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Contextual geometry teaching module: Innovation in developing practical learning materials for junior high school

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Abstract
A teaching module serves as a structured learning tool aligned with the Merdeka Curriculum, designed to meet established competency standards. However, a mathematics teacher in Banda Aceh reported the absence of a curriculum-compliant teaching module specifically addressing triangle-related topics. This study aims to develop a practical and pedagogically appropriate teaching module guided by the principles of the Merdeka Curriculum. Given the nature of data collection, this research adopts a research and development (R&D) approach, employing the ADDIE model for systematic module development. Data were gathered through validation and practicality questionnaires, evaluated by subject matter experts, material experts, and teachers. The findings indicate that the teaching module demonstrates high validity, receiving scores of 95.00% from subject matter experts and 92.13% from material experts. In terms of practicality, the module also achieved strong ratings, with 88.16% from practitioners and 87.74% from students. Consequently, the teaching module is valid, practical, and suitable for implementation in classroom settings, warranting further trials and application in educational practice.

Keywords: ADDIE, Merdeka curriculum, Teaching module, Triangle

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Introduction

The improvement of education quality to create human resources capable of critical, innovative, and creative thinking remains one of the key focuses of the Indonesian government. One of the efforts to achieve this goal is by developing the existing curriculum within educational institutions. Curriculum development is essential as it serves as a guideline for the implementation of learning at all educational levels, aiming to enhance the quality of students. The Minister of Education and Culture of the Republic of Indonesia introduced a concept for curriculum reform, transitioning the previous curriculum into the Merdeka Curriculum.

In general, this curriculum promotes collaborative engagement and is learner-centered, with teachers acting as facilitators throughout the learning process. The curriculum aims to help students develop social and affective skills, linguistic understanding, communication abilities, and the capacity to design unique and beneficial initiatives (Fatimah *et al*., 2024). The

Merdeka Curriculum incorporates diverse intraculicular learning approaches, allowing students to optimally grasp concepts and strengthen their existing competencies. Teachers are granted flexibility in selecting appropriate teaching materials that align with students' learning needs. Jannah and Budiman (2022) explain that the Merdeka Curriculum plays a crucial role in shaping the Pancasila Student Profile, ensuring alignment with the provided learning materials.

A teaching module is a learning tool used in the Merdeka Curriculum. It is developed from the Lesson Plan (RPP) and supplemented with detailed guidelines, including student worksheets and assessments designed to measure the achievement of learning objectives (Mukhlishina et al., 2023). There are three core components that must be considered in the development of a teaching module: learning objectives, learning activities, and assessments (Kemendikbud, 2017). According to the guidelines for the primary goal of developing teaching modules is to provide teachers with structured guidance in conducting lessons (Jabborovna, 2021). Implementing a teaching module tailored to students' needs can significantly enhance learning outcomes. A learning process that lacks a well-structured teaching module often results in unsystematic delivery, leading to an imbalance between teachers and students in the learning experience (Salsabilla *et al*., 2023). Thus, improving student learning outcomes can be achieved through the development of teaching modules that present problem-solving exercises to enhance students' mathematical thinking skills. This requires practice in solving mathematical problems that are relevant to real-life situations. One effective approach is to incorporate story-based problems that are contextually relevant to students' daily lives.

Based on an interview with an eighth-grade mathematics teacher at a junior high school in Banda Aceh, it was revealed that no teaching module on triangle topics was available for eighth-grade students in the 2023/2024 academic year that aligned with the Merdeka Curriculum criteria at the school. Additionally, previously developed mathematics teaching modules for other topics from previous academic years did not fully adhere to the Merdeka Curriculum criteria. One missing component was the stimulus question.

The guidelines in Jabborovna (2021) define stimulus questions as questions designed to spark curiosity and initiate discussions. Salsabila and Delyana (2023) further explain that stimulus questions serve as introductory prompts presented in teaching modules to enhance verbal intelligence, stimulate curiosity, and encourage discussions between teachers and students or among peers. However, the stimulus questions in the existing teaching module do not fully meet the criteria, as they lack a clear connection between the learning objectives and the phrasing of the questions.

Stimulus questions and other types of questions included in the module fall under Cognitive Level C4, which involves analysis. However, the target students for the module include regular students and slow learners. Slow learning occurs due to lack of concentration, which prevents students from effectively absorbing information during lessons. This difficulty can be observed in students' behavior and learning performance. Therefore, close guidance and appropriate learning strategies are essential to help students comprehend information effectively. Additionally, students require descriptive explanations using various engaging methods and media, which can facilitate understanding. Consequently, this approach positively impacts students' ability to think abstractly in a concrete manner (Mansyur, 2022).

The development of teaching modules is aligned with the Merdeka Curriculum and the school criteria outlined in the Operational Curriculum of Educational Units (KOSP). The triangle teaching module is designed to meet the learning tool requirements of schools and provide alternative learning activities, thereby enhancing students' learning outcomes. The module to be developed will be a comprehensive version, consisting of lesson sequences, teaching materials, assessments, and student worksheets (LKPD). Teaching materials, assessments, and LKPD serve as supporting tools essential for the learning process.

Previous studies (Mukhlishina et al., 2023; Nurdiyanti et al., 2024) examined the implementation of teaching modules aligned with the Merdeka Curriculum in an Indonesian school in Kuala Lumpur, Malaysia. Their findings indicate that the development of teaching modules has not yet fully met the criteria of the Merdeka Curriculum. Instead, their research focused more on assisting teachers in implementing the curriculum and developing various learning tools, primarily due to limited knowledge in designing learning materials and applying the Merdeka Curriculum in the school.

The subject to be developed in the teaching module is triangles, which are categorized under geometry in the Merdeka Curriculum. Geometry is a branch of mathematics that focuses on shapes, space, composition, properties, measurements, and relationships between elements. In learning geometry, students are expected to visualize, describe, and compare geometric shapes in various positions and apply them to real-life situations (Difinubun *et al*., 2022). Triangles are considered a fundamental topic in geometry. However, they are often perceived as challenging, potentially hindering students' understanding of subsequent topics. Therefore, special attention must be given to foundational concepts to ensure students can apply their knowledge and skills effectively in future learning (Purnamasari & Lestari, 2017).

Before the learning process begins, teachers conduct initial assessments to determine students' competency levels and skills in prerequisite topics necessary for upcoming lessons. Triangles are frequently encountered in everyday life, making prerequisite topics essential for contextual problem-solving in triangle-related learning. These contextual problems can stimulate students' critical thinking skills. Based on initial assessments, students scored an average of 54.55%, indicating the need for remedial instruction in specific areas. To support and improve initial assessment results, a contextual learning model can be applied. Contextual learning is a holistic educational approach that aims to motivate students to understand the meaning of a subject by connecting it to real-life contexts. This enables students to develop flexible knowledge and skills that can be applied across different problems (Rahman, 2020).

In contextual learning, students engage with realistic problems and transform them into mathematical problems. The goal is to help students better understand concepts through modeling, formulation, and visualization, thereby reinforcing and retaining knowledge effectively (Sumiati & Agustini, 2020). Active student participation in discovering concepts by linking them to real-life situations enhances motivation and learning outcomes (Anggraena, et al., 2022) In realistic problem-solving, students identify problems and translate them into mathematical concepts. Mathematical problem-solving requires visualization, abstraction, imagination, and information association. The scope of triangle-related topics developed in the teaching module includes line and angle concepts, types of angles, and angle measurements (Tosho, 2021).

Contextual learning is implemented through the Contextual Teaching and Learning (CTL) model. The learning process involves several stages: focusing attention and motivation, identifying problems, formulating questions, collaborating in teams, constructing understanding, conducting authentic assessments, and drawing conclusions. Most criteria in the Operational Curriculum of Educational Units (KOSP) are applied in the learning process using the CTL model. The KOSP curriculum is student-centered, contextual, essential, accountable, and involves stakeholders. Hasudungan (2022) highlights several advantages of the Contextual Teaching and Learning (CTL) model, including: Encouraging students to relate learning materials to real-life situations; Motivating students to apply acquired knowledge in practical contexts; and Emphasizing active student engagement in discovering learning materials.

Bell (1978) as cited in (Purnamasari & Lestari, 2017) states that middle school students (ages 13–15) have not yet fully developed abstract thinking skills. Their cognitive processes are transitioning from concrete operational stages to formal operational stages. Therefore, effective learning strategies are required to ensure that abstract mathematical concepts are understood according to students' cognitive abilities. One approach is to build students' knowledge and skills through real-life experiences, enabling them to actively participate in the learning process.

The implementation of the Contextual Teaching and Learning (CTL) model in classroom instruction is expected to help students solve contextual problems. This study aims to: Examine the development process of the eighth-grade triangle teaching module in a junior high school in Banda Aceh; Assess the validity of the triangle teaching module; and Evaluate the practicality of the triangle teaching module.

Methodology

The research conducted is Research and Development (R&D). Husein explains that R&D research is a process of producing and developing a product through research, ensuring that the final product is valid and suitable for use in the learning process (Husein, 2020). The product to be developed is a triangle teaching module.

The development model used in this study is ADDIE, a widely used instructional design model that outlines fundamental learning system stages in an accessible manner. The ADDIE model is frequently employed by educational designers, particularly teachers. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation. Each stage in the ADDIE model produces structured outcomes, allowing progression to the next phase (Spatioti *et al*., 2022). The ADDIE development model is well-suited for product development, including learning strategies, teaching methods, media, and instructional materials. Selecting an appropriate learning tool development model is crucial to ensuring the quality and feasibility of the instructional materials (Zulkarnaini *et al.*, 2022).

Stages of the ADDIE Model: (1) Analysis: This stage aims to collect data related to the information presented in the teaching module. Activities include initial analysis, curriculum analysis, material analysis, and student analysis. (2) Design: This stage focuses on designing and structuring the teaching module. Activities include planning module components and designing assessment instruments. (3) Development: This stage involves validating the

developed teaching module. The validation process is conducted through assessment questionnaires completed by experts/validators. The validation results are analyzed to determine the module's validity. Based on the validation questionnaire, experts/validators provide suggestions for improvement, which are incorporated into the module during the development phase. (4) Implementation: This stage involves applying the triangle teaching module to eighth-grade students through limited trials (small group trials). The module is implemented only if experts/validators confirm its validity, ensuring it is suitable for classroom use. (5) Evaluation: This stage aims to formatively evaluate the developed product. Formative evaluation is conducted based on feedback from experts/validators, teachers, and students.

The study was conducted in April 2024 in an eighth-grade class at a junior high school in Banda Aceh that has adopted the Merdeka Curriculum. The research subjects were eighth-grade students from the school. A review of the Operational Curriculum of Educational Units (KOSP) indicates that the school has diverse student backgrounds, which strengthens the implementation of the Pancasila Student Profile. The school also runs regular flagship programs, including religious programs, environmental awareness initiatives, human resource development, and partnership programs. Additionally, the school maintains strong professional associations, such as MGMP, which benefits educators. The school is located in a representative learning environment with a religious cultural atmosphere, fostering religious values among students.

The research instrument used in this study is: (1) Expert Assessment Sheet for Learning Tools: Experts evaluate the appropriateness and completeness of the components in the teaching module (Rosyidah & Sholihah, 2021). The learning tool experts consist of three mathematics teachers, two of whom are certified lead teachers. (2) Expert Assessment Sheet for Subject Matter: Experts assess content accuracy, presentation, material display, and language suitability (Cahyono *et al*., 2023). The subject matter experts include two mathematics education lecturers from UIN Ar-Raniry. (3) Practicality Assessment Sheet: This sheet measures the practicality of the teaching module, student worksheets (LKPD), and instructional materials. The practicality assessment is conducted by teachers and students. The validity of each instrument is measured using a Likert scale, which categorizes assessments into four levels: highly valid, moderately valid, less valid, and not valid.

Data collection was conducted using assessment questionnaires. The questionnaires provided to experts/validators contained a series of questions evaluating accuracy, content, presentation, language suitability, and validity of the teaching module components. The expert/validator assessments were analyzed to determine the accuracy, presentation, language suitability, and validity of the module components. The validity criteria for the teaching module are presented in Table 1.

Table 1. Validity Criteria for the Teaching Module:

No.	Validity Criteria	Validity Level
1	85,01% – 100%	Highly Valid
2	70,01% – 85,00%	Moderately Valid
3	50,01% – 70,00%	Less Valid
4	01,00% – 50,00%	Not Valid

Source: (Akbar, 2022)

The practicality test was conducted using assessment questionnaires, completed by 22 eighth-grade students and teachers. The collected data were analyzed to determine the practicality level of the teaching module, ensuring it meets the criteria for practical classroom use. The practicality criteria for the teaching module are presented in Table 2.

Table 2. Practicality Criteria for the Teaching Module

No.	Practicality Criteria	Practicality Level
1	85,01% – 100%	Highly Practical
2	70,01% – 85,00%	Moderately Practical
3	50,01% – 70,00%	Less Practical
4	01,00% – 50,00%	Not Practical

Source: (Akbar, 2022)

Results

Analysis Stage

This stage aims to identify and analyze the requirements or information needed for product development. The activities conducted in this stage include:

1) Initial Analysis: The initial analysis consists of two phases:

a. Availability analysis of teaching modules

b. Interviews with eighth-grade mathematics teachers

Based on interviews with eighth-grade mathematics teachers, it was found that no teaching module for triangle topics is available that aligns with the Merdeka Curriculum. While some teaching modules have been developed by teachers, they do not fully meet the Merdeka Curriculum criteria. Upon further examination, it was discovered that only certain components of these modules are relevant to the curriculum's requirements. One example is the stimulus question component, which does not fully meet the required criteria and lacks a clear connection between the stimulus question and the learning objectives.

2) Curriculum Analysis: This stage involves analyzing the implemented curriculum through interviews. The findings indicate that the school has adopted the Merdeka Curriculum and was among the first cohort of "driving schools" in Banda Aceh. The school's Operational Curriculum of Educational Units (KOSP) is designed to be student-centered, contextual, essential, accountable, and inclusive of various stakeholders.

3) Material Analysis: This stage involves analyzing learning outcomes and formulating learning objectives that align with the scope of triangle topics. The learning objectives are outlined in Table 3.

Table 3. Learning Objectives

Element	Competency	Scope of Material
Geometry	Explain	Triangle
Learning Objective: G1. **Explain the properties of triangle congruence and apply them to problem-solving.**		

Based on the learning objectives in Table 3, the sequence of learning activities is structured over time to ensure mastery. The formulation of learning objectives and the scope of triangle topics are adjusted according to students' learning resources at school.

4) Student Analysis: This stage involves analyzing students' needs based on several categories, including prior knowledge, background, social status, and personality differences. However, this study focuses on students' backgrounds and prior knowledge.
5) Background Analysis: Examines students' learning environments at school and home.
6) Prior Knowledge Analysis: Determines students' existing competencies before learning triangle topics.

Based on this analysis, the Contextual Teaching and Learning (CTL) model was selected for implementation during the learning process. The CTL model consists of seven effective learning stages: Focusing attention and motivation, identifying problems, formulating questions based on problems, collaborating in teams, constructing understanding, conducting authentic assessments, drawing conclusions.

The initial assessment was conducted to align the learning model with students' competency levels. In this activity, students completed five essay questions covering line and angle concepts. The initial assessment questions tested the knowledge and skills students must possess before learning triangle topics. Line and angle concepts serve as prerequisite knowledge for solving triangle-related problems. Based on the initial assessment results, students achieved an average score of 54.55%, indicating that mastery had not been achieved, and remedial instruction was required for certain areas. The low performance was attributed to students' difficulty in solving contextual problems presented in the initial assessment. Therefore, implementing the Contextual Teaching and Learning (CTL) model is expected to help students answer contextual questions by following the structured steps within the CTL framework, which will be applied throughout the learning process.

Design Stage

The design stage involves determining the components of the teaching module to be developed. This process begins with designing the cover, followed by the development of three main sections in the module: general information, core components, and appendix components. Each section consists of several specific components, as outlined in Table 4.

The next step involves designing assessment instruments, specifically questionnaires that will serve as guidelines for validators/experts in evaluating the triangle teaching module. The Likert scale is used for the assessment questionnaire, which includes aspects of completeness and relevance of the module components, validated by learning tool experts. Meanwhile, the subject matter experts validate aspects related to content accuracy, presentation, material delivery, and language suitability, and the practicality questionnaire assesses the practicality of the teaching module, LKPD, and teaching materials, validated by teachers and students.

Table 4. Components of the Teaching Module

No.	Section	Description
	Cover	**Cover front page of the teaching module**
1.	General Information	1) Author Identity 2) Prior Competencies 3) Pancalila Student Profile 4) Facilities and Infrastructure 5) Target Students 6) Learning Model
2.	Core Components	1) Learning objectives 2) Meaningful understanding 3) Stimulus questions 4) Learning activities 5) Assessment 6) Reflection for students and educators
3.	Appendix Components	1) Student worksheets (LKPD) 2) Remedial and enrichment 3) Teaching materials 4) Glossary 5) References

Source: (Anggraena, Ginanto, Felicia, Andiarti, et al., 2022)

Development Stage

Once the teaching module is developed, it undergoes validation in the development stage. The purpose of validation is to determine whether the module meets the validity criteria and is suitable for implementation or further testing. The validation process involves five experts/validators, consisting of two subject matter experts (mathematics education lecturers from UIN Ar-Raniry Banda Aceh) and three learning tool experts (mathematics teachers from a junior high school in Banda Aceh)

The module revisions are made based on suggestions and feedback from validators to ensure it meets the required criteria and quality standards for further implementation. The validation results are presented in Table 5.

Table 5. Validation Results

Assessment Sheet	Validator			Averaage Score	Description
	I	II	III		
Subject Matter Experts	95,00%	95,00%	-	95,00%	Highly Valid
Learning Tool Experts	90,28%	100,00%	86,11%	92,13%	Highly Valid

Based on Table 5, the average validation score for the completeness of module components from learning tool experts is 92.13% (Highly Valid). Meanwhile, the subject matter experts rated the content accuracy, presentation, material delivery, and language suitability with an average score of 95.00% (Highly Valid). The triangle teaching module is suitable for use, with minor revisions, and can proceed to the next stage.

Implementation Stage

This stage involves limited trials (small group trials) by applying the triangle teaching module in classroom instruction. The limited trial was conducted in an eighth-grade class at a junior high school in Banda Aceh, with 22 students participating. A series of learning activities was carried out according to the triangle teaching module.

During the final activity, students completed a summative assessment, which included problem-solving tasks based on the concepts taught during the learning process. The summative assessment aimed to measure the achievement of learning objectives. Based on the summative assessment results, students achieved an average score of 79.68%, indicating mastery of the material, with no need for remedial instruction.

During the implementation stage, both teachers and students completed practicality assessment questionnaires to evaluate the practicality of the teaching module, LKPD, and teaching materials used in the learning process. The practicality assessment results are presented in Table 6.

Table 6. Practicality Validation Results

No.	Assessment Sheet	Validator	Description
1	Teacher	88,16%	Highly Practical
2	Students	87,74%	Highly Practical

Based on Table 6, the practicality test results show that the teaching module was rated 88.16% (Highly Practical) by teachers and 87.74% (Highly Practical) by 22 eighth-grade students. The module is highly practical, with minor improvements needed.

Evaluation Stage

The evaluation stage aims to determine whether the developed teaching module meets the success criteria. Evaluation is conducted at each stage of the ADDIE model. This type of evaluation is known as formative evaluation, as its purpose is to improve the product during development (Widyastuti & Susiana, 2019). Formative Evaluation Includes: (1) Feedback from learning tool experts, (2) Validation by subject matter experts during the development stage, and (3) Practicality testing during the implementation stage

Module completeness: The initial competency statement was revised. Initially, the competency was defined as: "Students can identify the properties of isosceles triangles, equilateral triangles, and right triangle congruence."
It was revised to: "Knowledge and skills students need before learning triangle topics: (1) Students can explain the concept of lines and angles; (2) Students can describe different types of angles; (3) Students can determine the sum of angle measures; (4) Content completeness: Experts suggested adding an explanation of symmetry in the teaching materials and incorporating problems related to right triangle congruence.

Discussion

A series of stages in the ADDIE development model has been carried out to produce a triangle teaching module that is suitable for use. The development of this module has gone through multiple phases, starting from analysis, design, development, implementation, and evaluation.

The analysis stage is the primary activity conducted by the developer. In this phase, the researcher analyzes relevant information to justify the need for product development (Cahyadi, 2019). The findings from this stage include: (1) No existing triangle teaching module was available; (2) The research site is a school that has implemented the Merdeka Curriculum and

was part of the first cohort of "driving schools" in 2021. The Operational Curriculum of Educational Units (KOSP) applied in the school is student-centered, contextual, essential, accountable, and involves various stakeholders; (3) Formulation of Learning Objectives (LO) based on an analysis of Learning Outcomes (LO) and learning resources, which focus on explaining the properties of triangle congruence and applying them to problem-solving; (4) The learning model used for triangle topics is Contextual Teaching and Learning (CTL). The CTL model was selected based on students' competency levels, as indicated by the initial assessment results, which showed an average score of 54.55%, requiring remedial instruction in certain areas..

The design stage involves reviewing the analysis results and determining the strategies to be used (Hidayat & Nizar, 2021). This phase also includes product design based on the analysis findings (Firda & Nurhadi, 2023). The teaching module is the product designed in this stage, following the components established by the Ministry of Education and Culture (Kemendikbud, 2017). Additionally, the design stage includes the development of validation instruments, specifically assessment questionnaires. These questionnaires serve as evaluation guidelines for experts/validators in assessing the feasibility of the developed teaching module.

During the development stage, the teaching module undergoes validation by experts/validators. The validity assessment is conducted by: (1) Subject matter experts, who evaluate the module's presentation, language use, and content accuracy; and (2) Learning tool experts, who assess the completeness and relevance of the module components(Setiyani *et al*., 2020). The assessment questionnaire developed in the design stage serves as a measurement tool for module validity. A questionnaire is considered valid if its statements accurately measure the intended aspects (Sanaky, 2021). Based on validation results, the subject matter experts rated the module at 95.00% (Highly Valid), while the learning tool experts rated it at 92.13% (Highly Valid). The validators confirmed the module's validity, with minor revisions required. Syahbana states that validity is demonstrated when all validators agree on the content (aligned with the curriculum), structure (consistent with CTL characteristics), and language (adhering to linguistic standards) (Syahbana, 2012).

The implementation stage involves applying the triangle teaching module after it meets the validity and feasibility criteria for limited trials (small-scale testing). The trial was conducted in an eighth-grade class at a junior high school in Banda Aceh, with 22 students participating. During implementation, students received guidance to achieve learning objectives, solve problems, and improve their skills (Cahyadi, 2019). The learning activities followed the structured sequence outlined in the teaching module. In the final activity, students completed a summative assessment, which included problem-solving tasks based on the concepts taught during the learning process. The summative assessment aimed to measure mastery of learning objectives. The average score achieved in the summative assessment was 79.68%, indicating mastery, with no need for remedial instruction. After completing the learning activities, both students and teachers evaluated the practicality of the teaching module, LKPD, and teaching materials. The practicality assessment results are as: (1) Teachers rated the module at 88.16% (Highly Practical). (2) Students (22 participants) rated the LKPD and teaching materials at 87.74% (Highly Practical). (3) A product is considered practical if all students can effectively use it during field trials (Sanaky, 2021).

The evaluation stage involves formative evaluation, meaning that each stage of the ADDIE model undergoes continuous assessment. The evaluation process reviews necessary improvements to the teaching module (Widyastuti & Susiana, 2019). The evaluation stage also serves as an assessment of the developed product, determining whether it achieves the intended learning objectives.

Conclusion

Based on the research findings, the triangle teaching module is highly valid and practical, with validation scores of 95.00% from subject matter experts and 92.13% from learning tool experts, as well as practicality scores of 88.16% from teachers and 87.74% from students. Therefore, it is recommended that the teaching module be tested in other schools to ensure its effectiveness in various conditions. Future research can focus on refining the module based on classroom feedback and developing teaching modules for other geometry or algebra topics to enhance mathematics education at the junior high school level. By taking these steps, the developed teaching module is expected to be widely implemented and make a significant contribution to improving education quality.

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