EMTEKA: Jurnal Pendidikan Matematika
Volume 6, No. 2, 2025. 877-885
DOI: https://doi.org/10.24127/emteka.v6i1.10127

e-ISSN 2746-5594
p-ISSN 2746-5608

MOLMA (Mobile Learning Mathematics) as a Digital Learning Media

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Received 17 June 2025; Received in revised form 26 August 2025; Accepted 30 September 2025

ABSTRACT
This research aims to produce a feasible and practical MOLMA product when used on the subject of systems of linear equations in two variables. The method used in this study is Research and Development (R&D) using the ADDIE model. The instrument used in this study is a questionnaire. The participants in this study are from SMK Avicena, totaling 25. The data analysis technique in this study employs both quantitative and qualitative data. Based on the results of expert validation on the material, an average score of 86% was obtained, categorized as feasible, and the results of expert validation on the media yielded an average score of 85%, categorized as very feasible. The results from the practicality test by users obtained an average score of 80% with the category of very practical and interesting when used. The recommendation from this research is for teachers in particular and the community in general as an alternative in mathematics learning in the current era of educational technology digitalization.
Keywords: digital learning; mathematics; molma

ABSTRAK
Penelitian ini bertujuan untuk menghasilkan produk MOLMA yang layak dan praktis ketika digunakan pada materi sistem persamaan linier dua variabel. Metode yang digunakan dalam penelitian ini adalah Research and Development (R&D) dengan menggunakan model ADDIE. Instrumen yang digunakan dalam penelitian ini berupa angket. Partisipan dalam penelitian ini berasal dari SMK Avicena berjumlah 25 Teknik analisis data pada penelitian ini menggunakan data kuantitatif dan data kualitatif. Berdasarkan hasil validasi ahli materi diperoleh nilai rata-rata 86% dengan kategori layak dan hasil validasi ahli media diperoleh nilai rata-rata 85% dengan kategori sangat layak. Hasil pada uji coba kepraktisan pleh pengguna diperoleh nilai rata-rata 80% dengan kategori sangat praktis dan menarik ketika digunakan. Rekomendasi dari hasil penelitian ini untuk para guru secara khusus dan masyarakat pada umumnya sebagai salah satu alternatif dalam pembelajaran matematika di era digitalisasi teknologi pendidikan saat ini.
Kata kunci*: molma; pembelajaran digital*

Introduction

The results of the 2022 PISA survey indicate that Indonesia ranks in the bottom 12 in mathematics. This shows that Indonesian students who are 15 years old have not been able to apply their basic abilities correctly and cannot extract relevant information from a single source of literature (Pratiwi, 2019), with

e-ISSN 2746-5594
p-ISSN 2746-5608

cognitive domain application and reasoning still below 25% (Hadi & Novaliyosi, 2019). In addition, the daily learning outcomes in class are still not good (Bulut et al., 2022; Jensen & Skott, 2022; A. W. Kurniasih et al., 2022; Tabieh & Hamzeh, 2022) and also the students' independence is still lacking in working on the problems given by the teacher and only relies on smart friends (Afriyola et al., 2020; Asmar & Delyana, 2020; Febriyanti & Imami, 2021). These facts are very much in contrast with the independent curriculum that requires students to develop learning independence. This is because there are still mathematics lessons that do not encourage students to enhance their learning independence skills (Ishartono et al., 2022). Learning is still focused on basic, theoretical aspects, and is not yet applicable. According to Sumarmo, the emphasis on mathematics learning must meet current and future needs (Istianah, 2013).

The education world today is required to develop learning multimedia. This is in line with the development of the psychology of learners, social dynamics, and the dynamics of the education system in every country that continues to change. Current educational needs cannot be separated from the internet to support learning activities without being hindered by distance and time. One of the tools supporting the implementation of learning activities is learning media. In the learning process, media plays an important role in conveying lesson materials to students (Pradana et al., 2020). The existence of media in the teaching and learning process is expected to help teachers and students in a more visual, interactive, interesting, easy, and quickly understandable learning (Febriyandani & Kowiyah, 2021). The use of engaging learning media will enhance students' independence to learn, which will ultimately help them succeed in understanding the material provided (Harjanto et al., 2023). Seeing this potential, the development of learning media by utilizing mobile phones involves creating mobile learning aimed at all Android-based mobile phones. The emergence of smartphones and Androids aims to provide convenience in accessing all information needed by users that can be accessed anywhere and anytime. However, with the sophistication of both, people only use smartphones and Androids to access social media (Firdaus & Hamdu, 2020; Gao et al., 2020). This is reinforced by research results from the Indonesian Internet Service Providers Association, which found that internet users in Indonesia are still not seriously leveraging the power of technology for productive activities (Ambiyar & Arif, 2018).

One of the learning media that can be optimized for use in mathematics education today is mobile learning. Mobile learning can be accessed and used anywhere and anytime. The increasing number of students who have and use mobile devices also increases the opportunities for the use of technology in the field of education (Astuti et al., 2017; Atika et al., 2022). The presence of mobile learning aims to complement learning and provides students with the opportunity to study the material they have less mastery of wherever and whenever (Afthori et al., 2022; H Helly et al., 2022). Mobile learning matematika (MOLMA) is a learning strategy that involves the use of handheld and mobile technology (Saiful Rizal, 2023; Utomo, 2023). MOLMA is a learning approach using mobile learning where the learning materials are in the form of moving visualizations specifically designed to teach certain skills to students, thus motivating the learning process for students to think and solve problems.

e-ISSN 2746-5594
p-ISSN 2746-5608

Some studies show that the use of mobile learning in the classroom can enhance learning activities, motivation, and student learning outcomes (Adlit et al., 2023; Alda, 2023; Aripin, 2018; Nurhayati et al., 2022; Veronica et al., 2020). The independence of students in learning mathematics is influenced by the use of Android-based mobile learning, so Android-based mobile learning can be used as an alternative medium for mathematics learning. (Fabian et al., 2018; S. Kurniasih et al., 2020; Poçan et al., 2023); Mobile learning can help students understand mathematical material (Agus et al., 2019; Johnson et al., 2022; Rachma et al., 2020); Mobile learning in mathematics using virtual reality is effective in enhancing students' spatial abilities (Sugiarto et al., 2023).

However, there has not been specific research related to mobile learning as a teaching material for mathematics that facilitates an increase in student learning independence. In this study, a similar application was also developed, but more specifically related to mobile learning in mathematics teaching materials that facilitate student learning independence. The difference between this study and previous research is that the developed application not only aims to increase learning independence but also to enhance students' digital literacy. In addition, the designed MOLMA not only places materials and exercises, but also includes learning videos to confirm students' understanding, as well as questions for reinforcement and evaluation games. Therefore, it is necessary to develop tested and feasible Android-based learning materials in the form of MOLMA.

Research Methode

The type of research used is development research or Research and Development (R&D). The model used by the researcher is the ADDIE model (Analysis-Design-Develop-Implement-Evaluate). The use of the ADDIE model in this study is limited to only the Implementation and evaluation stages. (Jurado Soto & Martos Eliche, 2022; Musa et al., 2024; Saeidnia et al., 2022) due to the products that have been validated by experts. The quantitative data analysis in this study is used to analyze the data obtained from the validity questionnaire and the practicality questionnaire of the produced product.

Results and Discussions

This research and development uses the ADDIE model with five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The first stage is analysis, where the main activities include conducting preliminary studies, encompassing field surveys and literature studies on the importance of developing mobile learning teaching materials for mathematics based on game-based learning (Molma) along with the indicators that will be used. The literature study includes examining the mathematics curriculum at the senior high school level, ICT-based learning methods, and gamification in mathematics learning. The activities in the field survey involve collecting data related to planning and observing the implementation of mathematics learning in senior high schools, needs analysis, identifying problems encountered in learning, and summarizing issues regarding mathematical creative thinking skills and students' independent learning. The results of this activity are the mapping of variables used in the research, the formulation of indicators for those variables, and the measurement instruments

e-ISSN 2746-5594
p-ISSN 2746-5608

along with evaluation rubrics for the variables used, such as validation sheets, observation sheets, test instruments, and questionnaires.

Design and Development of Activities carried out in this stage include: 1) reviewing core competencies and basic competencies to determine learning materials based on facts, concepts, principles, and procedures, learning time allocation, indicators, and student assessment instruments; 2) designing learning scenarios or teaching activities created in the form of mobile learning mathematics based on game-based learning (Molma Bergambar) levels (1 to 4) and video games on relevant materials; 3) designing routine and non-routine questions on selected material, adjusted to the indicators used along with the answers; 4) creating a layout or design for the mobile learning teaching materials on games and video games that will be developed; 6) arranging and developing mobile learning teaching materials for mathematics based on game-based learning that conforms to the predetermined layout using game applications; and 7) validating the content of the product of mobile learning mathematics teaching materials for high school based on game-based learning to the expert team (Mathematics Education and ICT). The result of this activity is the creation of a product that has been validated by experts and is suitable for use in the next stages.

After the design is completed in the second phase, the development continues at this stage with the creation of the learning media product. After the product creation is completed, the product will be validated by media and material experts. The expert results can be seen in Table 1.

Table 1. Product validation results by experts

Validator	Percentage	category
Material expert	86%	very valid
Media expert	84%	very valid
Average	**85%**	**very valid**

Based on the assessment results above, the material expert rated 86% with the Very Valid category and the media expert rated 84% with the Very Valid category. Based on the percentage obtained from this analysis, it can be concluded that the developed product falls into the very good category and is suitable for use in mathematics learning.

MOLMA consists of two modules (main material). Each module consists of 2 levels of evaluation games (missions), starting from low, medium, and high levels. At level 1, players are invited to answer questions according to the main material of the module that has been adjusted to the learning independence indicators with a low difficulty level. At level 2, players are invited to watch animated videos discussing materials relevant to the module as well as measuring the players' understanding of the video content. The main development of this prototype is to add materials, learning videos, evaluation games, and confirmation features at level 2, which is to provide several questions as a confirmation of students' understanding after watching the video. This is due to the fact that in the previous feature, the materials provided were limited, practice was still lacking, there were no learning videos to strengthen students' understanding of trigonometry, and there was a lack of evaluation games and a place to upload the assigned tasks. To

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Volume 6, No. 2, 2025. 877-885
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e-ISSN 2746-5594
p-ISSN 2746-5608

measure the players' understanding of the provided video content, it is necessary to add a confirmation feature that contains questions related to the video content at level 2 of each module. The product design appearance can be seen in Figure 1.

Figure 1. The Display of the Product Design That Has Been Validated

After the produced product has been verified as feasible and valid for use, the next step is to carry out the Implementation and Evaluation phase of the practicality test by users. Participants in this practicality test were conducted at Avicena Vocational School in Tangerang Regency with a total of 25 participants. The practicality test questionnaire given to participants is adapted from research conducted by (Irawan & Hakim, 2021; Nurhikmah et al., 2023). The results of the practicality test by users can be seen in the table 2 below.

Table 2. Results of product practicality testing by users

assessment aspects	Percentage	Category
The language used	76%	practical
Material relevance	78%	very practical
The use of animation	82%	very practical
product display	84%	very practical
total score	**80%**	**very practical**

Based on the table above, it can be concluded that the results of the practicality test analysis by users show an average percentage of 80%. According to the students' responses, the developed product with the conversion of qualitative data regarding the aspect of attractiveness is rated as "very practical," indicating that the product can be used as a learning resource for students and can assist educators in presenting material in a more engaging way, thereby increasing students' enthusiasm for learning.

Conclusion and Suggestion

Based on evaluations from media experts and an average score of 85%, it means that the molma product produced is very valid (feasible). In terms of

e-ISSN 2746-5594
p-ISSN 2746-5608

practicality testing, based on assessment questionnaires from participants, a score of 80% was obtained, which means that the molma product produced is very practical and attractive when used. The molma product is expected to be a solution and alternative learning media in the current era of technology digitalization. The suggestions for this research and development still require follow-up to effectiveness in order to obtain a higher quality educational media product that can be used in learning. Hopefully, this research can be beneficial and serve as a reference or source for future research.

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