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Development of RME-Based Teaching Materials Assisted With Macromedia Flash To Improve Student Mathematical Problem Solving Abilities

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ABSTRACT

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The objectives of this research endeavour are as follows: 1) Elucidate the enhancement of students' mathematical problem-solving capabilities through the utilisation of Macromedia Flash-assisted RME-based instructional materials; and 2) Assess the validity, applicability, and efficacy of such materials in promoting mathematical problem-solving abilities. In this investigation, the Thiagarajan model of development was implemented. The findings indicated the following: 1) Students' ability to solve mathematical problems improved as a result of utilising RME-based instructional materials aided by the developed Macromedia Flash. The results of the initial trial indicated a moderate increase of 0.55 in the value of problem-solving ability, as measured by the normalised gain index ($0.3 \leq g \leq 0.7$). Similarly, the second trial yielded a 0.62 increase in the value of problem-solving abilities, which meets the moderate criterion range of 0.3 to 0.7. Furthermore, the utilisation of Macromedia Flash-assisted RME-based teaching materials resulted in a rise in the number of students engaged in the activity. Lastly, the study's developed RME-based teaching materials that assisted students in solving mathematical problems have satisfied the criteria of being valid, practical, and effective.

A. INTRODUCTION

Teaching resources are really crucial. The teacher's ability to create or compile learning materials or resources influences the teaching and learning process (Gazali, 2016). Government laws require effective teaching materials to assist all learning processes and help pupils understand subjects, particularly mathematics. Teaching materials encompass any elements used by teachers to help students learn (Maskur, 2020).

Teaching resources are essential for learning because they help pupils understand concepts. Learning is ineffective without teaching materials (Efuansyah & Wahyuni, 2018). Creating instructional materials is critical to making learning enjoyable and fascinating since it serves as a learning center and strategic learning tool for both teachers and students (Maskur, 2020).

According to Efuansyah and Wahyuni (2018), current mathematics teaching materials are abstract and solely provide formulae and problems, which contradicts theory. that this instrument does not waste pupils' mathematical knowledge and reasoning. Maskur contends that mathematics teachers' materials are dull, unchanging, and inappropriate for students.

Little has changed. According to Karmilah, Unaenah, and Oktrifianty (2019), while mathematics teaching resources provide student content and practice problems, the mathematical principles utilized in their production are inappropriate for the topic. students. Many students don't understand the subject.

The best instructional materials for junior high schools, where most pupils think concretely, must include problem-solving. The curriculum is different from actual life, making math challenging for kids. For slow learners, meaningful mathematics is essential (Mayani and Rizki, 2016).

Based on this, teachers might use the Realistic Mathematics Education (RME) approach in Indonesia to create instructional materials that relate mathematical problems to students' real lives.

RME teaches mathematical problem-solving, discussion, and teamwork using real-world scenarios, according to Zulhendri (2019). It invites pupils to discuss and solve issues individually or together. Manullang

(2018) said PMRI helps pupils grasp arithmetic challenges through personal experience. Students learn mathematical concepts, principles, and models through contextual problem solving.

Realistic math instruction helps pupils grasp real-world problems and how to improve their arithmetic skills (Nasriyah, 2019). Real-world mathematics instruction encourages students to investigate, discover, and acquire knowledge. This makes learning student-centered (Nasriyah, 2019). Teachers will be less dominating with PMRI's emphasis on "student-directed" or "problem-based" mathematics instruction (Wangge, 2019). Realistic Mathematics Education shows pupils how individuals utilize arithmetic in daily life. It clearly and effectively informs kids that mathematics is a field they created and developed.

This viewpoint contradicts learning paradigms and practices used to help students solve math issues. When teachers educate, children are less inclined to ask questions. Instead, they stay mute to avoid being questioned (Yuli and Eilza, 2019). Sari stated professors usually practice one-way learning, which makes pupils passive. Hartuti (2016) also noted that some kids still trust their group members despite teachers using group learning, where students play more with their group and are given teacher-assigned tasks. Teachers sometimes struggle to regulate children in noisy environments. In order to teach students, teachers usually lecture. Prendiani and Sariyasa (2019) say low student learning achievement is driven by various issues, especially in mathematics, where student motivation is low. Many students still don't follow what teachers do to help them learn and wait for peer or teacher answers to questions. Students' behavior throughout learning activities shows this.

Math teachers at SMP Negeri 1 Halongonan Timur 4 rarely employ inventive approaches. Teachers can't find a strategy to increase student engagement. Mathematics lessons bore students because they don't understand the teacher. Packaged learning does not engage pupils in mathematics. Students prefer playing outside to learn math in class. Teachers rarely use supplemental materials to help students understand.

The right learning technique or model is as vital as the right assistive medium for your child's math success. Technology helps Indonesians enhance their spatial skills when studying abstract geometry. The 2013 mathematics curriculum incorporates information and communication technology to improve teaching and learning. When all disciplines use ICT, teachers can maximize its benefits within and outside the classroom. Teachers with technology expertise may not use it well in the classroom.

Modern technology promotes educators to use engaging media to teach, according to Sinurat, Syahputra, and Rajaguguk (2015). Learn to use interactive multimedia to use sound, video, animation, text, and images. One is using Macromedia Flash. Macromedia Flash uses gifs, sprites, and vector animations to create dynamic and interactive webpages. This software also creates animated logos, films, menus, symbol fields, electronic greeting cards, display servers, websites, and web-based applications (Putri and Rakhmawati, 2018). According to Masykur, Nofrizal, and Syazali, Adobe Flash Player (2017) can view, play, and execute Macromedia Flash, a multimedia framework and software for making animated films, video games, and internet enlightenment applications.

Macromedia flash saves teachers time while planning lessons and preparing classes. Such medium also engages students' brains, allowing them to play with ideas and understand the reasoning behind seemingly abstract mathematical issues (Masykur, Nofrizal, Syazali, 2017). Interactive Macromedia Flash media will engage students in automatic transmission system and component maintenance. Samsudi, Hutomo (2015).

In practice, most classrooms still use technology poorly. Because professors don't let students build their own mathematical ideas, they can only learn arithmetic by imitating them. Additionally, when answering instructor practice questions, pupils cannot express their own opinions or ideas (Mulia 2019). Using standard learning approaches in daily classroom activities makes students inactive, according to Mayasari (2019). In addition, classroom media and arithmetic teaching instruments are scarce (Mashita, 2018).

The mathematics instructor at SMPN 4 Negeri One Roof in East Halongonan also failed to use ready-to-use software to develop teaching materials. One of the skills needed to face globalization and accept free market capitalism is the capacity to use computer software, especially interactive CDs, for mathematics learning. In mathematics education, problem-solving skills are developed. Based on NCTM in Rofiqoh, Rochmad, and Kurniasih (2019), learning mathematics aims to develop students' problem-solving skills. Problem solving is an important aspect of any mathematics course since it lets students apply their new skills to non-core topics.

Surya and Harahap (2017) claim that problem solving is an advanced cognitive activity requiring complex cognition. High-level cognitive skills, such as problem-solving, help students learn more (Helmi, Rokhmat, 'Ardhuha, 2017). Students must acquire these problem-solving techniques because mathematics demands them. It is vital to learn how to solve problems since mathematical reasoning relies heavily on problem solving. "The ability to carry out a sequence of operations with the aim of overcoming a problem using principles that have been mastered previously" is what Wibowo (2016) defines as difficulty solving. Success in school demands the ability to solve mathematical puzzles. The capacity to solve complex questions and crossword puzzles is known as problem-solving aptitude. Students are encouraged to think critically and creatively by posing non-routine questions and solving problems.

Branca describes "problem solving" as an outcome, approach, and talent (Hendriana, Rohaeti, & Sumarmo, 2018). To solve stress-related problems, one must practise arithmetic. This scenario has no pertinent questions, guidelines, procedures, or mathematical ideas. This is to help you develop your problem-solving skills so you can accurately respond to inquiries. Heuristics, processes, strategies, and approaches are all used in problem resolution. Teachers strive for social responsibility and problem-solving abilities in their students, and these are included in this fundamental competency.

Solving problems is a skill that students should acquire. The key to solving difficulties is to read and comprehend word problems, present them in mathematical models, plan calculations using mathematical models, and calculate from non-routine problems. Students solve mathematical puzzles to apply and integrate knowledge. Solving issues fosters students' creativity, confidence, and quantitative skills (Tambunan, 2019). For everyday decision-making, problem-solving exercises foster critical and analytical thinking (Uji, Asikin, Mulyono, 2018).

Novitasari and Wilujeng (2018) contend that in order for students to overcome obstacles in life, they must learn how to solve problems. According to Fadillah and Surya (2017), answering questions is a goal and a criteria for mathematical education. Students' thinking, perseverance, curiosity, and self-confidence are developed both within and outside of the classroom as they solve mathematical issues (Putri, Syahputra, Mulyono, 2020). But this idea is not true. According to Setyawati (2017), students still have difficulty with the questions, the course content, putting down what they know and what is requested, calculating, and drawing conclusions. Fear and math difficulties might also hinder one's ability to solve problems (Fitria, Hidayani, Hendriana, Amelia, 2018). Thought is required for math problems, children learn more material with practice (Febriani, Sidik, Zahrah, 2019).

Most students are not problem solvers, according to Rofiqoh, Rochmad, and Kurniasih (2019). Many pupils still use maths shortcuts. Some children struggle with the maths problems that teachers assign. Novitasari and Wilujeng (2018) contend that pupils' routine practice prevents them from understanding the difficulties of arithmetic. Pupils who understand the issue and adhere to the instructions without verifying their work produce incorrect results. Students' arithmetic problems are influenced by both internal and external factors, particularly when they call for complex reasoning. Instructors and, less frequently, conscientious peers assist pupils who are confused about a subject. Children are unaffected by teaching strategies, difficult exams, or unfavourable classroom environments.

Goulao (2014) asserts a connection between academic accomplishment and self-confidence. A pupil needs to have confidence in his capacity to study. Marpaung (2015) discovered that class X pupils at SMA Negeri 1 Lawe Alas had low self-efficacy in addition to inadequate problem-solving abilities. When pupils try to understand a question yet do nothing, they exhibit this tendency. Students who lack self-efficacy shun challenging assignments and mimic the work of their peers. Youngsters fail to absorb instruction and ask questions when they don't understand, which contributes to their low mathematical ability. An essential teacher in the classroom is (12). Rather than allowing students to participate in class discussions or ask questions, teachers maintain control over the course. Students were less interested and less inclined to offer to help with maths problems later on. It will also have an impact on kids' weak problem-solving abilities.

The researcher found a connection between teacher-arranged mathematics learning and students' low self-efficacy and problem-solving skills in their initial interview with teachers at One Roof Middle School, East Halongonan 4. Teachers need to identify and apply ways that enhance students' problem-solving skills and self-efficacy in order to overcome the aforementioned problems. Substitutions in maths are simpler for students who can solve problems. Students' ability to solve problems and participate in class may increase if they learn how to use Macromedia Flash to develop RME-based instructional modules. The researcher's planned project, "Development of RME-Based Teaching Materials Assisted by Macromedia Flash to Improve Students' Mathematical Problem Solving Ability," is based on the background information.

B. RESEARCH METHODS

Thia research use developmental studies. This study creates educational materials by combining realistic mathematics and Thiagarajan's four-dimensional development model. Educational materials include student workbooks, teacher textbooks, and student books (LKPD). The researchers also created a self-efficacy questionnaire and an assessment of problem-solving skills. During the even semester of the 2020-2021 academic year, Class VII students from SMP Negeri 4 East Halongonan went to Huta Baru Nangka Village in the East Halongonan District of North Padang Lawas Regency, North Sumatra. The study is anticipated to be completed in 2022. The research subjects for the 2020-2021 academic year were seventh-grade students at SMP Negeri 4 One Roof East Halongonan. The first experiment drew 30% of students from classes VII-3, whereas the second drew the same amount of students from VII-2. Although the research's goal was to create instructional materials for flat rectangular and square geometries, the study is divided into two parts: creating educational resources and implementing them. 2. Knowledge Acquisition and Personal Development (LKPD), Student's Book (BS). The second step is to apply trial-approved educational materials. Thiagarajan and Semmel's 4-D model (define, design, develop, and distribute) was used to build training materials. The development model for this inquiry, shown in Figure 1, is described below.

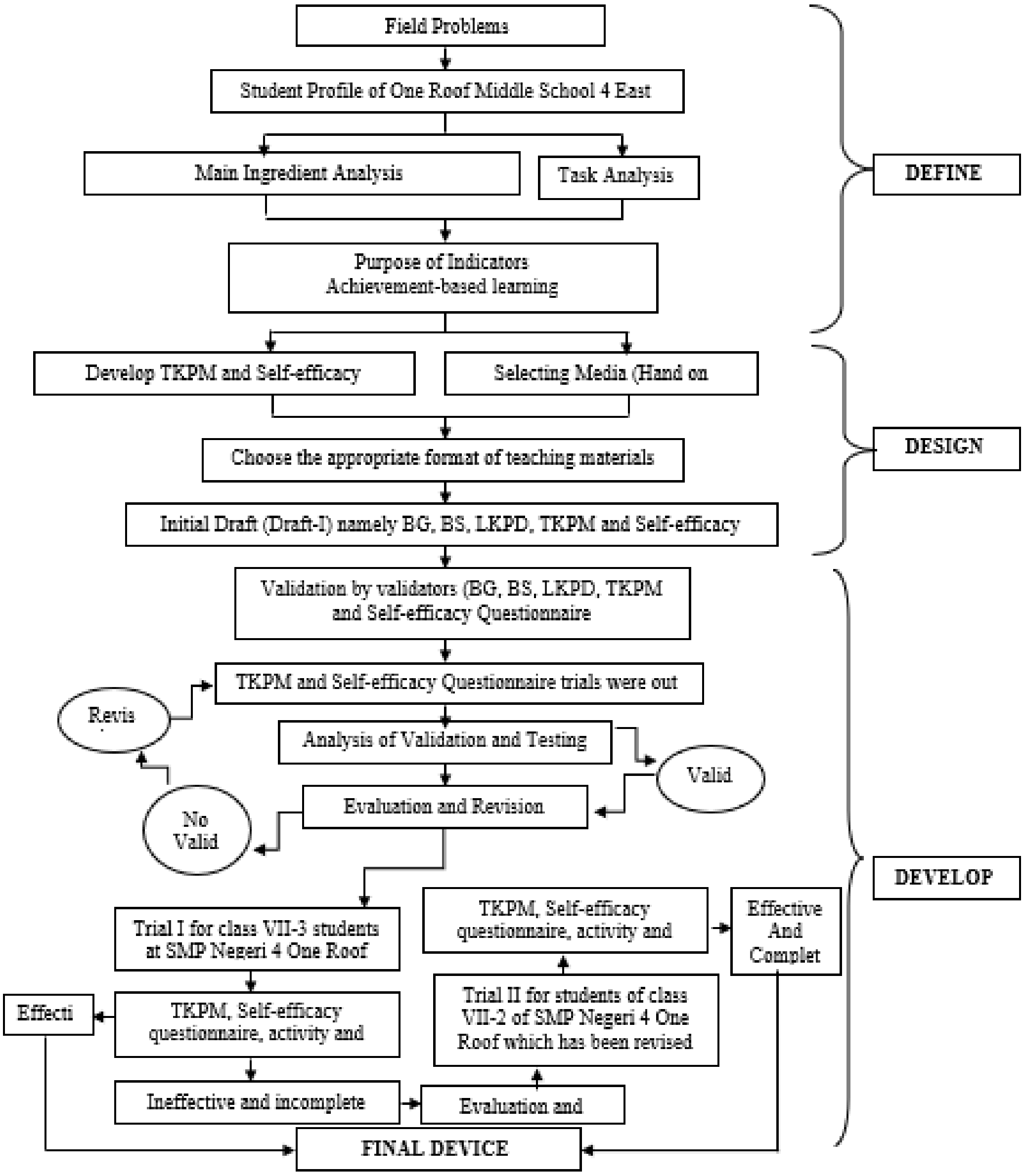

Figure 1. Research Procedure for Development of Teaching Materials Based on a Realistic Approach

Define Stage

In the definition stage, learning needs are identified by analysing the aims and limitations of the material being developed. Initial-finish, student, task, idea, and learning objective analysis are done at this stage.

Design Stage

The design stage creates a training material prototype. After determining learning, this step begins. Preparation for tests, media, formats, and early design occur here.

Development Stage

The objective of development is to produce a high-quality product, hence the initial version will undergo validation by experts and be tested in real-world conditions. The revision of draft 1 will be based on data obtained from expert and field testing. Initially, field professionals thoroughly examine the first draft. Competent validators in this scenario consist of mathematical education lecturers from UNIMED, junior high school mathematics instructors, and language experts. This study employed a mathematics problem-solving test consisting of three essay-based questions. Field trials yielded immediate input on the educational materials utilized in the development of the final product. The efficacy of these instructional materials was evaluated at SMP Negeri 4 Satu Roof East Halongonan. The effectiveness of teaching materials is assessed based on students' mastery of classical content, achievement of learning objectives, and the time taken to complete the tasks.

In addition, the assessment data was analyzed and modified to provide authentic teaching materials.

This trial devised and created these instruments:

Validation Sheet for Teaching Materials, Validation sheets utilize the expertise of professionals to assess the quality of educational materials. Validation sheets for the LKPD, BS, TKPM, and self-efficacy questionnaires are required. Descriptive statistical analysis is employed to analyze teaching resources by calculating the mean score assigned to each resource by experts in mathematical education. The materials are then modified according to the experts' corrections and suggestions..

The following processes determine the total average value of instructional material validity assessment features using a realistic approach:

1. List aspects (Ai), indicators (Ii), and Vji values for each expert in a table for instructional material validity evaluation data.
2. Calculate the expert average for each indication using a formula.

$$I_i = \frac{\sum_{j=1}^{n} P_{ji}}{n} \text{ (Susanto, 2012: 75)}$$

3. Determine the average value for each aspect using the formula:

$$A_i = \frac{\sum_{j=1}^{m} I_{ij}}{m} \text{ (Susanto, 2012: 75)}$$

4. Determine the Va value or total average value from the average values for all aspects using the formula

$$Va = \frac{\sum_{i=1}^{n} A_i}{n} \text{ (Susanto, 2012: 75)}$$

Next, the Va value or total average value is referred to in the interval for determining the level of validity teaching materials refer to as in Table 1:

Table 1. Validity Level Criteria

No	*Va* or total average value	Validity Criteria
1	1 ≤ Va < 2	Invalid
2	2 ≤ Va < 3	Not valid
3	3 ≤ Va < 4	Fairly valid
4	4 ≤ Va < 5	Valid
5	Va = 5	Very valid

Details: Va is the value used to assess the degree of validity of instructional materials using the RME model.

Problem-Solving Capabilities Assessment Tool

Tests measuring pupils' aptitude for solving mathematical problems will be used to gather data on their problem-solving skills. This test is designed in the form of a description.

Questionnaire on Student Response

A questionnaire asking students to respond was utilised to collect data on their responses. Students provide a checklist (□) in the designated column for every question posed in order to collect data. The reading level of LKPD and student books, as well as student reactions, were measured using this questionnaire.

As per Hasratuddin's (2015) findings, the evaluation of learning tools is predicated on four key indicators of learning effectiveness: (1) learning completeness achieved when 80% of students who take the mathematical problem solving ability test receive a score of 75; (2) learning time that is efficient or does not surpass normal learning; and (3) student responses to learning.

PKK ≥ 85% indicates that a class has finished learning (Trianto, 2011). Using the following formula, one can determine the percentage:

$$PKK = \text{x } 100\% \frac{Number\ of\ students\ who\ have\ completed\ their\ studies}{Total\ number\ of\ students}$$

Students' positive and negative answers to the student response questionnaire sheet, which was computed using a formula, were presented in order to analyse the data from the questionnaire. (Trianto, 2011).

$$PRS = \frac{\sum A}{\sum B} \text{x } 100\% \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(Trianto, 2011 :243)}$$

Information:
PRS : Rate of students who answered positively
ΣA : Voting percentage of students
ΣB : Respondent student count

Pretest and posttest problem-solving abilities were used to measure improvement. Students' problem-solving skills can be improved using normalized gain index data:

$$N - Gain = \frac{Postest - Pretest}{Score\ Ideal - Pretes}$$

The criteria for the Normalized Gain Index (g) can be seen in Table 1 below (Hake, 1999):

Table 2. Normalized Gain Index Criteria

Gains	Category
g > 0.7	Tall
0.3 < g ≤ 0.7	Currently
g ≤ 0.3	Low

Dissemination Stage (Disseminate)

Dissemination represents the last phase of the development process. The objective of the dissemination phase is to facilitate user acceptance of the development product, be they organisations, individuals, or systems. In additional courses, dissemination may be conducted to determine the efficacy of device utilisation during the learning process. During the distribution phase, validated instructional materials are disseminated. Only instructors and students were invited to participate in this activity, which was conducted exclusively at the educational institution where the researcher conducted his or her study, SMP Negeri 4 Satu Roof Halongonan Timur.

C. RESULTS AND DISCUSSION

The data acquired from the study results will determine whether or not the problem formulation or research question provided in the preceding section has been addressed. The findings from the data analysis are as follows:

Description of the Define Stage

Based on observations and analysis of teaching materials at SMP Negeri 4 Satu Roof East Halongonan, most mathematics teachers regard teaching materials as administrative requirements, resulting in inadequate preparations for the learning process, such as lesson plans (RPP), books, teacher handbooks, student books, learning results tests, and student activity sheets (LKPD). The teacher only asks students to answer questions using the formulas that the teacher has taught them and does not allow students to convey their mathematical ideas through other answers, causing them to focus on one solution. Aside from that, in the mathematics learning process, teachers have not generated learning materials utilizing computer-based software. In reality, in order to face the era of globalization and embrace the free market era, it is necessary to comprehend the evolution of learning technology, which involves the use of computer software as a mathematical learning medium, notably in the form of interactive CD.

Student analysis is carried out to analyze student characteristics in accordance with the design and development of learning materials as determined by the first final analysis. In this case, the analysis was carried out on VII SMP Negeri 4 Satu Roof East Halongonan students, specifically in terms of student characteristics such as cognitive development and background knowledge, in compliance with instructional material design and development guidelines. This study focuses on rectangular and square shapes at SMP Negeri 4 Satu Roof East Halongonan, with a reference to the 2013 Curriculum. This concept analysis seeks to identify, detail, and organize the concepts that students will learn from the text. the.

Description of the Design Stage.

The purpose of this stage is to generate instructional materials in order to obtain a prototype (first design) of rectangular and square materials. At this point, an initial design of RME-based teaching materials was created using Macromedia Flash, including Student Books, Teacher Books, Learning Implementation Plans (RPP) for three meetings, Student Activity Sheets (LKPD) for each meeting, problem-solving ability tests, scoring guidelines, and alternatives. completion and self-efficacy questionnaires. The teacher's book has been designed and is shown below.

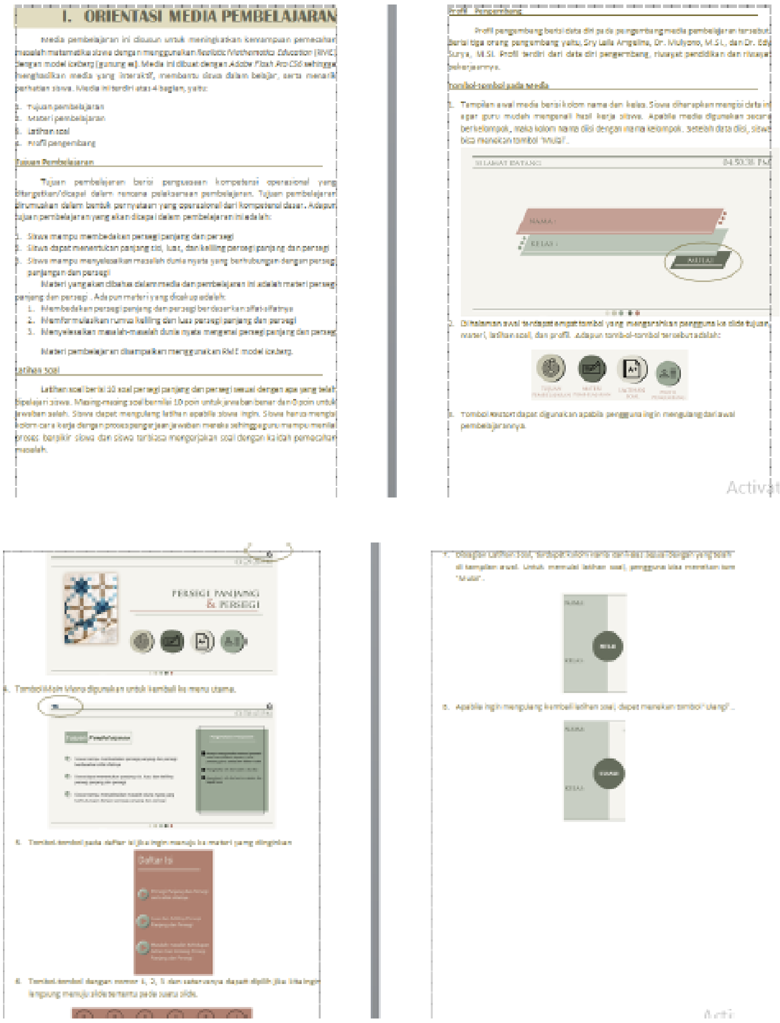

Figure 2. Display of contents in the teacher's book

Description of Development Stage (Develop)

The initial stage of the development process involves the validation of draft I by specialists, followed by the implementation of field experiments. The experts' assessment involves content validation, which encompasses the evaluation of all teaching materials created during the initial design phase, resulting in a revised draft II that is deemed appropriate for implementation. The findings from expert validation serve as a foundation for modifying and enhancing educational materials and tools. The validated aspects encompass the format, content, and language.

The average overall validation scores for student books, instructor books, lesson plans, and LKPD, as assessed by professionals, are 4.30, 4.27, 4.30, and 4.27, respectively. These scores fall into the "Very Valid" category according to the validity standards. The five validators determined that the student's book was suitable for usage. The results of the test instrument for testing students' problem solving abilities are presented in Table 3 below.

Table 3. Validity of Student Mathematical Problem Solving Ability Test Items

Question Items	rxy	t count	$t\ tab$le	Interpretation
1	0.72	4.97	2,063	Valid
2	0.66	4.21	2,063	Valid
3	0.57	3.32	2,063	Valid

Table 3 presents a research instrument trial for students' problem-solving abilities with 5 essay questions, 5% significant level, dk = 25, and rtable = 2.063 according to testing standards. Problem-solving tests are valid if testing criteria are countable. Trials I and II showed that students' problem-solving skills met customary completion requirements. The instructional materials' content and difficulties match the student's learning environment. With this teaching material, students will grasp flat shapes (rectangles and squares). Trial I's final problem-solving test yielded 63.3%, with 19 students passing. In experiment I, RME-based teaching materials aided by macromedia flash did not meet conventional completion (>80%) standards.

Trial II showed that students' problem-solving skills met standards with a 90% score. Completed pupils were 27. Therefore, RME-based instructional materials enhanced with Macromedia Flash met the efficacy requirement for developing students' critical thinking skills.

This study supports Hodiyanto, Darma, and Putra (2020) findings. They found that 16 students passed the posttest and 4 failed because their scores were below the passing mark. The instructional resources are successful in classical fullness. Sari, Irwan, and Musdi found that 20 of 23 students (86.5%) acquired classical completeness (Sari et al., 2022).

Trials I and II student self-efficacy questionnaires show considerable improvement. In the first trial, students had an average self-efficacy of 81.77 and a standard deviation of 8.31. In the second experiment, students' self-efficacy averaged 101.73 with a 9.76 standard deviation. Viviana et al. (2017) found that students who learned math realistically had higher math self-efficacy than those who learned conventionally (t-value=2.0764).

The examination of the results of student activity observations in trial I revealed that the average percentage of student activity deal time achievement for the three trial meetings was 20.98%, 18.19%, 19.93%, 23.78%, 8.74%, and 8.74%, respectively. In trial II, the average percentage of student active deal time achieved for the three sessions was 22.74%, 18.52%, 23.41%, 23.43%, 7.35%, and 3.85%, respectively. Based on the facts supplied, it is possible to conclude that all student activities in Trial II effectively met the designated percentage of deal time.

Utary Ariesta's research (Utary, 2022) provides evidence that students' learning activities exhibit a rise in positive attitudes with each session while utilizing Macromedia Flash learning media. In addition, a study conducted by Nilawasti, Suherman, and Utama (ZA et al., 2013) suggests that utilizing macromedia flash for learning purposes is not only more captivating but also encourages students to be attentive and engaged in the educational process. This demonstrates that pupils are intrigued and progressively eager to study through this medium. Upon analyzing the previously explained student replies, it was discovered that in both the trial and trial I, students expressed a strong interest in the generated instructional materials. This is evident from the mean score of student feedback indicating their enthusiasm for learning with the enhanced instructional resources. Based on the questionnaire score, the student replies in trial I were 84% and in trial II were 95%. Based on the students' feedback on the RME-based teaching materials that utilized Macromedia Flash media, it may be inferred that they were successful.

The findings of this study are reinforced by the research conducted by Hodiyanto, Darma, and Putra (Hodiyanto et al., 2020), which indicates that the average student response about the usability of Macromedia Flash was 81.71%, indicating a positive reception. Moreover, a study conducted by Sari, Irwan, and Musdi (Sari et al., 2022) revealed that students responded favorably to the instructional materials, with an 84.44% approval rate.

Gaining a thorough comprehension of the concepts and structure of material enhances the overall understanding of the material. In addition, pupils' retention and durability of knowledge is enhanced when it is acquired through a systematic framework. According to Brunner's theory, a practical approach is suitable for activities since it allows students to directly manipulate things that are relevant to contextual problems provided by the teacher at the start of the learning process. During the process of vertical mathematization, pupils engage in the manipulation of symbols.

This research is not free from shortcomings and weaknesses due to various limitations that cannot be avoided, including:

1. The teaching materials developed in the research can only be used for flat shapes (rectangles and squares) and do not include other materials.
2. Teaching materials can only improve students' problem solving abilities

D. CONCLUSION AND SUGGESTIONS

There is an increase in students' mathematical problem solving abilities by using the RME-based teaching materials assisted by Macromedia Flash that were developed. Based on the normalized gain index, it was found that in trial I in trial I there was an increase in the problem solving ability value of 0.55 with medium criteria ($0.3<g\leq 0.7$). Likewise, in trial II there was an increase in the problem solving ability score of 0.62 with moderate criteria ($0.3<g\leq 0.7$).

The RME-based teaching materials assisted by Macromedia Flash to improve students' mathematical problem solving abilities developed in this research have met the validity criteria. RME-based teaching materials assisted by Macromedia Flash to improve students' mathematical problem solving abilities have met practicality criteria. RME-based teaching materials assisted by Macromedia Flash to improve students' mathematical problem solving abilities have met the effectiveness criteria

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