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Development of Learning Devices Using the RME Approach Oriented Towards Mathematical Connection Ability and Learning Interest

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Abstract

The standard of the learning process emphasizes the importance of fostering students' mathematical connections from an early stage. However, the low proficiency in this aspect necessitates a more effective instructional model. Learning interest also plays a crucial role in enhancing students' motivation and mathematics learning outcomes. Therefore, it is essential to design innovative, adaptive, and student-centered learning materials. This study aims to develop mathematics learning materials using the Realistic Mathematics Education (RME) approach that are valid, practical, and effective in improving students' mathematical connection abilities and learning interest. The research employs the ADDIE development model and was conducted on seventh-grade students in a public junior high school in North Klaten, Central Java, in 2024. The validity of the learning materials was assessed through expert validation sheets, while practicality was measured based on teachers' and students' evaluations. Effectiveness was determined using a mathematical connection ability test and a learning interest questionnaire, analyzed through a paired sample t-test. Validation results indicate that the learning materials meet the validity criteria, with an average score of 80 for the teaching module and 116 for the student worksheet (LKS). Practicality was rated very high, with average scores of 86.892 for the teaching module, 87.56 for the student worksheet, and 92.1% for lesson implementation. The materials were deemed effective, as students achieved an average score of 80, exceeding the minimum mastery criteria (KKTP), supported by statistical test results. Thus, the developed learning materials fulfill the criteria of validity, practicality, and effectiveness.

Keywords: *Learning Interest; Mathematical Connection Ability; RME*

Introduction

The improvement of human resource quality can be achieved through various means, one of which is education. Education is a crucial aspect closely related to human life. There are several ways to enhance educational standards, such as increasing the availability of adequate facilities and infrastructure, improving the quality of educators, and refining the curriculum (Silitonga et al., 2016). The enhancement of knowledge through high-quality education significantly impacts the advancement of various fields such as the economy, health, and social welfare (Morris et al., 2013). Scientific progress is expected to facilitate the emergence of new discoveries that contribute to the development of these fields.

Referring to National Education System Law Number 20 of 2003, commonly known as the National Education System Law, it is a legal regulation in Indonesia governing the national education system. This law provides the framework and fundamental principles for the management of education in Indonesia. It emphasizes that every citizen has the right to receive quality and equitable education without discrimination. The law regulates the development of educational standards, including competency standards, content standards, process standards, assessment standards, and standards for educators and educational staff. These standards serve as references for the implementation of education at all levels.

To realize the goals of national education, one approach is through mathematics learning. This is also outlined in the Decree of the Head of BSKAP No.008/H/KR/2022 of 2022, which states that mathematics plays a central role in various scientific fields and significantly contributes to the development of human thinking abilities. Mathematics learning does not solely focus on arithmetic and logical reasoning but also involves logical thinking skills, problem-solving, communication, and connecting mathematical concepts with other intellectual activities. However, some students still face difficulties in understanding mathematical concepts. This is due to the lack of supportive learning tools or media. The minimal use of learning tools makes it difficult for teachers to deliver mathematics lessons effectively. Astuti (2018) also stated that the lack of variation in teaching methods in mathematics learning results in students failing to comprehend the material effectively. Moreover, Suastika & Amaylya Rahmawati (2019) explained in their research that mathematics learning in Indonesia remains conventional. This conventional learning method has several weaknesses, including monotonous instruction, passive students, and an emphasis on note-taking.

The National Council of Teachers of Mathematics (NCTM) has established five content standards and five process standards for mathematics learning. The content standards include numbers and operations, algebra, geometry, measurement, and data analysis and probability (NCTM, 2000b). However, many students struggle to master these content standards in mathematics learning. One of the most challenging areas for students is geometry. This is supported by data from national exam results, where the percentage of students correctly answering geometry-related questions in 2017, 2018, and 2019 showed that geometry received the lowest scores compared to other topics. In addition to content standards, process standards include problem-solving, reasoning and proof, communication, connections, and representation. However, research conducted by Septiani & Pujiastuti (2020) shows that students' mathematical connection abilities still need improvement, especially in linking mathematical concepts to real-world contexts.

According to research by Nurul Imam (2023), one of the reasons for the low mathematical connection abilities among students is that the learning tools used by teachers are often not designed to develop such skills. Learning that focuses on lecture-based methods and routine exercises makes students passive and less critical about mathematical concepts. This results in a low level of mathematical connection ability. Furthermore, research by Hutneriana et al. (2024) indicates that students' mathematical connection abilities remain low due to inappropriate learning tools, highlighting the need for suitable learning models to enhance mathematical connections. Therefore, it is crucial for teachers to design learning tools that build students' knowledge and train them to discover concepts and knowledge independently. This aligns with Asmara et al. (2021), who stated that using appropriate learning tools and methods can meet students' needs and improve their mathematical connection abilities.

Teachers and students have the freedom to determine the course of learning, adapting it to students' needs and interests. This allows each student to develop their potential uniquely. Therefore, it is essential for educators and the education system to give sufficient attention to the development of students' affective abilities, whether through a holistic learning approach or specific programs focused on students' psychological and emotional aspects. One of the aspects of students' affective abilities is learning interest. Learning interest refers to the level of students' interest, motivation, and desire to study a subject, in this case, mathematics (Falah & Fatimah, 2019). A high level of learning interest is closely related to academic success, including mathematics achievement (Fatimah et al., 2021). Enhancing students' learning interest can be achieved through various means, such as presenting mathematical material in an engaging manner, using real-world examples, relating it to students' interests and hobbies, and providing challenges appropriate to their skill levels. Interest is one of the affective factors that motivate individuals to achieve specific goals. As stated by Krapp & Prenzel (2011), interest is generally perceived as a phenomenon emerging from an individual's engagement with their environment. They further explain that interest represents a unique and specific relationship between a person and an object.

Learning tools function as guidelines for teachers to deliver material effectively. These tools provide lesson plans, teaching strategies, and related assessments. For students, learning tools offer clear instructions and guidance on what to learn, how to approach it, and how their performance will be assessed. To develop learning tools, it is necessary to choose appropriate learning strategies, including selecting suitable approaches and models. Various learning approaches can be used, one of which is Realistic Mathematics Education (RME). RME is a learning approach that incorporates real-life subjects or problems based on students' experiences. This approach has been adopted and adapted in Indonesia since 2000 (Zubainur et al., 2020). According to Ekowati et al. (2021), the implementation of RME involves real-life problems in mathematics learning, making learning more engaging and challenging. Based on this explanation, learning tools are needed to address the identified issues, particularly by utilizing the RME approach to enhance students' mathematical connection abilities and learning interest.

Literature Review

Realistic Mathematics Education (RME)

The Realistic Mathematics Education (RME) approach, known in Indonesia as Pendekatan Matematika Realistik Indonesia (PMRI), originates from the Freudenthal Institute in the Netherlands. This institute was established in 1971 as part of Utrecht University, named after its founder, Professor Hans Freudenthal (1905–1990). Since its establishment, the institute has developed a mathematics teaching method known as Realistic Mathematics Education (RME). Freudenthal stated that "mathematics as a human activity" (Freudenthal, 2002). Based on this statement, Freudenthal did not perceive mathematics as a fixed body of knowledge but rather as an evolving process or activity. With this foundation, Freudenthal, a mathematician, initiated a reform in mathematics education to make the subject more accessible and comprehensible for students.

RME is a mathematics teaching approach that utilizes contextual problems as a starting point for introducing mathematical concepts to students. In RME, "contextual" does not necessarily mean concrete objects but also includes situations that students can imagine and visualize (Moffett & Corcoran, 2007; Muslimin et al., 2020). The term "realistic" in RME does not solely refer to real-world situations but also to problems that students can conceptualize (Heuvel-Panhuizen et al., 2014). Implementing RME in classrooms has been shown to help students grasp abstract concepts more easily (Laurens et al., 2018).

RME emphasizes the use of real-life experiences and the environment as starting points in mathematics learning (Melawati, 2020). Students are encouraged to think about how to solve problems relevant to their own experiences, which, in turn, influences their attitude toward mathematics (Haji et al., 2019). Juandi et al. (2022) also highlighted that RME is a mathematics learning approach based on students' experiences, connecting those experiences with mathematical concepts in their minds. Therefore, it can be concluded that RME is a mathematics teaching approach that links learning materials to real-world situations.

According to Gravemeijer (1994), there are three main principles of RME that should be considered when designing mathematics instruction: (1) guided reinvention through progressive mathematization, (2) didactical phenomenology, and (3) self-developed models. These three principles can be further elaborated into five key characteristics of RME: the use of context, the use of models, student contribution, interactivity, and intertwinement.

Mathematical Connections

According to the National Council of Teachers of Mathematics (NCTM, 2000), mathematical connections refer to the ability to link mathematics with other subjects and emphasize the relationships between mathematical ideas. Through these connections, students do not merely learn mathematics but also understand how to apply it. Kennedy & Johnson (2007) define mathematical connection ability as the capacity to relate one mathematical concept to another, to other disciplines, and to real-life situations. Similarly, Bahr & Bahr (2008) describe mathematical connections as the ability to associate students' mathematical knowledge with other mathematical skills and real-world contexts. Sugiman (2008) further emphasizes that mathematical connections occur either within mathematics itself or between mathematics and external disciplines. Therefore, mathematics cannot be separated from other fields of knowledge or from real-life problems.

Flores et al. (2019) also highlight that mathematical connection ability is a cognitive process in which individuals relate two or more ideas, concepts, definitions, procedures, representations, and their meanings to one another, to other disciplines, or to real-life contexts. Based on the theories and studies discussed regarding mathematical connections, it can be concluded that mathematical connection ability is the capacity of an individual to recognize the interrelationships among mathematical concepts, express equivalent relationships, present concepts in different representations, and understand the relevance of mathematics in everyday life. The indicators of mathematical connections in this study include: (1) Presenting concepts and procedures across different mathematical topics. (2) Representing mathematical problems in various non-mathematical forms. (3) Applying mathematical concepts to real-life problems.

Learning Interest

Krapp & Prenzel (2011) emphasize that interest is generally perceived as a phenomenon that arises from an individual's engagement with their environment. The concept of interest is frequently applied in various contexts, including education, particularly in the learning process. Høgheim & Reber (2015) state that the learning process is directly related to situational conditions during learning, involving engagement, task involvement, motivation, and student performance. Interest is defined as the perception that an activity evokes a sense of curiosity and attraction, usually accompanied by cognitive engagement and positive affect (Omrod, 2017). An individual with an interest in a particular object tends to pay greater attention to it. Furthermore, Kahu & Nelson (2018) assert that career goals and subject choices are largely influenced by students' interests, as they tend to study what they enjoy.

Based on the definitions provided by experts, it can be concluded that students' learning interest refers to their tendency to acquire mathematical knowledge, thereby stimulating attention, curiosity, and engagement in learning activities. This definition simultaneously serves as a criterion for assessing students' tendencies toward mathematics learning and as the foundation for identifying variables in the questionnaire used to measure students' interest in mathematics learning.

Method

This study employs a Research and Development (R&D) approach and was conducted at a public junior high school in North Klaten, Central Java, which holds an excellent accreditation status. The research subjects were seventh-grade students, and the study was carried out from May to June 2024. The product developed in this research consists of mathematics learning materials, including a teaching module and student worksheets (LKS) on the topic of curved-surface three-dimensional shapes, designed using the Realistic Mathematics Education (RME) approach. After development, the learning materials were tested for their effectiveness in enhancing students' mathematical connection abilities and learning interest. The development model used in this study follows the ADDIE model (Analyze, Design, Development, Implementation, Evaluation) (Branch, 2009).

This study involves both quantitative and qualitative data. Quantitative data were collected through scores assigned by validators, teacher evaluations, student assessments of the learning materials, observations of lesson implementation, mathematical connection tests, and student learning interest questionnaires. Qualitative data were obtained by converting quantitative scores from validator assessments, teacher and student evaluations of the learning materials, and classroom observation results. The data collection instruments in this study are classified into three categories: Validity instruments, including the validation sheets for the teaching module, student worksheets (LKS), mathematical connection test items, and student learning interest questionnaire. Practicality instruments, consisting of the teacher practicality assessment sheet, student practicality assessment sheet, and lesson implementation observation sheet. Effectiveness instruments, comprising the mathematical connection test and student learning interest questionnaire. The data analysis results obtained from experts were used to determine the validity of the developed product. Meanwhile, the data analysis from field trials served as the basis for evaluating the practicality and effectiveness of the developed learning materials. After analysis, the final score categorization was converted from quantitative data into qualitative data, following the five-scale classification adopted from Widoyoko (2022).

Table 1. Interval Criteria for Validity, Practicality, and Effectiveness

Interval	Criteria
$X > \bar{X}_i + 1{,}8sb_i$	Very High
$\bar{X}_i + 0{,}6sb_i < X \leq \bar{X}_i + 1{,}8sb_i$	High
$\bar{X}_i - 0{,}6sb_i < X \leq \bar{X}_i + 0{,}6sb_i$	Moderate
$\bar{X}_i - 1{,}8sb_i < X \leq \bar{X}_i - 0{,}6sb_i$	Low
$X \leq \bar{X}_i - 1{,}8sb_i$	Very Low

Description:

X: Actual score (obtained score)
X_i: Ideal mean, calculated as $\frac{1}{2}(ideal\ maxium\ score + ideal\ minimum\ score)$
sb_i: Ideal standard deviation, calculated as $\frac{1}{6}(ideal\ maxium\ score - ideal\ minimum\ scare)$
Ideal maximum score: $\sum number\ of\ criteria\ items\ x\ highest\ score$
Ideal minimum score: $\sum number\ of\ criteria\ items\ x\ lowest\ score$

Results and Discussion

Results

This study aims to validate the feasibility and effectiveness of the developed product, which consists of mathematics learning materials designed using the Realistic Mathematics Education (RME) approach, with a focus on enhancing students' mathematical connection abilities and learning interest. The research procedure follows the ADDIE development model, which consists of five stages: Analyze, Design, Development, Implementation, and Evaluation.

Analyze

The analysis phase consists of needs analysis, curriculum analysis, and student characteristic analysis. The needs analysis indicates that mathematics instruction is still predominantly lecture-based with a question-and-answer method, resulting in low student engagement. Teaching materials are limited to textbooks and student worksheets (LKS), while teachers are not yet accustomed to developing instructional materials that align with students' needs. Additionally, teachers have limited understanding of the Realistic Mathematics Education (RME) approach and face challenges in designing instructional materials due to time constraints and a lack of familiarity with the approach.

The curriculum analysis is based on the Merdeka Curriculum, focusing on curved-surface three-dimensional shapes, including the surface area and volume of cylinders, cones, and spheres. Meanwhile, the student characteristic analysis reveals that most students have below-average mathematical abilities, come from families with limited academic support, and exhibit low learning interest. The pre-test results further indicate that students' understanding of curved-surface three-dimensional shapes remains low.

Therefore, it is essential to develop RME-based instructional materials oriented toward enhancing students' mathematical connection abilities. This approach is expected to help students construct their own knowledge, improve conceptual understanding, and foster their learning interest.

Design

This development focuses on the Realistic Mathematics Education (RME) approach, which emphasizes mathematical connection ability and students’ learning interest, with the main topic being curved-surface three-dimensional shapes. The learning process is structured into three phases: introduction (including apperception, motivation, and learning objectives), main activities (implementation of RME characteristics), and closure (reflection and concept reinforcement). During the main activities, students engage in problem-solving tasks that connect mathematical concepts to real-life situations, thereby deepening their understanding of the subject matter.

To enhance mathematical connections, the teaching module is designed with structured activities such as “Let’s Understand the Problem,” “Let’s Gather Information,” and “Let’s Conclude”, guiding students to think progressively from concrete to abstract concepts. Meanwhile, students' learning interest is fostered through group discussions and presentations of their work. The teaching module includes key components such as module identity, learning objectives, instructional steps, and necessary learning resources. In contrast, the student worksheets (LKS) incorporate the RME-based learning stages, including problem exploration, reflection, and real-life connections.The development of assessment instruments consists of a mathematical connection ability test and a learning interest questionnaire. The test instrument is designed through several stages, including the formulation of test blueprints and scoring guidelines, with multiple-choice questions as the assessment format. The learning interest questionnaire is developed based on key aspects such as students’ attention, engagement, and curiosity. With this design, students are expected to become more actively engaged in learning, develop stronger connections between mathematical concepts and real-life contexts, and exhibit higher learning interest. An example of the teaching module and student worksheet (LKS) layout is presented in Figure 1.

Figure 1. Layout of the Teaching Module

Figure 2. Student Worksheet (LKS) Layout

Development

The development phase was conducted with the aim of refining the design of the learning materials using the RME approach on the topic of curved-surface three-dimensional shapes, oriented toward enhancing mathematical connection abilities and learning interest. These materials, which were outlined in the design phase, were then validated by an expert (validator). The expert validation process was carried out to assess the developed learning materials, including the teaching module, student worksheets (LKS), mathematical connection ability test instruments, and the learning interest questionnaire. The validation was conducted by one expert, a faculty member in Mathematics Education at Universitas Negeri Yogyakarta. The validation results indicated that: The teaching module received a very high rating, while the student worksheets (LKS) and learning interest questionnaire were categorized as high, thus both were deemed valid with revisions. The mathematical connection ability test instruments (pre-test and post-test) were found to be valid for all items. Reliability testing using the Cronbach's Alpha method showed that the pre-test (0.703), post-test (0.712), and learning interest questionnaire (0.654) were all categorized as reliable. The learning interest questionnaire received a validation score of 0.72, which falls within the valid category. Overall, the learning materials were validated and considered appropriate for field testing with some revisions based on expert recommendations.

Implementation

The implementation phase involved a limited trial with a small group of students and a field trial of the learning materials through classroom instruction. The limited trial aimed to assess the readability of the student worksheets (LKS). The sample for this trial consisted of six ninth-grade students from a junior high school. The results of the readability questionnaire indicated an average score of 109.33, classified as very high, suggesting that the LKS was easily understood and suitable for field implementation. Additionally, students provided feedback for further improvements. The following table presents the results of the LKS readability questionnaire:

Table 2. Readability Questionnaire Results for Student Worksheets (LKS)

Student Name	Score	Criteria
S1	113	Very High
S2	104	High
S3	107	Very High
S4	112	Very High
S5	113	Very High
S6	107	Very High
Average	109,33	Very High

Following the revision process based on students' feedback from the limited trial, a field trial was conducted. The field trial aimed to collect data on the practicality and effectiveness of the learning materials developed using the RME approach, which included the teaching module, student worksheets (LKS), mathematical connection ability test instruments, and the learning interest questionnaire. The field trial was conducted with seventh-grade students in a junior high school (SMP) and spanned seven meetings. During meetings 2 to 6, the teaching module and LKS were tested for their effectiveness in delivering the curved-surface three-dimensional shapes material. Additionally, during meetings 1 and 6, the mathematical connection ability test instruments and learning interest questionnaire were administered as part of the trial process.

Evaluation

The evaluation phase aimed to assess the practicality and effectiveness of the developed mathematics learning materials using the Realistic Mathematics Education (RME) approach. These materials were implemented and evaluated based on collected data. Practicality analysis was conducted using teacher assessments of the teaching module and student worksheets (LKS), student assessments of the LKS, and observations of the implementation of learning activities. Effectiveness analysis was derived from students' mathematical connection ability test results and learning interest scores. The findings from both analyses are presented in the product trial results section.

Analysis of Practicality Assessment by Teachers

The practicality assessment by teachers included evaluations of the teaching module and LKS. The assessment was conducted following a field trial, during which the developed mathematics learning materials were implemented. Two teachers responsible for teaching seventh-grade classes carried out the evaluations. The results of the teacher's practicality assessment are presented in Table 3.

Table 3. Teacher Practicality Assessment Results

	Teacher 1		Teacher 2	
	Teaching Module	**LKS**	**Teaching Module**	**LKS**
Percentage	88,275%	90,3%	85,51%	84,82%
Criteria	Highly Practicsl	Highly Practicsl	Highly Practicsl	Highly Practicsl

Analysis of Practicality Assessment by Students

The practicality assessment by students focused on their evaluation of the LKS. The assessment was conducted by all seventh-grade students, and the results are presented in Table 4.

Table 4. Student Practicality Assessment Results

Category	Percentage	Criteria	Results
Practicality LKS	$P > 84\%$	Highly Practicsl	87,5%
	$68\% < P \leq 84\%$	Practical	21,875%
	$52\% < P \leq 68\%$	Moderate	3,125%
	$36\% < P \leq 52\%$	Less Practical	0%
	$P \leq 36\%$	Not Practical	0%

Analysis of Learning Implementation Observation

Observations on the implementation of learning activities were conducted by a mathematics teacher acting as an observer throughout the learning sessions. The observation results from the field trials are presented in Table 5.

Table 5. Observation Results of Learning Implementation

	Meeting				
	1	**2**	**3**	**4**	**5**
Teacher Activities	88,46%	88,46%	92.3%	96,2%	96,2%
Student Activities	88,46%	88,46%	92.3%	96,2%	96,2%
Average	88,46%	88,46%	92.3%	96,2%	96,2%

Analysis of Mathematical Connection Ability Test

The mathematical connection ability test consisted of 20 multiple-choice questions, designed based on the learning objectives derived from the competency standards for the topic of curved-surface three-dimensional shapes. The general results of the mathematical connection ability test are presented in Table 6.

Table 6. General Results of the Mathematical Connection Ability Test

Category	*Pre-Test*	*Post-Test*
Highest Score	70	100
Lowest Score	15	45
Average Score	36	80
Number of Student Who Passed	0	27
Number of Students Who Did Not Pass	32	5
Pass Percentage	0%	84,38%

In addition to measuring achievement and effectiveness, an analysis was conducted to assess the improvement in students' mathematical connection ability. The Kolmogorov-Smirnov normality test was conducted using IBM SPSS Statistics 16, and the results are presented in Figure 3.

Figure 3. Output of Normality Test for Pre-Test and Post-Test Data on Mathematical Connection Ability

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil Tes Kemampuan Koneksi Matematis	Pre-Test	.116	32	.200*	.943	32	.089
	Post-Test	.150	32	.064	.944	32	.099

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The normality test output in Figure 3 indicates that the significance values for the pre-test and post-test data were 0.089 and 0.99, respectively. Since these values exceed the significance level of 0.05, the data can be concluded to be normally distributed. Subsequently, a paired sample t-test was performed to test the hypothesis, as shown in Figure 4.

Figure 4. Results of Paired Sample T-Test for Mathematical Connection Ability

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PRETEST - POSTTEST	-45.781	17.279	3.055	-52.011	-39.552	-14.988	31	.000

Based on Figure 4, the significance value was 0.00 < 0.05, indicating that H_0 is rejected, while H_1 is accepted. This suggests a significant effect of the developed RME-based learning materials on students' mathematical connection ability, as evidenced by the difference in pre-test and post-test scores.

Analysis of Students' Learning Interest

The learning interest questionnaire consisted of 25 statements, including both positive and negative statements. The results of the student learning interest questionnaire are presented in Table 7.

Table 7. Results of Student Learning Interest Questionnaire

Category	Score Range	Criteria	Percentage
Minat Belajar Siswa	$X > 105$	Very High	62,5 %
	$85 < X \leq 105$	High	31,25%
	$65 < X \leq 85$	Moderate	6,25%
	$45 < X \leq 65$	Low	0%
	$X \leq 45$	Very Low	0%
	Average = 100.5	High	

Discussion

The product developed in this study consists of mathematics learning materials designed using the Realistic Mathematics Education (RME) approach, focusing on mathematical connection ability and student learning interest in the topic of curved-surface three-dimensional shapes. These materials include a teaching module and student worksheets (LKS), which were developed based on instructional needs. The learning materials were evaluated based on three main aspects: validity, practicality, and effectiveness. The details of these aspects are described below.

Validity of the Teaching Module and Student Worksheets

In terms of validity, the mathematics learning materials developed using the RME approach were evaluated by experts. The analysis and calculations conducted indicated that both the teaching module and student worksheets met the validity criteria. However, revisions were made based on expert recommendations to ensure the materials were fully appropriate for use. The fulfillment of the validity aspect demonstrates that the developed learning materials are based on sound theoretical foundations. Thus, it can be concluded that the RME-based learning materials focusing on mathematical connection ability and learning interest are valid for implementation.

Practicality of the Teaching Module and Student Worksheets

The practicality of the developed materials was assessed through teacher evaluations of the teaching module and LKS, student evaluations of the LKS, and classroom observation by observers. Teacher and student evaluations were conducted after completing all learning sessions, while classroom observations were carried out during each session. Teacher evaluations indicated an average teaching module score of 86.9% (categorized as highly practical) and an average LKS score of 87.57% (highly practical). Student evaluations showed that the LKS obtained an average score of 87.5%, indicating high practicality for implementation in RME-based learning focused on mathematical connection ability and learning interest. Classroom observations reported an average implementation percentage of 92.3%, exceeding the 80% threshold, further supporting the practicality of the developed learning materials. Based on these findings, the mathematics learning materials developed using the RME approach meet the practicality criteria for instructional use.

Effectiveness of the Teaching Module and Student Worksheets

The effectiveness of the mathematics learning materials was assessed through a mathematical connection ability test and a student learning interest questionnaire. The analysis results showed: 84.38% of students achieved the minimum mastery score (KKTP) in the mathematical connection ability test. This finding was statistically supported by a paired sample t-test, indicating that the learning materials were effective. 93.75% of students attained a high category score in the learning interest questionnaire, further confirming the effectiveness of the developed materials in enhancing student engagement in mathematics learning.

Conclusion

Based on the findings, it can be concluded that the RME-based mathematics learning materials developed in this study meet the criteria of validity, practicality, and effectiveness. The teaching module and student worksheets achieved high validity, were rated as highly practical by teachers and students, and demonstrated a classroom implementation rate of 92.3%, exceeding the minimum threshold. Furthermore, the learning materials proved effective in enhancing mathematical connection ability and student learning interest, with an average student score of 80, supported by paired sample t-test results.

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