

Development of Augmented Reality-Based Learning Media on Virus Material for High School Students

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Abstract: This research aims to develop and describe the feasibility of Augmented Reality-based learning media as a medium for virus material for 10th grade science students. This research is a development study that adopts the 4D Thiagarajan model which includes Define, Design, Development, and Disseminate. The subjects of this study were 42 10th grade science students. The object of this study is biology learning media based on Augmented Reality which was validated by 3 validators. The results of material expert validation showed that the learning media scored 84% and was categorized as Very Feasible, while the media assessment by media experts scored 78% and was categorized as Feasible. In addition, the study field teacher's assessment of the learning media scored 84% and was categorized as Very Feasible, while the student questionnaire results scored 95% with the category of Very Feasible. The results of this study indicate that Augmented Reality-based learning media is Very Feasible to be used to support the learning process.

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Introduction

Biology is the science that studies everything related to living organisms and life. One of the biology subjects taught in schools is the topic of viruses (Purwati, 2013). Viruses are microscopic parasites that infect the cells of biological organisms. Viruses are obligate parasites because they can only reproduce inside living material by invading and utilizing the cells of living organisms. Viruses lack cellular machinery to reproduce on their own (Akhani, 2018). The curriculum on viruses in schools covers their characteristics, structure, reproduction, classification, and their role in life. The virus topic at the high school level is closely related to everyday life issues faced by students, such as viruses infecting wounded skin or the spread of viruses through an unhealthy environment due to improper waste disposal (Hasibuan & Djulia, 2016). Therefore, understanding the virus topic is crucial, starting from understanding the concept of viruses to their role in life. However, in teaching the virus topic, teachers at MA Darusshiddiqien NW Mertak Paok have not found instructional media that allows students to actively and independently seek information to solve problems and understand concepts.

Based on observations and interviews with tenth-grade science students at MA Darusshiddiqien NW Mertak Paok, information was obtained regarding difficult biology topics. About 66% of students find the virus topic challenging to understand, while only around 34% find other topics, such as genetics, difficult. Students struggle to grasp the virus material because teachers use monotonous instructional media and teaching methods without interactive feedback between teachers and students, leading to boredom and disinterest in

learning. This was confirmed during interviews with subject-area teachers, who primarily use textbooks to teach the virus material without additional teaching materials such as worksheets, modules, or other learning media. Additionally, based on daily test scores, only 27% of students achieved the minimum passing grade, with a passing grade set at 73.

The rapid development of science and technology demands an improvement in the quality of education. Quality education can be enhanced by changing the mindset used as the foundation for implementing the curriculum (Surata et al., 2020). One way to achieve this is through the development of instructional media. However, many teachers still struggle to develop effective and efficient instructional media, especially for biology topics like viruses that involve abstract theories. Augmented Reality (AR) is identified as a practical instructional media solution, as it is portable, allows for 3D object visualization, and caters to both non-reading educators and active students. AR, being easy to operate and widely applicable, can make learning more interactive and effective, even enabling students to study at home using smartphones.

Augmented Reality is an interactive technology that combines 2D or 3D virtual objects with the real environment, creating a blended mixed reality space and projecting it in real-time (Efendi & Khoirunnisa, 2016). Research by Purnamasari (2016) revealed that the use of AR-based instructional media significantly influences the improvement of student learning outcomes. The average learning outcomes of students using AR-based instructional media were significantly higher than those not using it. This is because the technology encourages students to think realistically through visual media without the need for direct practical tools, making it suitable for schools with incomplete practical facilities, especially in vocational schools (Mus & Yahya, 2022). The development of AR-based instructional media, particularly for biology subjects, is not widespread. This study aims to develop AR-based instructional media for the virus topic to be used by high school students in understanding biology.

Research Method

This study is a development research that adopts the 4D model (Thiagarajan), which includes Define, Design, Development, and Disseminate stages. The developed product is then validated by three validators, namely content experts, media experts, and one biology teacher for the tenth-grade level. Additionally, a product feasibility test is conducted with 42 tenth-grade science students.

Result and Discussion

Development Results

The development of Augmented Reality-based learning media on the topic of viruses for tenth-grade science students aims to assist students in understanding the material presented by teachers through engaging and easily comprehensible animations. In the development phase, a framework for the application was created with the goal of facilitating the researcher in designing the layout and buttons of the application. The initial display of the application includes Play and Exit menus, with the main menu featuring AR camera, virus material, Quiz, download, and bibliography buttons. The AR camera button has three more buttons: the first for viruses attacking humans, the second for viruses attacking animals, and the third for viruses attacking plants. Each virus has a 3D object and audio explaining the characteristics of that virus. The virus material button includes seven topics: the history of virus discovery, virus structure, images of virus structures, virus properties, virus replication, and the role along with the bibliography.

In the design phase, a design display was created with buttons on the application and 3D objects to be used as supporting materials to capture the attention of students during the learning process. To explain the 3D objects and content in the application, recorded voiceovers were used to assist in explaining the presented 3D objects and content. Furthermore, the design and creation of quizzes in the application were done using Adobe Illustrator, voice recording using the Voice Changer application, while the creation of 3D objects utilized the Blender application. In Blender, the researcher created 3D objects based on virus illustrations in the textbook. The Quiz button includes music as a sound effect to prevent students from becoming bored. Additionally, there is special music when students answer correctly or incorrectly. The results of the development of Augmented Reality-based learning media on the topic of viruses are presented in Figure 1.

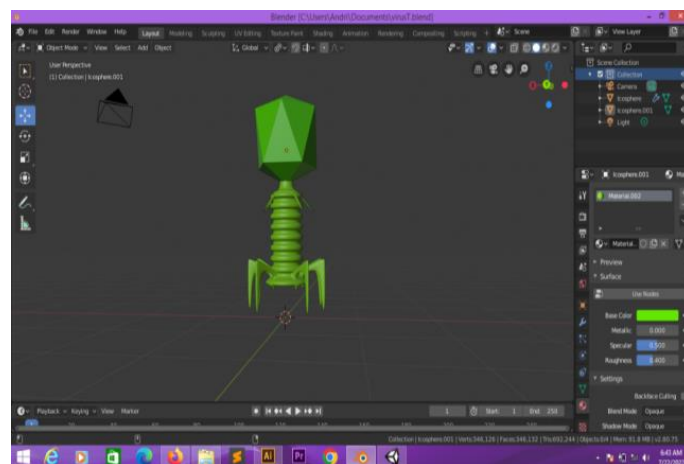


Figure 1. Results of the development of learning media on the topic of viruses.

Results of Learning Media Validation

1. Expert Content Validation

Expert content validation includes two aspects of assessment: content feasibility and presentation feasibility. Expert content validation is conducted to determine the accuracy and suitability of the content of the developed product, whether it meets the learning needs or not. Content validation is carried out on 15 assessment indicators, consisting of 9 content feasibility aspects with an average percentage of 87% (Very Feasible) and 6 presentation feasibility aspects with an average percentage of 80% (Feasible). The overall average percentage assessment from content experts is 84% (Very Feasible). According to Setiawati et al. (2017), media is considered valid if it falls within the range of >61%. This proves that the Augmented Reality media produced is valid and highly suitable for use in the school learning process.

2. Expert Media Validation

The purpose of expert media validation is to assess the suitability of the appearance and application of the produced product. The assessment consists of 2 aspects and 13 indicators, with content feasibility consisting of 4 assessment criteria with an average percentage of 78% and media graphics aspects consisting of 9 assessment criteria with an average rating of 80%. In general, the average percentage assessment is 78%. According to Setiawati et al. (2017), media is considered valid if it falls within the range of >61%. The research results indicate that the Augmented Reality learning media developed is valid from the perspective of media experts and is considered suitable for use in the school learning process.

3. Subject Area Teacher Validation

Validation by subject area teachers is conducted to assess the level of feasibility of learning media in the teaching process and to determine the alignment of learning media with the curriculum and learning needs. Validation by subject area teachers includes two aspects: content feasibility and presentation, consisting of 15 assessment indicators. Content feasibility consists of 9 assessment indicators with an average percentage of 87%, categorized as Very Feasible. Meanwhile, the presentation feasibility aspect consists of 6 indicators with an average percentage of 80%, categorized as Feasible. Overall, the average validation result from subject area teachers is 84%, categorized as Very Feasible.

Conclusion

The research results indicate that Augmented Reality-based learning media on the topic of viruses for tenth-grade science students is suitable for use in the learning process. This conclusion is based on the results of learning media validation by content experts with an average percentage assessment of 84% in the Very Feasible category, media experts with an average percentage assessment of 78% in the Feasible category, subject area teacher validation with an average percentage assessment of 84% in the Very Feasible category, and finally, validation conducted by students with an average percentage assessment of 95% in the Very Feasible category.

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