Vocational: Journal of Educational Technology
E-ISSN 3063-6639 | P-ISSN 3063-6647
Volume 1. No. 2, February 2025
https://jurnal.smpharapanananda.sch.id/index.php/vocational/

Designing Android-Based Smart Apps Creator Learning Media to Improve Critical Thinking Skills

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Keywords:
Android-Based Learning Media, Smart Apps Creator, Critical Thinking Skills, Educational Technology.

Abstract
The rapid evolution of technology in education necessitates innovative approaches to enhance critical thinking skills, a vital competency in the 21st century. This study aims to design and evaluate Android-based learning media using the Smart Apps Creator (SAC) platform, targeting the improvement of critical thinking skills among students in the educational technology course in the information technology education study program of the faculty of teacher training and education at Bina Bangsa University, Banten, Indonesia. The research adopts the ADDIE model, encompassing Analysis, Design, Development, Implementation, and Evaluation phases. The developed learning media consists of interactive components, including a main page, learning objectives, usage instructions, educational materials, and evaluation exercises. The media was evaluated by four expert validators for content and media validity, yielding scores of 93% and 91%, respectively, categorized as "very valid." Practicality was assessed through student feedback, with an average score of 89.5%, indicating "very practical" usability. Effectiveness was measured through pre-test and post-test evaluations, showing a significant improvement in critical thinking skills with an average effectiveness score of 90.5%. These results highlight the learning media's capability to enhance engagement and foster critical thinking skills effectively. The study underscores the potential of SAC-based applications as a scalable solution for integrating interactive and student-centered learning tools into higher education. Future research could explore the application of such media across various educational contexts and its impact on other 21st-century competencies.

Received: *Nov. 28, 2024.* ***Revised:*** *Des. 11, 2024.* ***Accepted:*** *Des. 17, 2024.* ***Published:*** *Feb. 03, 2025.*

Introduction

The demand for 21st-century skills in education has increased significantly, driven by rapid technological advancements and the complexities of the globalized world. Among these skills, critical thinking stands out as a vital competency, enabling students to analyse, evaluate, and synthesize information effectively to solve problems and make informed decisions. Critical thinking is not only a

Fricticarani, A., Nimpagaritse, S., Fauzansyah, T. A., Abraham, Rahmadhani, K., & Lelfita. (2025). Designing Android-Based Smart Apps Creator Learning Media to Improve Critical Thinking Skills. *Vocational: Journal of Educational Technology*, *1*(2), 41–53. https://doi.org/10.58740/vocational.v1i2.300

foundational element of lifelong learning but also an essential attribute for thriving in a knowledge-based economy. However, traditional teaching methods often fail to adequately nurture these skills, necessitating the adoption of innovative educational tools and strategies [1].

The integration of technology into education offers promising opportunities to address this challenge. Mobile learning, particularly through Android-based applications, has emerged as a flexible and accessible approach to enhance student engagement and foster higher-order thinking skills [2]. Android, as one of the most widely used mobile operating systems globally, provides an ideal platform for developing interactive and multimedia-rich learning applications tailored to diverse educational needs. Research has demonstrated the potential of mobile learning to support independent learning, personalized instruction, and skill development, making it a valuable resource for modern education [3].

The Smart Apps Creator (SAC) platform is a notable tool for developing educational applications without requiring extensive programming knowledge. SAC enables educators to design interactive learning media, incorporating multimedia elements, gamified content, and adaptive features that align with specific learning objectives. Despite its potential, the application of SAC in designing Android-based learning media to improve critical thinking skills remains underexplored in the literature. Existing studies on mobile learning and critical thinking primarily focus on general frameworks or isolated implementations, highlighting the need for research that integrates design, development, and empirical evaluation [4].

This study addresses these gaps by designing and evaluating Android-based learning media developed using the SAC platform to improve critical thinking skills. Guided by the ADDIE (Analysis, Design, Development, Implementation, Evaluation) instructional design model, the research aims to create a validated and effective learning tool that promotes critical thinking through interactive and engaging content. By focusing on secondary school students, the study provides insights into the practical applications of technology-enhanced learning in fostering critical thinking within real-world educational settings.

The findings are expected to contribute to the growing body of knowledge on mobile learning and its impact on skill development, offering practical implications for educators, curriculum developers, and policymakers. Furthermore, this study underscores the transformative potential of technology in addressing contemporary educational challenges, particularly in cultivating essential cognitive skills that prepare students for future academic and professional success.

Literature Review

The integration of technology into education has transformed traditional teaching methodologies, emphasizing the development of skills necessary for the 21st century, such as critical thinking. This literature review examines three key areas relevant to the study: critical thinking skills in education, the role of mobile learning in fostering these skills, and the potential of Smart Apps Creator (SAC) as a tool for designing Android-based educational applications.

A. Critical Thinking in Education

Critical thinking is defined as the ability to reason logically, evaluate arguments, and make sound judgments based on evidence [5]. It is a fundamental skill required for problem-solving, decision-making, and lifelong learning [6]. Educational frameworks such as Bloom's Taxonomy place critical thinking at the top of the cognitive domain, emphasizing higher-order skills like analysis, synthesis, and evaluation [7].

However, traditional educational practices often prioritize rote memorization overactive engagement and critical inquiry. This gap has spurred the need for innovative approaches that facilitate active learning, collaboration, and critical engagement. Research suggests that instructional tools promoting interactive, inquiry-based, and student-centered learning environments are effective in enhancing critical thinking [8].

B. Mobile Learning and Critical Thinking

Mobile learning (m-learning) has emerged as a transformative approach in education, leveraging the ubiquity and interactivity of mobile devices to support learning anytime and anywhere [9]. Android-based mobile applications have been widely adopted due to their flexibility, affordability, and accessibility [10]. Studies indicate that m-learning can enhance critical thinking by enabling personalized learning experiences, providing immediate feedback, and fostering collaborative problem-solving [11].

Interactive applications that integrate multimedia content, gamification, and adaptive learning pathways are particularly effective in developing critical thinking skills. Such tools provide students with opportunities to engage in scenario-based learning, analyse real-world problems, and apply knowledge in diverse contexts [12]. Despite the promising potential of m-learning, research highlights the importance of aligning mobile applications with pedagogical principles to maximize their effectiveness [13].

C. Smart Apps Creator for Educational Media Development

The Smart Apps Creator (SAC) platform is a user-friendly tool that enables educators to design and develop interactive learning applications without requiring advanced programming skills. SAC supports multimedia integration, gamified elements, and cross-platform compatibility, making it an ideal choice for creating educational content tailored to specific learning objectives [14].

Previous studies have demonstrated the effectiveness of SAC in fostering engagement and improving learning outcomes in various educational contexts. For instance, SAC-based applications have been used to teach STEM concepts, enhance language learning, and promote digital literacy [15]. However, there is limited research on leveraging SAC to design applications that specifically target critical thinking skills.

The integration of SAC with instructional design models, such as the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model, can further enhance its effectiveness. The ADDIE model provides a structured framework for designing, developing, and evaluating educational tools, ensuring that they meet pedagogical standards and achieve desired learning outcomes [16]. By incorporating iterative feedback and validation

processes, SAC-based learning media can be optimized for usability, engagement, and impact on critical thinking skills.

D. Research Gaps and Implications

While extensive research has been conducted on mobile learning and critical thinking, several gaps remain. First, there is limited empirical evidence on the use of SAC for designing Android-based learning applications targeting critical thinking. Second, most existing studies focus on general m-learning frameworks or isolated tools, without exploring the systematic design and implementation processes that enhance their effectiveness. Lastly, few studies have examined the impact of SAC-based learning media on diverse student populations and educational settings.

Addressing these gaps, this study aims to design, develop, and evaluate Android-based learning media using SAC to improve critical thinking skills. By employing the ADDIE model, the research ensures a rigorous and systematic approach to instructional design. The findings will provide valuable insights into the potential of SAC in fostering critical thinking, contributing to the broader field of educational technology and its application in skill development.

The integration of mobile learning with innovative tools like Smart Apps Creator represents a significant step forward in enhancing educational practices. By aligning technological affordances with pedagogical principles, SAC-based applications can create engaging and effective learning environments that promote critical thinking. This literature review highlights the importance of further research to explore and validate the use of SAC in designing learning media, offering practical implications for educators, curriculum developers, and policymakers.

Research Methods

This study employed a design and development research approach to create and evaluate Android-based learning media using the Smart Apps Creator platform. The research methodology aligns with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model to ensure systematic development and validation of the learning media. This section describes the research design, sample, instruments, and data analysis techniques used to assess the validity, practicality, and effectiveness of the developed learning media [17].

A. Research Design

The research follows a design and development methodology focused on the creation, validation, and evaluation of learning media. Figure 1 presents the ADDIE development procedure.

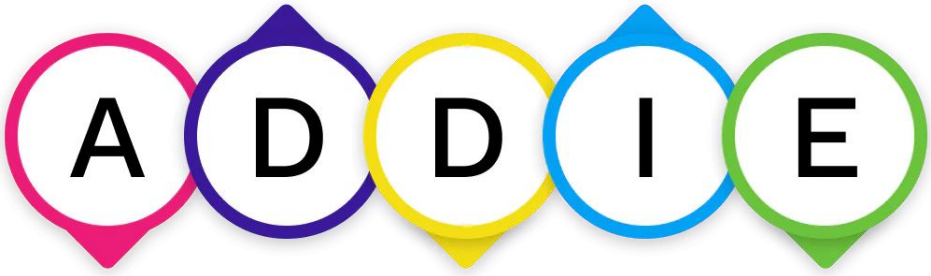

Figure 1. ADDIE development procedure.

The study adopts the ADDIE model, which consists of five stages:
Analysis: Identifying learning needs, challenges in fostering critical thinking, and course requirements for learning technology courses.
Design: Developing a blueprint for the Android-based learning media, including content, interactive features, and critical thinking exercises.
Development: Creating the learning media using the Smart Apps Creator platform and validating it through expert review.
Implementation: Implementing the learning media in a real classroom environment in the Information Technology Education study program.
Evaluation: Assessing the validity, practicality, and effectiveness of the learning media using qualitative and quantitative methods.

B. Participants

This research was conducted at Bina Bangsa University, Banten, Indonesia, specifically in the Information Technology Education program. The sample of this study consisted of 30 students enrolled in educational technology courses in the 2024 academic year. The participants were selected using purposive sampling, as they were directly involved in the implementation and evaluation of the developed learning media.

C. Research Instruments and Data Analysis

1. Research Instruments

a. Validity Assessment
   1) Expert validation sheets were used to evaluate the content, design, and functionality of the learning media.
   2) Validators included subject matter experts, media experts, and instructional design experts.
   3) Criteria included content relevance, alignment with critical thinking objectives, usability, and technical quality.

b. Practicality Assessment
   1) Student questionnaires were employed to gather feedback on the usability and practicality of the learning media.
   2) Observational checklists were used during the implementation phase to assess ease of use and engagement.

c. Effectiveness Assessment
   1) Pre-test and post-test instruments measured improvements in critical thinking skills, using validated test items based on Bloom's Taxonomy.
   2) Critical thinking tasks and scenarios were integrated into the media to evaluate higher-order thinking.

2. Data Analysis Techniques

a. Validity Analysis
   1) Data from expert validation sheets were analysed using a Likert scale (1–5).
   2) The average score for each criterion was calculated, and the media was deemed valid if the score exceeded 80% in all categories.

b. Practicality Analysis

1) Student responses were analysed quantitatively using descriptive statistics.
2) Practicality was considered high if at least 85% of the students rated the media as practical and easy to use.

c. **Effectiveness Analysis**

1) Pre-test and post-test scores were analysed using paired sample t-tests to determine significant improvements in critical thinking skills.
2) The effect size (Cohen's d) was calculated to measure the impact of the learning media.
3) Qualitative data from student feedback and observations were also analysed to support quantitative findings.

Results and Discussion

This section presents the results of the study, including the development of the Android-based learning media and the evaluation of its validity, practicality, and effectiveness. Each subsection details the outcomes from the development process and the findings from the data analysis.

A. Development of the Learning Media

The Android-based learning media was designed using the Smart Apps Creator (SAC) platform following the ADDIE model. The final product includes the following components:

1. Main Page

The main page serves as the entry point, featuring a visually appealing layout with navigational buttons leading to the learning objectives, instructions, material, and evaluation sections. Presented in figure 2.

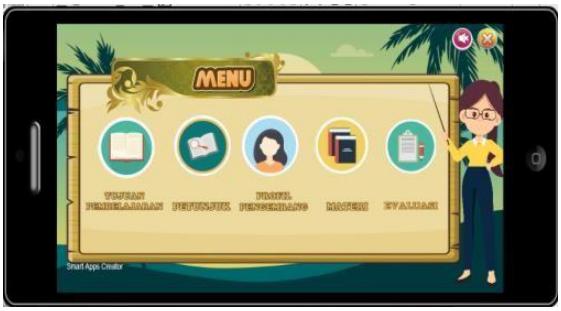

Figure 2. Main Page

2. Learning Objectives Page

This page outlines the learning objectives, emphasizing critical thinking skills such as analysis, evaluation, and problem-solving. The objectives are presented interactively to engage students from the outset. Presented in figure 3.

Figure 3. Objectives Page

3. Instructions Page

This page provides a clear guide on how to use the application, ensuring users can navigate the features and activities without difficulty. Instructions are enhanced with visual cues for better comprehension.

Figure 4. Instructions Page

4. Materials Page

The materials page presents multimedia-rich content, including text, images, videos, and interactive activities. The content is designed to align with the learning objectives and promote critical thinking through inquiry-based scenarios and case studies.

Figure 5. Materials Page

5. Evaluation Page

The evaluation page includes critical thinking exercises, quizzes, and scenario-based assessments. The tasks are designed to measure students' ability to apply, analyse, and evaluate information, with instant feedback provided to enhance learning.

Figure 6. Evaluation Page

B. Research Findings

1. Validity Results

The validity of the learning media was assessed by four expert validators: two content experts and two media experts. The average scores are presented in Table 1.

Table 1. Validation Results

Aspect	**Score (%)**	**Category**
Content Validity	93.0	Very Valid
Media Validity	91.0	Very Valid
Overall	**92.0**	**Very Valid**

The high validity scores indicate that the content aligns with the course objectives and critical thinking requirements, while the media design is user-friendly and pedagogically sound.

2. Practicality Results

Practicality was evaluated through student feedback using a questionnaire after the implementation phase. The average practicality score is presented in Table 2.

Table 2. Practicality Results

Aspect	**Score (%)**	**Category**
Usability	90.0	Very Practical
Engagement	89.0	Very Practical
Overall	**89.5**	**Very Practical**

The results demonstrate that students found the learning media easy to use, engaging, and supportive of their learning process.

3. Effectiveness Results

Effectiveness was measured using pre-test and post-test assessments of critical thinking skills. The results are summarized in Table 3.

Table 3. Effectiveness Results

Assessment	**Average Score (%)**	**Improvement (%)**
Pre-test	74.0	
Post-test	90.5	+16.5

The improvement in scores indicates a significant enhancement in students' critical thinking skills. This finding is supported by a paired sample t-test, which showed a statistically significant difference between the pre-test and post-test scores ($p < 0.05$).

C. Discussion

The results highlight the success of the developed Android-based learning media in improving critical thinking skills. The high validity scores confirm that the content and design of the media align well with the learning objectives and instructional standards. Similarly, the practicality results demonstrate that the application is user-friendly and engaging, promoting active learning and student participation [18], [19]. The significant improvement in critical thinking skills, as evidenced by the effectiveness scores, underscores the potential of mobile learning platforms like Smart Apps Creator to transform traditional learning environments [20], [21]. The findings are consistent with previous studies that emphasize the role of interactive and multimedia-based learning in fostering higher-order thinking skills [22], [23], [24]. Furthermore, the use of the ADDIE model in this study ensured a systematic approach to designing, developing, and evaluating the learning media, enhancing its overall quality and impact. This structured process can serve as a model for future research and development efforts in educational technology. The Android-based learning media developed using Smart Apps Creator proved to be valid, practical, and effective in improving critical thinking skills among Information Technology Education study program students. The findings provide a strong basis for integrating similar tools into a broader educational context to promote critical thinking and 21st century skills.

Conclusion

This study demonstrates the successful design, development, and evaluation of Android-based learning media using the Smart Apps Creator platform to improve critical thinking skills. Guided by the ADDIE instructional design model, the developed media integrates interactive and multimedia features that effectively support the learning objectives of educational technology courses. The findings highlight several key outcomes:

1. The validity assessment, with an average score of 92%, confirms that the learning media meets high standards in content quality and usability, ensuring its relevance and alignment with critical thinking development goals.
2. The practicality evaluation, achieving a score of 89.5%, indicates that students found the media highly usable and engaging, enhancing their overall learning experience.
3. The effectiveness analysis, with a post-test score of 90.5% and a significant improvement from the pre-test, demonstrates the media's substantial impact on fostering critical thinking skills.

These results underscore the potential of integrating mobile learning technologies into higher education to address critical skills gaps. The use of Smart Apps Creator as a development tool provides a scalable and accessible approach for educators to create interactive learning resources without requiring advanced technical expertise. This study contributes to the growing body of research on mobile learning and its role in promoting higher-order thinking skills. It also offers practical implications for educators, curriculum developers, and policymakers seeking to enhance educational outcomes through technology. Future research

should explore the scalability of such media across diverse educational contexts and its long-term impact on learning outcomes. By aligning pedagogical principles with innovative technology, this study reaffirms the transformative potential of educational technology in preparing students for the challenges of the 21st century.

Acknowledgement

No funding information from the author.

Author Contributions

Ade fricticarani: conceptualization; formal analysis; data curation; methodology; writing- review and editing. Stève Nimpagaritse: validation; data curation; writing- review and editing. Tengku Ahmad Fauzansyah: validation; formal analysis; data curation; writing- review and editing. Abraham: validation; writing-original draft; writing- review and editing. Kurniati Rahmadhani: formal analysis; data curation; methodology; writing- review and editing. Lelfita: validation; writing-original draft; writing- review and editing.

Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

Additional information

No additional information from the authors.

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