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E-Book With a Realistic Mathematics Education Approach Helped by Smart Apps Creator to Improve Students' Problem Solving Abilities

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Abstract: The low problem solving ability of students at SMP Negeri 1 Kisaran is influenced by the use of less varied teaching materials. This research aims to produce E-Book products with the Realistic Mathematics Education (RME) approach assisted by Smart Apps Creator to improve students' problem solving skills that meet valid, practical, and effective criteria. This development uses the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The sample consists of two classes, namely class VIII-5 (experimental) and class VIII-2 (control), each with 30 students. Data were collected through tests, namely pretest posttest and non-test consisting of observation, interview, and questionnaire. Analysis data were analyzed through independent sample t-test with the help of SPSS 25. The results showed that: (1) The developed E-Book meets the valid criteria with an average expert assessment of 87.4% "very valid" category. (2) The practicality of the E-Book is obtained from the results of the teacher and student response questionnaire with an average value of 88.8% "very practical" category. (3) Based on the results of the Independent Samples T-test test, the sig. (2-tailed) 0.000 <0.05, which means there is a significant difference between the experimental class and the control class. Thus, the use of E-Books with the RME approach assisted by Smart Apps Creator is effective in improving students' problem solving skills.

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Introduction

Problem-solving skills are very important and must be developed in mathematics learning. Problem-solving skills are a provision for students to solve problems encountered in everyday life. Kamsurya, (2019: 59) states that problem-solving skills are the ability to solve problems that come from the context of the student's real world by using the abilities that the student already has. The statement regarding the importance of students' problem-solving skills is also reinforced by Purnamasari & Setiawan (2019: 208) and NCTM (2020) who say that in the learning process and in everyday life, problem-solving skills are very important and must be possessed by students. Problem solving as the first step for students in developing ideas, building new knowledge, and developing mathematical skills, so it cannot be separated from mathematics learning.

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A student is said to have problem-solving skills in mathematics learning if he has achieved certain indicators. Polya (1973, 5-6), states that there are four steps in solving problems, namely: 1) understanding the problem; 2) planning a solution strategy, 3) implementing the plan, 4) rechecking. In reality, this problem-solving ability has not been mastered by students at school. There are still many students who are not optimal in solving problems. The level of problem-solving ability in schools can be seen based on the results of observations that have been carried out in class VIII-5 UPT SMPN 1 Kisaran on March 2, 2024, it was found that in the first indicator, out of 32 students, only three students could understand the problem in the question. This shows that students have not been able to write down what is known and asked in the question. In the second indicator, only five students can plan a solution strategy, this shows that students have not been able to write down a solution strategy for the given question. In the third indicator, only six students can carry out the solution plan, this indicates that students have not been able to solve problems according to the planned strategy. In the fourth indicator, only six students can recheck the results of the problem solving, this shows that students have not been able to check and write conclusions from the results of the solution that has been obtained.

The results of this observation as a whole show that students' mathematical problem-solving abilities are still low. Based on observations that have been made, the low problem-solving ability of students is influenced by the use of teaching materials that are not optimal, where the use of teaching materials is less varied. Of the six mathematics teachers, only one teacher developed and also used teaching materials that he developed himself. Meanwhile, other teachers only use teaching materials provided by the Ministry of Education and Culture of the Republic of Indonesia. In addition, in learning activities, teachers still use conventional approaches. According to Nahdi (2019: 12), a conventional approach is a learning approach that usually begins with explaining concepts to students, providing examples of questions related to the material being studied, and ending with providing practice questions. This causes the learning process that takes place to be less meaningful for students because learning is only centered on the teacher without involving student activity. Then, the use of technology in mathematics learning is not optimal, where students and teachers have not used teaching materials that can support interactive learning activities.

Teaching materials have an important role, namely as a center of learning and a strategic learning tool for teachers and students (Maskur, 2020: 79). Ideally, teaching materials can support the entire learning process and make it easier for students to understand the material. However, in reality, the application of mathematical concepts used in compiling teaching materials does not match the characteristics of students so that the material is difficult for students to understand (Karmilah et al., 2019: 67). With teaching materials, teachers are no longer the only source of information, but rather as facilitators who help and direct students in the learning process. Meika, et, al., (2023: 94) emphasizes the importance of teacher creativity in choosing learning resources that are appropriate to the development and needs of students. One of the difficulties faced by students when learning is the lack of relevance of mathematics material to the real world. In order to support the learning process

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that actively involves students and develops problem-solving skills, it is necessary to develop teaching materials that should be focused on applications in everyday life (contextual) and adjusted to student characteristics, so that learning is more meaningful and easy to remember. The teaching materials developed in this study are non-printed teaching materials, namely digital books commonly called E-Books or electronic books. Bayani (2019: 8) stated that e-books are learning materials or tools that are systematically arranged and designed containing a series of learning activities to achieve learning objectives. Furthermore, (Bakoban, et., al, 2022: 2964) explained that e-books also allow individual learning and make it easier for students to understand the material because they are equipped with various features such as video, audio, and discussion of questions that support the independent learning process.

The development of e-books requires a learning approach that can be used as a reference in designing and compiling learning activities. This study uses the Realistic Mathematics Education (RME) approach, which has been proven to be more effective in improving students' mathematical problem-solving abilities than conventional approaches (Agustin & Utami, 2022: 295). In the RME approach, teachers do not directly provide information when teaching, but must create learning activities that are contextual and relevant to everyday life, so that students can build their own mathematical understanding. In accordance with the characteristics of the RME approach according to Treffers (1987: 255-263), that in this approach, the use of problem contexts in learning is associated with students' daily lives. Thus, students are motivated to be involved in lessons and active in learning. Student activity in the learning process can increase understanding of the material, as well as help improve student problem solving. In addition to the use of context, other characteristics include the use of models and symbols, utilization of student work and construction, interaction, and interconnectedness.

The characteristics of the RME approach can improve students' problem-solving abilities. This is reinforced by the results of research conducted by Kamsurya (2019), which shows that the application of the Indonesian Realistic Mathematics Education (PMRI) approach is able to develop and improve students' problem-solving abilities in the learning and problem-solving process. The use of context is able to shape students' thinking patterns that mathematics learning comes from daily activities to formal mathematics and is then reapplied in the problem-solving process. The use of student construction results plays a role in developing the ability to understand the material being studied and students' problem-solving abilities. The interactions that are formed are not only between teachers and students, but also between students and students through discussion activities and solving problem-solving questions. And the intertwinement of previous concepts also plays an important role in deepening understanding and improving students' problem-solving abilities.

One of the technologies that is developing rapidly today is smartphones, especially with the Android operating system which is in great demand and owned by students. Android-based learning will not be monotonous with text alone, but can create audio or visual elements and even animations so that they are more interactive and easy to understand (Nengsih, et, al., 2022: 503). The Android-based application used to develop e-books with the

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RME approach in this study is Smart Apps Creator. This is supported by the results of research conducted by Khasanah & Rusman (2021) and Mahuda et, al., (2021) which shows that Android-based learning media assisted by Smart Apps Creator is declared feasible, practical, and effective in improving students' mathematical problem-solving abilities. The Smart Apps Creator application is a program that allows users to create various multimedia applications that can be published on smartphones, Android, laptops or PCs and HTML5 (Faqih, 2020; Azizah, 2020). This application has a display like a ppt or e-book so that it makes it easier for students to understand the information presented. In addition, this application can be developed according to needs to produce products that can optimize the learning process. Habiburrahman, et al., (2023: 98) stated that the Smart Apps Creator application is an interactive media that can help improve students' learning experience, understanding, and attention to the material so that it can make it easier for students to achieve their learning success and improve students' problem-solving abilities.

Based on the problems that have been described, this study aims to provide a solution through the development of an E-Book with a Realistic Mathematics Education (RME) approach assisted by Smart Apps Creator to improve students' problem-solving abilities reviewed based on validity, practicality, and effectiveness.

Research Method

This research is a Research and Development (R & D) that aims to develop an E-Book with an RME approach assisted by Smart Apps Creator to improve students' problem-solving abilities that meet valid, practical, and effective criteria. The development model used is ADDIE, which consists of five stages, namely: analyze, design, development, implementation, evaluation. At the implementation stage, the study used a Quasi Experimental Design with a Pretest-Posttest Control Group Design which aims to test the effectiveness of the product being developed. This research was conducted at SMP Negeri 1 Kisaran in the odd semester of the 2024/2025 academic year. The sample of this study consisted of two classes, namely class VIII-5 (experimental class) and class VIII-2 (Control class). The experimental group was given treatment in the form of using the developed E-Book, while the control group was not. Pretest and posttest were given to see the difference in students' mathematical problem-solving abilities between the experimental group and the control group. Data collection was conducted through tests (pretest and posttest) and non-tests (observation, interviews, and questionnaires). Observations were conducted to observe the learning process, interviews were used to obtain information related to the learning process, media used, and student abilities according to teachers, and questionnaires were used to validate material and media experts and collect teacher and student responses to improve the quality of the developed e-book. Validity and practicality data analysis was conducted using a Likert scale with five alternative answers to change the validation results in the form of qualitative data into quantitative data. The scoring rules used can be seen in table 1. below.

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Table 1. Converting Quantitative Data to Qualitative Data with a 5-point Scale

Score		Category
Calculation	Result	
$\bar{X} > 3 + (1{,}8 \times 0{,}67)$	$3{,}4 < \bar{X} \leq 4{,}2$	Very good
$3 + (0{,}6 \times 0{,}67) < \bar{X} \leq 3 + (1{,}8 \times 0{,}67)$	$3{,}4 < \bar{X} \leq 4{,}2$	Good
$3 - (0{,}6 \times 0{,}67) < \bar{X} \leq 3 + (0{,}6 \times 0{,}67)$	$2{,}6 < \bar{X} \leq 3{,}4$	Quite good
$3 - (1{,}8 \times 0{,}67) < \bar{X} \leq 3 - (0{,}6 \times 0{,}67)$	$1{,}8 < \bar{X} \leq 2{,}6$	Not good
$\bar{X} \leq 3 - (1{,}8 \times 0{,}67)$	$\bar{X} \leq 1{,}8$	Very bad

(Source : Widoyoko, 2009 : 238)

The developed e-book can be said to be valid and practical if it meets the minimum assessment category of "Good". Meanwhile, the analysis of effectiveness data was carried out through homogeneity tests, normality tests, and Independent Sample T-Test tests calculated using SPSS 25 to see if there was a significant difference between the mathematical problem-solving abilities of students in the experimental class and the control class.

Result and Discussion

Based on the research that has been conducted, an e-book with the RME approach assisted by Smart Apps Creator was obtained to improve students' quality problem-solving abilities in terms of validity, practicality and effectiveness.

1. Validity of E-Book

The developed e-book is said to be valid based on the validation results by material experts and media experts. The validation data is presented in table 2 below.

Table 2. Validity of E-Book

	Assesment Aspects	Average	Category
Material Expert	Material Suitability	4,86	Very Good
	Language Suitability	4,83	Very Good
	Presentation Suitability	4,53	Very Good
	Appealing Appearance	4,16	Good
	RME Approach Suitability	4,86	Very Good
	Benefits	4,88	Very Good
	Total Average	**4,69**	**Very Good**
Media Expert	Component	4,26	Very Good
	Content	4,13	Very Good
	Ease	4,16	Very Good
	Technology	3,66	Good
	Total Average	**4,05**	**Good**

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Based on the validation results by the three material and media experts, it is known that the average validation results for all aspects got a score of 4.37 or 87.4%. Based on the validation results obtained from the material and media experts, the developed e-book received the criteria of "very good" so that it can be said to be "valid" or suitable for use. Although it is already in the very good category, there are still suggestions from experts to maximize the e-book to make it even better. The e-book obtained with the RME approach assisted by Smart Apps Creator which is valid is due to several things, including: (1) The e-book developed with the RME approach assisted by Smart Apps Creator is in accordance with the indicators that have been set and improved based on revisions/comments and suggestions from the validators to obtain learning devices with good RME approach characteristics. (2) This e-book is also compiled in accordance with the independent curriculum for junior high school level by considering the learning achievements that must be achieved in mathematics learning activities. (3) the e-book developed is in accordance with the characteristics of the RME approach which contains real problems.

2. Practicality of E-Book

The developed e-book is stated to be practical as seen from the results of the teacher and student response questionnaire, where the questionnaire contains statements that can help teachers and students to assess the ease of use of the developed e-book after being used in learning. Data from the results of the teacher and student response questionnaire are presented in table 3 below.

Table 3. Practicality of E-Book

	Assesment Aspects	Average	Category
Teacher	Component	4,40	Very Good
	Content	4,71	Very Good
	Ease	5	Very Good
	Technology	4,67	Very Good
	Total Average	**4,70**	**Very Good**
Student	Material Suitability	4,33	Very Good
	Ease of Use	4,03	Very Good
	Benefits	4,18	Very Good
	Total Average	**4,18**	**Good**

Based on the implementation stage carried out on 30 students in the experimental class, the average score of the teacher and student response questionnaire results on all aspects of the teaching materials was 4.44 with a percentage of 88.8%. So the results of the questionnaire indicate that the developed e-book meets the minimum criteria for practicality and can be categorized as very practical.

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3. Effectiveness of E-Book

The effectiveness of the developed e-book was analyzed based on the results of the prerequisite test and hypothesis test from the pretest and posttest data that had been obtained during the implementation. The prerequisite test includes the normality test, homogeneity test, and hypothesis test assisted by SPSS 25. The normality test shows that the pretest data for the experimental class and control class are normally distributed, with significance values of 0.203 and 0.156, respectively, both of which are greater than 0.05. Then, the pretest scores of both classes have also been tested for homogeneity, where the results show that the significance value on Based On Mean is 0.05 or 0.240 ± 0.05, then H0 is accepted, which means that the selected samples, namely classes VIII-5 and VIII-2, are declared homogeneous. After knowing the initial abilities of students, treatment was given to the experimental class (class VIII-5) by implementing the developed e-book. Furthermore, both classes were given a posttest. The posttest results showed that the average value and standard deviation of the experimental class were 79.30 and 8, while the average value and standard deviation of the control class were 67.83 and 11.6. The normality test of the posttest data obtained significance values in the experimental and control classes of 0, 102 and 0.455 ± 0.05, respectively, so the posttest values of both classes were declared normally distributed.

After the posttest data of both classes were declared normally distributed and homogeneous, to see if there was a significant difference between the mathematical problem-solving abilities of students in the experimental class and the control class, a hypothesis test was carried out using the independent samples t-test. Based on the results of the hypothesis test that had been carried out, a significance value (2-tailed) of 0.000 <0.05 was obtained, and the statistics also showed that. So according to the basis for decision making in the independent samples t-test, it was rejected and accepted or there was a significant difference between the mathematical problem-solving abilities of students in the experimental class and the control class. These results indicate that the use of teaching materials with the RME approach assisted by Smart Apps Creator is effective in improving students' mathematical problem-solving abilities.

The results of this study are supported by Mahuda et, al., (2021) in a study entitled "Development of Android-Based Mathematics Learning Media Assisted by Smart Apps Creator in Improving Problem-Solving Ability" which shows that the Sig. value (2-tailed) with α = 0.05 is 0.000 so that Sig. < 0.05. Thus, it can be concluded that it is rejected and accepted, which means that there is a significant difference between the pretest and posttest results of students' mathematical problem-solving abilities. These results indicate that the use of Android-based mathematics learning media assisted by Smart Apps Creator is effective in improving students' mathematical problem-solving abilities. From this study, there are similarities in the study, namely using Smart Apps Creator media with its novelty in this study, namely the device developed in the form of teaching materials or e-books.

The results of this study are also in line with previous research, entitled "Development of Mathematics E-Modules on Sequence and Series Materials Assisted by Smart Apps Creator for High School/Vocational High School Students" by Alpiani, et al., (2022) which

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shows that the E-Module developed is effective for use in the learning process. This can be seen from the results of the average test score of 77.4 with a percentage of completion of 76% so that it is categorized as effective for use on students. In addition, research conducted by Maryani, et al., (2023) entitled "Development of RME-Based Teaching Materials to Improve Students' Mathematical Problem Solving Ability and Self-Efficacy" also supports the results of this study by showing that the implementation of teaching materials at SMP AN-Nizam Medan that were developed resulted in an increase in students' problem solving abilities, so that teaching materials with the RME approach were proven to be valid, practical, and effective.

Conclusion

Based on the results and discussions in this study, it can be concluded that the teaching material product developed with the RME approach assisted by Smart Apps Creator to improve students' mathematical problem-solving abilities meets the valid criteria, as indicated by the assessment results by material experts with a score of 4.69 and by media experts with a score of 4.05. In addition, the teaching material also meets the practical criteria based on teacher responses with an average score of 4.70 and student responses of 4.18. Furthermore, the results of the hypothetical test using the independent samples t-test showed a significance value (2-tailed) of 0.000 <0.05, which means that there is a significant difference between students' mathematical problem-solving abilities in the experimental class and the control class. Thus, teaching materials with the RME approach assisted by Smart Apps Creator have proven effective in improving students' mathematical problem-solving abilities.

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