JPPIPA 11(9) (2025)

Jurnal Penelitian Pendidikan IPA

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Development of Google Slides Assisted Interactive Multimedia in Biology for Grade X High School

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Received: July 21, 2025
Revised: August 20, 2025
Accepted: September 25, 2025
Published: September 30, 2025

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DOI: 10.29303/jppipa.v11i9.12247

Abstract: This study is motivated by the low student engagement and understanding of biology concepts due to the limited use of engaging learning media. At SMA N 4 Batam, although tools and technology are available, the use of effective media in teaching is still limited. The purpose of this study is to develop valid, practical, and effective biology learning media for grade X high school students. The research method used is Research and Development (R&D) with the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The validity of the media was tested by four experts: an instrument expert, a media expert, a language expert, and a content expert, while practicality testing was conducted by five educators and 34 students. The results show that the interactive multimedia developed is highly valid, practical, and effective. The validation results show that all tested instruments received a 100% score, categorized as "Very Valid." The practicality assessment by educators also showed very positive results, with average scores ranging from 4.53 to 4.89, categorized as "Very Practical." The student trial results showed an average score of 4.59, categorized as "Very Practical." The effectiveness of the multimedia is evident from the improvement in student learning outcomes, with an average posttest score of 84.71, categorized as "Very Good." The N-Gain obtained was 0.64, falling under the "Medium" category. The increase in pretest and posttest scores shows that the use of interactive multimedia with Google Slides is effective in enhancing students' understanding of biology content.

Keywords: ADDIE; Biology; Google slides; Interactive multimedia

Introduction

The digital era has brought significant changes in the world of education, especially with the integration of technology in the learning process (Jamil, 2022; Jusman & Usman, 2025; Wang, 2024). Technology has changed the way teaching is done and how students understand and process information. One effective tool to improve students' understanding is interactive multimedia, which combines elements such as text, images, audio, and animation (Handayani et al., 2024; Mantoviana et al., 2023; Rahayu & Ansori, 2025). This is especially useful in biology learning, where many concepts are abstract and require more concrete visualization to help students understand.

At SMA N 4 Batam, even though tools and technology are available, the use of effective learning media is still limited. Many teachers still rely on textbooks as the main source of learning, while the use of existing technology has not been utilized to its fullest. In fact, technology has great potential to enrich students' learning experiences and make learning more engaging and interactive (Haleem et al., 2022; Joshi et al., 2024; Kim & Jang, 2020; Safi'i et al., 2025).

Teachers have an important role in managing the learning process, setting an example, and facilitating

How to Cite:
Anggreini, Zen, Z., Darmansyah, & J, F. Y. (2025). Development of Google Slides Assisted Interactive Multimedia in Biology for Grade X High School. *Jurnal Penelitian Pendidikan IPA*, *11*(9), 135–141. https://doi.org/10.29303/jppipa.v11i9.12247

effective learning (Aditya Ramadhan, 2024; M. Andini et al., 2024; Hediansah & Surjono, 2020). In the 21st century, skills in information and communication technology (ICT) have become very important for educators to be able to adapt to the times and improve the quality of education (Herlinawati et al., 2024; Kinanthi et al., 2024; Lai & Bower, 2019; Timotheou et al., 2023). Therefore, mastery of ICT by teachers is very necessary in order to be able to utilize technology optimally in supporting the learning process.

The use of interactive multimedia in learning can increase students' motivation and help them be more active in the learning process (Aini & Mufit, 2022; Nasir & Fatonah, 2023; Puteri et al., 2023; Rahman et al., 2024). Although its benefits have been proven, challenges remain in its implementation. At SMAN 4 Batam, there is a problem of low interest and student participation in learning biology, especially on topics that are considered difficult and abstract, such as the concept of viruses. Many students feel bored and less motivated when the material is only delivered through lectures or textbooks.

This research aims to overcome this problem by developing an interactive Google Slides-based biology learning media. By integrating technology in learning, it is hoped that students can be more interested and motivated to understand abstract biological concepts. The use of interactive multimedia based on Google Slides is expected to improve students' understanding of biology materials and overcome the limitations of traditional learning methods.

Method

This research falls into the category of research and development with the ADDIE development model, which serves as a guideline for designing more effective, adaptive learning that can improve the quality of the learning process (Huang, 2024; Mahayanti et al., 2024; Adeoye et al., 2024).

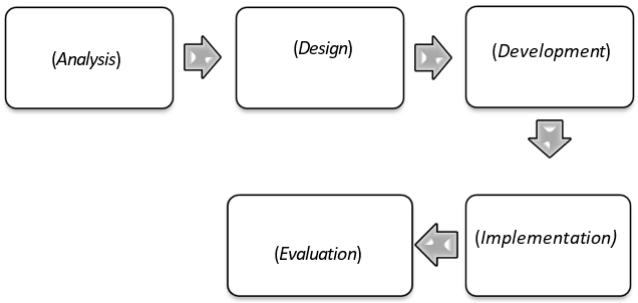

Figure 1. Model ADDIE

The development stage of interactive multimedia using the ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Spatioti et al., 2022; Suratnu, 2023; Zou et al., 2024). In the Analysis stage, the difficulties faced by students in learning biology were identified by collecting information as the basis for the development of learning media. It involves needs analysis to determine appropriate multimedia types, curriculum analysis to ensure alignment with learning standards, and learner analysis to tailor products to student development at the secondary school level. The Design Stage aims to design an interactive multimedia concept based on Google Slides, which includes the selection of media and presentation formats that are interesting and useful for students, as well as initial design that produces media in the form of images, text, sound, and video. At the Development stage, the designed product is evaluated by biologists and media to ensure its quality, and then revised based on the feedback provided

The Implementation stage involves testing the revised product in the learning process to assess its practicality and effectiveness, with feedback from teachers and students. Finally, the Evaluation stage is conducted to assess the effectiveness of the product and identify any shortcomings that need to be addressed, by gathering input from educators and students based on their experiences using the product in learning, which is then analyzed to determine its feasibility. The subjects for the interactive multimedia research involved three validators (biology, media, and language experts), five biology educators, and 34 students from class X C at SMA Negeri 4 Batam as the practicality test subjects. The research instruments used were media, content, language, and practicality validation instruments. Data collection techniques included interviews, observations, tests, and questionnaires, while data analysis techniques used validity tests and practicality tests.

$$Vs = \frac{\Sigma x}{\Sigma y} \times 100\% \quad (1)$$

Description:
Vs = Validation score percentage
ΣX = Total score obtained
ΣY = Maximum Score

The criteria for interpreting the validity percentage of the validity calculation results can be seen in the table below (Nila & Mustika, 2022).

Table 1. Validity Interval Category

Interval (%)	Validity category
81%-100%	Highly valid
61%-80%	valid
41%-60%	Suffiently valid
21%-40%	Less valid
0%-20%	Tidak not valid

Analysis of the Practicality of Learning Media

$$Vs = \frac{\Sigma x}{\Sigma y} \times 100\% \quad (2)$$

Vs = Validation score percentage
ΣX = Total score obtained
ΣY = Maximum Score

The practicality categories of the learning media based on the practicality score obtained can be observed in the table below:

Table 2. Practicality Categories

Interval (%)	Practicality categories
81%-100%	Very practical
61%-80%	Practical
41%-60%	Fairly practical
21%-40%	Less practical
0%-20%	Not practical

Analysis of the Effectiveness of Interactive Multimedia

To evaluate the effectiveness of interactive multimedia based on google slides in improving student learning outcomes, the assessment was carried out through tests with an objective question format.

$$\text{Final score} = \frac{Score\ obtained\ by\ the\ student}{maximum\ score} \times 100 \quad (3)$$

To determine the improvement in student learning outcomes, the difference between the pre-test and post-test scores is calculated. The difference between the two tests is called the Gain. The formula for calculating the N-gain is as follow (Andini & Fitria, 2021):

$$N\text{-}Gain = \frac{Skor\ Posttest - Skor\ Pretest}{Skoir\ Ideal - Skor\ Pretest} \quad (4)$$

The next step, the results of the N-Gain calculation are presented using the following criteria :

Tabel 3. N-Gain Interpretation

N-gain value	Category
N-Gain > 0.7	High
0.3 < *N-Gain* < 0.7	Medium
N-Gain < 0.3	Low

Table 4. N-Gain Effectiveness Category

N-gain percentage interval	Effectiveness criteria
Percentage *N-Gain* < 40%	Ineffective
40% ≤ Percentage *N-Gain* <55%	Less effective
56% ≤ Percentage *N-Gain* ≤ 75%	Moderately effective
Percentage *N-Gain* < 76%	Effective

To evaluate the criteria for media effectiveness, it can be seen from the students' learning outcomes obtained through the N-Gain score, which will be presented in the table 4.

Result and Discussion

Analysis Stage

This stage aims to identify the difficulties students face in learning biology and the need to develop interactive multimedia assisted by Google Slides. The three main steps involved are needs analysis, curriculum analysis, and student analysis. The needs analysis reveals the limitations of learning media that cause difficulties for students, especially in understanding the material about "viruses," where existing media have not been able to overcome difficult concepts. Curriculum analysis shows that the material on "viruses" is difficult to understand due to its abstract nature, and the curriculum does not adequately provide an adequate way of visualization. Meanwhile, the analysis of students revealed low motivation and student participation in learning, as well as difficulties in understanding the material due to the monotonous lecture method and limited learning time. All of these factors indicate the need to develop more interactive and interesting learning media to improve students' understanding of biology materials.

Design Stage

The design stage aims to create an interactive multimedia based on Google Slides for biology learning. The product selection process is conducted to choose Google Slides that support buttons, navigation, and the integration of text, images, animations, sound, and video that can be run on laptops or computers. The format selection aims to design learning materials in the form of interactive multimedia, which includes learning outcomes, objectives, and material descriptions. After selecting the media and format, the creation process begins with a flowchart that illustrates the overall program flow, followed by the development of a storyboard that explains the flow in more detail, and finally, the creation of interactive multimedia using Google Slides.

Figure 2. Login view

Figure 3. Home page view

Figure 4. Initial menu display

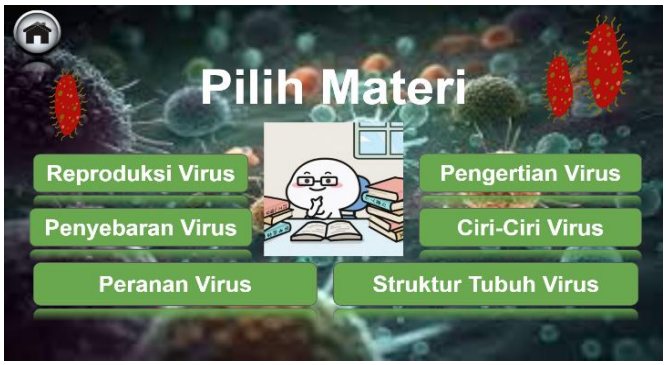

Figure 5. Material menu display

Figure 6. Profile menu display

Development Stage

After the interactive multimedia is designed, a validity test will be conducted by media experts, subject matter experts, and language experts to make further improvements to the product for its feasibility to be tested in the field.

Table 5. Results of the Validation Assessment for Media, Content, Language, and Practicality Instruments

Aspect	Percentage	Category
Media	100%	Very valid
Material	100%	Very valid
Language	100%	Very valid
Practicality	100%	Very valid

Based on the results of the validation assessment for the media, content, language, and practicality instruments, these instruments are ready to be tested.

Table 6. Summary of Expert Assessment Scores for Media, Content, and Language

Aspect	Expert score	Category
Media	81%	Valid
Material	95%	Very valid
Language	98%	Very valid

Based on the results of the assessment from media experts, it received a score of 81% with the category of "valid". The assessment from the subject matter expert received a score of 95% with the category "very valid". The assessment from the linguist received a score of 98% with the category "very valid". Based on the results of assessments from media, material and language experts, it can be concluded that Google Slides-based interactive multimedia is very valid to be tested at the practicality stage, this is in accordance with the results of research from Susilowati et al. (2023) That interactive multimedia based on Google Slides is very valid to be tested. The results of the validity of media, content, and language for interactive multimedia assisted by Google Slides in biology class X of high school can be seen in the diagram below :

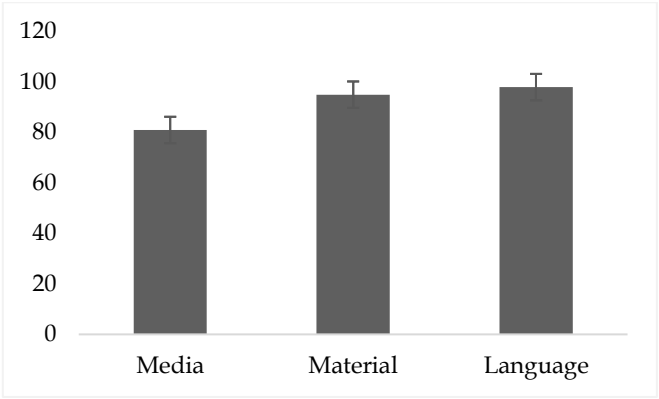

Figure 7. Media, material, and language validity diagram

Implementation Stage

The product implementation is carried out to measure the practicality and effectiveness of the product

and is revised based on feedback and responses from users.

Teacher's Practicality

Based on the results of the practicality test with educators, the results were obtained with an average of 91% with the category of very practical. Furthermore, interactive multimedia was tested for 34 students.

Table 7. Summary of Educator's Practicality Assessment

Educator	Percentage	Category
Educator i	91%	Very practical
Educator ii	93%	Very practical
Educator iii	98%	Very practical
Educator iv	93%	Very practical
Educator v	82%	Very practical
Average	91%	Very practical

Student's Practicality Test

Based on the results of the practicality test with students, the results of the examination were obtained of 91.70% with the category of very practical and suitable for use in learning.

Table 8. Results of Student's Practicality Assessment

Criteria variable	Percentage	Category
Easy of use	93.50%	Very practical
Time efficency	91.90%	Very practical
Usefulness	89.80%	Very practical
Avarage	91.70%	Very practical

Effectiveness Test Analysis

The effectiveness of the Google Slides-assisted interactive multimedia can be seen from the students' learning outcomes, which are obtained through knowledge tests in the form of pretests and posttests with objective questions to measure the success of the interactive multimedia in improving students' learning outcomes. The pretest and posttest were conducted in class XC at SMAN 4 Batam with 34 students using Google Forms. Below are the data from the pretest and posttest results before and after using the Google Slides-assisted interactive multimedia.

Table 9. N-Gain Test Results Summary

Class	Description	Meeting 1	Meeting 2
		Pre-Test	Post-Test
X.C	Total	1980	2880
	Average	58.24	84.71
	N-gain		0.64
	N-gain %		63.62
	Category		“Medium” 0.3 ≥ (N-gain) > 0.7

Based on the results of the calculation above, the gain score from the results of the comparison of the average score of pretest and posttest class XC in learning before and after using interactive multimedia assisted by google slides is 0.64 with the "Medium" category of 0.3 ≥ (N-gain) > 0.7. The increase in the average score of the pretest and posttest shows that interactive multimedia assisted by google slides is effective in increasing students' knowledge of the subject of Biology of viral material.

Evaluation Stage

The final development process is the evaluation of the Google Slides-assisted interactive multimedia product, which includes two main steps. First, the evaluation of perceptions from educators and students shows that this interactive multimedia is engaging and enhances learning motivation, although there are some suggestions for improvements, such as adjusting the text color contrast and adding a "Home" button for the materials and quizzes. Second, the evaluation of learning outcomes through pretest and posttest shows the effectiveness of using the E-Module, with an average pretest score of 58.24, which increased to 84.71 in the posttest, resulting in an N-gain value of 0.64 (g > 0.7) and an N-gain percentage of 63.62%, indicating a significant improvement in learning outcomes after using the Google Slides-assisted interactive multimedia.

Conclusion

This research develops a valid, practical, and effective Google Slides-based biology learning media for high school grade X students. Using the ADDIE model, this study involved four experts and was tested by five educators as well as 34 students. The validation results showed that the developed media was very valid, with a very positive assessment of practicality. Student trials showed that this media was very practical, with a significant increase in learning outcomes, as seen from the average posttest score of 84.71 and N-Gain of 0.64, which showed its effectiveness in improving students' understanding of biology material.

Acknowledgments

During the process of completing this research, the researcher received a lot of support, bothmoral and material, from various parties. Therefore, on this occasion the author would like to thank Mr. Prof. Drs. Zelhendri Zen, M.Pd. Ph.D, Mr. Prof. Dr. Darmansyah, S.T., M.Pd, Mrs. Dr. Fetri Yeni J. M.Pd, Mrs. Dr. Mutiara Felicita Amsal, S.Pd.I, M.Pd, Dr. Rahmi Pratiwi, M.Pd, Mr Dr. Rayendra, M.Pd, Mr. Dr. Abdurahman, M.Pd, and Mr, Hartoyo, S.Pd for the motivation, guidance, direction and instructions provided during the process of completing this article.

Author Contributions

Conceptualization, A. and Z; methodology, A; software, A.; validation, M, R, A, H.; formal analysis, A; investigation, A.;

resources, A.; data curation, A.; writing—original draft preparation, A.; writing—review and editing, A, Z, D, J.; visualization, A, Z.; supervision, A, Z.; project administration, A. All authors have read and agreed to the published version of the manuscript.

Funding
No external funding.

Conflicts of Interest
No conflict interest.

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