

Development of Android-Based Educational Game Learning Media for The Informatics Subject at SMA PGRI 3 Padang

Heri Mulyono^{1*}, Reski Budiman², Bernediv Nurdin³, Ade Pratama⁴

^{1,2,3,4}Universitas PGRI Sumatera Barat

Correspondent Author: Heri Mulyono

ABSTRACT: The learning process for the Informatics subject at SMK PGRI 3 Padang has not been optimal due to several issues: 1) limited availability of learning media (textbooks), 2) a lack of student learning motivation, and 3) a lack of understanding of the learning material. These conditions have resulted in low student grades; observations indicate that the student mastery rate for the Informatics subject stands at 46.15%. The objective of this study is to develop and produce valid and practical educational game learning media.

The research method employed is Research and Development (R&D) using the ADDIE model. This model comprises five stages: analysis, design, development, implementation, and evaluation. The study involved 13 Grade X students participating in Informatics classes.

The research resulted in Android-based educational game software that can serve as a supplementary learning tool, specifically for the Informatics subject. The learning media underwent validity and practicality testing. Validity testing regarding the media aspect was conducted by three validators, yielding an average score of 91.59%, while the material aspect was assessed by three validators with an average score of 88.52%. Meanwhile, practicality testing was conducted by one validator and the 13 students, resulting in an average practicality score of 90.18%.

KEYWORDS: Informatic Learning, Games Education, Validity Test, Practicality Test

INTRODUCTION

The Law No. 20 of 2003 concerning the Education System defines education as a conscious and planned effort aimed at creating a learning atmosphere and process wherein students actively develop their potential and acquire spiritual strength, religious self-control, character, moral intelligence, noble qualities, and skills beneficial to society, the nation, and the state. To achieve the functions and goals of education, learning activities must be structured within a formal learning program. Education is a primary factor in developing high-quality human resources; it transforms individuals into assets that contribute to the nation's life and the achievement of state objectives.

Advancements in information technology, particularly within the education sector, have influenced learning processes—affecting teaching methods, student study habits, and the use of instructional media. Currently, communication devices used in learning primarily consist of laptops and smartphones. However, the use of smartphones—such as Android devices—by students has not been optimally leveraged to support the learning process. Most students use Android devices solely to access entertainment, such as social media or games, for extended periods. Ideally, such technological advancements should be utilized to enhance the quality of learning. The learning process requires teachers capable of integrating information and communication technology in step with the times. Teachers are expected to creatively design instructional materials that enable students to directly utilize available learning resources (Kuswanto, 2022).

Instructional media serves as a tool within the teaching-learning process. It encompasses both software and hardware used to convey instructional content from the source to students (whether individuals or groups), stimulating the learners' thoughts, feelings, attention, and interest to make the learning process—both inside and outside the classroom—more effective (Cholifah, 2023). Instructional media is essential for making the teaching-learning process effective and ensuring the material is easily understood by students. Utilizing digitally packaged instructional media can spark learning interest and significantly impact

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student engagement with the competencies being taught (Basrul et al., 2021). Educational games are a type of game designed to address specific themes and topics chosen to enhance users' understanding and capabilities. Educational games (on computers, consoles, and mobile phones) serve as a medium capable of delivering learning material to players in a highly effective and efficient manner (Yusup, 2025).

(Firmadani, 2024) identifies several benefits of using media in learning: 1) standardization of lesson material delivery; 2) making the learning process clearer and more engaging; 3) increasing interactivity in the learning process; 4) efficient use of time; 5) improving the quality of student learning outcomes; 6) enabling learning to take place anywhere and at any time; 7) fostering positive student attitudes toward the material and the learning process; and 8) shifting the teacher's role toward a more positive and productive direction. This use of instructional media can be applied at any educational level—whether formal or non-formal—provided the goal is to facilitate or support the teaching and learning process. Senior High School (SMA) is one level of education that requires instructional media for the teaching and learning process. SMA PGRI 3 Padang offers several specialized skill programs, one of which is Software Engineering (RPL). The RPL program—specifically regarding web programming coursework—has not yet utilized instructional media accessible via Android devices..

Several related studies have been conducted previously. For instance, (Hutapea, 2025) used Unity to develop interactive instructional media in the form of an educational game that integrates learning content, a game environment, and quizzes; the study demonstrated that Unity can be utilized to create media combining educational and gaming elements within a single application. (Asril, 2022) developed basic programming instructional media using the 4D development model, involving 25 students and 5 teachers as respondents; the results showed that the developed media achieved a validity rate of 88% and a practicality rate of 90%. Meanwhile, (Salsabila, 2023) developed a cooperative learning-based printed module for the production management subject using the 4D development model, with 30 students and 6 teachers as respondents; the study results indicated a media feasibility score of 93.33% and a content feasibility score of 94.64%. Research by Hapsari (2021), titled "Development of Android-Based Interactive Learning Media on Matrix Operations," resulted in an Android application covering matrix operations. Feasibility ratings were 93.18% from the subject matter expert and 88.59% from the media expert, while student evaluations averaged 83.18%, resulting in an overall average score of 88.32%. In a study titled "Development of an Android-Based E-Module for the Production Management Subject for Grade XI Students at SMK Negeri 1 Surabaya," (Irawan, 2021) aimed to equip students to execute production processes optimally; production management serves as a preliminary step before actual production begins. This subject requires students to understand everything from script preparation to the selection of the film crew. (Juanda, 2022) developed an Android-based learning medium using Camtasia Studio 8.0 and Android Studio as the primary tools. The medium underwent validation by subject matter and media experts, with results indicating that it was suitable for use following specific revisions or improvements. This learning media application assists both students and lecturers in conducting the teaching and learning process, whether online or offline.

Based on prior research and findings from observations and interviews conducted on July 14, 2026, with an Informatics teacher and Grade X students at SMA PGRI 3 Padang, several obstacles in the learning process were identified: 1) limited learning media facilities, 2) student difficulty in comprehending the learning material, and 3) low student learning outcomes. Regarding the issue of limited learning media facilities, the media currently employed is conventional—specifically, printed textbooks borrowed from the school library for a limited duration. Students find these printed textbooks difficult to understand due to both the language used and the content itself. The limited availability of Grade X Informatics textbooks can also negatively impact student learning interest. Furthermore, unsuitable learning media can affect student learning outcomes; this is evident from end-of-semester exam results, where students failed to meet the Minimum Mastery Criteria (KKM) score of 75. Out of 13 students, only 6 achieved mastery, while 7 did not—representing a mastery rate of 46.15% and a non-mastery rate of 53.85%.

RESEARCH METHODS

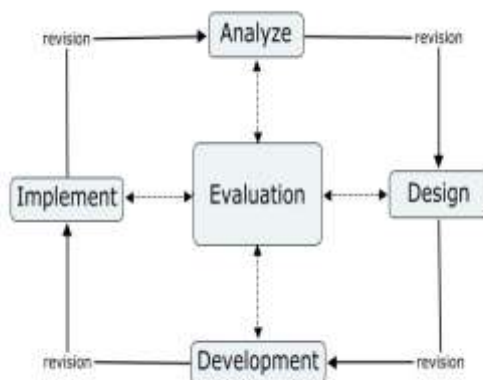
This study was conducted with 13 Grade X students at SMA PGRI 3 Padang during the 2026/2027 academic year in the Informatics subject. The research site was located at Jalan Seberang Padang Utara I No. 10, South Padang District, Padang City, West Sumatra Province. During the study, the researcher engaged an "informant"—an individual integral to the research context who provided information regarding the conditions and situations central to the study and the focus of the investigation.

The research methodology employed was Research and Development (R&D) utilizing the ADDIE development model. R&D aims to create new products or refine existing ones. It is a robust research approach for enhancing teaching and learning practices. Specifically, developmental research is necessary to seek solutions to learning challenges associated with particular

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issues (Tegeh, 2013). The ADDIE model—a systematic instructional design framework—served as the development paradigm for creating the learning materials.

The decision to use this model was based on its systematic development process and its grounding in instructional design theory. The model is structured as a programmed sequence of systematic activities designed to address learning issues related to the provision of learning resources that align with students' needs and characteristics. It comprises five stages: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The ADDIE model is illustrated in Figure 1 below:



Gambar 1. Model Pengembangan ADDIE

Based on Figure 1, the stages can be described as follows:

1. Analysis: This stage involves analyzing the requirements for the learning media to be designed. The activities carried out at this stage are as follows:

a. Initial Analysis

Observations were conducted at SMA PGRI 3 Padang; the researcher identified a problem regarding the lack of variety in the learning media used, noting that printed textbooks were among the primary resources utilized.

b. Needs Analysis

Interviews with teachers and students revealed that while all students owned Android-based smartphones, there were no existing Android-based learning media. Consequently, there is a need for learning media—specifically an educational game—to stimulate student interest and improve their understanding of the subject matter.

c. Student Characteristic Analysis

This analysis aims to understand the characteristics of the students as they engage in Informatics learning.

d. Curriculum Analysis

Curriculum analysis involves examining the learning outcomes for the Grade X Informatics subject. This step is essential for establishing the learning objectives to be developed.

2. Design: This stage involves designing the media—including the visual layout, interface, game mechanics, and content sequencing—verifying the desired outcomes (learning objectives), and determining the approach or strategy to be employed.

3. Development: Activities at this stage include developing, creating, and verifying learning resources, as well as preparing the necessary content and supporting materials.

4. Implementation: This stage involves preparing the learning environment and conducting the instruction with student participation.

5. Evaluation: This stage entails evaluating the overall quality of the product and the instructional process (Hidayat, 2024).

The instruments used in this study are questionnaires. Two types of questionnaires are employed: one assessing the validity of the content and learning media, and another assessing the practicality of the learning media. Before the instruments are distributed to respondents, a validation process is conducted to ensure the questionnaires are truly valid for data collection. This validation process is carried out by an expert in research instruments who possesses extensive research experience. The learning material assessment questionnaire comprises two aspects: 1) achievement of learning objectives (8 items) and 2) curriculum alignment (6 items). The learning media validity questionnaire consists of three aspects: 1) ease of use (6 items), 2) attractiveness (6 items), and 3) readability (5 items). The practicality questionnaire consists of two parts: teacher practicality (12 items) and student practicality (15 items). All questionnaires utilize a 1-to-4 Likert scale with the following categories: 1 = Disagree, 2 = Somewhat Disagree, 3 = Agree, and 4 = Strongly Agree.

DISCOVERY AND DISCUSSION

This development research resulted in an Android-based educational game designed to teach the "Computational Thinking" concept within the Informatics subject. The study employed the Research and Development (R&D) approach using the ADDIE development model, which comprises five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. The analysis stage involved assessing needs and issues regarding the subject matter, learning media, student learning conditions, and the basic competencies relevant to designing the Android-based educational game. Specifically, this discussion focuses on the teaching methods employed in Grade X classes.

Issues faced by Grade X students indicated that many struggled to grasp the material presented by teachers; this was largely due to unengaging learning media—such as conventional lecture-based instruction relying solely on printed textbooks. To address this problem, an Android-based educational game was designed to facilitate the students' learning process. During the design stage, the learning media was planned in alignment with basic competencies and learning indicators, utilizing a storyboard. Once the storyboard was finalized, the project proceeded to the media development stage. Figures 2 through 7 illustrate the development sequence.



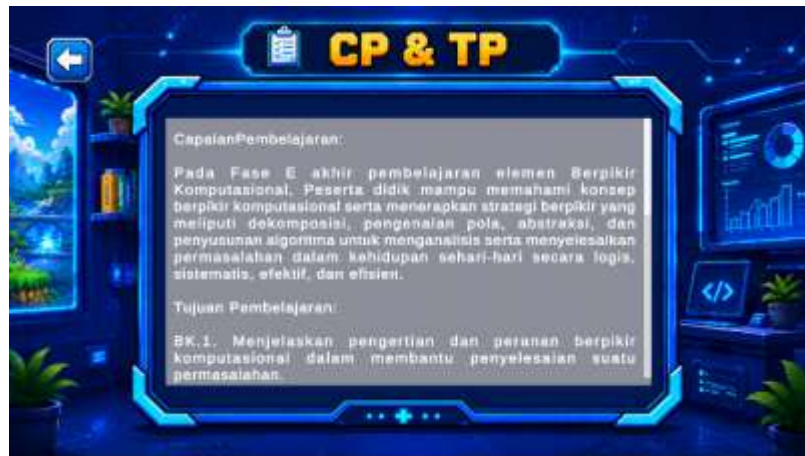
Gambar 2. Halaman Home

The Home page is the initial screen displayed when the application is launched and serves to direct users to the main menu.



Gambar 3. Halaman Menu

Main Menu serves as a navigation hub that directs users to the Games, Materials, CP/TP, Profile, and Instructions features.



Gambar 4. Halaman Capaian Pembelajaran

The CP/TP page displays the learning outcomes and objectives that guide the content within the media.



Gambar 5. Halaman Daftar Materi Pembelajaran

The Materials page presents Computational Thinking content aligned with the scope established during the analysis phase; advanced materials can be configured to unlock based on learning progress.



Gambar 6. Halaman Materi Komputasional



Gambar 7. Halaman Permainan

As illustrated in Figure 7, the game menu displays three game levels. Access to subsequent levels can be configured via an unlock system based on game progress.

The developed learning media required subsequent validation by media and subject matter experts. Validation by media experts aimed to assess the product's suitability as a learning medium and to provide a basis for refining and enhancing its quality. The validation process involved presenting the developed media and completing a questionnaire comprising 17 statements across three assessment aspects: ease of use, visual appeal, and readability. The results of the media expert validation are presented in Table 1.

Table 1. Media Validity Results

No	Assessment Aspects	Media Validator			Category
		V1	V2	V3	
1	Ease to used	100	92,86	100	Valid
2	Attractiveness of the look	100	93,75	100	Valid
3	Readability	100	91,67	100	Valid
Average		91,59 %			Valid

Based on Table 1, the assessment results from three learning media experts yielded an average score of 91.59%, indicating that the developed learning medium is classified as "Valid." The criterion for validity is a score greater than 66, while a score of 66 or lower is considered invalid. Additionally, validation by three subject matter experts was conducted to assess the suitability of the content within the developed learning medium. This process involved presenting the learning medium and administering a questionnaire to the validators. The questionnaire comprised 13 items categorized into two aspects: the achievement of objectives and curriculum alignment. The results of the subject matter expert validation are presented in Table 2.

Table 2. Material Validity Results

No	Assessment Aspects	Material Validator i			Category
		V1	V2	V3	
1	Goal achievement	90.25	89,50	88.15	Valid
2	Curriculum fit	89,75	87,75	85,75	Valid
Average		88.52 %			Valid

Based on Table 2, the assessment results from three subject matter experts yielded an average score of 88.52%, indicating that the developed learning medium is classified as "Valid." The criterion for validity is a score greater than 66, while a score of 66 or lower is considered invalid.

Once the learning medium was deemed valid, a practicality test was conducted using a questionnaire administered to the object-oriented programming teacher to determine the medium's actual practicality in the learning process. The questionnaire covered

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four assessment aspects: content, visual design, language, and ease of use. It consisted of 12 statement items, and the results of the practicality test are presented in Table 3.

Table 3. Results of the Teacher's Practicality Test

No	Assessment Aspects	%	Category
1.	Contents of the material	84,65	Practical
2.	Media display	87.72	
3.	Language	91.25	
4.	Ease of use	92.34	
Average		88,99	

Based on Table 3, the subject teacher's assessment yielded an average score of 88.99%, indicating that the developed learning medium is classified as "Practical." Regarding the content aspect, the score was 84.65%, suggesting a need to align the material with the existing curriculum.

Subsequently, a practicality test was conducted with 13 students taking the Informatics course to determine the practicality of this Android-based educational game. The questionnaire covered four assessment aspects: content and student interest, media appearance, language, and student engagement. It comprised 15 items (questions or statements), and the results of the student practicality test are presented in Table 4.

Table 4. Results of Student Practicality Test

No	Assessment Aspects	%	Category
1.	Student interests	91.03	Practical
2.	Media display	92.79	
3.	Language	89.42	
4.	Student activeness	92.31	
Average		91,38	

Based on Table 4, the assessment results from the 13 students participating in the Informatics course yielded an average score of 91.38%, indicating that the developed learning medium is classified as "Practical." The criterion for being classified as practical is a score greater than 66, while a score of 66 or lower is considered impractical.

CONCLUSION

Based on the research results and discussion regarding the development of an Android-based educational game learning medium for the "Computational Thinking" topic at SMA PGRI 3 Padang, it can be concluded that the medium was created using Unity software and subsequently tested for validity and practicality. Validity testing for the medium was conducted by three validators, and content validity testing was also performed by three individuals. The results showed an average media validity score of 97.59% (categorized as "Valid") and a content validity score of 88.99% (categorized as "Valid"). Thus, the learning medium is deemed highly valid.

Regarding practicality, the data from teachers yielded a score of 88.99% (categorized as "Practical"), while the response from the 13 students resulted in a score of 91.38% (also categorized as "Practical"). Consequently, it can be concluded that the responses from both teachers and students indicate the Android-based learning medium is practical and suitable for use in the learning process for Grade X students at SMA PGRI 3 Padang.

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