
Development of Mobile Learning Using Contextual Teaching and Learning Approach to Improve Mathematical Communication Skills of High School Students

M. Taufik Akbar^{1*}, Jefri Marzal², Yantoro³

^{1,2,3} Master of Mathematics Education Study Program, Faculty of Teacher Training and Education, Jambi University

e-mail: taufik.danil3rdson@gmail.com¹, jefri.marzal@unja.ac.id², yantoro@unja.ac.id³

Article Info

Article history:
Received: Juni 27th, 2025
Revised: April 8th, 2026
Accepted: April 10th, 2026
Available online: April 30th, 2026

<https://doi.org/10.33541/edumatsains.v10i4.7113>

Abstract

Limited mathematical communication ability among students represents a key challenge that educators must address. Therefore, learning activities should be structured around problem-based tasks that encourage students to express mathematical ideas more effectively. The purpose of this study is to produce mobile learning-based instructional media employing the Contextual Teaching and Learning approach that is valid, practical, and effective in fostering students' mathematical communication skills. The participants were tenth-grade students of SMA Negeri 8 Batang Hari during the even semester of the 2024/2025 academic year. A Research and Development approach guided by the ADDIE model was applied in this study. The findings demonstrate that the developed mobile learning instructional media meets the criteria of validity, practicality, and effectiveness. Validity was established through expert evaluations of both media design and instructional content, indicating that the mobile learning media is appropriate and suitable for use. The practicality of the developed media was substantiated by favorable feedback from both educators and learners. Furthermore, its efficacy in bolstering students' mathematical communication skills was confirmed through N-Gain analysis. The resulting score of 0.71, categorized as a high improvement, demonstrates a significant progression from pre-test to post-test results. Therefore, integrating a Contextual Teaching and Learning (CTL) approach into mobile learning media serves as a viable strategy for advancing mathematical communication proficiency.

Keywords: Learning Media, Mobile Learning, Mathematical Communication Skill, Contextual Teaching and Learning

1. Introduction

A primary objective in mathematics education is the cultivation of students' capacity to articulate conceptual ideas and logical reasoning. This involves utilizing diverse representational modes including graphical illustrations, tabular data, visual tools, and formal notation to interpret and resolve complex mathematical scenarios. Thus, mathematical communication skills play a vital role in facilitating the attainment of mathematics learning objectives (Nasri & Jamaan, 2022).

National Council of Teachers of Mathematics (2000) identified several essential mathematical competencies that should be fostered through mathematics instruction, namely: (1) problem solving, (2) reasoning and proof, (3) communication, (4) connections, and (5) representation. In accordance with the Independent Curriculum's objectives, these standards emphasize the necessity for learners to grasp mathematical principles and clarify their interconnectedness. Furthermore, Utami and Amidi (2022) suggest that such a curriculum aims to equip students with the ability to implement algorithms and concepts accurately and adaptably across various problem-solving scenarios.

Among the higher-order thinking skills targeted in mathematics education, mathematical communication holds a significant role. This skill refers to students' ability to express mathematical ideas both orally and in written form. Mathematical communication can be enhanced through school-based learning activities, particularly within mathematics classrooms, as mathematics is grounded in logical reasoning that supports the development of students' thinking abilities. In this regard, mathematics functions as a vital instrument for enhancing mathematical discourse and communication skills among learners (Hodiyanto, 2017).

There is a notable tendency for students to exhibit deficient mathematical communication abilities. This is consistent with research by Osterholm, which highlights the hurdles students face when attempting to articulate their logical thinking (Nuraeni & Luritawaty, 2016). When asked to provide logical explanations, students tend to focus on limited portions of the text—particularly symbolic problems—and often state their lack of understanding without offering clear justifications. In addition, research conducted by **Sriwahyuni** (as cited in Firdaus & Aini, 2019) revealed that approximately 65% of students' mathematical communication skills fall into the low category (Hanipah & Sumartini, 2021).

Considering the crucial role of mathematical communication skills, an effective strategy to enhance these skills is the implementation of instructional approaches that promote active student engagement. To support the development of mathematical communication, appropriate

instructional media must be designed. In this study, mobile learning is utilized as the instructional medium, as it is flexible and accessible, allowing students to engage in learning activities anytime and anywhere using their personal devices.

Contextual Teaching and Learning (CTL) may be applied as an instructional approach to develop students' communication skills. This view is supported by **M. Hosnan** (2016), who describes contextual learning as an approach that acknowledges and reflects the natural conditions under which knowledge is acquired. Through this approach, learning concepts are presented by connecting the subject matter to real-life contexts in which the knowledge is applied, as well as to the ways students learn and construct understanding.

2. Methods

The research adopts a Research and Development methodology, with the ADDIE model serving as a widely recognized framework for instructional design. The outcome expected from this research is the development of mobile learning media integrated with a Contextual Teaching and Learning approach to enhance the mathematical communication skills of tenth-grade students at SMA Negeri 8 Batang Hari. The development stages of the ADDIE model, as proposed by **Robert Maribe Branch** (2009), are illustrated in Figure 1.

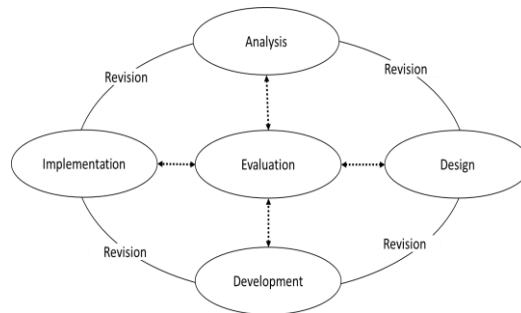


Figure 1. Steps of the ADDIE Development Model

1. Analysis stage (*Analyze*)

The analysis phase serves as the initial step in the planning process, focusing on the formulation of the product concept. As stated by Robert Maribe Branch (2009), this stage seeks to determine potential factors that contribute to existing gaps or issues.

The curriculum analysis stage aims to identify the curriculum implemented at the school where the research is conducted. This is followed by a performance gap analysis, which is intended to formulate basic objective statements in order to identify implementation gaps or existing problems, determine their underlying causes, and propose appropriate solutions. Goal setting focuses on

identifying performance gaps and priority actions, leading to the development of mobile learning instructional media based on the Contextual Teaching and Learning (CTL) approach.

2. Design Stage

The design phase involves the creation of an instructional platform rooted in mobile learning, which purposefully incorporates the principles of the Contextual Teaching and Learning (CTL) framework. The learning materials presented address the topic of systems of linear equations in three variables. The design is then validated through expert judgment involving specialists or practitioners to evaluate the product's feasibility and quality.

3. Development Stage

Following the completion of the mobile learning product, the next phase is the development stage, during which the product undergoes validation to ensure that it meets acceptable quality standards. Validation is a systematic process aimed at evaluating whether the newly designed product is rationally more effective than the previously used learning media.

According to **Robert Maribe Branch** (2009), formative evaluation involves the systematic collection of data intended to inform revisions prior to implementation. This evaluation consists of three stages: individual trials, small-group trials, and large-group trials.

4. Implementation

The implementation stage involves the application of the developed product in actual learning settings. According to **Robert Maribe Branch** (2009), this stage requires products that have undergone testing to be used in real instructional contexts. Mathematics instruction for tenth-grade learners at SMA Negeri 8 Batang Hari was conducted through the deployment of mobile-based learning media. This implementation strictly adhered to the Contextual Teaching and Learning (CTL) framework to ensure the integration of real-world contexts into the learning process.

5. Evaluation

To ensure the quality of the developed media, the evaluation stage initiates with professional validation by subject and media experts. The refinement process is further guided by the recommendations of instructional designers and specialists, alongside a comprehensive analysis of results obtained from initial product testing. The trials are conducted in two phases, starting with a small-scale trial involving nine students and continuing with a large-scale trial involving thirty-four students. Branch (2009) explains that evaluation in the ADDIE model is conducted at three levels, namely perception, knowledge (learning), and implementation (performance).

This study limited the evaluation process to Level 1 (perception) and Level 2 (knowledge) of the ADDIE evaluation framework. Therefore, the Level 3 evaluation, which focuses on measuring students' ability to apply knowledge and skills in authentic work settings, was not carried out.

3. Result and Discussion

The findings of this research are multifaceted: first, they highlight the successful design of mobile-based instructional media that incorporates the Contextual Teaching and Learning (CTL) framework to strengthen students' mathematical communication. Second, the quality of this tool was verified through rigorous appraisals by both content and media specialists. Furthermore, the practical utility of the media was evidenced by favorable feedback and perceptions from educators and learners alike, collected via validated instruments. Ultimately, the effectiveness of this pedagogical intervention was confirmed by student performance data, specifically through post-test scores following the classroom application of the CTL-based mobile platform.

The research employed a mixed-data approach, incorporating both qualitative and quantitative data. Qualitative data consisted of evaluations from material experts and learning and media design specialists, in addition to mathematics teachers' feedback and students' questionnaire responses regarding the developed instructional media. Quantitative data were collected from students' learning outcomes, as indicated by post-test (final test) results.

This study developed mobile learning media through the application of the ADDIE model, encompassing the stages of Analyze, Design, Development, Implementation, and Evaluation.

The preliminary phase of the Analyze stage involves a systematic examination of the curriculum, which serves as the foundational step for designing the instructional media. The findings indicate that tenth-grade students at SMA Negeri 8 Batang Hari have implemented the Merdeka Curriculum. At this stage, a performance gap analysis is also conducted by gathering feedback from colleagues and interviewing mathematics teachers at the school to gain a clearer understanding of existing problems and the factors contributing to performance gaps. Following the identification of these gaps, goal setting is carried out. Based on the researchers' observations, the actual conditions revealed that students require interactive learning media that can be accessed flexibly through their personal devices. In light of these considerations, this research aims to design and implement a CTL-based mobile learning application. The primary goal is to provide a technologically integrated platform that specifically fosters the advancement of students' mathematical communication proficiency.

At the Design stage, researchers develop mobile learning media based on the Contextual Teaching and Learning (CTL) approach to enhance students' mathematical communication skills on the topic of systems of linear equations in three variables. The preparation of a design or storyboard is considered essential to ensure that the developed media aligns with learning needs and objectives. During this stage, the product is conceptualized as mobile learning media incorporating the CTL approach. The design process begins with the collection of relevant instructional materials from various sources, including textbooks, online resources, and other learning media. The outcomes of the mobile learning design are presented in the following figure.



Figure 2. Initial Appearance of the Application

The results of designing the initial appearance of the mobile learning application as a menu for students to enter the application. Students can press the Start button to enter the mobile learning application menu.



Figure 3. Menu Display

The menu interface provides various features that can be accessed by students, including learning outcomes, the sequence of learning objectives, instructional objectives, learning materials, instructional videos, student worksheets, assessment tests, conclusions, and a profile of the application developer.

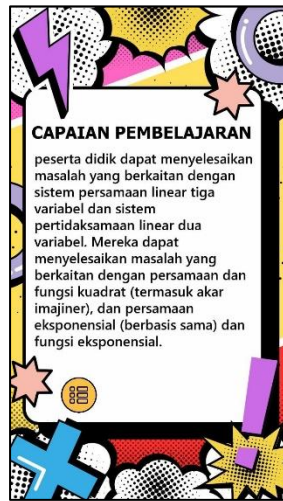


Figure 4. Learning Outcomes Menu

Through this menu, students can access information about learning outcomes. Learning outcomes refer to the competencies that students are expected to attain by the end of a learning phase. These outcomes replace the Core Competencies (KI) and Basic Competencies (KD) that were applied in the 2013 Curriculum.

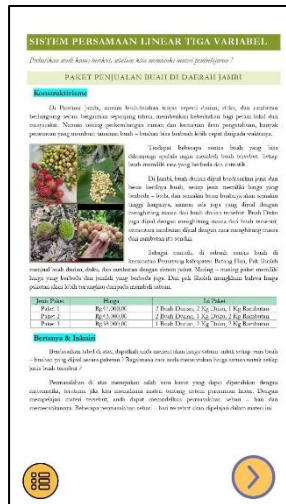


Figure 5. Material menu display

In this menu section, students can study SPLTV material together or independently both at school and outside school.

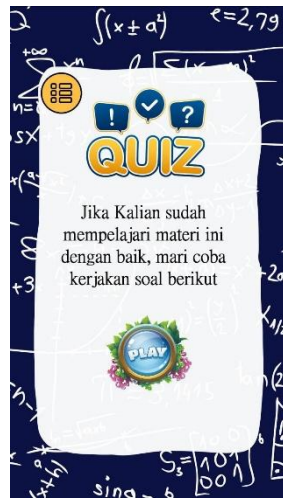


Figure 6. Test Menu

In this menu, students can take tests after studying SPLTV material, the test contains questions related to SPLTV and students can directly see the test scores they have done.

Furthermore, the developed mobile learning media was subjected to expert validation. This study involved two types of validation, namely material validation and media validation. The experts selected for this process were chosen based on their competence, expertise, and experience in developing mobile learning media and in teaching the topic of systems of linear equations in three variables (SPLTV). This validation process was conducted to identify the strengths and limitations of the developed mobile learning design.

The material expert validation was conducted by Dr. Syamsir Sainuddin, S.Pd., M.Pd., who evaluated the mobile learning media based on the Contextual Teaching and Learning (CTL) approach for the topic of systems of linear equations in three variables (SPLTV) for tenth-grade students at SMA Negeri 8 Batang Hari. The validation process was carried out by completing a questionnaire consisting of 16 assessment items.

The results of the material expert evaluation indicated that, following several revisions, all assessment indicators of the developed mobile learning media were rated as very good and appropriate in terms of instructional content.

The design expert validation was conducted by Dr. Rohati, S.Pd., M.Pd., who evaluated the developed mobile learning media based on the Contextual Teaching and Learning (CTL) approach for the topic of systems of linear equations in three variables (SPLTV) for tenth-grade students at SMA Negeri 8 Batang Hari. The evaluation was carried out using a questionnaire comprising 15 assessment items.

Based on the results of the design expert evaluation, all assessment indicators received very good and appropriate ratings for every component of the developed mobile learning media after several revisions were implemented.

During the development phase, the conceptual designs were translated into a functional mobile learning platform. This production process strictly adhered to the Contextual Teaching and Learning (CTL) framework while simultaneously integrating critical refinements derived from expert appraisals and constructive feedback. At this stage, product trials were conducted, consisting of three phases: individual trials, small-group trials, and large-group trials (field testing).

The individual trial involved a mathematics teacher from SMA Negeri 8 Batang Hari as the subject. This pilot study sought to secure professional perspectives and early-stage feedback regarding the utility and design of the newly developed mobile learning media. The participant was asked to observe and evaluate the mobile learning media based on the CTL approach for the topic of systems of linear equations in three variables (SPLTV) as a whole. To collect evaluation data, the researcher administered a questionnaire consisting of 19 items covering indicators of content feasibility, language use, presentation, and graphical design.

The analysis of individual trial responses indicated that the developed mobile learning media was evaluated very positively. Nonetheless, recommendations were provided for further enhancement, especially in relation to improving content clarity and optimizing text size. These revisions aim to facilitate students' comprehension, learning, and analytical processes. Consequently, the improved media is expected to more effectively support students' learning outcomes.

Following the individual trial, a small-group trial was conducted involving nine tenth-grade students at SMA Negeri 8 Batang Hari representing low, medium, and high ability levels, as identified by the mathematics teacher. Students accessed and used the mobile learning media directly on their personal devices through the application file provided by the researcher. They were then asked to review the mobile learning media comprehensively and provide evaluations in the form of response questionnaires. The small-group trial questionnaire consisted of 28 items. Based on the students' responses, it can be concluded that the small-group trial participants provided positive feedback and expressed interest in learning through the mobile learning media using the Contextual Teaching and Learning (CTL) approach.

Based on the responses of the small-group trial participants, it can generally be concluded that the developed mobile learning media is suitable for use as a learning resource. The language used in the mobile learning content is clear and easy to understand, while the visual presentation effectively attracts students' interest. The material is presented in a structured manner and is supported by practice exercises, which help students comprehend the content more easily. In addition, the mobile learning media increases students' motivation to learn, encourages active participation, and supports independent learning. The exercises provided are aligned with the topic

of systems of linear equations in three variables (SPLTV), enabling students to better understand the material and apply it in real-life contexts.

Following the small-group trial, a large-group trial was conducted involving 34 students from class X4 Phase E at SMA Negeri 8 Batang Hari. During this stage, all participants accessed and explored the mobile learning application using their own smartphones. After completing the learning activities, students were asked to provide evaluations in the form of responses or perceptions regarding the mobile learning media that had been developed.

Student assessments were collected through a questionnaire designed to capture learners' responses to the developed mobile learning media. The analysis of the questionnaire results showed that all 34 participating students expressed positive perceptions and demonstrated a strong interest in learning through mobile learning integrated with the CTL approach.

Based on the analysis of responses from participants in the large-group trial, it can be generally concluded that the developed mobile learning media is appropriate for use as a learning resource. The language employed in the mobile learning effectively stimulates students' communication, while its visual design is engaging. The presentation of the material is clear and easy to understand, contributing to the improvement of students' mathematical communication skills. In addition, the practice exercises are aligned with the SPLTV content, encourage active student participation, support independent learning, and help students better understand SPLTV concepts.

At the implementation stage, the tested product was applied in a real classroom setting through actual teaching and learning activities using mobile learning media with a Contextual Teaching and Learning (CTL) approach. The implementation involved 34 students of class X4 Phase E at SMA Negeri 8 Batang Hari and was conducted over two meetings. Each meeting consisted of three stages: opening activities, core learning activities, and closing activities.

During the learning process, each student used a mobile learning application installed on their respective smartphones, which contained SPLTV learning materials integrated with the CTL approach. The design of this mobile learning platform integrates the core tenets of the CTL framework, such as constructivism, inquiry-based learning, and the formation of learning communities. It also emphasizes modeling, questioning techniques, and reflective practices, culminating in authentic assessment. Before the pedagogical intervention began, a pre-test was conducted to establish a baseline for the students' existing mathematical communication proficiency. After the completion of the SPLTV learning activities, a post-test was conducted to evaluate the improvement of students' mathematical communication skills.

At the evaluation stage, researchers measured students' final competencies in relation to the predetermined learning objectives. The evaluation was conducted after the completion of all learning activities, and the results obtained served as feedback for researchers to assess the quality

of the developed product. Through this stage, the effectiveness of the mobile learning media implemented in real classroom learning could be identified and analyzed.

This evaluation was conducted using student perception questionnaires and post-learning tests administered after the completion of the learning process. The evaluation results were used to determine the effectiveness of the developed mobile learning media. The mobile learning was considered effective if it received positive perceptions from students and if the objectives of its development were achieved, namely improving students' mathematical communication skills on the System of Linear Equations in Three Variables (SPLTV) material.

The student perception questionnaire was administered after students had completed and understood the learning content delivered through the mobile learning media. The instrument consisted of 13 statement items, and a recapitulation of the student perception results is shown in the following table.

Table 1. Recapitulation of student perception assessment

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Point	153	154	154	154	153	160	159	146	150	162	144	153	161	2003
% (Butir)	90%	90,6%	90,6%	90,6%	90%	94,1%	93,5%	85,9%	88,2%	95,3%	84,7%	90%	94,7%	90,6%
Category	Very Good													

Students at SMA Negeri 8 Batang Hari, particularly those in Class X4 Phase E, demonstrated a strong positive response toward the mobile learning media. The data shows an overall perception score of 90.6%, suggesting that the integration of CTL components effectively met the learners' needs and expectations. This result indicates that students' perceptions fall into the **very good** category.

In addition, the analysis of pre-test and post-test results was conducted using expert-validated scoring guidelines aligned with indicators of students' mathematical communication skills. The pre-test and post-test scores collected during the implementation stage for the Systems of Linear Equations in Three Variables (SPLTV) topic are illustrated in the following diagram.

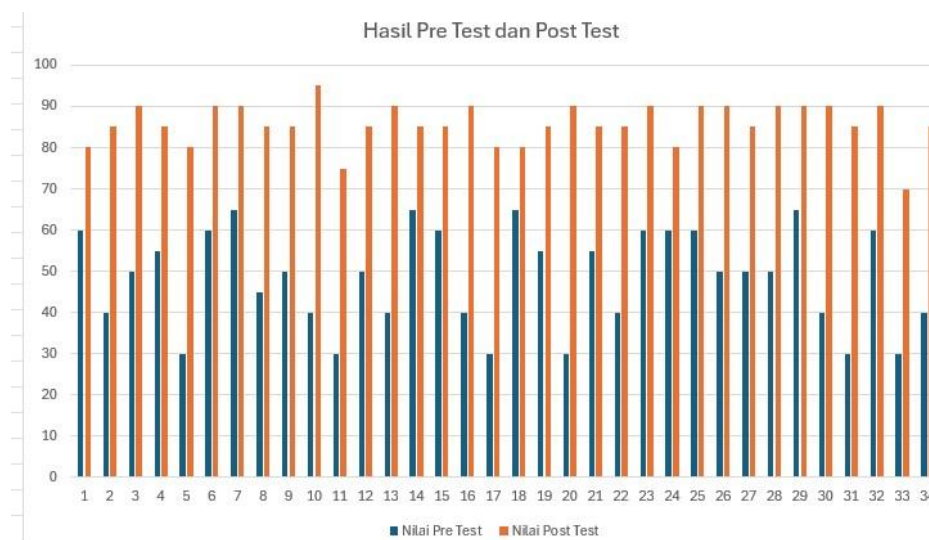


Figure 7. Diagram of Pre-test and Post-test Results

There is a comparison table of pre-test and post-test results according to Figure 7.

Table 2. Comparison of pre-test and post-test results

No	Score Range <i>Pre-Test</i>	Students	Score Range <i>Post-Test</i>	Students
1	$0 \leq Skor \leq 10$	0	$0 \leq Skor \leq 10$	0
2	$11 \leq Skor \leq 20$	0	$11 \leq Skor \leq 20$	0
3	$21 \leq Skor \leq 30$	6	$21 \leq Skor \leq 30$	0
4	$31 \leq Skor \leq 40$	7	$31 \leq Skor \leq 40$	0
	$41 \leq Skor \leq 50$	7	$41 \leq Skor \leq 50$	0
6	$51 \leq Skor \leq 60$	10	$51 \leq Skor \leq 60$	0
7	$61 \leq Skor \leq 70$	4	$61 \leq Skor \leq 70$	1
8	$71 \leq Skor \leq 80$	0	$71 \leq Skor \leq 80$	6
9	$81 \leq Skor \leq 90$	0	$81 \leq Skor \leq 90$	26
10	$91 \leq Skor \leq 100$	0	$91 \leq Skor \leq 100$	1
Average <i>Pre-Test</i>		34	Average <i>Pos-Test</i>	34
34 Students = 48,53			34 Students = 85,73	

The empirical data illustrated in the preceding figures indicates a substantial progression in student performance, with mean scores ascending from a pre-test average of 48.53 to a post-test average of 85.73. To quantify this advancement in mathematical communication, the normalized gain (N-gain) was calculated using Hake’s (1998) framework. The analysis yielded an N-gain coefficient of 0.71, signifying a high level of academic improvement. These results indicate a significant increase in students’ mathematical communication skills after learning using the

developed mobile learning media. This finding is further supported by students' positive responses following the learning process using the mobile learning application developed by the researcher.

Thus, the mathematical communication skills of students in class X4 Phase E at SMA Negeri 8 Batang Hari improved after the use of mobile learning media with a CTL approach.

4. Conclusion

The outcomes of this development study demonstrate that the CTL-integrated mobile learning platform has achieved high standards of validity. Consequently, the media is deemed highly appropriate and ready for implementation within the context of mathematics education. This is supported by revisions carried out based on expert evaluations and recommendations. The practicality of the media was confirmed through positive responses from both teachers and students, who agreed that the media increased students' interest in learning. Furthermore, the effectiveness of the media was demonstrated by a significant improvement in students' mathematical communication skills, as shown by the pre-test and post-test analysis. The acquisition of an N-gain score of 0.71, situated within the 'high' improvement tier, provides empirical validation for the efficacy of CTL-based mobile learning media. This result underscores the platform's success in significantly advancing the mathematical communication competencies of the participating students.

The researcher also recommends that future development studies design mathematics mobile learning media using more advanced applications to make the learning media more engaging and to enhance students' interest and enthusiasm for learning.

5. References

- Apriyanto, M. T., & Hilmi, R. A. (2009). Media Pembelajaran Matematika (Mobile Learning) Berbasis Android. *Seminar Nasional Penelitian Pendidikan Matematika (SNP2M)*, 115-124. doi:<http://dx.doi.org/10.31000/cpu.v0i0.1690>
- Branch, R. M. (2009). *Instructional Design : The ADDIE Approach*. Athens: Springer. doi:10.1007/978-0-387-09506-6
- Dhani, M. I., & Rahayu, W. (2023). Literatur Review : Contextual Teaching and Learning (CTL) dalam pembelajaran Matematika. *Jurnal Ilmiah IKIP Mataram*, 10(2), 118-135.
- Firdaus, M. F., & Aini, I. N. (2019). Analisis Kemampuan Komunikasi Matematis Siswa SMP pada Materi Segitiga dan Segiempat. *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika Sesiomadika*, 529-537.
- Giyarti. (2020). *Matematika untuk SMA / MA / SMK / MAK Kelas X*. Jakarta: Graha Pusta.

- Hanipah, H., & Sumartini, T. S. (2021). Perbandingan Kemampuan Komunikasi Matematis Siswa Antara Problem Based Learning Dan Direct Instruction. *PLUSMINUS : Jurnal Pendidikan Matematika*, 1(1), 83-96.
- Hasi, A., Ermiana, I., & Fauzi, A. (2024). Pengaruh Model Pembelajaran Contextual Teaching and Learning (CTL) Berbantuan Video Animasi Terhadap Pemahaman Konsep Matematika Peserta Didik. *Journal of Classroom Action Research*, 6(2), 433-441. doi:10.29303/jcar.v6i2.7823
- Hodiyanto. (2017). Kemampuan Komunikasi Matematis Dalam Pembelajaran Matematika. *AdMathEdu : Jurnal Ilmiah Pendidikan Matematika, Ilmu Matematika dan Matematika Terapan*, 9-18. doi:https://doi.org/10.12928/admathedu.v7i1.7397
- Hosnan, M. (2016). *Pendekatan Saintifik dan CTL pada Pembelajaran Abad 21*. Bogor: Ghalia Indonesia.
- Jannah, F. N., Nuroso, H., Mudzanatun, & Isnuryantono, E. (2023). Penggunaan Aplikasi Canva dalam media pembelajaran Matematika di Sekolah Dasar. *Jurnal Pendidikan Dasar*, 11(1), 138-146. doi:https://doi.org/10.20961/jpd.v11i1.72716
- La'ia, H. T., & Harefa, D. (2021). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematik Siswa. *Aksara : Jurnal Ilmu Pendidikan Nonformal*, 7(2), 463-473. doi:https://dx.doi.org/10.37905/aksara.7.2.463-474.2021
- Lestari, W. P., Ningsih, E. F., C, C., Sugianto, R., & Lestari, A. S. (2023). Efektivitas Model Pembelajaran Kooperatif dengan pendekatan Contextual Teaching and Learning (CTL) terhadap Hasil Belajar Matematika. *Jurnal Penelitian Tindakan Kelas*, 28-33. doi:http://doi.org/10.61650/jptk.v1i1.155
- Nasri, R., & Jamaan, E. Z. (2022). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Problem Based Learning (PBL) untuk Meningkatkan Kemampuan Komunikasi Matematis Peserta Didik SMP. *JEMS (Jurnal Edukasi Matematika dan Sains)*, 10(1), 140-148. doi:10.25273/jems.v10i1.12051
- Noormandiri, B. K. (2022). *Matematika Untuk SMA / MA Kelas X*. Jakarta: Erlangga.
- Nuraeni, R., & Luritawaty, I. P. (2016). Mengembangkan Kemampuan Komunikasi Matematik Siswa melalui Strategi Think Talk Write. *Mosharafa : Jurnal Pendidikan Matematika*, 5(2), 101-112.
- Rapsanjani, D. M., & Sritresna, T. (2021). Kemampuan Komunikasi Matematis Ditinjau dari Self-Efficacy Siswa. *PLUS MINUS Jurnas Pendidikan Matematika*, 1(3), 481-492.
- Risma, Farida, & Andriani, S. (2021). Android Mobile Learning : MIT App Inventor dan Pengembangannya pada Pembelajaran Matematika. *AlphaMath : Journal of Mathematics Education*, 7(1), 64-72. doi:10.30595/aphamath.v7i1.8800
- Suhenda, L. L., & Munandar, D. R. (2023). Kemampuan Komunikasi Matematis Siswa Dalam Pembelajaran Matematika. *Jurnal EDUCATIO*, 9(2), 1100-1107. doi:https://doi.org/10.31949/educatio.v9i2.5049
- Utami, P. Y., & Amidi. (2022). Kajian Teori : Pengembangan Bahan Ajar Matematika Bernuansa STEAM Berbasis Outdoor Learning dengan model PBL untuk meningkatkan koneksi Matematis Siswa. *PRISMA, PROSIDING SEMINAR NASIONAL MATEMATIKA*, 551-558.

Wahab, A., Junaedi, & Efendi, D. (2021). *Media Pembelajaran Matematika*. Pidie: Yayasan Penerbit Muhammad Zaini.