USE OF VIRTUAL REALITY LEARNING MEDIA IN THE ANIMAL DEVELOPMENTAL STRUCTURE COURSE - LECTURER AND STUDENT RESPONSES

ABSTRACT

This research aims to reveal the perspectives of lecturers and students regarding the use of virtual reality (VR) learning media in animal development structure courses in the biology education study program, Faculty of Teacher Training and Education, Khairun University. Responses were collected using a questionnaire with a Likert scale and analyzed using percentages. The data collected includes notes regarding media appearance, instructional design, difficulty of use, clarity of material, and visual and interactive effectiveness, which are analyzed in depth. The research results show that lecturers and students have the same understanding and thoughts regarding learning media virtual reality (VR) which is used in the learning process of animal development structures, means that it is easy to use and useful in the learning process. The results of lecturers' and students' assessments of VR media design were categorized as very valid, with an average of 91% and 92%. The implications of this research can contribute to the application of VR learning media in various scientific disciplines and other study programs to improve the quality of learning.The study's implications suggest that VR learning media can significantly enhance student learning outcomes and engagement in biology education, particularly in courses like animal development structures. The findings support the use of VR media in various scientific disciplines to improve the quality of learning. The research contributes to the development of more effective and innovative learning methods, especially in the field of biology and science education.

Keywords: *learning media, user response, animal development structure, virtual reality*

INTRODUCTION

The development of information and communication technology has changed many things, including education. The use of virtual reality (VR) technology in the learning process is one innovation that is receiving increasing attention. VR technology allows students to learn complex concepts in an easier and more engaging way [1]. The use of VR learning media can be useful in biology education, especially in Animal Development Structure courses, because it can provide an in-depth three-dimensional picture of the structure and process of animal development which is difficult to achieve through conventional learning approaches[2].

In the Animal Development Structure course, conventional learning usually uses textbooks, two-dimensional images, and laboratory practicums. Although this method has many benefits, it has limitations in terms of visualization and interaction. Textbooks and two-dimensional drawings are often insufficient to fully depict the complexity of animal structures and developmental processes. Laboratory practice, although providing hands-on experience, is often limited by the specimens, equipment, and time available [3].

Student-centered learning (Student Centered Learning) can be mediated by presenting interactive learning media, and student learning outcomes can be measured by presenting interactive forms of assessment as well. This condition provides a new color for teachers to continue to strive to provide varied, creative and innovative learning media so that learning is more meaningful and can improve students' abilities.

Students generally consider science subjects as abstract material, so they require in-depth understanding and visualization skills[4]. Students who have difficulty understanding concepts well can give rise to misconceptions, and can interfere with students' learning process regarding scientific principles and concepts, so that the choice of learning media is an important factor in minimizing students' misconceptions [5].

It is hoped that the use of learning media can attract more students' attention to concentrate on the lesson material so that students can more easily understand and remember the material that has been taught, thereby achieving learning objectives and making learning less rigid. Experience-based

learning allows students to relate theory to the real world. This experience encourages active engagement, motivation, and better knowledge retention, as well as providing a better understanding of relevant concepts and skills. Additionally, experience-based learning helps students develop critical thinking and problem-solving skills. Teachers help students reflect on their experiences and relate them to theoretical ideas. Experiential learning can also be incorporated into the curriculum to make lessons more interesting and relevant for students.

Usage virtual reality Scientific learning procedures are believed to be able to improve students' learning outcomes and critical thinking skills [6]. This is because science has many complicated procedures and intuitive processes that are difficult to imagine and understand in the correct way [7]. Therefore, science learning with the addition of technological tools in the form of virtual reality, it is necessary to extract intuitive and abstract learning content so that it can be understood well by students [8].

The main purpose of using virtual media is to explain interesting topics and provide additional information to students [9]. VR simulations can be used to train higher order thinking skills and students are able to identify problems [10]. Besides that, virtual reality can also influence students' technical skills to replicate real-world environments in a clinical simulation, thereby increasing their knowledge and abilities [11]. Virtual media can help students learn better because it allows them to connect theory with practice. Virtual reality provides students with real learning experiences and can increase retention and understanding of learning material.

Use of learning media virtual reality in North Maluku province it has not been widely used by teachers at primary, secondary and tertiary education levels. In several previous studies, virtual reality proven effective in increasing learning motivation and understanding of concepts from various scientific disciplines. The results of research [12] state that students in the Biology Education study program at FKIP Khairun University need virtual technology to understand the concepts of gametogenesis and fertilization. Students are more likely to feel happy and learning is more enjoyable if technology is present in the learning process in class [13]. The use of virtual media in higher education has not been widely implemented, one of which is constrained by funding and budgets which are quite expensive. However, teachers as facilitators in learning can provide cheap and affordable virtual tools with qualified specifications, so that learning can be facilitated and learning objectives can be achieved.

A review of the literature shows that, although some research has shown that virtual technology can help students understand human anatomy and the medical field, research focusing on animal developmental structures is still limited. In addition, most previous studies emphasized technological aspects rather than material aspects in animal development structure courses. The focus of this research is to increase scientific insight, by assessing the use of virtual learning media in the Animal Development Structure course. Some of the advances in this research include special emphasis on animal developmental structure, thorough analysis, innovative methodology, and real-world applications of learning. This research specifically examines the use of virtual reality to visualize the structures and developmental processes of animals, providing a deeper understanding compared to conventional approaches. Additionally, this research not only evaluates the technical aspects of VR use, but also examines how VR impacts student understanding of concepts, motivation to learn, and engagement.

This research will obtain a broader picture of the effectiveness of virtual reality in learning by using a mixed approach, which combines quantitative (pre-test and post-test, questionnaires) and qualitative (in-depth interviews, observation) elements. It is hoped that this research can make a significant contribution to the development of more effective and innovative learning methods, especially in the field of biology and science education in general, because it was carried out in the context of real lectures at universities.

RESEARCH METHODS

This type of research is quantitative descriptive. The subjects in this research were lecturers and students in the biology education study program, a total of 5 lecturers and 14 students in semester 4. The data collection techniques used in this research used non-test techniques in the form of observation and questionnaires. The dataset used for analysis in this study consists of responses collected from lecturers and students regarding the use of virtual reality (VR) learning media in the Animal Development Structure course. The data was gathered using a questionnaire with a Likert scale, which assessed various aspects of the VR media, including media appearance, instructional design, difficulty of use, clarity of material, and visual and interactive effectiveness. The questionnaire scores ranged from 1 to 4, with higher scores indicating stronger agreement or effectiveness. The

data was analyzed using percentages to determine the average scores and categorize the responses based on predefined criteria.

The dataset included responses from a total of 5 lecturers and 14 students in the biology education study program at FKIP Khairun University. The average scores for the lecturers and students were calculated and compared to the categorization made in Table 1. The results showed that both lecturers and students had a high average score, indicating that the VR media was considered very valid and effective. The high scores on media display and instructional design suggest that the visual and interactive elements of the VR media were highly effective and interesting for both groups. The ease of access to material and the appearance of the VR media also received high scores, indicating that the media was well-received and easy to use.

The Likert scale is used in questionnaires with a score range of 1-4, with the following conditions:
A score of 4 is given for Strongly Agree/Decent/Effective/Practical
A score of 3 is given for Agree/Decent/Effective/Practical
A score of 2 is given for Somewhat Agree/Decent/Effective/Practical
A score of 1 is given for Disagree/Feasible/Effective/Practical
Then the average score is calculated by dividing the total score by the number of assessors using the formula:

$$X = \frac{x_i}{n}$$

Information:
X = average score
Xi = total score
N = number of assessors
The average score is then compared with the categorization made in table 1 below:

Table 1. Effectiveness and feasibility criteria

Value Range	Practical Category	Eligible Category
X > Mi + 1.8 SBi	Very Valid	Very Worth It
Mi + 0.6 Sbi < X ≤ Mi + 1.8 SBi	Quite Practical	Decent enough
Mi - 0.6 Sbi < X ≤ Mi + 0.6 SBi	Less Practical	Not worth it
Mi – 1.8 Sbi < X ≤ Mi – 0.6 SBi	Impractical	Not feasible
X ≤ Mi + 1.8 SBi		

Information:
X = average final score
Mi = ideal average sought by the formula $Mi = \frac{1}{2}(maximum\ score\ +\ minimum\ score)$
SBi = Ideal standard deviation sought by the formula

$$SBi = \frac{1}{6}(Maximum\ score\ +\ minimum\ score)$$

Classroom observation is a crucial method used to gather qualitative data on the effectiveness and usability of virtual reality (VR) learning media in the Animal Development Structure course. This method involves the researcher observing and recording the behavior, interactions, and engagement of students and lecturers during VR sessions. The observation checklist includes items such as student engagement, lecturer guidance, technical issues, and overall classroom dynamics. The researcher takes detailed notes during each session and may use a digital recorder to capture audio for further analysis. The collected data is then analyzed using thematic analysis to identify patterns and trends in student and lecturer behavior. This helps in understanding how VR media influences classroom dynamics and learning outcomes, providing a firsthand look at how VR is integrated into the classroom and identifying potential issues or areas for improvement. By incorporating classroom observation into the research method, a more nuanced understanding of the impact of VR media on the learning environment and student engagement can be gained.

Engagement Levels:

Students were observed to be highly engaged during VR sessions, often fully immersed in the virtual environment.

There was a noticeable increase in student participation, with many students actively contributing to discussions and asking questions.

Technical Issues:

Some minor technical issues were noted, such as occasional lag or disconnection from the VR environment. However, these issues were quickly resolved by the instructors.

Despite these minor setbacks, students generally adapted well to the technical aspects of the VR media.

Learning Outcomes:

Observations revealed that students demonstrated a deeper understanding of the animal development structures and processes.
Students were observed to be more interactive and inquisitive, asking more detailed questions about the structures and their functions.

Collaboration:

The VR sessions facilitated collaborative learning, with students working in small groups to explore and analyze the virtual models.
This collaborative approach enhanced their problem-solving skills and critical thinking abilities.

Feedback and Reflection:

Post-session feedback from students indicated that they found the VR experience to be highly engaging and effective in enhancing their understanding of the subject matter.
Students also provided constructive feedback on how to improve the VR media, such as adding more interactive features and improving the user interface.
The classroom observation results complemented the quantitative data collected through questionnaires and interviews, providing a comprehensive picture of the effectiveness of VR media in the Animal Development Structure course. The high levels of engagement, participation, and learning outcomes observed during the VR sessions support the conclusion that VR media is a valuable tool for enhancing student learning experiences in this subject area.

RESULTS AND DISCUSSION

The data collected includes notes regarding media appearance, instructional design, difficulty of use, clarity of material, and visual and interactive effectiveness, which are analyzed in depth. The results of this research can be a reference in determining the practicality of virtual reality media in learning the structure of animal development in the biology education study program at FKIP Khairun University.

Table 2. Aspects of Lecturer Assessment

Indicator	Score		% Indicator	Average Percentage	Criteria
	Maximum	Rate			
Media Display	32	29	91%	92%	Very Valid
Instructional Design	48	44	92%		

Based on the data in Table 2 regarding Lecturer Assessment Aspects, the media display indicator gets an average score of 29 out of a maximum of 32, or 91%, and the design Instructional students obtained an average score of 44 out of a maximum of 48, or 92%. Overall, the average percentage was 92%, and was categorized as "Very Valid." The high score on media display shows that the visual aspect of learning media is very good and interesting. This is in line with the cognitive theory of multimedia which requires that good media is one that maximizes students' attention and retention of information through effective visual elements [14].
The results of respondents' high assessment of instructional design show that virtual learning media is not only visually attractive [15,16], but also meets student needs and helps achieve educational goals (Branch, 2009 in [17]. Based on this analysis, done improvements to aspects that are less than optimal, such as improving instructional design, adding more in-depth interactive features, and increasing language clarity. The development of the final product involves the integration of the revision results to produce VR media that is not only attractive and easy to use, but is also able to stimulate students' critical thinking skills and improve learning outcomes. This is done by including problem-based learning elements and simulation scenarios that challenge students to analyze, evaluate and create solutions to problems related to gametogenesis and fertilization.
This approach is based on constructivism theory which emphasizes the importance of active and reflective learning experiences, as well as cognitive multimedia theory which supports the use of visual and interactive elements to improve understanding and retention of information [18–20]. Thus, the final VR product not only enriches the learning process but also significantly improves students' critical thinking skills in understanding the complexity of animal development.

Table 3. Aspects of Student Assessment

Indicator	Score		% Indicator	Average Percentage	Criteria
	Maximum	Rate-rate			
Ease of access to Material	32	29	91%	91%	Very Valid
Appearance *virtual reality*	80	72	90%		

Based on the data in Table 3 regarding Student Assessment Aspects, the indicator of ease of access to material received an average score of 29 out of a maximum of 32, or 91%, and the display indicator virtual reality obtained an average score of 72 out of a maximum of 80, or 90%. Overall, the average percentage was 91%, which is categorized as “Very Valid.” The high score on ease of access to materials indicates that students can easily access and use learning materials, which is very important in the context of digital learning.

Cognitive Load Theory says that good accessibility can reduce external cognitive load, allowing students to focus more on core lessons. Cognitive multimedia theory emphasizes how important visual and interactive elements in virtual media are for increasing student understanding and engagement [21,22]. A high score on the VR display indicates that the visual and interactive elements of VR are very effective and interesting for students [14,23]. The results of this assessment show that the designed virtual learning media is not only easy to access but also has an attractive appearance, has the ability to increase learning efficiency and increase students' understanding of the topics being taught.

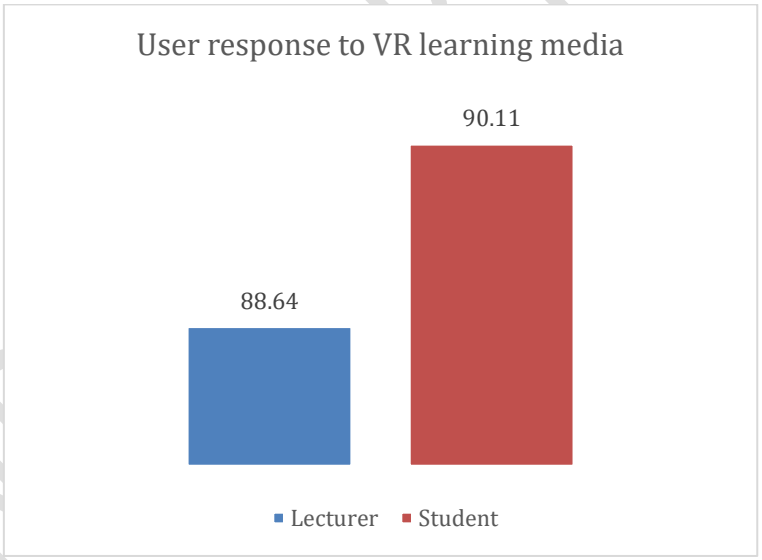

Figure 1. User response to VR learning media

The results of the analysis show that the student response score for using VR learning media is 90.11 and is within the practical criteria. Meanwhile, the lecturer's response score to the use of learning media was 88.64 and was also within the practical criteria. In line with Tricahyani's research on the use of learning media virtual reality which states that learning by utilizing practical virtual technology can improve the learning outcomes of sixth grade elementary school students [24].

A more interactive and in-depth learning experience has been felt by the use of virtual reality technology [19] in learning in the biology education study program at FKIP Khairun University. Apart from that, the practical test of virtual reality learning media showed positive results with a score of 88.64 for lecturers and 90.11 for students. This test shows that virtual reality learning media is not only effective in improving student learning outcomes, but is also easy to use and well received by lecturers and students. The Technology Acceptance Model (TAM) theory states that people's perceptions of the usefulness of new technology and its ease of use (user friendly) greatly influences the acceptance of new technology in learning [25]. The high number of positive responses shows that

lecturers and students have the same understanding that the designed virtual reality (VR) learning media is easy to use and useful in the process of learning animal development structures..

Virtual reality (VR) is a powerful tool in education because it offers an immersive environment where students can safely practice their skills and explore complex concepts, encouraging student engagement and increasing their understanding [26]. By adopting virtual reality in education, student motivation increases, student engagement increases, and knowledge retention increases. This shows its potential to revolutionize modern education, with educators playing an important role in the successful use of virtual reality in educational environments [1].

In the world of education, virtual reality is considered an innovative tool that can enhance students' learning experience by increasing their motivation, encouraging their active participation, and creating new knowledge. Studies conducted in research by [27] show that students are very interested in incorporating virtual technology into their learning environment.

A study conducted by Klan in 2023, reveals how virtual reality (VR) technology influences STEM education by prioritizing interaction, learning and accessibility. Research results show significant differences between real conditions and virtual use, resulting in better post-test scores, better spatial skills [28], and better learning abilities [29]. Qualitative evaluations reveal that students prefer virtual reality to real conditions, and learning with virtual reality can improve students' learning experiences [30].

This research provides important results for teachers in modifying and facilitating learning to improve students' abilities. With the development of technology, it can provide easy accessibility in learning, thereby helping teachers in integrating abstract material and concepts into concrete ones and constructing students' understanding can be achieved. The implications of this research can contribute to the application of virtual learning media in various scientific disciplines and other study programs to improve the quality of learning.

CONCLUSION

The results of lecturers' and students' assessments of VR media design were categorized as very valid, with an average of 91% and 92%. Instructional Media virtual reality which is designed, considered interesting and easy to use in studying the structure of animal development. The lecturer's response to the virtual reality learning media design was 88.64, and the student response was 90.11 and was categorized as practical and easy to use in learning.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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Details of the AI usage are given below:

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