JURNAL ABSIS
Jurnal Pendidikan Matematika dan Matematika
Vol. 7 No. 2, December 2024

DEVELOPMENT OF CONTEXTUAL MATHEMATICS TEACHING MATERIALS TO FACILITATE STUDENTS' PROBLEM-SOLVING SKILLS ON SYSTEMS OF LINEAR EQUATIONS

Yovita Dwi Ananda[1], Maimunah[2], Titi Solfitri[3]
[1,2,3] Universitas Riau, Indonesia
yovita.dwi1273@student.unri.ac.id

ABSTRACT The underlying issue in this research is the suboptimal level of students' mathematical problem-solving abilities. This study aims to develop contextual mathematics teaching materials on the topic of systems of linear equations in two variables to enhance students' problem-solving skills, meeting criteria for validity and practicality. The research employs the ADDIE model, encompassing the phases of analysis, design, development, implementation, and evaluation. The participants in this study consisted of 31 students from SMPN 8 Pekanbaru, including 6 students from class VIII.9 for the small group trial and 25 students from class VIII.2 for the large group trial. Data collection instruments included validation sheets and student response questionnaires. The findings indicated that the material expert validation score was 87.2% and the media expert validation score was 88.7%, both categorized as very valid. Furthermore, the practicality scores were 93% for the small group trial and 85.3% for the large group trial, both classified as very practical. Thus, it can be concluded that the developed teaching materials are both valid and practical for facilitating students' problem-solving abilities.

Keywords: contextual mathematics, problem-solving ability, teaching materials, linear equations

ABSTRAK Masalah utama dalam penelitian ini adalah kemampuan pemecahan masalah matematis siswa yang masih belum optimal. Penelitian ini bertujuan untuk mengembangkan bahan ajar matematika berbasis kontekstual pada topik sistem persamaan linear dua variabel untuk meningkatkan kemampuan pemecahan masalah siswa, dengan memenuhi kriteria validitas dan kepraktisan. Penelitian ini menggunakan model ADDIE, yang meliputi tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Partisipan dalam penelitian ini terdiri atas 31 siswa SMPN 8 Pekanbaru, termasuk 6 siswa dari kelas VIII.9 untuk uji coba kelompok kecil dan 25 siswa dari kelas VIII.2 untuk uji coba kelompok besar.

https://doi.org/10.30606/absis.v7i2.2656

Instrumen pengumpulan data meliputi lembar validasi dan kuesioner tanggapan siswa. Hasil penelitian menunjukkan bahwa skor validasi ahli materi adalah 87,2% dan skor validasi ahli media adalah 88,7%, keduanya dikategorikan sangat valid. Selain itu, skor kepraktisan adalah 93% untuk uji coba kelompok kecil dan 85,3% untuk uji coba kelompok besar, keduanya dikategorikan sangat praktis. Dengan demikian, dapat disimpulkan bahwa bahan ajar yang dikembangkan valid dan praktis untuk memfasilitasi kemampuan pemecahan masalah siswa.

Keywords: matematika kontekstual, kemampuan pemecahan masalah, bahan ajar, persamaan linear

INTRODUCTION

Mathematics is a fundamental subject that plays a pivotal role in education. According to the Decree of the Head of the Agency for Education Standards, Curriculum, and Assessment (BSKAP) regarding Educational Units Implementing the Independent Curriculum, the objectives of mathematics learning in the independent curriculum include addressing problems through model-based solutions and interpreting the results obtained, emphasizing mathematical problem-solving. Branca (in Hendriana & Soemarmo, 2017) highlights that problem-solving in mathematics is not only a critical objective in mathematics education but also represents the essence of mathematical learning itself.

Mathematical problem-solving involves engaging with concepts, skills, and processes to find solutions to mathematical challenges (Roebyanto & Sri, 2017). The ability to solve mathematical problems is indispensable in mathematics education and is a skill every student must develop to effectively tackle various challenges (Mukasyaf et al., 2019). In essence, problem-solving is integral to human life, as individuals are continuously faced with issues that require critical and logical solutions, whether consciously or unconsciously, in their daily activities (Azzahra & Pujiastuti, 2020).

Given its importance, mathematical problem-solving ability must be prioritized in mathematics education. This skill equips students with the capacity to address real-world problems, fostering critical and analytical thinking. As Derniati et al. (2020) assert, mathematical problem-solving ability is a vital component of mathematics learning, and its cultivation should be a central focus. Therefore, instilling this ability in students is essential to prepare them for problem-solving scenarios in everyday life.

The results of the Trends in Mathematics and Science Study (TIMSS) reveal that Indonesian students' mathematical problem-solving skills remain significantly low. In 2018, Indonesia ranked 73rd out of 79 participating countries, with an average score of 397. The TIMSS problems emphasize the importance of students being capable of solving complex mathematical problems. According to Yunengsih (in Hapsari, 2016), the cognitive domain in TIMSS questions places a substantial focus on problem-solving skills. Similarly, research by Anggraeni (2014) highlights the suboptimal

mathematical problem-solving skills of students, as evidenced by test scores ranging from a highest of 43 to a lowest of 13. These findings underscore the urgent need for targeted interventions to improve students' mathematical problem-solving skills. Mathematics learning is not merely about understanding concepts and theories; students must also be able to apply this knowledge to solve real-world problems. Mawaddah and Anisah (2015) emphasize that problem-solving methods developed by students stem from their knowledge and experiences related to the problems at hand. Consequently, teachers must integrate problem-solving skills into classroom learning by connecting them to students' everyday lives.

The need for contextual learning arises from students' inability to relate what they learn in school to their daily experiences. This disconnect contributes to the low levels of students' mathematical problem-solving skills and highlights the necessity of implementing contextual learning. Effective learning occurs when students can develop their thinking skills and connect their knowledge with real-life situations (Kurniati, 2016). Contextual learning, which uses everyday contexts in the learning process, enables students to construct their understanding through active experience rather than passive memorization (Gita, 2019). This approach helps students build knowledge through observation and experience, fostering active participation in problem-solving during the learning process (Suhandri & Sari, 2019).

In the independent curriculum, learning is designed to provide varied opportunities that allow students sufficient time to explore and understand competencies (Kemdikbud, 2022). Teachers have the freedom to independently select teaching materials that cater to the interests and learning needs of their students (Barlian et al., 2022). These teaching materials, often developed as learning resources, play a critical role in the teaching and learning process (Priantini et al., 2022). Zuriah et al. (2016) stress the importance of teachers creating innovative and creative teaching materials that align with the curriculum, meet students' evolving needs, and incorporate advancements in information technology. Context-based teaching materials, in particular, are effective in creating a meaningful learning environment that connects the content to students' everyday experiences (Purwanto & Rizki, 2015).

Observations at SMP Babussalam Pekanbaru reveal that while some students pay attention during lessons, many lack enthusiasm for the teacher's explanations. Additionally, the practice questions provided rarely include contextual problems, making it challenging for students to apply mathematical concepts to real-life situations. Interviews with students further reveal difficulties in solving linear equations with two variables due to a lack of contextual examples during lessons. Students often find the explanations in textbooks unclear and difficult to understand, leading to boredom and disengagement.

The topic of linear equations with two variables is fundamental knowledge for eighth-grade students and serves as a prerequisite for more advanced topics, such

https://doi.org/10.30606/absis.v7i2.2656

as linear programming and equations involving three variables. Without a solid understanding of this topic, students may face significant challenges in mastering subsequent materials. Therefore, there is a critical need for contextual teaching materials that can effectively facilitate students' understanding of this topic.

This research builds upon previous studies (Kurniati, 2016; Yuherni et al., 2020; Rahmah, 2022) by focusing on the development of contextual teaching materials specifically for the topic of linear equations with two variables. These materials are designed to facilitate students' mathematical problem-solving skills, meet the criteria of validity and practicality, and align with the demands of the independent mathematics curriculum.

METHODS

The development of teaching materials in this research followed the systematic stages of the ADDIE model, which consists of five phases: analysis, design, development, implementation, and evaluation. This model was chosen because of its structured and straightforward approach (Rusdi, 2018). During the analysis phase, the focus was on understanding the students, identifying their learning needs, and reviewing the curriculum to establish the foundation for developing teaching materials. The design phase involved drafting the teaching materials, gathering relevant references for systems of linear equations in two variables, and creating validation and practicality assessment instruments. In the development phase, the teaching materials were created based on the findings from the previous phases and then validated by subject matter and media experts to ensure their quality and relevance.

The implementation phase involved applying the developed teaching materials in a classroom setting, allowing researchers to observe their practicality and effectiveness. Finally, in the evaluation phase, revisions were made to the teaching materials based on the feedback and suggestions gathered from validators and students during implementation. The research subjects comprised 31 students from SMPN 8 Pekanbaru, with six students from class VIII.9 participating in a small group trial and 25 students from class VIII.2 participating in a large group trial.

The data collected included qualitative data, such as feedback and suggestions from validators and students, and quantitative data, including scores from validation sheets completed by experts and responses from student questionnaires. The analysis employed validity and practicality criteria adapted from previous studies. Teaching materials were considered valid if the minimum validity score reached 61% and practical if the practicality score was 61% or higher (Ernawati & Sukardiyono, 2017; Hidayat & Irawan, 2017). This systematic approach ensured that the developed teaching materials met the required standards for validity and practicality, supporting their effectiveness in enhancing students' problem-solving skills.

FINDING AND DISCUSSION

This research produced teaching materials for mathematics on the topic of systems of linear equations in two variables. This research uses the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation) with the stages explained as follows.

In the analysis of the students, the activity conducted was an observation at SMP 8 Negeri Pekanbaru. The information obtained indicates that some students are less active during the learning process, resulting in a lack of interaction or reciprocal relationships in learning. Instead, the students merely receive the material presented by the teacher. The students' ability to solve problems is still low, one of the reasons being that the teaching materials used have not been able to facilitate students' problem-solving skills. Additionally, teachers still often use lecture methods, where students listen, take notes, and complete tasks as instructed, which makes students bored and perceive mathematics as an unpleasant subject. Researchers concluded that it is necessary to develop teaching materials that can address students' issues and somewhat diminish the perception that mathematics is difficult, as well as minimize the teacher's role in the learning process, so that students are expected to be more active in their learning.

Based on the needs analysis in the school, it is known that in the mathematics learning process, students are not supported by learning resources that can help them study independently in reviewing the material they have received. In the learning process, there is still a lack of interest among students in understanding the material due to the fact that the learning resources used by teachers are only the mathematics textbooks provided by the school. In addition, students are also confused when trying to relate math problems to everyday life. Therefore, context-based teaching materials are expected to facilitate mathematical problem-solving skills as students are guided to engage in activities to understand the problems, plan their solutions, then solve the issues and check each step of the solution they have undertaken.

The curriculum analysis is conducted by examining the learning outcomes in the algebra elements and the topic of linear equations with two variables, resulting in learning objectives that align with the demands of the independent curriculum. From the learning objectives, a learning objective flow is formed. The learning objective flow consists of several learning objectives. Here are the learning objectives obtained after reviewing the learning outcomes.

The learning objectives of this research are as follows:

1. Students will be able to identify systems of linear equations with two variables, formulate mathematical models for contextual problems related to these systems, and solve contextual problems using the graphical method.

https://doi.org/10.30606/absis.v7i2.2656

2. Students will be able to solve contextual problems related to systems of linear equations with two variables using the substitution method.
3. Students will be able to solve contextual problems related to systems of linear equations with two variables using the elimination method.
4. Students will be able to solve contextual problems related to systems of linear equations with two variables using the combined method.

The activities undertaken during the design stage began with the collection of reference materials for systems of linear equations in two variables. These materials were sourced from various relevant printed and online mathematics books. The next step was the preparation of research instruments, which included validation sheets and student response questionnaires. The validation sheet for the teaching materials was designed based on several aspects, including content feasibility, presentation feasibility, language feasibility, contextual relevance, and graphical quality. Meanwhile, the practicality instrument for students was prepared using a practicality grid that encompassed aspects such as the attractiveness of the teaching materials, content relevance, and language clarity. Finally, the teaching material format was prepared, covering the cover page and the content sections.

In the development stage, the teaching materials were created in alignment with the analysis and design phases. These materials were developed using Microsoft Office Word and Adobe Photoshop. The components of the teaching materials included a cover page, preface, table of contents, instructions for using the materials, a concept map, learning activities, evaluation of learning activities, answer key, self-assessment for students, summary, bibliography, glossary, and author profile. This process resulted in a draft of the teaching materials, which was subsequently validated before being implemented with students.

The validation conducted consists of two types: validation by subject matter experts and media experts. The results of the subject matter expert validation of the developed teaching materials can be described as follows.

Table 2. Results of Expert Validation on the Material

No	Aspect	Average from 3 validators (%)	Category
1.	Content Feasibility	85,4	Very Valid
2.	Presentation Feasibility	90,1	Very Valid
3.	Linguistic Feasibility	84,3	Very Valid
4.	Assessment for Contextual-Based Teaching Materials	88,9	Very Valid
Average		87,2	Very Valid

From Table 2, it is known that the expert validation results show an overall average of 87.2%, meaning that the context-based mathematics teaching materials produced are considered very valid and can proceed to the practicality testing stage.

This aligns with Arikunto (in Ernawati & Sukardiyono, 2017), who states that a product is considered valid if its validation score is at least 61%. The conclusions and comments or suggestions from the subject matter experts regarding the contextual-based mathematics teaching materials on the topic of systems of linear equations in two variables emphasize that the materials should be used with revisions. Specifically, the validators suggested clarifying the numbers in the Cartesian diagram and correcting any spelling mistakes.

The results of the media expert validation provide insights into the quality of the design, layout, and overall presentation of the developed teaching materials, which are summarized as follows in Table 3.

Table 3. Results of Media Expert Validation

No	Aspect	Average from 3 validators (%)	Category
1.	Size of Teaching Materials	100	Very Valid
2.	Cover Design of Teaching Materials	83,3	Very Valid
3.	Content Design of Teaching Materials	82,8	Very Valid
Average		88,7	Very Valid

From Table 3, it is known that the results of the media expert validation show an overall average percentage of 88.7%. According to Arikunto (in Ernawati & Sukardiyono, 2017) this value falls into the "very valid" category, making it suitable to proceed to the trial stage. From the assessments of the three validators regarding the contextual-based mathematics teaching materials developed, an average validity percentage of the product was obtained, which is 87.9%, categorized as very valid. The validator also provides feedback and suggestions as a way to improve the teaching materials before they are tested on the students.

The comments and suggestions from media experts regarding the contextual-based mathematics teaching materials on the topic of systems of linear equations in two variables are outlined as follows:

1. Sentence Formatting
   Media experts suggested avoiding mirrored sentence structures as it may confuse students and reduce clarity. The recommendation is to use straightforward and direct sentence construction.
2. Avoiding Abbreviations
   It was advised to avoid abbreviating sentences in the teaching materials to maintain clarity and ensure students can fully understand the content without ambiguity.
3. Clarifying Problem-Solving Steps
   For solving problems using the graphical method, the steps to determine the values of variables x and y should be elaborated further to guide students better.

https://doi.org/10.30606/absis.v7i2.2656

Additionally, the Cartesian diagram should be enhanced to improve clarity and visual appeal, ensuring students can easily comprehend and apply the concepts.

These revisions aim to enhance the usability and effectiveness of the teaching materials for facilitating students' mathematical problem-solving skills.

The activities carried out in the implementation stage include testing the validated teaching materials, which involves small and large group trials. The trial is conducted with the aim of obtaining practical data. The small group trial was aimed at 6 students from class VIII.9 of SMP Negeri 8 Pekanbaru, who were randomly selected with heterogeneous academic abilities. The research subjects consist of two high-ability students, two medium-ability students, and two low-ability students. In this small trial, the students used teaching materials, and the final test for the small group of students was given in the form of a questionnaire. It can be seen in Table 4 below the results of the small group trial assessment.

Table 4. Percentage of Questionnaire Responses from Students

No	Assessment Criteria	Average (%)	Category
1.	The appeal of teaching materials	94	Very practical
2.	Material	91	Very practical
3.	Language	94	Very practical
Average		93	Very practical

Based on the results of the questionnaire from the small group trial participants, the average percentage score is 93%. According to Hidayat & Irawan (2017), this score is categorized as "very practical" since its practicality value is above 61%. This means that the developed teaching materials are engaging for the students, the content is clear, and the language is easy to understand. Thus, the teaching materials can be further tested in the next stage. After the small group trial, the teaching materials will be tested again on a larger group with the aim of determining the feasibility and practicality of the teaching materials. The subject of the large group trial consists of 25 students from class VIII.2 of SMP Negeri 8 Pekanbaru, using a questionnaire to determine the students' responses to the teaching materials. It can be seen in Table 5 below the results of the large group trial assessment.

Table 5. Results of the Large Group Trial

No	Assessment Criteria	Average (%)	Category
1.	The appeal of teaching materials	86	Very practical
2.	Material	86	Very practical
3.	Language	85	Very practical
Average		93	85,3

The results of the large group trial, as presented in Table 4, indicated that the average percentage of student responses to the teaching materials was 85.3%, which falls under the "very practical" category. This finding is consistent with Hidayat & Irawan (2017), who assert that teaching materials are deemed very practical if their quality ranges between 81% and 100%. Consequently, the developed teaching materials have been validated as practical and suitable for use as a learning resource, particularly for eighth-grade students studying systems of linear equations in two variables. During the evaluation stage, reviews and revisions were conducted based on the suggestions and feedback collected throughout the research process to ensure the continuous improvement and refinement of the teaching materials.

CONCLUSIONS AND RECOMMENDATIONS

The findings of this research conclude that the final product is a contextual-based teaching material on the topic of linear equations with two variables that effectively facilitates students' mathematical problem-solving skills in phase D. The validation results from subject matter experts and media experts confirm that the developed teaching materials meet the criteria for validity. Furthermore, the practicality questionnaire results indicate that the teaching materials are practical, with engaging content and clear language that supports ease of use in teaching and learning activities. It is suggested that future researchers explore the development of teaching materials for different educational levels and mathematical topics using contextual or alternative models. Researchers are also encouraged to extend their studies to include larger group trials to assess the effectiveness and broader applicability of the developed products.

REFERENCES

Anggraeni, F. N. D. (2014). Penggunaan bahan ajar berbasis pendekatan kontekstual untuk meningkatkan kemampuan pemecahan masalah matematik peserta didik pada materi aljabar. *Skripsi.* Universitas Islam Negeri Syarif Hidayatullah Jakarta.

Azzahra, R. H., & Pujiastuti, H. (2020). Analisis kemampuan pemecahan masalah siswa pada materi sistem persamaan linear tiga variabel. *Transformasi: Jurnal Pendidikan Matematika dan Matematika, 4*(1), 153–162. https://doi.org/10.36526/tr.v4i1.876

Barlian, U. C., Solekah, S., & Rahayu, P. (2022). Implementasi kurikulum merdeka dalam meningkatkan mutu pendidikan. *Journal of Educational and Language Research, 1*(12).

Derniati, R., Roza, Y., & Maimunah. (2020). Analisis kemampuan pemecahan masalah matematis siswa MTsN 3 Kuantan Singingi. *Eksakta: Jurnal Penelitian dan Pembelajaran MIPA, 5*(1), 1–12.

https://doi.org/10.30606/absis.v7i2.2656

Ernawati, I., & Sukardiyono, T. (2017). Uji kelayakan media pembelajaran interaktif pada mata pelajaran administrasi server. *Elinvo (Electronics, Informatics, and Vocational Education), 2*(2), 204–210.

Gita, I. N. (2019). Implementasi pendekatan kontekstual untuk meningkatkan prestasi belajar matematika siswa di sekolah dasar. *Jurnal Penelitian dan Pengembangan Pendidikan, 1*(1), 28.

Hapsari, O. (2016). Pengembangan soal serupa TIMSS untuk mengukur kemampuan berpikir kritis dan pemecahan masalah pada konten aljabar kelas VIII. Universitas Muhammadiyah Surakarta.

Hendriana, H., & Soemarmo, U. (2017). *Penilaian pembelajaran matematika.* Refika Aditama.

Hidayat, A., & Irawan, I. (2017). Pengembangan LKS berbasis RME dengan pendekatan problem solving untuk memfasilitasi kemampuan pemecahan masalah matematis siswa. *Journal Cendekia: Jurnal Pendidikan Matematika, 1*(2), 51–63.

Kemdikbud. (2022). *Buku saku kurikulum merdeka: Tanya jawab.* Kementerian Pendidikan dan Kebudayaan.

Kurniati, A. (2016). Pengembangan modul matematika berbasis kontekstual terintegrasi ilmu keislaman. *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam, 4*(1), 43–58.

Mawaddah, S., & Anisah, H. (2015). Kemampuan pemecahan masalah matematis siswa pada pembelajaran matematika dengan menggunakan model pembelajaran generatif (Generative Learning) di SMP. *Edu-Mat: Jurnal Pendidikan Matematika, 3*(2), 166–175.

Mukasyaf, F., Fauzi, K. M. A., & Mukhtar. (2019). Building learning trajectory mathematical problem-solving ability in circle tangent topic by applying metacognition approach. *International Education Studies, 12*(2), 109–116. https://doi.org/10.5539/ies.v12n2p109

Priantini, D. A. M. M. O., Suarni, N. K., & Adnyana, I. K. S. (2022). Analisis kurikulum merdeka dan platform merdeka belajar untuk mewujudkan pendidikan yang berkualitas. *Jurnal Penjaminan Mutu, 8*(2), 238–244. http://ojs.uhnsugriwa.ac.id/index.php/JPM

Purwanto, Y., & Rizki, S. (2015). Pengembangan bahan ajar berbasis kontekstual pada materi himpunan berbantu video pembelajaran. *Aksioma, 4*(1), 67–77.

Rahmah, F. (2022). Pengembangan bahan ajar materi SPLDV berorientasi kemampuan representasi matematis siswa. UIN Syarif Hidayatullah.

Roebyanto, G., & Sri, H. (2017). *Pemecahan masalah matematika untuk PGSD.* PT Remaja Rosdakarya.

Suhandri, & Sari, A. (2019). Pengembangan modul berbasis kontekstual terintegrasi nilai keislaman untuk meningkatkan kemampuan pemecahan masalah matematis siswa. *Suska Journal of Mathematics Education, 5*(2), 131–140. https://doi.org/10.24014/sjme.v5i2.8255

Yuherni, Maimunah, & Yuanita, P. (2020). Bahan ajar matematika berbasis kontekstual pada materi fungsi untuk meningkatkan kemampuan pemecahan masalah matematis. *Aksioma: Jurnal Program Studi Pendidikan Matematika, 9*(4), 1293–1306. https://doi.org/10.24127/ajpm.v9i4.2976

Zuriah, N., Sunaryo, H., & Yusuf, N. (2016). Guru dalam pengembangan bahan ajar kreatif inovatif berbasis potensi lokal. *Jurnal Dedikasi, 13*, 39–49.

https://doi.org/10.30606/absis.v7i2.2656