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Development of interactive learning media using Adobe Animate for computational thinking materials

Arif Dwinanto, Abd. Aziz Bouty, Mukhlisulfatief Latief, Dian Novian, Bait Syaiful Rijal, Ilsan Rambing

Information Technology Education Study Program, Universitas Negeri Gorontalo, Indonesia

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ABSTRACT. Integrating technology for teaching computational thinking presents ongoing challenges in Indonesian secondary schools, particularly in maintaining student engagement and comprehension. Through careful analysis of these challenges, we developed and assessed the effectiveness of interactive learning media using Adobe Animate for computational thinking materials at SMA Negeri 1 Tilamuta. Our research employed a development methodology using the ADDIE model, working with a focused group of 25 tenth-grade students. We gathered comprehensive data through media expert evaluations, material specialist assessments, and detailed user feedback questionnaires. Our findings revealed impressive results, with media experts rating the design and functionality aspects at 92%, while material specialists validated the content appropriateness at 90%. Student implementation proved remarkably successful, achieving a 96% practicality rating and demonstrating strong acceptance of the interactive features. These outcomes suggest that our developed media effectively supports computational thinking instruction through its dynamic presentation and adaptable assessment capabilities. We recommend future explorations into long-term impacts and broader subject applications, as this study contributes valuable insights to both theoretical understanding and practical implementation of interactive learning media in computational thinking education.

Corresponding Author:
Ilsan Rambing
Universitas Negeri Gorontalo
Jl. Prof. Dr. Ing. B. J. Habibie, Gorontalo, Indonesia
Email: mamatrambing@gmail.com

INTRODUCTION

The educational landscape continues to evolve alongside technological advancements. The role of education extends beyond knowledge transfer to include skill development, habit formation, and attitude cultivation in students. Research consistently shows that learning effectiveness increases significantly when educational media aligns with subject matter and students' psychological development stages (Devega & Suri, 2019). The learning process involves complex interactions within educational environments, with studies by Kong and Abelson (2019) revealing that well-designed learning environments can increase student engagement by up to 40%. Tang et al. (2020) further emphasize that technology-enhanced learning environments particularly benefit the development of complex cognitive skills like computational thinking.

Initial observations at SMA Negeri 1 Tilamuta revealed several pressing challenges in computational thinking instruction. Students frequently left classrooms during lessons and struggled to grasp concepts presented through traditional teaching methods. These observations align with findings from Prastyo et al. (2023), documenting significant obstacles Indonesian students face in mastering computational thinking without adequate instructional support. Contemporary literature defines

computational thinking as a learning approach emphasizing systematic problem-solving processes (Hurt et al., 2023). Grover and Pea (2023) emphasize that computational thinking has emerged as a vital competency in modern education, serving as a framework for utilizing computational tools in data collection, processing, modeling, and problem-solving.

The investigation identified several underlying factors contributing to these challenges: traditional teaching methods lack innovation, insufficient engaging learning materials, and limited interactive elements in current instructional approaches. Research by Hidayah et al. (2023) indicates that only 35% of Indonesian secondary schools effectively utilize interactive media for computational thinking instruction. Addressing these concerns requires the integration of varied learning models, the introduction of innovative materials, and the implementation of creative learning media. Muthoharoh and Sakti (2021) emphasize that learning media must incorporate innovative and engaging design elements to enhance classroom learning outcomes. The function of learning media extends beyond essential tools to foster meaningful dialogue between educators and students while providing comprehensive teaching resources (Khuzaini & Sulistyo, 2020). Engaging multimedia technology can significantly enhance learning experiences, creating more diverse and enriching educational opportunities (Dwinanto et al., 2024).

Based on these insights, developing specialized interactive learning media using Adobe Animate for computational thinking instruction at SMA Negeri 1 Tilamuta presents a promising solution. Recent studies by Prakasiwi et al. (2021) and Benaida et al. (2022) support this approach, demonstrating Adobe Animate's effectiveness in facilitating concept comprehension. The platform excels in creating straightforward yet engaging animations that effectively convey complex subject matter. The educational media integrates instructional content with interactive assessments, allowing educators to tailor materials to curriculum requirements. This study aims to develop and evaluate the effectiveness of interactive learning media using Adobe Animate for computational thinking materials. The research contributes to the field by integrating real-time feedback mechanisms, developing curriculum-aligned content, and implementing adaptive learning pathways tailored to Indonesian educational contexts.

METHOD

The development of interactive learning media employed the ADDIE model framework for its comprehensive approach to educational design. This framework systematically evaluates component interactions (Sugiyono, 2018) and offers robust processes that surpass traditional design models (Suratnu, 2023). The systematic organization of planning steps (Rachma et al., 2023) incorporated Research and Development (R&D) methodology within the ADDIE framework. This approach enables thorough development and testing of educational products (Maydiantoro, 2021), ensuring systematic evaluation of product effectiveness (Okpatrioka, 2023).

The research implementation followed the ADDIE model phases (Figure 1):

Analysis

The Analysis phase began with a comprehensive needs assessment through classroom observations and in-depth teacher interviews at SMA Negeri 1 Tilamuta. The focus centered on identifying specific challenges in computational thinking instruction, understanding student characteristics, and evaluating existing learning media. Data collection encompassed student learning patterns, current teaching methodologies, and available technological infrastructure, providing crucial insights for media development.

Design

The Design phase involved crafting detailed specifications for the interactive learning media. The process included developing content structure, creating user interface layouts, and planning

interaction flow based on initial analysis results—all design elements aligned with computational thinking learning objectives and curriculum requirements, ensuring pedagogical effectiveness.

Development

During the development phase, interactive learning media was created using Adobe Animate, which was selected for its advanced features, including WebGL and HTML5 Canvas capabilities (Febriane, 2019). Implementation followed design specifications while incorporating ongoing improvements based on iterative testing. The resulting media seamlessly integrated instructional content, interactive elements, and assessment components.

Implementation

The Implementation phase involved carefully introducing the developed media in actual classroom settings. Following Fitriyah et al.'s (2021) guidelines, the process included comprehensive orientation for teachers and students, structured learning sessions, and detailed user feedback collection. Close monitoring ensured proper usage and identified practical challenges.

Evaluation

The Evaluation phase incorporated both formative and summative assessments. Following Safitri and Aziz's (2022) framework, the evaluation focused on media functionality, content appropriateness, and user experience through expert validation and comprehensive user feedback.

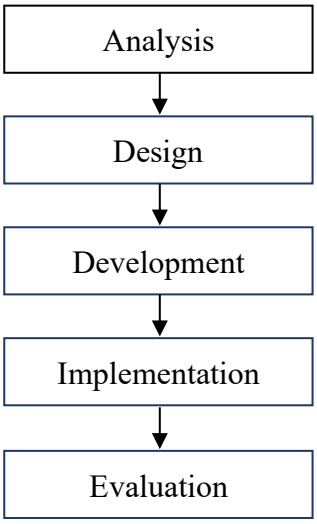


Figure 1. Research stages

The study population comprised tenth-grade students at SMA Negeri 1 Tilamuta, with 25 participants selected through purposive sampling based on computational thinking course enrollment. Data collection utilized three validated instruments: a media expert validation questionnaire examining design and technical aspects, a material expert validation questionnaire assessing content accuracy and presentation clarity, and a user response questionnaire measuring student experiences. Instrument validity establishment occurred through expert review with reliability confirmation using Cronbach's Alpha ($\alpha > 0.70$), followed by descriptive statistical analysis of collected data.

RESULTS

The development process through the ADDIE model phases yielded significant findings at each stage. Analysis at SMA Negeri 1 Tilamuta revealed critical issues: frequent student disengagement during lessons, difficulties comprehending computational thinking concepts, limited use of innovative teaching media, and traditional presentation methods failing to capture student interest.

Analysis Phase

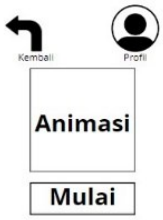
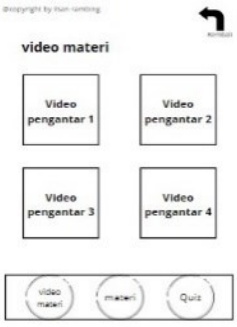
Based on observations and interviews conducted at SMA Negeri 1 Tilamuta, we identified several critical issues in the learning process:

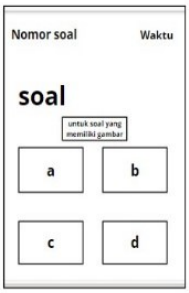
- Students frequently left the classroom during learning hours
- Students faced difficulties understanding computational thinking materials
- Limited use of innovative learning media in classroom instruction
- Traditional presentation methods that failed to engage students. These findings formed the basis for developing interactive learning media to address these challenges.

Design Phase

At this stage, we developed the interactive learning media concept through detailed storyboarding. Table 1 presents the storyboard design of key interfaces. The storyboard demonstrates four main interfaces: the Home Page, Material Page, Video Material Page, and Quiz Page, each designed with specific functionalities and user interaction elements to support computational thinking instruction.

Table 1. Interactive learning media storyboard

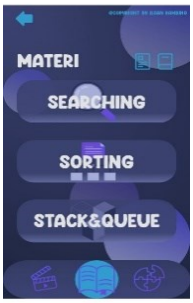
No	Appearance	Design	Description
1	Home Page		The main page serves as the initial display before accessing the media. This page has a back button, a creator profile button, and a button to enter the application.
2	Material Page		On the Material page, a collection of materials will be presented in the application. On this page, there are various material buttons, material achievement buttons, material introduction buttons, back buttons, copyright writing, and various menu buttons at the bottom of the application.
3	Video Material Page		On this page, 4 introductory material videos obtained from various sources are displayed. The bottom of the application has buttons to start the video, a close button, a back button, copyright text, and various menu buttons.

4	Quiz Page		This page displays the quiz's contents. Ad-related answer buttons and question images are on this page.

Development Phase

The development process transformed the storyboard designs into functional interactive media using Adobe Animate. Table 2 shows the final design implementation.

Table 2. Interactive learning media design

No	Appearance	Design	Description
1	Home Page		The main page serves as the initial display before accessing the media. This page has a back button, a creator profile button, and a button to enter the application.
2	Material Page		On the Material page, a collection of materials will be presented in the application. On this page, there are various material buttons, material achievement buttons, material introduction buttons, back buttons, copyright writing, and various menu buttons at the bottom of the application.
3	Video Material Page		On this page, 4 introductory material videos obtained from various sources are displayed. The bottom of the application has buttons to start the video, a close button, a back button, copyright text, and various menu buttons.

4	Quiz Page		This page displays the quiz's contents. Ad-related answer buttons and question images are on this page.

Implementation Phase

The implementation involved introducing the interactive learning media to 25 Grade X students at SMA Negeri 1 Tilamuta. The process included:

- Initial demonstration of the media's features and functionality
- Distribution of interactive learning media to students
- Guidance on media usage in computational thinking instruction
- Collection of user feedback through questionnaires

Evaluation Phase

The evaluation phase yielded three key sets of data:

Media Expert Validation

Media expert validation showed the Very Worth It category with 92% achievement, calculated from a total score of 132 against the ideal score of 144 (Table 3). This high validation rate demonstrates the interactive learning media's strong design quality and functionality. Based on the detailed evaluation components, experts emphasized the effectiveness of screen layout and navigation design, suggesting background color adjustments to improve readability during learning sessions.

Table 3. Media expert validation results data

Answer Score	Ideal Score	Percentage Amount	Criteria
132	144	92%	Very Worth It

Material Expert Validation

Material expert validation also achieved the "Very Worth It" category, scoring 90% from a total score of 93 out of 104 possible points (Table 4). This validation focused on content accuracy, curriculum alignment, and material presentation. The experts noted the systematic organization of computational thinking concepts while recommending language simplification to match student comprehension levels better.

Table 4. Material expert validity results data

Answer Score	Ideal Score	Percentage Amount	Criteria
93	104	90%	Very Worth It

Practicality Test

The practicality test involving 25 students resulted in a Very Practical categorization with a 96% acceptance rate, derived from a score of 1004 out of 1100 possible points (Table 5). This high practicality score reflects strong user acceptance across material understanding, media usability, and

learning benefits. Students' responses indicated that the interactive elements and self-paced learning features effectively supported their understanding of computational thinking concepts, directly addressing the learning challenges initially identified at SMA Negeri 1 Tilamuta.

Table 5. Practicality test result data

Score obtained	Highest Score	Level of Practicality	Criteria
1004	1100	96%	Very Practical

The table above shows that the practicality or user-friendliness test results for interactive learning media using Adobe Animate on computational thinking material put it in the Very Practical category with a 96% score.

DISCUSSIONS

Developing and evaluating interactive learning media using Adobe Animate for computational thinking materials demonstrated significant achievements aligned with the research objectives. Following the ADDIE model, the development process allowed the systematic creation of learning media that effectively addresses the initial challenges observed at SMA Negeri 1 Tilamuta.

Validation results from media and material experts strongly support the media's feasibility. The media expert validation score of 92% (Table 3) indicates that the developed media successfully meets design and functionality standards for educational technology. This aligns with Benaida et al.'s (2022) findings that emphasize the importance of user interface design in educational media effectiveness. The suggested improvements regarding background color optimization reflect the need for continuous refinement in visual design elements to enhance learning experiences.

Similarly, the material expert validation score of 90% (Table 4) confirms the media's content quality and appropriateness for computational thinking instruction. This high validation rate supports Grover and Pea's (2023) assertion about the importance of well-structured content in computational thinking education. The recommendation for language simplification highlights the critical balance between maintaining content accuracy and ensuring student comprehension, particularly in technical subjects like computational thinking.

The practicality test results of 96% (Table 5) are particularly significant as they demonstrate successful implementation from the user perspective. This high acceptance rate suggests that the interactive learning media effectively addresses the initial problems identified, particularly student engagement and understanding of computational thinking concepts. The positive response to interactive features and self-paced learning capabilities supports Tang et al. (2020) findings on the effectiveness of interactive media in improving student engagement and comprehension.

However, several limitations should be noted. First, while the sample size of 25 students was sufficient for initial validation, broader implementation might reveal additional insights. Second, the current evaluation focused on immediate user response rather than long-term learning outcomes. Future research should consider:

- Implementing the media across different school contexts to test its broader applicability
- Conducting longitudinal studies to assess sustained learning impacts
- Investigating specific features' effectiveness in supporting computational thinking skill development

Our findings contribute to the theoretical understanding and practical implementation of interactive learning media in computational thinking education. This media's successful development and

validation provide a framework for similar educational technology initiatives, particularly in Indonesian secondary schools.

CONCLUSION

Developing and implementing interactive learning media using Adobe Animate for computational thinking instruction has demonstrated significant effectiveness through systematic validation. The notably high validation scores from media experts (92%) and material specialists (90%), coupled with outstanding student acceptance (96%), provide strong evidence of the media's capability to support computational thinking education. The results directly address the research objectives by showcasing successful media development through the ADDIE model, confirming feasibility through expert validation, and demonstrating practical value through user implementation. The media's strength lies in its integration of dynamic content presentation with customizable features, enabling teachers to adapt materials and assessments according to evolving learning needs. This adaptability, combined with high acceptance rates from experts and users, indicates a successful resolution of the initial challenges in student engagement and comprehension of computational thinking instruction at SMA Negeri 1 Tilamuta. Future research opportunities exist to expand this interactive learning approach to other subjects, potentially broadening its impact across various disciplines. Longitudinal studies are recommended to evaluate sustained learning impacts and refine the media based on extended implementation experiences. This study contributes valuable insights to the theoretical understanding and practical application of interactive learning media in computational thinking education, particularly within Indonesian secondary schools.

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