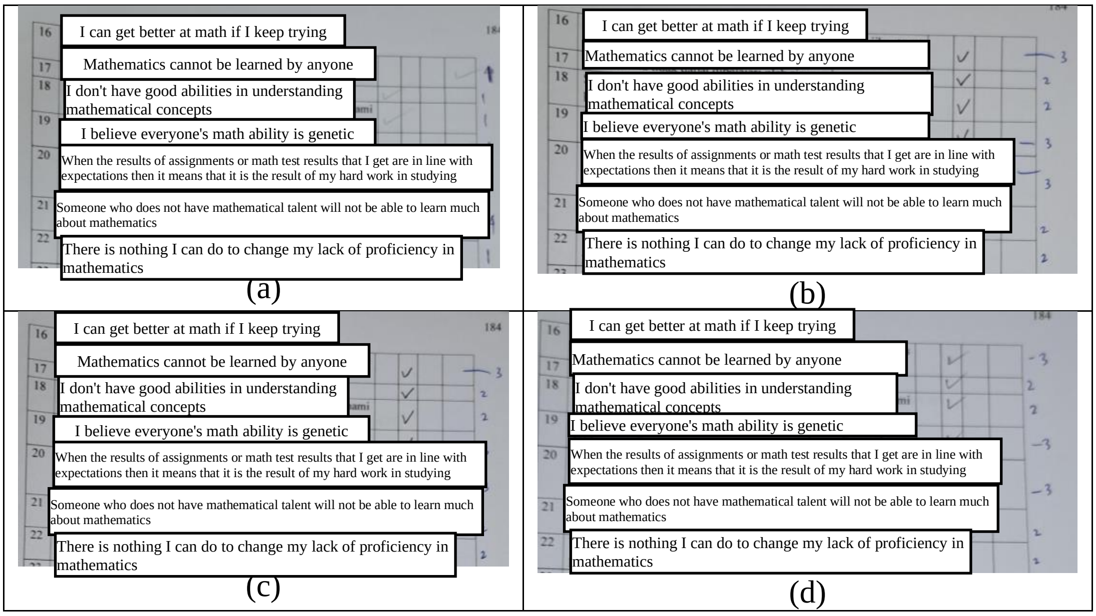


Figure 4. Analysis of Deficiencies in Student Answer Results

Figure 4, it can be seen in figure (a) at points 19 and 20, student A strongly disagrees that a person's mathematical ability is a genetic factor and that when the assignment results are as expected, it means that the assignment results are the result of his hard work in studying. Meanwhile, in pictures (b), (c), and (d) in points 21 and 22, students agree that someone who does not have mathematical talent will not be able to learn much about mathematics and there is nothing he can do to change his lack of intelligence in mathematics. Based on the outcomes of the students' answers to the fourth indicator of mathematical resilience in this research, namely realizing the limitations they have in studying and mastering mathematics, it appears that students are still less aware of the limitations they have in studying and mastering mathematics. Of the seven indicators of mathematical resilience, only one indicator did not increase, namely the indicator of realizing one's limitations in studying and mastering mathematics.

Appropriate learning media can increase students' level of resilience (Dewantoro & Rachmawati, 2020). Like research conducted by Khairiyyah (2021) where Google Classroom media can increase students' mathematical resilience and also research by Agustin, et al. (2022) through the use of Sainsmatika-Based Teaching Materials media. However, contrary to the research of Sundah, et al. (2022) who found that Desmos media did not have a significant influence on increasing students' mathematical resilience in geometric transformation material. From the outcomes of the N-Gain calculation, the average score value is -0.0189, which is in the low category, even with a negative value it can be categorized as N-Loss. It was also explained that the research was carried out after semester exams, so that students became less motivated to study and this had a big impact on the level of mathematical resilience.

Almost all indicators of mathematical resilience come from internal factors of the students themselves. And also the level of student mathematical resilience is closely related to the level of student motivation. Lack of student motivation has a big impact on students' level of mathematical resilience (Resnick, et al., 2018).

Based on the findings of observer observations during trials I and II, researchers have identified a number of indicators of effective learning implementation. These include: 1) aspects of learning steps, such as the use of activities to explain and solve contextual problems; 2) social system aspects of learning implementation, such as fostering a democratic environment, encouraging student collaboration, and having teachers remind students to work together; and 3) the principle of management reaction, which involves teachers encouraging students to construct knowledge rather than positioning themselves as learning sources.

An important and valuable consequence or multiple examples may be looked based on the effect of using interactive learning media with assistance from Desmos, which was designed using the RME strategy and has satisfied these three indicators: 1) students' responses in learning straight line equation material using interactive learning media assisted by RME-based Desmos were very positive, at 86.23%; 2) students' classical learning mastery has reached 90.62% with an average score on the mathematical representation skill test of 80.47; and 3) students' resilience attitudes, as measured by questionnaires, showed a high category with an average of 76.02. This study support by Sihite, et al. (2023) which found that utilizing Desmos for learning fosters students' active, innovative, and constant critical thinking while addressing challenges.

From the discussion above, it means that the interactive learning media assisted by Desmos based on RME is valid (seen from the outcomes of the validation of learning media and research instruments), practical (seen from the outcomes of observations of learning implementation), and effective (seen from the achievement of mathematical problem solving skills, achievement mathematical resilience, and positive student responses).

The implication of the results of this research in the field of education and subsequent research is that interactive learning media assisted by RME-based Desmos makes a very significant contribution to mathematics learning, especially straight line equation material in improving students' mathematical representation abilities and resilience. For this reason, it needs to be used again in other mathematical material that is relevant to the usefulness of the Desmos application and is able to develop students' representation abilities. For example, material for flat shapes and space shapes.

This research is inseparable from shortcomings and weaknesses due to various limitations that cannot be avoided, including: 1) teachers experience difficulties in providing guidance to students evenly. This is because students are not used to being faced with RME-based learning and group activities; and 2) the learning media in this research was used specifically for students' mathematical representation abilities and resilience in straight line equation material, but could not measure other high-level thinking abilities, such as logical, critical, creative and other thinking abilities.

CONCLUSION

Based on the outcomes of the analysis and discussion in this research, several conclusions are put forward as follows: 1) The validity of the RME-based Desmos-assisted interactive learning media developed is in the valid category. Research instruments include the Mathematical Representation Ability Test and the Resilience Questionnaire, which are included in the valid and reliable categories; 2) Increasing students' mathematical representation abilities can be showed in each aspect of mathematical representation abilities. Based on the normalized gain index, it was cloncluded that in trials I and II there was an increase in the mathematical representation ability score. So it means that the RME-based interactive learning media assisted by Desmos that was developed can improve students' mathematical representation abilities; 3) Increased student resilience can be seen in each aspect of mathematical resilience. Based on the normalized gain index, it means that in trial I and trial II there was an increase in students' resilience questionnaire scores. So it means that the RME-based interactive learning media assisted by Desmos that was developed can increase student resilience; 4) The RME-based interactive learning media assisted by Desmos that has been developed has met the criteria for the practicality of learning media in terms of analysis of the outcomes of observations of learning implementation.; 5)The developed RME-based Desmos-assisted interactive learning media meets the effectiveness criteria based on: (1) Mastery of learning students' mathematical representation abilities, (2) students' achievement of mathematical resilience and, (3) students' responses to RME-based Desmos-assisted interactive learning media.

In order assist students develop their resilience and mathematical representation skills at both the same and different learning lesson levels, the interactive learning media that has been developed with aid from RME-based Desmos can be used as a model for developing an interactive learning media component with support from Desmos and other materials.

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