ETDC Indonesian Journal of Research and Educational Review
Volume 5, No. 3, 2026, pp 1594 - 1606
e–ISSN 2809-3682
p–ISSN 2809-7505

https://doi.org/10.51574/ijrer.v5i3.4833

Development of Interactive Learning Media Canva Based on Virus Material at High School

Delsa Mahmudah[1], Marlinda Nilan Sari Rangkuti[2]
[1, 2] Department of Biology Education, Universitas Negeri Medan, Indonesia

Article Info

Article history:

Received February 11, 2026
Accepted April 14, 2026
Published April 25, 2026

Keywords:

ADDIE;
Canva;
Interactive Media;
Learning Outcomes;
Virus.

ABSTRACT

Virus material in biology subjects is abstract and often difficult for students to understand, which results in low effectiveness of the learning process in the classroom. This study aims to develop Canva-based interactive learning media on virus material, as well as to test its feasibility, practicality, and effectiveness in improving student learning outcomes. This research is development research (R&D) using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The research subjects included material experts, media experts, learning experts, biology teachers, and grade X students at High School 1 Labuhan Deli. Data was collected through interviews, questionnaires, and learning outcome tests (pretest and posttest), which were then analyzed descriptively, qualitatively, and quantitatively. The research findings indicated that this Canva-based learning media is categorized as "Very Feasible" with validation scores of 93.33% from material experts, 98.33% from media experts, and 86.11% from learning experts. The media's practicality was rated "Very Good" with a 93.33% response from biology teachers, as well as 91.94% in small groups and 90.45% in large group trials. In terms of effectiveness, there was a significant increase in student learning outcomes with an average score from 65.21 to 92.79. An N-Gain score of 0.79 (79.45%) indicates high effectiveness. This research contributes to the development of practical and effective digital learning media for biology teachers in visualizing abstract material, thereby supporting the optimization of the teaching and learning process at the high school level.

Corresponding Author:

Delsa Mahmudah,
Department of Biology Education, Universitas Negeri Medan, Indonesia
Email: delsadilfanjaarkhan04@gmail.com

1. INTRODUCTION

21st-century education demands a transformation in the learning paradigm, oriented toward developing critical, creative, communicative, and collaborative thinking skills (the 4Cs) (Thornhill-Miller et al., 2023; Tohani & Aulia, 2022). The success of this transformation is measured through student learning outcomes, which represent a deep understanding of the material being taught (González-Pérez & Ramírez-Montoya, 2022;

Zebua, 2025). However, in reality, students' scientific literacy achievements in Indonesia remain concerning. The Trends in International Mathematics and Science Study (TIMSS) report ranked Indonesia 44th out of 47 countries with an average score of 397, indicating students' low ability to construct scientific concepts and apply them to everyday life (Ismail et al., 2025; Putri & Mufit, 2023).

This gap between global competency demands and literacy achievements is evident in biology learning at the senior secondary level, particularly in conceptual and abstract material. One topic that poses a significant challenge for students is viruses (Buthelezi & Mpuangnan, 2024; Nasution et al., 2024; Safitri & Tanjung, 2023). The characteristics of viruses as complex microscopic agents that can only replicate within host cells make them difficult to observe directly without adequate visualization (Övermöhle et al., 2026; Touizer et al., 2021). This often creates cognitive barriers for students in understanding the structure, variety of forms, and mechanisms of viral replication that occur at the cellular level.

The difficulty in understanding this non-contextualized material can actually be mitigated through the integration of interactive learning media. The use of appropriate media has proven effective in bridging students' understanding of abstract biological objects (Putri et al., 2024; Situmorang et al., 2024; Weng et al., 2020). However, a recent study by Firmanshah et al. (2020) revealed that students' understanding of viruses remains very limited, suggesting that existing conventional learning media are unable to fully facilitate students' cognitive needs for in-depth study of microbiology.

As an innovative solution, the Canva platform has emerged as a potential tool for developing interactive learning media (Andani et al., 2025; Gurning et al., 2024). Using Canva allows for clearer, more aesthetically pleasing, and more interactive visualizations, which can significantly improve students' understanding of biological concepts and learning outcomes (Amalia et al., 2026; Andani et al., 2025). This technology integration aligns with the demands of 21st-century teachers for digital skills and the wisdom to create learning innovations that are relevant to current developments (Wulandari, 2025).

However, field observations at High School 1 Labuhan Deli revealed a gap between the implementation of the Independent Curriculum and the availability of teaching materials. Although the curriculum demands student-centered learning, media use is still dominated by textbooks, static PowerPoint presentations, and one-way YouTube videos. The lack of specifically designed interactive media results in low student participation in class. Consequently, student learning outcomes on viruses have not met the learning objective achievement criteria (78), necessitating more systematic technological intervention.

The uniqueness of this research lies in the development of Canva interactive media, specifically integrated with the characteristics of the virus material and the contextual needs of students at High School 1 Labuhan Deli through the ADDIE model. Unlike previous research that may have used Canva solely as a presentation tool, this development emphasizes interactivity and content integration tailored to the school's independent curriculum. The focus of this development is to create teaching materials

that not only visualize data but also actively engage students in the concept discovery process.

Building upon this urgency, this research was conducted to develop a Canva-based interactive learning media for viruses that meets the criteria of validity, practicality, and effectiveness. Through this development approach, it is hoped that the media can become a supporting instrument in optimizing the teaching and learning process. This research will comprehensively examine the media's feasibility, user response, and effectiveness through a comparative analysis of pretest and posttest results on 10th-grade students at High School 1 Labuhan Deli.

2. METHOD

This research is a Research and Development (R&D) project aimed at producing a product in the form of Canva-based interactive learning media for viruses. The development model used is the ADDIE model, which includes five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The research was conducted at High School 1 Labuhan Deli, involving test subjects consisting of one material expert, one media expert, one learning expert, two biology teachers, and tenth-grade students as end users.

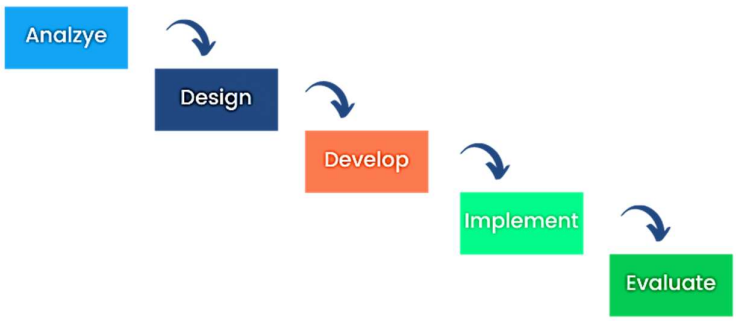

Figure 1. ADDIE Model Design

The research procedure began with an analysis phase to identify learning problems through teacher interviews and the distribution of student needs questionnaires. The design phase involved developing a media flowchart, material mapping, and developing research instruments such as validation sheets and test questions. Next, in the development phase, the product was constructed using the Canva platform, validated by experts, and revised based on suggestions for improvement to meet the established quality standards before being piloted.

The implementation phase involved a product trial in grades X-6 of High School 1 Labuhan Deli, involving 29 students. The sample was selected using purposive sampling because the characteristics of the class were considered most representative of the study population. At this stage, the media was integrated into the learning process to directly measure its practicality and effectiveness. This was then refined during the evaluation stage based on learning outcome data and user responses.

Data collection instruments included structured interviews, questionnaires, and learning outcome tests. The questionnaire was used to measure the media's suitability

according to experts and its practicality according to teachers and students using a four-level Likert scale. Meanwhile, to measure the media's effectiveness in improving students' cognitive competence, a test instrument consisting of 30 multiple-choice questions was administered through a pretest before use and a posttest after the learning process was completed.

The collected data were analyzed descriptively using qualitative and quantitative methods. Qualitative data, including comments and suggestions from validators, were used as the basis for product revisions. Quantitatively, questionnaire scores were converted into feasibility criteria, while media effectiveness was measured using the N-Gain test. The results of the N-Gain calculation are then categorized into high ($g > 0.7$), medium ($0.3 < g \leq 0.7$), or low ($g \leq 0.3$) ranges to determine the extent to which this media is able to significantly improve student learning outcomes.

3. RESULTS AND DISCUSSION

Results

This research has successfully produced an innovative product in the form of Canva-based interactive learning media specifically designed for virus material for 10th-grade high school students. The development process was carried out systematically through the five stages of the ADDIE model: analysis, design, development, implementation, and evaluation, to ensure the quality of the resulting product. This media integrates various multimedia elements, including comprehensive virus material, illustrations of virus structures, supporting animations, learning videos, and interactive quizzes that can be accessed digitally, creating a more dynamic learning experience.

In terms of design, this media prioritizes attractive visuals, intuitive navigation, and the use of communicative language to facilitate students' construction of virus concepts that tend to be abstract and non-contextual. This user-oriented design approach aims to minimize cognitive barriers during both independent and classroom learning. As a visual illustration of the developed product, the home screen of this Canva-based interactive learning media is presented in detail in Figure 2.

Figure 2. Initial display (home) of Canva-based interactive learning media

In addition to the main display, this learning media also integrates a comprehensive visual presentation of the material as well as an interactive quiz feature specifically designed to directly measure students' level of understanding of the concepts they have learned.

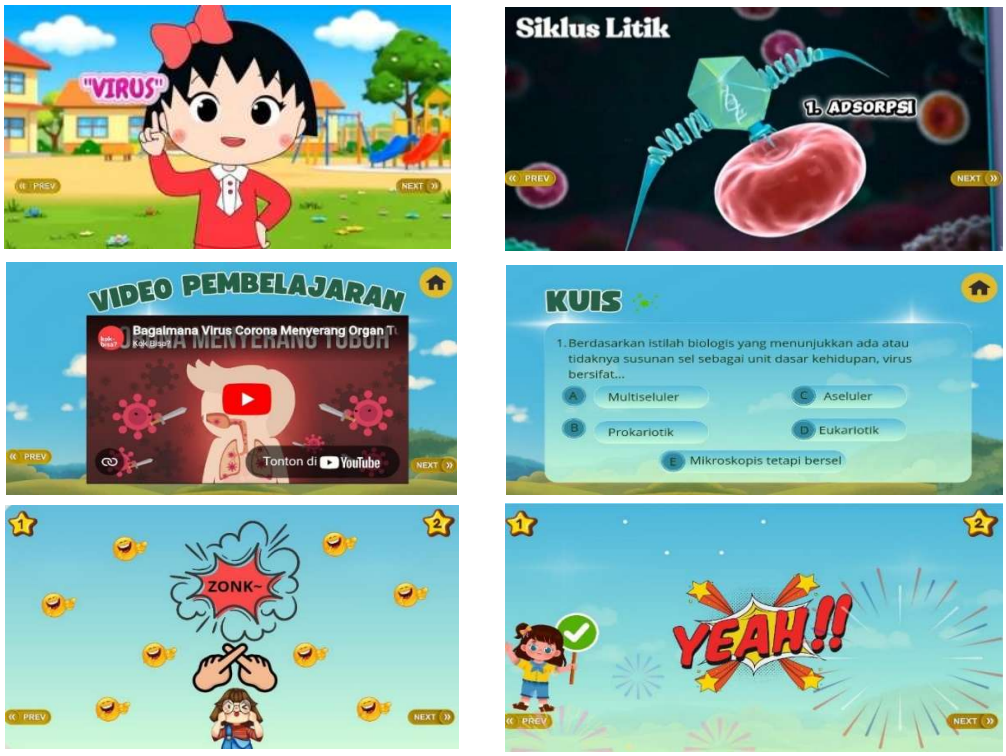

Figure 3. Example of display of interactive materials and quizzes on Canva media

The validation process for this Canva-based interactive learning media was carried out comprehensively by subject matter experts, media experts, and learning experts, who collectively provided an assessment with results that placed the developed product in the very suitable category for use.

Table 1. Material Expert Validation Results

No	Assessment Aspects	Validation (%)
1.	Material Suitability	91,66%
2.	Material Presentation	87,5%
3	Language	95%
4	Benefits of Learning	100%
	Avarage (%)	93,33%
	Category	Very Eligible

Validation results by content experts demonstrated a very high level of feasibility across all aspects of the assessment. The highest score was achieved for the Benefits of Learning aspect, with a perfect 100% score, followed by the Language aspect, with 95%. This indicates that the developed material not only possesses strong functional relevance

for users but is also delivered through excellent and easily understood language structure.

Overall, the accumulated scores from all four assessment aspects resulted in an average score of 93.33%. Based on the established assessment criteria, this achievement places the material in the "Very Eligible" category. The high scores for the appropriateness and presentation aspects (91.66% and 87.5%, respectively) confirm that the content meets the required academic and technical quality standards, making it highly recommended for implementation without the need for major revisions.

Table 2. Media Expert Validation Results

Assessment Aspects	Validation (%)
Display of Interactive Learning Media	97,22%
Interactive Learning media design	100%
Avarage (%)	98,33%
Category	Very Eligible

Validation results by media experts demonstrated the exceptional quality of this interactive learning media development. The Interactive Learning Media Design aspect received a perfect score of 100%, indicating that the structure, flow, and logic of the media design met the highest pedagogical and technical standards. Meanwhile, the Interactive Learning Media Display aspect also recorded a highly impressive score of 97.22%, indicating that the media's visual interface and aesthetics were highly engaging and supported an optimal user experience.

Cumulatively, the average score obtained from the media expert assessment was 98.33%, placing this learning media in the "Very Eligible" category. This high score reflects the media's thorough development process and readiness for use in a live learning environment. With its strong design and intuitive interface, this media is considered highly effective in increasing student engagement and facilitating interactive material delivery.

Table 3. Learning Expert Validation Results

No	Assessment Aspects	Validasi (%)
1.	Question Material	91,66%
2.	Construction	83,33%
3.	Language	83,33%
	Avarage (%)	86,11%
	category	Very Eligible

Validation results by learning experts showed a score of 86.11%, placing this media in the highly appropriate category. This assessment covered aspects of the suitability of the evaluation instrument, item construction, and appropriate language use. To improve the quality of the instrument, revisions were made to several items to clarify answer options and ensure assessment accuracy. Comprehensively, this medium was declared to have met quality standards in terms of material, media, and learning, making it highly representative for implementation in the biology learning process.

In addition to expert validation, the media's practicality was also measured through user responses in the field. These assessments were collected through Teacher and

Student Response Sheets to assess the media's usability and acceptance on a broader scale. Data regarding these responses are presented in detail in Table 4 below.

Table 4. Results of Biology Study Teacher Responses for Class X

No	Assessment Aspects	Evaluation (%)
1.	Display of Interactive Learning Media	95,83%
2.	The Language of Interactive Media	93,75%
3.	Suitability of Interactive Learning Materials	95%
4.	Use of Interactive Learning Media	90%
	Avarage (%)	93,33%
	Category	Very Eligible

Evaluation results from the perspective of educational practitioners indicate a very high level of satisfaction with the interactive learning media developed. The Display of Interactive Learning Media aspect received the highest rating of 95.83%, indicating that the media's visual quality significantly supports the instructional process in the classroom. Furthermore, the Suitability of Interactive Learning Materials aspect, with a score of 95%, confirmed that the content presented aligns with the 10th grade Biology curriculum, leading teachers to consider this media highly relevant for use as a formal learning support tool.

Overall, this media achieved an average score of 93.33%, confirming its position in the "Very Eligible" category from the perspective of expert users (teachers). Although the Use of Interactive Learning Media received the lowest score at 90%, this score remains at an excellent level, indicating adequate operational ease of use. With consistent validation results above 90% across nearly all aspects, this learning media has proven to be an effective, practical solution for teachers in delivering Biology material in a more interactive and comprehensive manner.

Table 5. Results of Small and Large Group Student Responses

No	Assessment Aspects	Average Rating (%)
1	Small Group Trials	91,94%
2	Large Group Trials	90,45%

Student responses in the small group trial obtained a percentage of 91.94%, while in the large group it was 90.45%, both in the very good category. Students stated that the media helped understand the structure and characteristics of viruses, increased interest in learning, and made learning more interactive. These findings show that the medium is not only theoretically feasible, but also practical and very well received by users. Apart from showing excellent responses from teachers and students, the effectiveness of learning media is also analyzed through increasing student learning outcomes based on pretest and posttest scores.

Table 6. Pretest, Posttest and N-Gain Results

Pretest Avarage	Posttest Average	N-Gain Score	N-Gain Score (%)
65,21	92,79	0,79 (High)	79,45% (Effective)

The results of the effectiveness test showed a significant increase in students' academic competence after using Canva-based interactive learning media. The research

data recorded an impressive increase in average scores, from a pretest score of 65.21 to 92.79 in the posttest. This jump in scores reflects that the learning media intervention was able to effectively bridge gaps in students' understanding, particularly in constructing new understandings of viruses, a topic known to be highly complex in high school.

The success of this media was reinforced by an N-Gain score of 0.79 (79.45%), placing the learning effectiveness in the High Category. Empirically, this figure proves that Canva-based interactive media is not merely a visual aid but also plays a crucial role in optimizing students' conceptual mastery. Achieving this high gain score provides strong validation that the developed media has good absorption capacity and can trigger stronger information retention than conventional methods.

Comprehensively, this study concludes that Canva-based interactive learning media meets quality standards covering aspects of feasibility, practicality, and effectiveness. The appropriate integration of multimedia elements within this medium has been proven to create a dynamic and adaptive learning environment. Therefore, this instrument is considered a reliable learning tool and is highly recommended to support the achievement of graduate competency standards in secondary education.

Discussion

Product Quality and Validity Analysis

The development of Canva-based interactive learning media using the ADDIE model demonstrates a very high level of validity, aligning with Richard Mayer's Multimedia Learning theory. The integration of illustration, animation, and instructional video elements in this product has been proven to technically meet cognitive criteria in aiding student information retention. This is supported by a perfect score (100%) for both learning benefits and media design, confirming that systematic visualization of material can minimize cognitive load while increasing student engagement. The achievement of an average score above 90% from material and media experts confirms that this product excels not only aesthetically but also academically.

These findings reinforce previous studies that suggest that the collaborative design platforms like Canva in a pedagogical context can create a dynamic and adaptive learning ecosystem (Kosakoy et al., 2025; Nwachukwu et al., 2025). Validation from learning experts, at 86.11%, indicates that this media meets the instructional feasibility standards required for classroom implementation. Thus, the comprehensively validated synchronization between multimedia elements and material structure demonstrates that the developed media is a reliable learning tool. Theoretically, this success validates the effectiveness of the ADDIE model in producing precise products, from the needs analysis stage to the final quality evaluation that exceeds conventional pedagogical quality standards (Dilaines et al., 2024; Spatioti et al., 2022).

Practicality and User Response in the Field

Practicality testing results indicate that this Canva-based learning media is highly effective in facilitating instructional needs in the field, aligning with the Technology

Acceptance Model (TAM), which emphasizes perceived usefulness and perceived ease of use (Natasia et al., 2022; Tao et al., 2022). A 93.33% rating from educational practitioners confirms that this media not only meets the 10th-grade biology curriculum standards but also has a high level of usability in assisting teachers in delivering material. This aligns with previous studies that suggest that systematically developed learning media can serve as a pedagogical bridge that strengthens interactions between educators and students, thus enhancing the efficiency of knowledge transfer (Bizami et al., 2023).

From the student perspective, the above 90% scores in both small and large group trials reinforce the constructivist learning theory, which argues that interactive learning environments foster active student engagement (Vijayakumar Bharathi & Pande, 2025). The use of communicative features and virus visualizations in this medium has been empirically proven to reduce cognitive barriers in understanding abstract concepts. These findings support previous research demonstrating that integrating multimedia into user-centered learning design significantly increases learning interest and intrinsic motivation (Safitri & Tanjung, 2025; Situmorang et al., 2025). Thus, this media has fulfilled the essential practicality criteria for widespread implementation on a more massive learning scale.

Media Effectiveness in Improving Learning Outcomes

The effectiveness test results showed a significant increase in academic competency, with an average score increasing from 65.21 to 92.79. The N-Gain of 0.79, which falls into the "High" category, provides strong empirical evidence for Allan Paivio's Dual Coding theory, which states that the simultaneous combination of verbal and visual stimuli can strengthen long-term memory (retention). This data demonstrates that Canva-based interactive media functions not merely as a visual aid but as a cognitive accelerator capable of optimizing student conceptual mastery. These findings align with numerous previous studies demonstrating that systematically designed technology-based learning environments can produce significantly superior academic performance compared to conventional methods, which tend to be one-way (Arici & Yilmaz, 2025; Felszeghy et al., 2019; Tarigan et al., 2021; Woldemariam et al., 2024).

This successful improvement in learning outcomes also confirms the effectiveness of Contextual Teaching and Learning (CTL) in dissecting complex and abstract biological material such as the structure of viruses. By integrating adaptive multimedia elements, this medium successfully creates concrete representations that facilitate students' development of a coherent understanding. This is supported by an effectiveness score of 79.45%, confirming the media's reliability for use at the secondary school level. Theoretically, these results reinforce the proposition that the use of interactive digital media can trigger deeper cognitive engagement, thereby maximizing students' core competencies (Alexiou & Schippers, 2018; Tang, 2025). This integration of appropriate technology is a strategic solution to address pedagogical challenges in materials with high levels of difficulty.

This research makes a significant contribution to the development of instructional design literature, particularly in the use of modern graphic design platforms as the basis for interactive learning media. Theoretically, the results reinforce the relevance of the ADDIE model in producing methodologically tested educational products. The successful integration of multimedia elements, which achieved a media expert validation score of 98.33%, demonstrates that non-instructional platforms like Canva can be transformed into reliable pedagogical tools. These findings provide a new framework for curriculum developers in developing learning media that are not only visually rich but also maintain rigorous material accuracy and align with learning outcomes in complex biology.

Practically, this research provides an innovative solution for educators to overcome the challenges of presenting material on viruses, which tends to be abstract and difficult to visualize. The improvement in learning outcomes, evidenced by an N-Gain value of 0.79 (high category), indicates that the use of this media significantly optimizes information retention and student conceptual understanding. For schools and education practitioners, this research offers a practical and ready-to-use learning tool (93.33% positive teacher response), which can enhance teaching effectiveness while encouraging active student engagement through interactive features. Thus, this research contributes to efforts to digitalize education that are oriented towards improving academic competency standards at the senior secondary level.

4. CONCLUSION

This Canva-based interactive learning media for viruses has been comprehensively tested and declared to meet superior quality standards based on three main parameters: feasibility, practicality, and effectiveness. Expert validation gave it a "Very Feasible" rating with a significant cumulative score: 93.33% from material experts, 98.33% from media experts, and 86.11% from learning experts. The media's practicality also ranked "Very Good" based on the positive response from biology teachers (93.33%), as well as the results of small group (91.94%) and large group (90.45%) trials with students. Furthermore, the media's effectiveness was empirically proven through an increase in students' average score from 65.21 to 92.79, with an N-Gain value of 0.79 (79.45%), which is considered high. Therefore, this instrument is considered highly reliable in optimizing student conceptual understanding and learning outcomes.

As a suggestion, it is recommended that Biology teachers integrate Canva-based interactive learning media as an alternative learning instrument to increase student engagement and conceptual understanding of complex material, while continuing to carry out continuous development through minor improvements to the cognitive aspects and periodic evaluation question editing. Furthermore, future researchers are expected to expand the scope of research by developing similar media on other materials or subjects and involving a wider range of research subjects to test the consistency of the Canva platform's effectiveness in a wider variety of instructional contexts.

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