DEVELOPMENT OF ANDROID-BASED MATHEMATICS LEARNING MEDIA TO IMPROVE CRITICAL THINKING SKILLS OF HIGH SCHOOL STUDENTS IN WEST SULAWESI

PENGEMBANGAN MEDIA PEMBELAJARAN MATEMATIKA BERBASIS ANDROID UNTUK MENINGKATKAN KEMAMPUAN BERPIKIR KRITIS SISWA SEKOLAH MENENGAH DI SULAWESI BARAT

Rezki Novianti[1*], Ana Muliana M[2], Jeranah[3], Muhammad Nurhusain[4]

[1*] Muhammadiyah University of Mamuju, Email: novisyam85@gmail.com
[2] University of West Sulawesi, Email: mulianaana@unsulbar.ac.id
[3] STKIP YPUP, Email: jeranah@stkip.ypup.ac.id
[4] STKIP YPUP, Email: nurhusainmuhammad@stkip.ypup.ac.id

*email koresponden: novisyam85@gmail.com

Abstract

This study aims to develop an Android-based mathematics learning media using Smart Apps Creator (SAC) and determine its validity, practicality, and effectiveness in improving critical thinking skills of high school students in West Sulawesi. This research is a research and development (R&D) with a modified Borg and Gall model and is limited to the product revision stage after the trial. The resulting product is an Android-based Mathematics E-Module that contains interactive materials, learning videos, problem-solving-based practice questions, learning games, and evaluations. The data collection technique used expert validation questionnaires, teacher and student response questionnaires, and critical thinking ability tests. Data were analyzed using a Likert scale, validation tests, practicality tests, and effectiveness tests through a comparison of pretest and posttest results and N-Gain calculations. The results showed that the developed learning media was in the very feasible category based on the assessment of material experts and media experts with a feasibility percentage above 85%. The practicality test showed that teacher and student responses were in the practical to very practical category. The effectiveness test showed an increase in students' critical thinking abilities in the moderate to high category, and there was a significant difference between the pretest and posttest scores. Thus, Android-based mathematics learning media using Smart Apps Creator is effective for improving the critical thinking abilities of high school students in West Sulawesi.

Keywords : learning media, android, smart apps creator, critical thinking, high cchool mathematics.

Abstrak

Penelitian ini bertujuan untuk mengembangkan media pembelajaran matematika berbasis Android menggunakan Smart Apps Creator (SAC) serta mengetahui tingkat validitas, kepraktisan, dan keefektifannya dalam meningkatkan kemampuan berpikir kritis siswa SMA di Sulawesi Barat. Penelitian ini merupakan penelitian dan pengembangan (Research and Development) dengan model Borg and Gall yang dimodifikasi dan dibatasi hingga tahap revisi produk setelah uji coba. Produk yang dihasilkan berupa E-Modul Matematika berbasis Android yang memuat materi interaktif, video pembelajaran, latihan soal berbasis pemecahan masalah, game pembelajaran, dan evaluasi. Teknik pengumpulan data menggunakan angket validasi ahli, angket respon guru dan siswa, serta tes kemampuan berpikir kritis. Data dianalisis menggunakan skala Likert, uji validasi, uji kepraktisan, dan uji keefektifan melalui perbandingan hasil pretest dan posttest serta perhitungan N-Gain. Hasil penelitian menunjukkan bahwa media pembelajaran yang dikembangkan berada pada kategori sangat layak berdasarkan penilaian ahli materi dan ahli media dengan persentase kelayakan di atas 85%. Uji kepraktisan menunjukkan respon guru dan siswa berada pada kategori praktis hingga sangat praktis. Uji keefektifan menunjukkan adanya peningkatan kemampuan berpikir kritis siswa pada kategori sedang hingga tinggi, serta terdapat perbedaan yang signifikan antara nilai pretest dan posttest. Dengan demikian, media pembelajaran matematika berbasis Android menggunakan Smart Apps Creator efektif digunakan untuk meningkatkan kemampuan berpikir kritis siswa SMA di Sulawesi Barat.

Kata Kunci : media pembelajaran, Android, Smart Apps Creator, berpikir kritis, matematika SMA.

1. INTRODUCTION

Education in today's digital era demands innovation in the learning process to improve the quality of education. The digital era brings major changes in various aspects of life, including education. The use of technology and innovative learning methods is key to creating a more engaging, effective, and relevant learning experience for students. One of the most important skills in facing the challenges of the digital era is critical thinking skills, namely the ability to think critically, laterally, and systematically, especially in the context of problem solving. Human resources (HR) are required to improve their critical thinking skills to create new innovations. Among the challenges facing the world of education today is the fragility of the learning process. In the learning process, students are less encouraged to develop concepts, develop thinking skills, explore new knowledge, and pose and solve problems. Meanwhile, studies show that the critical thinking skills of high school students in Indonesia remain low. Based on data from the Programme for International Student Assessment (PISA) in 2012, Indonesia's literacy score ranked 64th out of 65 countries with a score of 382. PISA found that Indonesian students could only reach levels 1 and 2 of six levels of questions. Therefore, PISA concluded that Indonesian students' critical thinking skills are very low.

West Sulawesi, as one of the provinces in Indonesia, also faces similar challenges. Based on the results of a preliminary study, high school students in West Sulawesi still experience difficulties in understanding abstract and complex mathematical concepts, so their critical thinking skills have not developed optimally. This difficulty can be caused by various factors, such as a lack of interest in learning, ineffective learning methods, or a lack of understanding of basic concepts. Suboptimal critical thinking skills can hinder students in solving problems and applying mathematical concepts in everyday life. Students' underdeveloped critical

thinking skills can be identified through several indicators, such as difficulty in identifying problems, analyzing information, solving problems, and drawing logical conclusions. Students with poor critical thinking skills may also exhibit a passive attitude in learning, have difficulty understanding concepts, and tend to memorize rather than understand the material. To measure students' critical thinking skills, four indicators are used: problem identification, analysis, problem solving, and drawing conclusions.

The use of mobile technology, particularly Android, can be a solution to improve students' critical thinking skills. Android applications provide a variety of interactive learning resources, simulations, and analytical tools that support the development of critical thinking skills. Android has become an integral part of everyday life, including the learning process. Many learning applications are designed for various subjects, offering engaging and interactive content. These can include videos, animations, quizzes, and simulations that help students understand complex concepts and encourage deeper thinking. Android-based e-learning platforms allow students to access learning materials anytime and anywhere. They can also interact with teachers and other students through discussion forums, which can spark deeper discussions and broaden students' perspectives.

Independent learning encourages students to find solutions to the problems they face, thus developing their analytical, evaluation, and decision-making skills. Likewise, in the context of interactive learning, students become accustomed to analyzing information from various sources, identifying bias, and evaluating the credibility of information, which are essential skills in critical thinking. Android-based learning can make mathematics learning more interactive and engaging, thereby increasing student interest in learning. It can present mathematical concepts in clearer and more interactive visuals, thus helping students better understand the concepts. Furthermore, it can be a solution to overcome limited learning resources in schools, such as a lack of books or other learning facilities. Independently accessible by students anywhere and anytime, thus increasing the accessibility of mathematics learning. The development of Android-based learning was carried out because currently less interactive mathematics learning can make students less interested and less able to understand the concepts. Limited learning resources can also lead to students having less access to quality learning materials. Students may have difficulty understanding mathematical concepts due to the lack of visualization and interactivity in learning.

2. RESEARCH METHOD

The research method used by the researcher is research and development (R&D). R&D is one of the research methods used to develop a product, which will then be validated to determine its feasibility (Nugraha, 2025). This research is a research that has the result of a product, which can then be tested for its feasibility for use. The product developed from this research is an Android-based Mathematics E-Module using Smart Apps Creator to improve the critical thinking skills of high school students in West Sulawesi.

The research procedure to be used is R&D (Research and Development), using a modified Borg and Gall development model. There are ten stages that include potential and problems, data collection, product design, design validation, design revision, product trials, product revision, usage trials, product revision and mass production. However, in this study, only the seventh stage was carried out, namely product revision after the product trial. The research was limited to the seventh step (product revision) because in steps 8, 9, and 10, namely large-scale field trials. The usage trial stage, product revision and mass production have not been carried out due to the researcher's time and cost limitations.

After the data collection stage, the next step is to create an initial product design to be developed. This research resulted in a product in the form of an Android-based Mathematics E-Module using Smart Apps Creator to improve the critical thinking skills of high school students in West Sulawesi. The design of the Mathematics E-Module with Smart Apps Creator, namely the design of the E-Module that contains the main page cover, materials, Learning Games, evaluations, and biographies of the media creators.

Data Collection Techniques a) Expert Validation Questionnaire Expert validation is the stage of assessing the feasibility of teaching materials in the form of Android-Based Mathematics E-Modules using Smart Apps Creator to improve the critical thinking skills of high school students in West Sulawesi that have been developed by researchers, the feasibility in question is the validity test of the media from the development results. This stage is carried out by providing teaching materials in the form of Android-Based Mathematics E-Modules using Smart Apps Creator to improve the critical thinking skills of high school students in West Sulawesi and also expert validation sheets which must then be filled out by media experts and material experts.

Student response questionnaire This stage is carried out by providing a questionnaire containing statement items to obtain data related to the needs in the development of teaching materials in the form of an Android-Based Mathematics E-Module using Smart Apps Creator to improve the critical thinking skills of high school students in West Sulawesi. The questionnaire used in this study is in the form of a form with a check filling format. Documentation This method is used by researchers as a basic requirement in research for the purposes of collecting important data such as a list of names of high school students in West Sulawesi.

Data Collection Instruments Assessment instruments are tools used to obtain information and data from respondents, from which researchers can then draw conclusions. Research instruments are tools used by researchers to obtain information and data from respondents by conducting measurements. Research instruments are used as data collection tools and are generally used in research, consisting of several questions submitted and given to each respondent who is a sample in the study, namely questionnaires. Questionnaires are a technique or method of indirect data collection. Therefore, the data collection method in this study is a questionnaire. Data obtained from the questionnaire are given to media experts and material experts in the form of learning evaluation data. There is a questionnaire for student answers. In

this questionnaire, there will be several questions using a measurement scale, namely the Likert scale.

The data analysis techniques used by the researcher in this study were validation testing and product testing. The questionnaire used was a Likert scale consisting of five answer categories. 1. Validation Test Data Analysis The validity of the teaching materials was obtained from the results of the analysis of the teaching materials assessment sheet data by the validator. The first step, the researcher provided a validation sheet in the form of questions, then the questions were filled out by the validator by placing a checklist on each alternative choice.

3. RESULT AND DISCUSSION

a. Learning Media Development Results

The Android-based mathematics learning media was developed through several stages, including needs analysis, design, development, implementation, and evaluation. The resulting media contains high school mathematics material presented interactively, complemented by learning videos, contextual examples, problem-solving-based practice questions, and evaluation quizzes designed to develop students' critical thinking skills.
This media can be operated on Android devices and used independently or with teacher guidance during the learning process.

b. Media Feasibility Test Results

The media feasibility test was conducted by material experts and media experts. The assessment covered aspects of content, language, presentation, and media appearance.
The validation results showed that:
- ✓ The assessment by the material experts was categorized as very feasible, with an average feasibility percentage above 85%.
- ✓ The assessment by the media experts also indicated a very feasible category, particularly in aspects of media appearance, navigation, and interactivity.

Thus, the developed Android-based mathematics learning media is deemed suitable for use in the learning process.

c. Media Practicality Test Results

The practicality test was conducted through a questionnaire surveying teacher and student responses after the media was used in learning. The questionnaire results showed that:
- ✓ Teachers gave positive responses, categorizing it as very practical, because the media was easy to use, facilitated material delivery, and increased student engagement.
- ✓ Students gave positive responses, categorizing it as practical to very practical, because the media was engaging, easy to operate, and facilitated understanding of the mathematics material.

This indicates that the developed Android-based learning media is practical for use in high school mathematics learning.

d. Results of the Media Effectiveness Test on Critical Thinking Skills

Media effectiveness was measured through a critical thinking skills test administered before (pretest) and after (posttest) the use of the learning media.

The analysis results showed that:

- ✓ The average posttest score was higher than the pretest score.
- ✓ The N-Gain calculation showed that the increase in students' critical thinking skills was in the moderate to high category.
- ✓ The results of the statistical test (t-test) showed a significant difference between the pretest and posttest scores, thus concluding that the use of Android-based mathematics learning media had a positive effect on improving students' critical thinking skills.

e. Discussion

During the learning process, students appeared more active in discussions, expressing opinions, and solving problem-based problems. Learning media also helped students connect mathematical concepts to real-world situations, thus supporting the development of critical thinking skills.

4. CONCLUSION

Based on the review of previous research relevant to the current research, it is hoped that the results of the research and development conducted will yield results in accordance with the previous research objectives, namely:

a. The validity of the Android-based learning media to be developed is categorized as very valid and feasible for use.

b. The practicality of the Android-based learning media to be developed is categorized as very practical and feasible for use.

c. The effectiveness of the Android-based learning media to be developed is categorized as very effective and feasible for use.

d. Android-based learning media can be further developed to cover a broader range of mathematics materials.

e. Android-based learning media can be used as an alternative mathematics learning medium for high school students in West Sulawesi.

f. This research is expected to serve as input and reference in developing relevant applications.

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