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DEVELOPMENT OF ANIMATED VIDEO LEARNING MEDIA OF HUMAN REPRODUCTIVE SYSTEM MATERIAL TO IMPROVE THE 4CS

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Abstrak

Penelitian ini membahas tentang pengembangan video animasi pada pembelajaran biologi materi reproduksi di kelas XI SMU Daarut Tauhid Boarding School Bandung. Tujuan penelitian untuk mengetahui tingkat kelayakan dan menganalisis efektifitas pengembangan media pembelajaran video animasi pada pelajaran biologi. Pendidikan sebagai fondasi utama dalam membentuk generasi yang kompeten dan siap menghadapi tantangan global dengan berbagai kemajuan teknologi digital. Metode penelitian yang digunakan penelitian pengembangan atau R & D model 4D (*Four-D*) dengan produk media video animasi mampu meningkatkan hasil belajar biologi, skor siswa sebelum mendapat perlakuan penggunaan media video animasi pembelajaran rata-rata kelas sebesar 60 dan setelah mendapatkan perlakuan penggunaan media video animasi pembelajaran sebesar 88, hasil analisa menunjukan bahwa rata-rata perbedaan nilai pengajaran metode baru dengan metode lama sebesar 27.4, dengan nilai signifikan 0.000. Hasil analisa uji normalitas menunjukan bahwa rerata validasi produk oleh ketiga validator sebesar 94.05 % dan termasuk pada kategori sangat valid, rata-rata perbedaan nilai pengajaran metode baru dengan metode lama sebesar 2.45, dengan nilai signifikan 0.000, meningkatkan keterampilan abad ke-21 yang dikenal dengan 4C (*Communication, Collaboration, Critical Thinking, Creative*) sebagai keterampilan untuk meningkatkan kemampuan siswa dalam berkomunikasi, berkolaborasi, berpikir kritis, dan berpikir kreatif. Hasil validasi ahli menunjukkan rerata 94.05 yang menunjukkan video animasi materi sistem reproduksi secara kognitif dapat meningkatkan hasil belajar biologi materi Sistem Reproduksi Manusia kelas XI.

Kata kunci : media pembelajaran, teknologi digital, video animasi, model 4C, biologi.

Abstract

This study discusses the development of animated videos in biology studies on reproduction in grade 11 of Daarut Tauhid Boarding School, Bandung. The research's purpose was to determine the feasibility and analyze the developing animated video effectiveness as learning media in biology lessons. Education is the primary foundation in shaping a high-quality generation to face global challenges. The research method used the 4D research and development (R&D) model, showing the average score increased from 60 before intervention to 88 afterward. The analysis results showed the average difference in teaching scores between the new and old methods was 27.4, with a significance value of 0.000.

The normality test analysis showed the average product validation by the three validators was 94.05%, categorized as highly valid. The average difference in teaching scores between the

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new and old methods was 2.45, with a significance value of 0.000. This improved 21st-century skills, known as the Communication, Collaboration, Critical Thinking, and Creativity. The expert validation showed an average of 94.05, indicating the animated video on the reproductive system can cognitively improve biology learning outcomes for grade 11 on the Human Reproductive System

***Keywords**: learning media, digital technology, animated videos, 4C model, biology.*

I. Introduction

Education is one of the main foundations in shaping future generations who are competent and able to face global challenges, especially amidst the rapid advancement of digital technology that underpins survival in the 21st century.

Technological developments in the digital era are increasingly bringing significant changes in various aspects of life. These changes are mainly in the aspect of education, especially in the process of teaching and learning activities in schools.

According to Ridwan Sa 'adiI (2020) quoting the opinion of Thorndike, learning is a process of behavior change as a result of the interaction between stimulus and response. These changes can be in the form of real and observable behavior as well as behavior that is internal and difficult to observe directly.

The learning outcomes obtained by students in the context of education in schools reflect changes in student behavior after going through the learning process. One example is in biology learning in class XI of high school, students are expected to not only obtain theoretical knowledge but also experience changes in attitudes, skills, and ways of thinking that are more scientific and in line with the increasing development of digital technology.

Education in the era of digital technology is not only focused on knowledge transfer, but also focuses on the process of forming the character of students who are able to have critical thinking skills and think scientifically in biology learning.

Biology in the national curriculum plays an important role as a means to equip students with an in-depth understanding of various issues related to natural resource materials, environmental quality, health, interactions between living things, as well as materials for prevention and management of various diseases.

The study of biological material also provides students with insight into the use of biological technology which is one of the main challenges of 21st century society. This is based on Law No. 20 of 2003 concerning the National Education System, the educational process aims to develop dignified abilities, character, and civilization so that it does not only aim to educate the nation's life. This goal is realized through the development of students' self-potential in line with 21st century skills, one of which is through the application of the 4C concepts (*critical thinking, creativity, collaboration, and communication*) which are included in the realm of soft skills.

Biology as part of the Natural Sciences (IPA) is taught with an approach that emphasizes experiments and direct observations of natural phonomenes and the

impacts that occur. This approach aims to make students understand the concept of science in depth, not just memorize the material as presented by Wiji Sulikah,2020.

Biology learning in practice uses contextual and inquiry methods, where all learning activities are student-centered. This allows students to actively build knowledge through experience so as to develop curiosity and practice critical thinking and problem solving skills that are relevant to the needs of the modern century.

The Ministry of Education, Research and Technology (2022) in the guide to biology textbooks for Public Secondary Schools states that several obstacles are generally found in biology learning, including that biology is considered a difficult subject to understand, this is because biology has a variety of materials with sub-sections of many Latin terms that tend to be difficult to understand so that students are less motivated to learn them. In managing teaching and learning activities that can meet the needs of the learning process, supporting facilities that are in accordance with the development of the times are needed, one of which is the existence of learning media. The right learning media must consider the type of media that is in accordance with the subject being studied, one of which is biology learning so that theories and concepts can be more interesting and can be more easily understood by students.

The right learning media is expected to influence the success of the learning process, one of which is in material that emphasizes understanding theories and concepts. One of the effective media used is audiovisual media because it is able to combine visual elements in the form of illustrations and audio that support so that students can more easily understand the concepts learned thoroughly. Animated videos are considered to be a popular and effective choice among various types of audiovisual media. Animated videos are composed of a series of moving images that form objects with the addition of certain effects so that they look realistic, lively, and attractive. Objects in animation can represent living and inanimate objects so that they are able to visualize things that are difficult to observe directly in real life. The advantages of animation are increasingly prominent with the right combination of colors, the use of clear supporting text, and the inclusion of appropriate audio or sound so that the learning message is conveyed more optimally. The combination of attractive visuals and relevant audio can improve focus, memory, and active involvement of students in the learning process (Malik, 2023).

Biology learning is important for students because in biology learning there are materials that discuss human life processes and the environment so that many provide benefits not only in the results of cognitive assessment, but also the application of attitudes for students as social beings that are in line with the objectives of the curriculum in national education.

The learning activities carried out must be in accordance with national education which leads to efforts to equip the quality of graduates with 21st century skills.

The Partnership for 21st Century Learning recommends some skills that are important to master in the 21st Century known as 4C skills.

According to Ida (2024), 4C skills that are included in the soft skills category have far greater benefits in the implementation of daily life than just mastering hard skills. This is in line with the demands of 21st century skills, where individuals are expected to be able to master the 4Cs as a provision to achieve success in various aspects of life, both in the world of work and social interaction in the community. These four skills include the ability to communicate effectively (communication), the ability to collaborate with others productively to achieve common goals (collaboration) , the ability to think critically and solve problems logically, creatively, and based on data (critical thinking and problem solving), and the ability to create new ideas in innovating to present relevant and useful solutions (creativity and innovation).

Meta Askarina (2023) quoted a statement from Edgar Dale who asserted that learning activities are strongly influenced by the type of media used effectively.

The use of media that combines audio and visuals such as video has been shown to improve students' memory by 50%, much higher than media that only involves the sense of sight (20%), the sense of hearing (20%), or text-based media that can only be read (10%). This finding shows that the more senses seen in the learning process, the higher the level of information retention obtained by students. The use of media that can be read, seen, heard, and observed simultaneously will provide a richer and more interactive learning experience.

Another advantage of video media according to Meta Askarina (2023) is that it is able to display moving images and sounds, which is a special attraction because students are able to absorb messages or information using more than one sense. Videos that are packaged with animation become one of the interesting digital innovations and increase students' understanding in biology learning, because animated videos are the delivery of messages in video media with movement, sound and motion images, the media become more interesting in the effort to deliver learning materials to students.

The process of making learning animation video media can be done using the canva application. Canva is a technology-based platform that offers a variety of creative features and is easy to use. Canva's advantages lie in its ability to provide attractive visual elements, harmonious color combinations, and ease of audio integration so that it can produce interactive and aesthetic learning media. The use of canva-based animated video media in biology learning is able to show and increase students' enthusiasm so as to help visualize abstract concepts, as well as encourage their active involvement during the learning process.

Animated video media products in learning make Ouput in development research.

According to Khairiyatul Jannah (2020), development research in the field of education has special characteristics because it focuses on the creation of educational products that can be a solution to improving the quality of learning. Unlike pure research, development research produces outputs in the form of products that can be

directly applied in the field and outcomes in the form of improving the quality of the learning process.

According to Fayrus (2022), research and development in education is a systematic process used to develop and validate educational products so that the products produced are not only innovative but also tested for effectiveness.

Thestepstaken by researchers in conducting a development research in the process must follow a systematic process flow and aim to produce effective, efficient, and tested educational products.

The first stage in conducting development research is the identification of problems that are the starting point as well as the foundation of the research. This identification was carried out to clearly understand the problems faced by blunting information through interviews, direct observation, or dissemination of questionnaires to relevant respondents. The second stage is a literature study, which aims to review and organize the results of a previous study as a theoretical basis and reference in product development. Then it is necessary to design a product to design a system or learning media that is still hypothetical in nature where its effectiveness can only be proven after going through the testing stage.

The next stage is expert validation, which is to ask an appraiser from an expert or experienced expert to assess the quality, feasibility, and suitability of the product that has been designed. The fifth stage is to improve the design so that the product is more optimal before entering the product testing stage. This test is usually carried out experimentally by comparing the effectiveness and efficiency of the new system with the old system. Based on the trial results, the next stage is product revision to correct the weaknesses found. The last stage is the trial use of the product is carried out extensively to see the performance of the product in real conditions in the field.

Several models in development research such as Addie, Borg and Gall modes, Dick and Carey models, IDI models, assure models, and 4D models.

The 4D development model is a Four-D device development model suggested by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel, 1974. Various development models exist, the author applies development research with the 4D model as one of the learning innovations that can be used in the 4D development model is learning animation video media.

As a reference in research on the development of the 4D model, several references can be seen in research that has been carried out before as conducted by Nurhayati (2022) with the title of her research Development of an Animation Video-Assisted Inquiry Learning Model to Improve Science Process Skills and Creativity in Science Learning in Grade 5 Elementary School Students in the Pringgabaya Cluster, Prinngabaya District, East Lombok Regency. Whereas in this study, the use of an animated video-assisted inquiry learning model showed more effective results in increasing student creativity than in conventional learning. The effectiveness of these results is evidenced by the acquisition of an Effect Size (ES) value of 2.822, which is

included in the category of high value results, indicating a significant impact on increasing students' creativity results.

In addition, other data contained in research conducted by Yunita Wardianti (2023) confirms the importance of science process skills as one of the main skills emphasized in biology learning, especially in the 21st century which requires the integration of 4C skills. Yunita in her research developed a 4C integrated science process skill assessment instrument in high school biology learning that was proven to be realibal with a reliability coefficient of 0.729, which means that the instrument is consistent and feasible to be used to measure students' skills.

Research conducted by Gita Permata Puspita Hapsari and Zulherman (2021) entitled Canva Application-Based Animated Video Media Development to Improve Student Motivation and Learning Achievement resulted in the finding that canva application-based animated video media was able to increase student learning motivation as well as academic achievement. This proves that the integration of technology-based learning media such as creatively and interactively designed animated videos has a positive impact on students' intrinsic motivation to learn. The combination of inquiry learning models, 4C skills, and the use of technology-based animation media makes a strong contribution in realizing effective, fun, and relevant learning to the demands of the 21st century.

Based on the increasing number of developmental research that has been carried out with the 4D development model, it can be stated that the 4D development model with animated video media products is proven to increase the motivation of students' interest in learning and learning outcomes not only limited to cognitive but able to have an impact on students' skill levels, especially on 4C Communication, Collaboration, Critical thinking and Problem Solving, and Creativity and Innovation skills.

The development research that has been carried out has several links with other processes, including in research and development methodologies that are very closely related to the field of learning technology by discussing how to develop patterns, sequences, growth or changes that can have an impact on the success of learning for students and teachers. To be able to produce certain products, development research can be used with products that are needs analysis to test the effectiveness of these products and to function and apply them in the community, especially the world of education (Zaenal Arifin, 2010:15),

The renewal of this study lies in the use of animation technology specifically designed to increase students' interest and motivation to learn in the subject of human reproductive material biology in a more dynamic and enjoyable manner. In addition, the existence of learning animation video media can benefit and facilitate teachers and students in learning activities, increase teaching and learning motivation, and be able to increase effectiveness in the learning process by overcoming space and time limitations (Ni kadek, 2024).

The purpose of the 4D development model research is to determine the level of feasibility and analyze the effectiveness of developing animated video learning media in the biology lesson of the Human Reproductive System material in class XI of SMU Daarut Tauhiid Boarding School Bandung (Putra) to improve the 4C.

II. Research Method

This development research uses a development research method with an R&D model (Reaseach and Development) or the development of a 4-D model (Four D) which is a development model found in learning tools. This model was developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel, research model.

The development of the 4D model consists of four stages, namely the define, design, develop,and disseminate stages. The 4D model was adapted into 4Ps, namely; starting from the process of defining, designing, developing, and deploying (Thiagarajan, 1974: 5).

R&D research is a process or steps to develop a new product or improve an existing product that can be accounted for and focuses on the development of learning media with the resulting product in the form of learning animation video media (Askari, 2020). The results of development research are not only the development of an existing product but also to find knowledge or answers to practical problems (Getar Rahmi Pertiwi;2023). The 4D Model researchprocedure is described by Thiagarajan and Semmel in the following figure (Rita Widhiyanti, 2021).

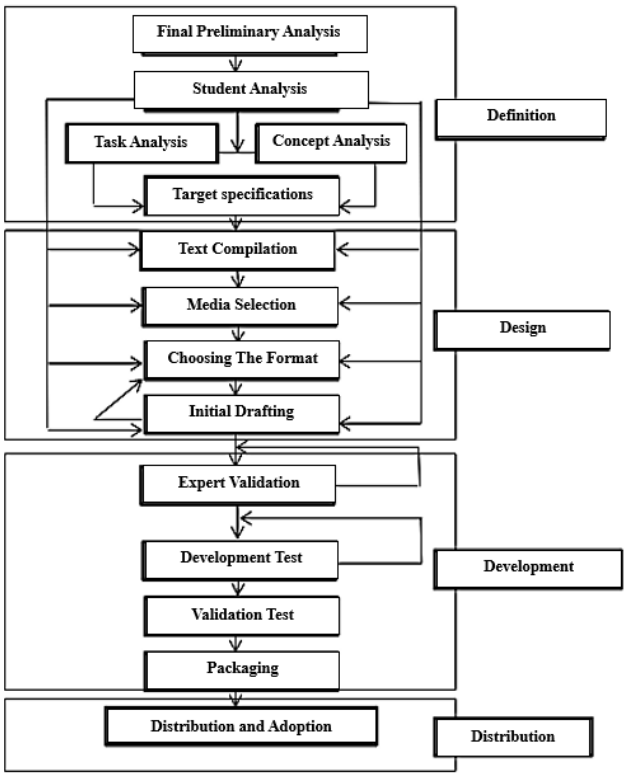

Figure 1 Model Development Procedure

III. Results and Discussion

A. Results of the Study

The results of the analysis of the effectiveness of animated video-based learning media in biology subjects are presented based on predetermined criteria, namely validity, practicality, and effectiveness.

This research was conducted from January 2024 to July 2024 in class XI of SMU Daarut Tauhid Boarding School Bandung (Putra). Research implementation activities are carried out in stages through surveys, interviews, needs analysis, product development, validation and product analysis, trials and research implementation.

Based on the results of observations that the authors made in the study, it was found that biological problems were related to students, teachers and the media, as in 1). Students : low interest in learning and ability of biological learning outcomes. 2). Teachers : the need for innovation in the method of delivering learning materials that suit the needs of students and technological advances. 3). Source media: books or media, it is necessary to update the media and write and explain more relevant material, especially in Latin terms, besides that the appearance of books needs to be modified so that it is more interesting and students become increasingly motivated to read and study biology.

In the analysis of the results of the validity test of video media, animation of biological learning of human reproductive system materials used feasibility criteria in the process phase level on certain criteria.

Table 1 Percentage of Eligibility Criteria

Number	Percentage	Comments
1.	81 - 100	Very Feasible
2.	61 - 80%	Feasible
3.	41–60	Moderately Feasible
4.	21–40	Less sloppy
5.	0-20%	Very unfeasible

Source : (Sugiyono;2019)

Based on the results of the analysis and validation on the learning animation video media, the following summary is obtained;

Table 2 Three Experts Development Product Validation Data

Notes	Learning Video Media Expert	Learning Materials	Learning Design	Average
Score	88.25%	100%	93.89%	94.05
Percentage	Highly Valid	Highly Valid	Highly Valid	Highly Valid
Category				
Average Category of Learning Media Products				

The average product validation by the three validators is 94.05% and is included in the very valid category. So it can be stated according to experts that animation-based video learning media products that have been developed by researchers are very valid.

The data for the analysis showed that the average difference in the teaching value of the new method with the old method was 13.75, with a significant value of 0.006, which means reject Ho (There was a significant difference in test scores with the new teaching method compared to the old teaching method). Based on normality test data using SPSS. The results of the analysis showed that the average difference in the teaching value of the new method with the old method was 0.75, with a significant value of 0.014, which means reject Ho (There was a significant difference in test scores with the new teaching method compared to the old teaching method).

The data for the analysis showed that the average difference in the teaching value of the new method with the old method was 13.75, with a significant value of 0.006, which means reject Ho (There was a significant difference in test scores with the new teaching method compared to the old teaching method).

B. Discussion

The final result of this study is to determine the validity, practicality, and effectiveness of learning media in learning the biology of reproductive materials in humans. Based on the results obtained from the test, the implementation of animation videos is feasible and can be used in biology learning because the validation results by experts are 94.05 with very valid categories.

Animated video media is stated to be effective in improving student learning outcomes in learning the biology of human reproductive materials. In addition, in video learning media, animation of human reproductive material biology learning is seen to be able to show performance on innovative learning concepts, increase motivation for students, increase understanding and students are more active, in cognitive it is seen to significantly increase learning outcomes, in addition it is able to realize skills in 4C in accordance with the needs of the times, especially in the 21st century era. Meanwhile, teachers show an increase in the role of conveying information as a facilitator of learning and teachers are able to guide and direct students in the process of learning activities. They are seen to be increasingly exploring knowledge, encouraging them to learn independently, and shaping the character of students to have 4C competencies, namely communicating, collaborating, thinking critically, and being creative.

IV. Conclusion

The process of developing animated video media for learning the biology of human reproductive materials using the canva application with the 4-D (Four-D) model can cognitively improve the learning outcomes of class XI of SMU Daarut Tauhiid Boarding School Bandung (Putra) and be able to increase the strengthening of communication,

collaboration, critical and creative thinking skills so that students have improved not only hard skills but also soft skills of class XI students.

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