



Development of a mathematics teaching module based on the realistic mathematics education (RME) approach for grade VII algebra material at MTs Negeri Gowa

Nur A'laa Ihsan, Sri Sulasteri, Nur Khalisah Latuconsina

Universitas Islam Negeri Makassar

¹²³⁴Email : nuralaaaihsan@gmail.com

Receive: 27/09/2025

Accepted: 29/09/2025

Published: 01/10/2025

Abstrak

Penelitian ini membahas tentang proses pengembangan berbasis pendekatan *realistic mathematics education* (RME) materi aljabar kelas VII MTs Negeri Gowa, mengetahui kualitas dapat dilihat dari tingkat (kevalidan, kepraktisan dan keefektifan) berbasis pendekatan *Realistic Mathematics Education* (RME) materi aljabar kelas VII MTs Negeri Gowa. Jenis penelitian yang digunakan adalah *research and development* (penelitian dan pengembangan) dengan mengacu pada model pengembangan ADDIE yang terdiri dari beberapa fase yaitu *Analysis* (Analisis), *Design* (Desain), *Development* (Pengembangan), *Implementation* (Implementasi), dan *Evaluation* (Evaluasi). Produk yang dikembangkan berupa bahan ajar yaitu modul ajar matematika berbasis *Realistic Mathematics Education* (RME) materi aljabar, subjek uji coba dalam penelitian ini adalah peserta didik kelas VII MTs Negeri Gowa dengan jumlah siswa 21 orang. Instrumen yang digunakan dalam penelitian ini adalah lembar validasi ahli, lembar observasi aktivitas peserta didik, lembar observasi aktivitas guru dalam keterlaksanaan pembelajaran, angket respon peserta didik, angket respon guru, dan tes hasil belajar. Hasil validasi bahan ajar adalah 0.87 pada kategori “sangat tinggi” karena berada pada interval $0.80 < V \leq 1.00$. Praktis karena presentase rata-rata untuk respon guru adalah 95.8% dan presentase rata-rata untuk peserta didik adalah 90.4%, masing masing berada pada kategori “sangat positif”, efektif sehingga dapat memenuhi tiga kriteria yaitu rata-rata aktivitas guru dalam keterlaksanaan pembelajaran adalah 3.77 berada pada kategori “sangat baik”, dan presentase ketuntasan belajar peserta didik berada pada kategori “sangat baik”, dan presentase ketuntasan belajar peserta didik berada pada kategori “tinggi” serta mencapai 85% peserta didik tuntas secara klasikal. Sehingga dapat disimpulkan bahwa pengembangan modul ajar matematika berbasis *Realistic Mathematics Education* (RME) pada materi aljabar kelas VII MTs Negeri Gowa pada uji coba yang dilaksanakan telah memenuhi kriteria kevalidan, kepraktisan dan keefektifan

Kata Kunci : *Realistic Mathematics Education* (RME), Modul, Aljabar

Abstract

This study examines the development process of an instructional module based on the Realistic Mathematics Education (RME) approach for teaching algebra to Grade VII students at MTs Negeri Gowa, as well as evaluates the quality of the resulting product in terms of validity, practicality, and effectiveness. The research employed a Research and Development (R&D) design following the ADDIE model, which consists of five phases: Analysis, Design, Development, Implementation, and Evaluation. The product developed in this study was a mathematics teaching module grounded in the RME approach for algebraic content. The trial subjects included 21 Grade VII students at MTs Negeri Gowa. The instruments used to assess the module included expert validation sheets, student activity observation sheets, teacher activity observation sheets, student response questionnaires, teacher response questionnaires, and a learning achievement test. The expert validation results yielded a coefficient of 0.87, which falls within the “very high” validity category ($0.80 < V \leq 1.00$). The module demonstrated a high degree of practicality, indicated by an average positive response rate of 95.8% from the teacher and 90.4% from students both categorized as “highly positive.” The module also met the criteria for effectiveness, as shown by: (1) an average teacher activity score of 3.77, classified as “very good”; and (2) student learning mastery reaching 85%,

placing it in the “high” category and meeting the classical mastery threshold. Overall, the findings indicate that the RME-based mathematics instructional module for Grade VII algebra at MTs Negeri Gowa satisfies the criteria of validity, practicality, and effectiveness based on the outcomes of the implementation phase.

Keywords: Realistic Mathematics Education, Module, Algebra

Introduction

One of the fundamental aims of the Indonesian state, as stated in the fourth paragraph of the Preamble to the Constitution, is to educate the nation. Education is regarded as one of the primary means to achieve this national goal. In Indonesia, citizens are required to complete twelve years of formal schooling, which is generally carried out in educational institutions.

According to the National Education System Law (Law No. 20 of 2003), education is defined as a conscious and deliberate effort to create learning conditions and processes that enable learners to actively develop their potential spanning spiritual and religious strength, self-control, character, intellectual capacity, noble values, and the skills needed for themselves, society, the nation, and the state (Depdiknas, 2003). Education serves as a planned effort to cultivate these capacities within learners (Ilham, 2022). It is not merely the delivery of existing skills; rather, it must anticipate future competencies and identify effective ways for students to acquire them efficiently (Nathaniel, 2022).

In everyday life, humans engage in educational processes consciously or unconsciously. Any purposeful activity undertaken to achieve an objective forms part of an individual's learning experience. These experiences shape practical knowledge, which can later be structured into formal understanding to help individuals reach their goals. Establishing education as a scientific discipline requires fulfilling certain conditions, enabling educational theory to guide human behavior and decision-making. Historically, while educational practices have existed since the beginning of human life, the formal discipline of educational science only emerged in the nineteenth century (Pratiwi & Arifin, 2022).

One of the subjects taught at every level of formal education including elementary, junior high, and senior high school is mathematics. Teachers are expected to possess adequate understanding and mastery of the subject matter before delivering it to students. The question “What is mathematics?” is not easy to answer

because its meaning varies depending on scholars' perspectives and backgrounds. Mathematics has been described as the “queen of sciences,” the “science of numbers and space,” a “symbolic language,” a “numerical language,” a “method of logical reasoning,” and a “study of patterns, forms, and structures” (Rahmah, 2013).

According to Sukardjono (2011), mathematics is a method of thinking and reasoning. It serves as a tool for determining whether an idea is true, false, or possibly true. Mathematics is a field of exploration and discovery in which new ideas emerge continuously. It is also a method of reasoning used to solve problems across science, government, and industry. As a symbolic language, mathematics is universally understood across cultures. Furthermore, mathematics may also be regarded as an art—rich in symmetry, patterns, and rhythms, similar to music.

Riyanto (2022) emphasizes that mathematics functions as a language of symbols, with numbers as its primary representations. As a foundational discipline, mathematics supports the development of other fields of study, especially in technological advancement. Its fundamental nature makes mathematics essential for defining scientific concepts and drawing logical conclusions. Thus, mathematics remains a core subject at all levels of education. Rokhima and Fitriyani (2017) state that mathematics instruction aims to prepare learners to think critically, argue logically, and solve problems encountered in daily life.

In everyday life, mathematical understanding plays an important role. Studying mathematics enhances methodological thinking, scientific reasoning, critical thinking, and creativity. Despite its significance, mathematics achievement in Indonesia remains relatively low. Results from the TIMSS (Trends in International Mathematics and Science Study) 2015 showed that Indonesia scored an average of 397 below the international mean of 500 placing Indonesia 44th out of 49 participating countries (McComas, 2014). These results indicate that students' mathematical competence in Indonesia is still inadequate.

Several factors contribute to this low achievement. One notable factor is students' limited conceptual understanding of mathematical content taught by teachers. Instructional materials used in classrooms often lack clarity or fail to support conceptual comprehension. To improve student learning outcomes, effective instructional procedures and a supportive classroom environment are needed (Muhtadi, 2005). However, classroom instruction in many schools remains teacher-centered, with students positioned merely as passive recipients of information. Such an approach hinders meaningful learning and limits students' ability to develop their potential.

As a system, the learning process is shaped by various components, with teachers playing the most crucial role (Junaedi, 2019). Regardless of how well-designed a curriculum is or how complete the learning resources are, the quality of learning remains inadequate if teachers are unable to implement them effectively. Therefore, teachers must continuously improve their professional competence. One essential component that supports effective learning in the Merdeka Curriculum is the use of well-developed teaching modules.

Teaching modules serve as structured instructional tools designed to help teachers plan and implement learning aligned with competency standards. Teachers play a central role in developing these modules, allowing them to innovate and adapt learning materials to students' needs. Developing teaching modules is part of teachers' pedagogical competence and is crucial to ensuring that classroom learning remains focused, efficient, and aligned with learning outcomes (Maulida, 2022). A mathematics teaching module, therefore, specifically guides learning of mathematical concepts.

Integrating Contextual Teaching and Learning (CTL) with the principles of Realistic Mathematics Education (RME) in a mathematics module can create more meaningful learning experiences. Through this approach, students can relate the learning material to real-life situations and understand algebraic concepts through familiar contexts. Such modules encourage active participation, critical thinking, problem solving, and mathematical communication (Putri et al., 2022). Additionally, they are designed to align with the Merdeka Curriculum, allowing

differentiated instruction and supporting teachers in delivering adaptive and creative learning activities.

MTs Negeri Gowa is one of the "Sekolah Penggerak," a program that aims to support educational transformation through the implementation of the Merdeka Curriculum. Each subject, including mathematics, is expected to implement learning processes that effectively achieve the intended learning outcomes. Therefore, appropriate management and design of mathematics instruction are essential (Malikah et al., 2022).

Based on the researcher's preliminary observations in Grade VII at MTs Negeri Gowa, the learning process was still predominantly teacher-centered and did not make use of teaching modules as independent learning tools. Learning activities consisted mostly of assignments and rote memorization, a pattern inherited from earlier schooling. Students tended to memorize formulas without understanding the underlying concepts, resulting in poor retention and low interest in mathematics. This condition demonstrates the need for developing teaching modules to improve conceptual understanding.

An interview with Drs. Syarifuddin, the Grade VII mathematics teacher, revealed that algebra is among the most difficult topics for students to understand. This difficulty stems from limited learning resources, as instruction relies mainly on the available textbook. The lack of supplemental materials indicates the need for developing a teaching module that provides structured and contextual support to help students understand algebraic concepts more deeply.

Similarly, Rani (2022) reported that students at MTs Al-Muttaqin Pekanbaru struggled with applying algebraic concepts in problem solving, leading to low learning outcomes. At MTs Negeri Gowa, students' difficulties in algebraic factorization were associated with weak conceptual understanding and limited arithmetic skills since elementary school, which reduced motivation and interest in learning. These difficulties were evident in assessment results: in the odd semester of the 2022/2023 academic year, only 37% (10 out of 27 students) achieved the minimum mastery criteria (KKM), while 63% scored below the KKM.

Learning resources used in class were limited to textbooks and lecture-based instruction.

Since the quality of learning depends partially on the availability of appropriate learning resources, selecting relevant and supportive materials becomes essential. Teaching modules provide structured content, learning steps, worksheets, and assessments that can guide both teachers and students throughout the learning process. Unlike textbooks, modules are flexible and can be tailored to students' characteristics and classroom needs.

Given the growing emphasis on independent and contextual learning in the Merdeka Curriculum, teaching modules written in clear, engaging, and contextual language can enhance students' understanding of mathematical concepts. Incorporating the RME approach is expected to support independent learning while assisting teachers in implementing mathematics instruction aligned with the curriculum's learning outcomes.

Based on the issues described above, the researcher was motivated to conduct a study entitled "Developing a Mathematics Teaching Module Based on the Realistic Mathematics Education (RME) Approach for Grade VII Algebra at MTs Negeri Gowa."

Method

The research employed a Research and Development (R&D) design following the ADDIE model, which consists of five phases: Analysis, Design, Development, Implementation, and Evaluation. The product developed in this study was a mathematics teaching module grounded in the RME approach for algebraic content. The trial subjects included 21 Grade VII students at MTs Negeri Gowa. The instruments used to assess the module included expert validation sheets, student activity observation sheets, teacher activity observation sheets, student response questionnaires, teacher response questionnaires, and a learning achievement test.

Result and Discussion

The development of the mathematics module grounded in the Realistic Mathematics Education (RME) approach for Grade VII students at MTs Negeri Gowa was carried out using the ADDIE instructional design model. The overarching aim of this study was to produce an instructional medium that meets the criteria of validity, practicality, and effectiveness for use by seventh-grade learners at MTs Negeri Gowa.

The ADDIE model encompasses five essential phases. The Analysis phase involves examining students' learning needs, identifying difficulties encountered in mathematics learning, and reviewing curriculum alignment. The Design phase focuses on planning the structure and components of the module, including learning materials and assessment instruments. During the Development phase, the module is produced according to the planned design and subsequently undergoes expert validation and revision based on professional feedback. The Implementation phase centers on the use of the developed module in actual classroom settings with Grade VII students. Finally, the Evaluation phase is conducted to assess the module's overall effectiveness in supporting students' understanding of algebraic concepts.

Development Process of the RME-Based Module for Grade VII Algebra at MTs Negeri Gowa

This research and development study was conducted to produce an instructional module grounded in the Realistic Mathematics Education (RME) approach for Grade VII algebra at MTs Negeri Gowa. The resulting module underwent a series of validation procedures, including assessments of validity, practicality, and effectiveness. The developmental framework adopted in this study refers to the ADDIE model, which consists of five sequential phases: Analysis, Design, Development, Implementation, and Evaluation.

Analysis Phase

The Analysis phase serves as the foundation of the development process. At this stage, several forms of analysis were conducted, including a needs analysis, curriculum analysis, and learner characteristics analysis.

Needs Analysis

The needs analysis aimed to identify core issues that necessitate the development of a new instructional module. At this stage, the researcher reviewed challenges encountered in mathematics learning at MTs Negeri Gowa. Two principal aspects were examined, the learning tools currently used in the classroom to support students' mathematical understanding, and the experiences of both teachers and students with existing learning modules and materials.

Based on the results, a module utilizing the Realistic Mathematics Education (RME) approach was developed to enhance students' mathematical

problem-solving abilities. Through the RME-oriented module, students are expected to engage more actively and creatively in addressing mathematical tasks while building conceptual understanding through contextual classroom activities. Hence, the development of this module was considered necessary as an innovative learning resource capable of improving the quality of mathematics instruction.

Curriculum Analysis

Curriculum analysis was conducted to determine the curriculum implemented at the school, identify the learning outcomes (CP), establish the learning objectives (TP), and select relevant algebraic content to be incorporated into the RME-based module.

The curriculum analysis revealed that MTs Negeri Gowa currently implements the Kurikulum Merdeka, which guided the selection and organization of learning materials for module development.

In the algebra content area, the researcher focused exclusively on a single topic, namely algebraic material taught in Grade VII of SMP/MTs. Consequently, the learning outcomes within the algebra element were limited solely to this topic, which in turn served as the basis for formulating the specific learning objectives for the module.

Analysis of Learner Characteristics

At this stage, an analysis of learner characteristics was conducted to understand both the general profile of the students and their prior knowledge. This process involved consulting the mathematics teacher and homeroom teacher of Grade VII to gather information regarding students' learning traits and their previous mathematics achievement. According to the mathematics teacher at MTs Negeri Gowa, students are classified as achieving mastery if they obtain a minimum score of 75. This standard applies uniformly to all Grade VII students at the school.

Although the students at MTs Negeri Gowa display diverse characteristics, the school implements a policy of not grouping them based on academic ability or learning profiles. Based on interviews with the mathematics teacher, many students tend to face difficulties when solving mathematical problems, particularly when the question format or the method of solving differs from the teacher's examples. This challenge arises

largely because students are accustomed to a teacher-centered instructional approach that emphasizes worked examples. As a result, learners often rely heavily on memorizing formulas rather than understanding underlying concepts or the reasoning behind the procedures.

Design Stage

During the design phase, the researcher began planning the instructional product to be developed, namely a learning module grounded in the Realistic Mathematics Education (RME) approach for Grade VII algebra content at MTs Negeri Gowa. This phase involved several components:

Learning Module

The development process in this stage consisted of selecting the instructional components, determining the format, and preparing the preliminary design of the module. The chosen instructional product was a mathematics learning module based on the RME approach, intended for use at the SMP/MTs level. The module was designed using the Canva application.

Development Stage

The development stage involved producing the instructional module based on the specifications outlined during the design phase, namely a mathematics learning module grounded in the Realistic Mathematics Education (RME) approach for Grade VII algebra at MTs Negeri Gowa. At this stage, the draft module underwent expert review to ensure its appropriateness and feasibility. If any weaknesses were identified, revisions were made prior to pilot testing with students.

Expert Validation

Expert validation was carried out to evaluate whether the designed learning module was suitable for instructional use. The validators assessed the module using structured validation sheets, which measured various elements of the learning components.

Validators

The validation process involved expert review of the module and research instruments developed in the earlier stages. The experts consisted of two lecturers from the Faculty of Tarbiyah and Teacher Training at UIN Alauddin Makassar, who served as content and media validators. Their evaluation ensured that the module met academic, pedagogical, and technical

criteria before being implemented in the classroom.

The expert team conducted validation of the module by examining several key aspects, including content accuracy and substance, structural organization, language use, and practicality. In addition, design validation focused on evaluating the physical appearance of the module, such as layout, visual elements, and their alignment with the presented material. Through this expert review, the product was expected to meet rational academic standards while also offering an attractive and functional design that could engage students. The validation was carried out through direct consultation with the experts, during which they assessed the module based on the provided design specifications, enabling the identification of its strengths and areas needing improvement.

Revision of the Module and Instruments

The initial validation process began by submitting the first draft of the RME-based module to the validators. The instructional tools developed in this study included the mathematics module, learning achievement test (THB), teacher response questionnaire, student response questionnaire, student activity observation sheet, and teacher activity observation sheet used to assess the implementation of instruction.

Validation was conducted twice. After receiving the initial feedback, revisions were made according to the validators' comments. The revised version was then resubmitted for a second validation round. Following this process, the validators provided final assessments using the validation sheets, confirming the quality of the improved RME-based mathematics module and accompanying instruments.

Preliminary Testing Prior to Implementation

Based on the expert validation results, all developed instruments including the learning module, instructional materials, learning achievement test (THB), teacher and student response questionnaires, student activity observation sheet, and teacher performance observation sheet—were classified as “highly valid.” This indicated that the materials were appropriate and ready for pilot testing.

Practicality of the Module

After expert revision, the module was evaluated by practitioners to obtain feedback from the perspective of actual classroom users.

Practitioner insights serve as a bridge between expert recommendations and the needs of students and teachers in real learning environments. Evaluation was conducted by the mathematics teacher and an observer, who were provided with teacher response questionnaires and implementation observation sheets to assess the instructional tools. The results of this practicality analysis are presented in the Implementation stage, the fourth phase of the ADDIE model.

Effectiveness of the Module

Once the module was evaluated by practitioners, its effectiveness was assessed to determine whether it facilitated successful student learning. This evaluation involved Grade VII students and observers, who completed student response questionnaires and activity observation sheets to assess the instructional process and outcomes. The effectiveness findings are detailed in the Implementation stage, corresponding to the fourth phase of the ADDIE model.

Implementation Stage

The implementation stage followed the development phase and involved a small-scale (limited) trial of the module. This trial aimed to examine the practicality and effectiveness of the developed material. During the trial, student and teacher activities were observed throughout the instructional process. After the lesson concluded, students completed a learning achievement test, and both students and the teacher were given response questionnaires to evaluate their perceptions of the module.

Evaluation Stage

The evaluation phase is the final component of the ADDIE development model. At this stage, the researcher reviews and refines the developed module based on feedback obtained from users, including teachers and students, to ensure the instructional material achieves optimal quality. In this study, the evaluation process did not lead to major modifications, as the module had already undergone substantial revision during the validation and implementation stages. Consequently, only minor adjustments were made to enhance the overall presentation and usability of the learning material.

Validity, Practicality, and Effectiveness of the Realistic Mathematics Education (RME)-Based Module on Algebra for Grade VII Students at MTs Negeri Gowa *Validity Level*

The validity of the module was assessed through expert evaluations of both the instructional module and all accompanying research instruments. These instruments included the module validation sheet, the learning achievement test (THB), the teacher response questionnaire, the student response questionnaire, the student activity observation sheet, and the teacher activity observation sheet used to assess the implementation of learning. The scores provided by each validator were averaged for every assessed component.

Validator Assessment

The overall mean score obtained was 0.87, which falls within the interval $0.80 < V \leq 1.00$. This score is categorized as “*very high*.” Consequently, the module, the learning achievement test (THB), the teacher and student response questionnaires, the student activity observation sheet, and the teacher implementation observation sheet are all deemed to be highly valid and appropriate for use, requiring only minor revisions.

Revision of the Module and Instruments

The validation process was carried out by submitting the initial draft of the module, developed using the Realistic Mathematics Education (RME) approach, to the team of expert validators. Several instructional components were evaluated in this stage, including: (1) the learning materials consisting of the module and student worksheets (LKPD) based on the RME approach; (2) the teaching module; (3) the Learning Achievement Test (THB); (4) the student response questionnaire; (5) the teacher response questionnaire; (6) the student activity observation sheet; and (7) the teacher performance observation sheet used to assess the implementation of the learning process.

Based on the validation results obtained at this stage, the team of validators assessed the developed module along with the accompanying assessment instruments. The scores provided by each validator were averaged for every evaluation aspect. Subsequently, an overall mean score was calculated to determine the final level of feasibility of the module and instruments, which then served as the basis for identifying whether revisions were necessary.

The module, the Learning Outcome Test (THB), the teacher response questionnaire, the student response questionnaire, the student

activity observation sheet, and the teacher performance observation sheet in implementing the learning process obtained an overall average score of 0.87. This score falls within the interval $0.80 < V \leq 1.00$, which categorizes it as *very high* according to the criteria presented in Table 4.8. Therefore, the learning materials and instruments developed in this study are considered highly valid and suitable for use in the trial phase.

Practicality Data Analysis

The practicality of the developed materials was assessed using the teacher response questionnaire and the teacher activity observation sheet during the implementation of the learning process. The results obtained from both the teacher responses and the observation of teacher activities were analyzed to determine the level of practicality of the instructional materials. The following presents the analysis of the teacher response questionnaire and teacher activity data as a basis for evaluating the practicality of the module developed using the Realistic Mathematics Education (RME) approach.

Teacher Response Questionnaire

The overall results show that the total teacher response to the learning process using the instructional module reached a value exceeding 95.8%. This percentage falls within the interval of $85\% \leq RS \leq 100\%$, which corresponds to the “*Very Positive*” category. Thus, it can be concluded that the practicality criteria from the teacher’s perspective were fulfilled.

Student Response Questionnaire

The student response questionnaire was administered to 21 seventh-grade students after they had completed all learning activities using the algebra-based module. The analysis results indicate that the average percentage of student responses toward the learning activities using the Realistic Mathematics Education (RME)-based module was 90.4%. This percentage lies within the interval of $85\% \leq RS < 100\%$, categorized as “*Very Positive*,” indicating that the students responded favorably to the module used in the learning process.

Considering both practicality components the teacher response questionnaire and the student response questionnaire the analysis shows consistently very positive responses toward the implemented module. Therefore, the developed module meets the criteria for practicality.

Effectiveness Data Analysis

As explained in the previous chapter, the components used to assess effectiveness include three aspects: student response, student activity, and the learning achievement test (THB). The results of these effectiveness components are described as follows:

Teacher Activity in the Implementation of Learning

The purpose of observing teacher activity during the learning process is to determine the extent to which the teacher carries out instructional practices while using the module developed based on the Realistic Mathematics Education (RME) approach.

The analysis of teacher activity data during the implementation of mathematics learning using the Realistic Mathematics Education (RME) approach in the trial phase revealed an average teacher activity score of 3.77. This score falls within the range of $3 \leq \text{TKG} < 4$, indicating that teacher activity in conducting learning using the RME-based module is categorized as "Very Good." This result fulfills one of the practicality components of the module.

Student Activity

Student activity during the learning process was observed based on five criteria: (1) students read and examine the problem contexts presented in the module, (2) students attentively listen to and observe explanations related to the lesson while noting important points, (3) students form groups to solve problems provided in the module, (4) students discuss the solutions to the problems within their groups, and (5) students present or respond to the discussion results of other groups and draw conclusions or summaries from the material studied.

Based on the analysis, student activity during the learning process using the Realistic Mathematics Education (RME)-based module reached 76%, which falls within the interval of $60\% \leq P < 80\%$ and is categorized as "Good." Therefore, it can be concluded that student activity in the learning process can be considered effective.

Learning Outcome Test (THB)

The analysis of students' learning outcome test scores after the implementation of the Realistic Mathematics Education (RME)-based module revealed that, out of 21 students who participated in the test, 6 students (28.57%) achieved a "very high" category, 13 students

(61.90%) attained a "high" category, and 2 students (9.52%) fell into the "medium" category.

Thus, it can be concluded that the average learning outcome score falls within the "high" category. Furthermore, 85% of the students achieved mastery at the classical level. Therefore, the effectiveness component related to the learning outcome test has been fulfilled.

Discussion

Prior to developing the instructional material in the form of a module based on the *Realistic Mathematics Education* (RME) approach, an analysis of the learners at MTs Negeri Gowa was conducted. The results indicated the need for learning materials that align with students' characteristics, namely resources that encourage active participation rather than teacher-centered instruction. This approach positions students as constructors of their own knowledge, while the teacher functions primarily as a facilitator providing guidance when necessary. Such an approach also reflects behaviorist perspectives, which view learning as the transmission of knowledge wherein the teacher acts as a medium that shapes students' learning outcomes.

Learning constitutes the central activity in the educational process. Consequently, the quality of instructional implementation plays a decisive role in achieving educational goals. Effective instruction requires the use of appropriate pedagogical models and supporting learning materials. One essential stage in the instructional process is selecting suitable learning resources that assist students in achieving the required competencies. In practice, students require learning materials that are relevant to their needs, such as modules designed to respond to current developments in technology and information.

A high-quality learning module must meet several essential characteristics: it must align with students' interests, enable independent learning without heavy reliance on the teacher, utilize accessible resources and facilities, and provide clear guidance for teachers. Modules that meet these criteria can serve not only as classroom materials but also as tools that foster learner autonomy. The development of the module is expected to contribute to improved student achievement. Algebra was selected as the focus of the module because it offers opportunities for

students to explore and solve contextual problems, making it highly compatible with RME principles.

Before the module was produced, quality indicators were established validity, practicality, and effectiveness. A module is deemed successful if it meets all three criteria. Furthermore, modular-based instruction encourages students to take responsibility for their own learning and accommodates individual differences, as it allows students to progress according to their respective abilities.

The development process followed the ADDIE model, comprising Analysis, Design, Development, Implementation, and Evaluation. Through these stages, a mathematics module grounded in RME principles was produced. The material was organized systematically according to RME procedures and aligned with the existing curriculum. As a key component of the instructional process, the module functions not only as a medium for delivering content but also as a tool designed to enhance conceptual understanding through contextual learning.

Expert validation results indicate that the RME-based mathematics module and its accompanying instruments meet the required standards of validity. The average validity score of 0.87 falls within the *very high* category, demonstrating that the module is suitable for implementation.

Practicality was assessed through teacher responses and classroom implementation sheets. Analysis revealed that the teacher responded very positively to the use of the module, with a score of 95.8%. Student responses were also highly positive, reaching 90.4%. These results indicate that the module is easy to use and compatible with classroom needs.

Following the confirmation of practicality, the module was tested to determine its effectiveness. The findings show that the teacher's implementation score reached 3.77, categorized as *very positive*; student activity reached 76%, categorized as *good*; classical learning mastery reached 85%, falling into the *high* category.

These results demonstrate that the module successfully meets the effectiveness criteria. The study concludes that the mathematics module based on the *Realistic Mathematics Education* (RME) approach, developed using the ADDIE model, satisfies the criteria of being valid, practical, and effective. This aligns with the

objectives of the research, which were to produce an RME-based mathematics module on algebra for Grade VII students at MTs Negeri Gowa, to identify teacher and student responses to the module, and to evaluate its effectiveness in enhancing students' conceptual understanding of algebra.

Conclusion

The module was developed using the ADDIE instructional design framework, which consists of five sequential phases: analysis, design, development, implementation, and evaluation. This model guided the creation of a PMRI-based mathematics module supported by the GeoGebra application for the topic of geometric transformations. The resulting product is expected to meet the standards of validity, practicality, and effectiveness.

The developed module satisfied all three criteria. The validity aspect was demonstrated through expert evaluations, which produced an average score of 4.5. Additional indicators of validity were reflected in student response scores (mean 3.4), teacher response scores (mean 3.5), teacher competence in managing instruction (mean 4.4), student activity observations (mean 4.5), the quality of the lesson plans (mean 4.5), and the learning achievement test (mean 4.5). Each of these components fell within the "highly valid" category, confirming that both the learning materials and the associated instruments were appropriate for use.

The practicality of the module was assessed through student and teacher response questionnaires. The data revealed that 90.4% of students gave positive evaluations, while 90% of teachers also expressed favorable responses, indicating that the module is practical and easy to apply in the classroom.

The effectiveness criterion was measured using three indicators: teacher performance during instruction, student learning activities, and student learning outcomes. The average score for teacher performance reached 4.6, classified as "excellent." Student activity reached 76%, which falls within the "good" category. Furthermore, student learning outcomes demonstrated that 85.8% of learners achieved mastery, placing the results within the "high" achievement category. Based on

these three indicators, the module meets the requirements for effectiveness.

The developed module serves as an alternative form of instructional material that can be implemented in classroom learning. However, its use requires adaptation to the specific conditions and characteristics of each class. The module was designed to accommodate learners with diverse ability levels and heterogeneous backgrounds. The module is grounded in the Indonesian Realistic Mathematics Education (PMRI) approach and integrates the GeoGebra application. Since not all students have adequate access to digital devices such as smartphones or laptops, the successful implementation of this module may require additional provision of technological resources.

The module was developed using the ADDIE instructional design model, which consists of five sequential phases. Analysis, In this stage, the researcher examined the fundamental problems underlying the need for module development, including difficulties observed in mathematics learning, curriculum alignment, and the core materials used at MTs Negeri Gowa. Design, this phase involved planning the structure of the teaching module, preparing the learning materials, and constructing the assessment instruments. Development, At this stage, the teaching module was produced based on the established design, followed by validation and revision processes according to feedback obtained from expert validators. Implementation, The refined module was then applied in the classroom with Grade VII students at MTs Negeri Gowa. Evaluation, The final phase consisted of assessing the extent to which the developed module improved student learning outcomes, resulting in a mathematics module based on the Realistic Mathematics Education (RME) approach for algebra material.

Module Quality Assessment which consists of Validity, Practicality, and Effectiveness The module meets all three quality criteria validity, practicality, and effectiveness. Validity was confirmed through expert evaluation of the learning tools, with the following mean scores: module validity (0.88), student response instrument (0.87), teacher response instrument (0.84), teacher implementation activity (0.92), module content (0.87), learning outcome test (0.86), and student activity (0.88). All values fall within the *very high* category, demonstrating that

the module and its supporting instruments are valid. Practicality was determined through teacher and student responses. The teacher response percentage reached 95.8%, while the student response average was 90.4%, both categorized as *very positive*. These findings indicate that the module is practical and feasible for classroom use. Effectiveness was evaluated using three indicators. Student activity averaged 76%, categorized as *very good*. Teacher implementation achieved an average score of 3.77. Student learning mastery reached a high percentage, with 85% of students meeting classical mastery criteria. These results demonstrate that the module is effective in improving learning outcomes.

The outcomes of this research may serve as a reference for future development of similar instructional materials for other mathematics topics, encouraging student engagement and motivation an outcome reflected in the student responses obtained in this study. The developed product may be considered as an alternative learning resource to support teachers in delivering algebra content more effectively.

References

- Abi, A. M. (2016). Integrasi Etnomatematika Dalam Kurikulum Matematika Sekolah. *JPMI (Jurnal Pendidikan Matematika Indonesia)*, 1(1), 1–6. <https://doi.org/10.26737/jpmi.v1i1.75>
- Arsyad, N. (2016). *Model Pembelajaran Menumbuhkembangkan Kemampuan Metakognitif*. pustaka refleksi.
- Azka, H. H. AL, Setyawati, R. D., & Albab, irkham U. (2019). Pengembangan Modul Pembelajaran. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, 1(5), 224–236.
- Beauchamp, G. A. (1975). *Curriculum Theory* (3rd ed.).
- Bou-Fakhreddine, B. (2018). *Modeling, Control and Optimization Of Cascade Hydroelectric-Irrigation Plants : Operation and Planning* [lebanese university]. <https://theses.hal.science/tel-02598915>
- Efuansyah, & Wahyuni, R. (2018). Pengembangan Bahan Ajar Matematika Berbasis PMRI Pada Materi Kubus Dan

- Balok Kelas VII. *Jurnal Derivat*, 5(2), 28–41.
- Fitri, I. M., & Zanthi, L. S. (2020). Analisis Kesulitan Siswa Dalam Menyelesaikan Soal Materi Transformasi Geometri. *Jurnal Gammath*, 5(1).
- Hariastuti, R. M. (2017). Permainan Tebak-Tebak Buah Manggis: Sebuah Inovasi Pembelajaran Matematika Berbasis Etnomatematika. *Jurnal Matematika Dan Pendidikan Matematika*, 2(1), 25–36.
- Hayani, R. (2021). *Pengembangan Modul Pembelajaran Berbasis Meaningful Intructional Design (MID) Untuk Meningkatkan Kemampuan Pemahaman Konsep Matematis Siswa MTsN 8 Tanah Datar*. Institut Agama Islam Negeri.
- Hohenwarter, M., Hohenwarter, J., Kreis, Y., & Lavicza, Z. (2008). Teaching And Calculus With Free Dynamic Mathematics Software GeoGebra. *11th International Congress On Mathematical Education*, 1–9. www.geogebra.org/wiki
- Ibda, F. (2015). Perkembangan Kognitif: Teori Jean Piaget. *Jurnal Intelektualika*, 3(1), 27–38.
- Isandhyta, E. (2018). *Pengembangan Lembar Kerja Siswa (LKS) Berbasis PMRI Berbantuan Geogebra Pada Pokok Bahasan Limit Fungsi Untuk Siswa Kelas XI Program IPA*. Universitas Sriwijaya.
- Jupri, A. (2018). Peran Teknologi Dalam Pembelajaran Matematika Dengan Pendekatan Matematika Realistik. *Seminar Nasional Matematika Dan Pendidikan Matematika*.
- Khoirul, S. M., Sunismi, & Fathani, A. H. (2019). Pengembangan Bahan Ajar Matematika Dengan Pendekatan Pendidikan Matematika Realistik Indonesia Pada Materi Sistem Persamaan Linier Dua Variabel. *Jurnal Komunikasi Pendidikan*, 3(1), 33–41.
- Maghfiroh, Y., & Hardini, A. T. A. (2021). Pengembangan Modul Pembelajaran Matematika Materi Pecahan Kelas V Sekolah Dasar. *Jurnal Educatio*, 7(2), 272–281. <https://doi.org/10.31949/educatio.v7i2.997>
- Mahendra, I. W. E. (2017). Project Based Learning Bermuatan Etnomatematika Dalam Pembelajaran Matematika. *Jurnal Pendidikan Indonesia*, 6(1), 2541–7207.
- Maulida, N. (2022). *Pengembangan Modul Pembelajaran Matematika Dengan Model Problem based Learning Pada Materi Limit Tingkat SMA*. Universitas Islam Negeri Syarif Hidayatullah.
- Mustafa, P. S., & Angga, P. D. (2022). Strategi Pengembangan Produk Dalam Penelitian Dan Pengembangan Pada Pendidikan Jasmani. *Jurnal Pendidikan : Riset Dan Konseptual*, 6(3), 413–424. https://doi.org/10.28926/riset_konseptual.v6i3.522
- Nababan, N. (2020). Pengembangan Media Pembelajaran Berbasis Geogebra Dengan Model Pengembangan ADDIE di Kelas XI SMAN 3 Medan. *Jurnal Inspiratif*, 6(1), 38–50.
- Nababan, N. (2020). Pengembangan Media Pembelajaran Berbasis Geogebra Dengan Model Pengembangan Addie Di Kelas XI SMAN 3 Medan. *Jurnal Inspiratif*, 6(1), 37–50.
- Nila Kencana, Sam Hermansyah The digital dilemma: opportunities and threats for elt students in the evolving classroom. (2025). *Language and education journal*, 10(2), 290–313. <https://doi.org/10.52237/lej.v10i2.312>
- Noviandi, A. (2019). Integrasi Nilai Pendidikan Iman Dan Ilmu Pengetahuan Dalam Tafsir Al-Misbah (Kajian Surat Al-Mujadilah 58:11). *Andragogi: Jurnal Pendidikan Islam Dan Manajemen Pendidikan Islam*, 1(3), 418–440. <https://doi.org/10.36671/andragogi.v1i3.66>
- Novitasari, R. D., & Wijayanti, A. (2019). Analisis Penerapan Penguatan Pendidikan Karakter Sebagai Implementasi Kurikulum 2013. *Indonesian Values and Character Education Journal*, 2(2), 79–86.

- Nur, M. (2008). *Guru Yang Berhasil dan Model Pengajaran Langsung*. Depdiknas.
- M U, Sari H, Hermansyah S, Maming K, Kahar A, Hasan, Elfahmi FK (2025), "Understanding Indonesian students' reading knowledge in digital literacy within socio-cultural of rural middle schools". *International Journal of Information and Learning Technology*, Vol. 42 No. 5 pp. 432–448, doi: <https://doi.org/10.1108/IJILT-12-2023-0239>
- Prihartini, N., Sari, P., & Hadi, I. (2020). Design Research: Mengembangkan Pembelajaran Konsep Peluang Dengan Pendekatan Pendidikan Matematika Realistik Indonesia pada Siswa Kelas IX di SMPN 220 Jakarta. *Jurnal Riset Pembelajaran Matematika Sekolah*, 4.
- Rahayu, T., & Purwoko. (2008). Pengembangan Instrumen Penilaian Dalam Pendidikan Matematika Realistik Indonesia (PMRI) Di SMPN 17 Palembang. *JURNAL PENDIDIKAN MATEMATIKA*, 2(2), 17–33.
- RI, D. A. (2015). *Al-Quran Terjemahan*. CV Darus Sunnah.
- Riduwan. (2011a). *Belajar Mudah Penelitian* (B. Alma, Ed.). Alfabeta.
- Riduwan. (2011). *Belajar Mudah Penelitian* (B. Alma, Ed.). Alfabeta.
- Riliyanti, B. T., & Noviyana, H. (2020). Pengembangan Lembar Kerja Peserta Didik (LKPD) Pada Materi Segitiga Dan Segiempat Dengan Pendekatan Matematika Realistik Indonesia (PMRI). *Epsilon*, 2(1), 2715–6028.
- Riyani, W. (2020a). *Pengembangan Modul Berbasis STEM Pada Materi Perubahan Lingkungan Untuk Siswa SMA*. Universitas Negeri Semarang.
- Riyani, W. (2020b). *Pengembangan Modul Berbasis STEM Pada Materi Perubahan Lingkungan Untuk Siswa SMA*. Universitas Negeri Semarang.
- Sa'adah, W. N. (2010). *Peningkatan Kemampuan Penalaran Matematis Siswa Kelas VIII SMP Negeri 3 Banguntapan Dalam Pembelajaran Matematika Melalui Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI)*.
- Simanulang, J. (2013). Pengembangan Bahan Ajar Materi Himpunan Konteks Laskar Pelangi Dengan Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) Kelas VII Sekolah Menengah Pertama. *Jurnal Pendidikan Matematika*, 7(2), 27–35.
- Sudjana, N. (2010). *Penilaian Hasil Proses Belajar Mengajar* (15th ed.). PT Remaja Rosdakarya.
- Sugiyono. (2020). *Cara Mudah Menyusun Skripsi, Tesis, dan Disertasi*. Alfabeta.
- Syafri, F. S. (2018). *Pengembangan Modul Pembelajaran Aljabar Elementer Di Program Studi Tadris Matematika IAIN Bengkulu* (D. Isran & A. Sunarto, Eds.). CV. Zigie Utama.
- Trianto. (2017). *Mendesain Model Pembelajaran Inovatif, Progresif dan Kontektual* (3rd ed.). Kencana.
- Widoyoko, E. E. P. (2010). *Evaluasi Program Pembelajaran: Panduan Praktis dan Calon Pendidik*. Pustaka Pelajar.
- Widoyoko, E. E. P. (2010). *Evaluasi Program Pembelajaran: Panduan Praktis dan Calon Pendidik*. Pustaka Pelajar.
- Yuana, R. A. (2020). *Perspektif Matematika 2* (Suwardi, Ed.). PT. Tiga Serangkai Pustaka Mandiri.
- Yuanita, & Kurnia, F. (2019). Pengembangan Bahan Ajar Berbasis STEM (Science, Technology, Engineering, And Mathematics) Materi Kelistrikan Untuk Sekolah Dasar. *Profesi Pendidikan Dasar*, 1(2). <https://doi.org/10.23917/ppd.v1i2.9046>