

## Biology Teaching and Learning

p-ISSN 2621 – 5527

e-ISSN 2621 – 5535

**Abstract.** *The increasing demand for the use of technology in learning requires adjustments to the use of technology in learning. The learning process requires innovative media to increase learning motivation. One of the innovative learning media is virtual reality media. The application of VR media in learning provides many benefits, especially in material that is complex, abstract and cannot be observed directly, such as the digestive system material which discusses the digestive organs and bioprocesses that occur in the body. The purpose of this literature review is to determine the learning potential of using learning media in an effort to increase learning motivation and student learning outcomes on digestive system material. The research method used is a systematic literature review of several Scopus indexed articles published from 2018 to 2023 through content analysis. The results of the assessment study show that the use of virtual reality media in learning has great potential to increase student motivation and student learning outcomes in terms of cognitive, affective and psychomotor.*

**Keywords:** *virtual reality, learning motivation, learning outcome, digestive system.*

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## Literature Review: The Application of Virtual Reality Media to Increase Student Motivation and Learning Outcomes on Digestive System Material

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### Introduction

The increasing demand for the use of technology in learning necessitates adjusting the use of technology in learning (Paxinou et al., 2020). Technology-assisted education will be a successful learning platform in open learning spaces (Zhou et al., 2020). Several studies show that science concepts or material, especially biology, are difficult to understand using traditional visual media alone. Learning using conventional methods also makes students disinterested and bored so that students are not actively involved in learning. Schools with limited facilities may find it difficult to provide a broader and more interesting learning experience. Therefore, learning media is needed that can visualize learning in a real way. Students can learn science more deeply when technology is used appropriately in science learning (Putrawangsah and Hasanah, 2018; NCTM, 2000). The use of innovation and technology in the learning process is becoming increasingly relevant to improving learning effectiveness (Aisa and Linta, 2020). The learning process requires self-learning tools so as to increase student interest in learning and increase learning effectiveness (Tchao et al., 2023). One innovation that attracts attention in this context is the use of virtual reality (VR) technology as a learning tool. Virtual reality can simulate using 3D environments that are fully immersive and interactive in real time (Wang et al., 2019). Educators still have many challenges in teaching biology, one of which is the lack of learning motivation and student learning outcomes because learning is not interesting (Georgia, 2018). Students must like learning activities to engage. The self-directed learning process can increase learning motivation. Technology-rich educational environments are thought to facilitate deep learning that can increase motivation to learn biology (Maloy et al., 2019). VR has great potential for increasing students' motivation to engage in learning. VR is easy to use for visual analysis and very engaging to use. Students who have high learning motivation and good learning behavior tend to

achieve the required competency standards (Tokan, 2019). Student learning motivation can be seen in domain-specific motivation, which includes intrinsic and extrinsic motivation. This domain-specific motivation is a positive predictor of entering the engagement level. In addition to encouraging students to learn, motivation also affects learning outcomes.

Student learning outcomes are still unsatisfactory because. Students still use the memorization method to understand the material (Senimun, 2022). Low learning outcomes can be influenced by the learning style used by students. This is in line with the opinion (Chania et al., 2018), which suggests that the appropriate learning style is the key to student success in learning. Learning outcomes assessment is an important component of learning activities. Efforts to improve the quality of learning can be achieved through improving the quality of the assessment system (Noor, 2020). Limited digital tools for learning can affect learning outcomes. Students who have difficulty accessing or understanding material can affect learning outcomes. One of the materials that is difficult to understand is the digestive system material.

Digestive system material is a complex subject and requires in-depth understanding (Yoe et al., 2022). Students have moderate knowledge about the digestive system. In addition, students' interest in learning this material is still low. Students often face difficulties in visualizing and understanding the processes that occur in the human body, which can affect their learning motivation and learning outcomes (Feijo et al., 2019). Therefore, it is necessary to use virtual reality media in the learning process.

The use of VR technology offers the potential to create a more immersive and interactive learning experience (Zhang et al., 2019). By presenting digestive system material in a virtual environment, students can more easily understand difficult concepts while remaining engaged in the learning process. In addition, the unique and fun learning experience through VR can increase students' motivation to actively engage in learning (Benett and Colin, 2019).

This literature research will try to explore key concepts in the use of VR technology to improve students' learning motivation and learning outcomes on digestive system material. By understanding the theoretical underpinnings and related empirical findings, this research is expected to provide valuable insights for educators, researchers, and curriculum developers in designing effective and innovative learning strategies. Through a literature review using content analysis in several scientific journals, this research is intended to answer the following questions: 1) How is the implementation of virtual reality media in learning? 2) How is the implementation of virtual reality media improving motivation and learning outcomes?

## **Research Method**

The method used in this research is a systematic literature review by analyzing internationally published articles with a focus on the implementation of virtual reality media in learning, learning motivation, learning outcomes, and digestive system material. Articles were obtained through the Scopus, Elsevier, Science Direct, and Springer databases by entering keywords according to the focus of the study, namely virtual reality media, learning motivation, learning outcomes, and digestive system material. The primary articles analyzed in this study have several inclusion criteria, which can be seen in Table 1.

**Table 1. Conclusion Criteria for Articles**

No	Aspect	Inclusion
1	Article Types	Research Article
2	Publication Year	2018-2023
3	Source of article	National/international
4	Journal status	Scopus index
5	Article samples	Meddle School Students, Higher Education Student, and Educators
6	Including content focus	Biology/science/medical

The criteria for articles discuss six aspects, namely the type of article which is a research article, year of publication between 2018 to 2023, articles sourced from national and international articles, Scopus indexed journal status from Q1 – Q3, sample articles used are Meddle School Students, Higher Education Students, and Educators, the content focuses on biology, science and medicine.

## Result and Discussion

Based on the analysis of 20 articles obtained, the results of empirical studies related to articles are presented in Table 2 below

**Table 2. Article Information Used**

Literature Focus	Author	Journal Name	Country
Media of Virtual Reality	Zhang <i>et al.</i> (2019)	BMC Bioinformatics	USA
	Zhou <i>et al.</i> (2022)	Virtual Reality & Intelligent Hardware	China
	Paxinou <i>et al.</i> (2020)	Research in Science & Technological Education	Yunani
	Christopoulos <i>et al.</i> (2023)	British Journal of Educational Technology	Finland
	Tchao <i>et al.</i> (2023)	Epilepsy & Behavior Reports	Canada
	Reen <i>et al.</i> (2021)	Frontiers in Virtual Reality	German
	Benett dan Collin (2019)	Journal of Microbiology and Biology Education	USA
	Lengeth, et al (2021)	iScience	Sweden
	Wang, et al (2019)	Interactive Learning Environments	United Kingdom
Learning Motivation	Tokan dan Mbing (2019)	South African Journal of Education	Indonesia
	Maloy, et al. (2019)	CBE—Life Science Education	USA
	Yeo, et al (2022)	Education Tech Research Dev	Taiwan
	Bawanch dan Almanshan (2023)	International Journal of Information and Education Technology	Saudi Arabia
Student's Learning Outcomes	Georgiou dan Eleni (2018)	Computers in Human Behavior	Cyprus
	Lamb, et al (2022)	Computers and Education: Artificial Intelligence	USA
	Sari, et al (2018)	Unnes Science Education Journal	Indonesia
	Senisum, et al (2022)	Education Sciences	Indonesia
Dygestive System	Zumbach, et al (2019)	Journal of Educational Computing Research	Austria
	Feijo, et al (2020)	Journal of Biological Education	Brazil
	Tapia, et al (2023)	EURASIA Journal of Mathematics, Since and Technology Education	Spain

The information article used in table 2 discusses the literature focus, author, year of publication, journal name and country of origin where the author wrote the article. There are four topics of discussion in the literature focus, namely virtual reality media with a total of nine articles used, student learning motivation with a total of four articles, student learning outcomes with a total of four articles and digestive system material with a total of three articles used.

## **Discussion**

### ***Application of Virtual Reality Media in Learning***

The application of virtual reality (VR) media in learning has become one of the most revolutionary breakthroughs in the world of education. Referring to research conducted by Zhang et al. (2019) VR provides an immersive and interactive learning experience, allowing students to interact directly with learning content. This approach has been shown to improve students' conceptual understanding and help them achieve educational goals, as found in research by Paxinou et al. (2020). Applying VR to teaching allows teachers to create realistic simulations that are difficult to achieve with conventional methods. Furthermore, the utilization of VR can improve students' memory and understanding through immersive and multisensory learning experiences (Reen et al., 2021). In addition to increasing the attractiveness of learning, the use of VR also helps students understand abstract concepts better through hands-on experience (Benett and Colin, 2019). With the ease of use of VR for visual analysis, teachers can utilize it as an engaging and effective tool in the learning process, opening the door to a deeper and more memorable understanding for students (Wang et al., 2019).

In addition, the application of VR in learning can also increase student engagement. Research results from several articles show that the use of virtual reality media can improve student learning motivation, learning outcomes, and student achievement. Students can feel more motivated to learn when they are involved in a fun and interesting learning experience (Bawanch and Almanshan, 2023). This is in line with research (Zhou et al., 2022). VR can increase student involvement in learning, especially biology learning, by seeing visualizations of biological processes and the practical simulations displayed so that students more easily understand the material and do the practicum well. VR can also help students develop critical skills, such as problem solving and teamwork, through situational simulations that require collaboration (Paxinou et al., 2019). In addition, Lamb et al. (2022) suggested that the use of VR in distance learning or self-directed learning allows students to learn anytime and anywhere, expanding the accessibility of education.

In implementing virtual reality (VR) media as learning media, several key aspects need to be considered. Based on research (Paxinou et al., 2019), learning objectives are important and clear so that the use of VR can be directed and useful. Compatibility with learning materials should also be prioritized by ensuring that VR content is relevant and supports the curriculum being taught (Wang et al., 2019). In addition, technical aspects and device security should be overseen, including hardware and software compatibility as well as the implementation of data security policies. Creativity in the design of VR learning experiences needs to be promoted to create interesting and immersive learning situations (Tchao et al., 2023). Interactivity and student engagement are also key foci, ensuring that the VR experience provides space for active participation and exploration (Bawanch and Almanshan, 2023). Regular evaluation of the effectiveness of VR use needs to be done for the collection of feedback from students.

Although the potential of using virtual reality (VR) in learning is huge, significant challenges also arise along with its implementation. One of the main obstacles is the high cost of hardware and software, which can be a barrier for educational institutions with limited budgets (Paxinou et al., 2019). To overcome these challenges, strong support is needed from the education sector, be it the government, educational institutions, or the private sector.

### ***Application of Virtual Reality Media in Improving Student Motivation***

Virtual reality (VR) media plays a significant role in increasing students' learning motivation through a more immersive and interactive learning experience. First of all, VR creates an immersive learning environment, allowing students to truly engage in the subject matter (Zhang et al., 2019). Research (Benett and Colin, 2019) suggests that the use of VR headsets can help students feel the sensation of being in the place they are studying, such as seeing human organs in three-dimensional form. This ability creates a more vivid and memorable learning experience, which intrinsically motivates students to actively engage. Research conducted by Tokan and Mbing (2019) has proven that intrinsic motivation has a direct effect on student learning behavior that arises from oneself. Learning behavior includes focused learning in class, diligent reading, frequent visits to the library, and preparing well if you want to take an exam. The existence of intrinsic motivation has a major impact on student learning achievement (Yeo et al., 2022). In addition to intrinsic motivation, the application of VR can also affect students' extrinsic motivation. VR can also provide additional incentives for students, such as virtual awards or interactive assessments, which can provide external encouragement to achieve learning goals (Toka and Mbing, 2019).

Utilizing VR technology, educators can create learning experiences tailored to students' needs and preferences, maximizing their understanding and interest in the subject matter (Christopolous and Nikolaos, 2023). This relates to research (Maloy et al., 2019), which suggests that actively engaged students can succeed in overcoming lesson challenges, which can help increase students' cognitive motivation. Cognitive motivation is more easily achieved through the advanced features of VR. Virtual environments encourage students' creative thinking and problem-solving skills as they are exposed to situations that represent real challenges (Zhang et al., 2019). Applying VR to learning, which makes students participate in simulated scientific experiments or explore virtual environments to find solutions, can increase students' confidence and stimulate their cognitive motivation to continue exploring and understanding the concepts taught (Lengeth et al., 2021).

In addition, the application of virtual reality (VR) media in an educational context opens up great opportunities to increase student motivation in various domains. Based on research conducted by Georgiou and Eleni (2018), domain motivation, which includes students' desire to achieve goals or success in a particular learning domain, can be strengthened through the learning experience offered by VR. Through VR, students can experience the real-world context of the learning material, building relevance and urgency for the concepts being taught (Benett and Colin, 2019). The motivational aspect of the domain is also strengthened by VR through simulation and practical experience (Zhou et al., 2022). In science lessons, students can conduct virtual experiments without physical risk, which creates confidence and motivation to better understand scientific concepts (Paxinou et al., 2019). In this context, VR allows students to relate learning to real-world applications, increasing their learning motivation by providing a more relevant and meaningful context (Benett and Colin, 2019).

The use of virtual reality (VR) in education not only increases students' learning motivation in terms of cognitive and domain domains but also encourages collaboration between them, forming a supportive social learning environment (Georgiou and Eleni, 2018). In virtual spaces, students can interact, discuss, and cooperate in completing learning tasks (Paxinou et al., 2019). Research conducted by Bennett and Colin (2019) suggests that by effectively utilizing the potential of VR, this medium can be a powerful tool to create sustainable and deep learning motivation for students.

### ***Application of Virtual Reality Media to Improve Learning Outcomes***

Virtual reality (VR) media has opened up new opportunities in education with its potential to improve student learning outcomes (Zhang et al., 2019). VR has potential benefits in

visualizing abstract information, and many studies show that users tend to understand data better and faster in VR environments than conventional 2D and 3D desktop visualizations. The use of VR as a learning medium has a positive impact on increasing student engagement and motivation (Reen et al., 2021). Fun and engaging learning experiences through VR can overcome boredom and stimulate students' interest in learning. Students become more active and engaged in the learning process because they can control their own experience (Georgiou and Eleni, 2018). Research conducted by Tchao et al. (2023) also suggests that student learning outcomes can improve overall because the use of VR media creates a learning experience that is more real, interesting, and relevant to the learning content being taught.

Based on research by Hanifah and Purwanti (2019), in seeing student learning outcomes, there are three aspects that need to be considered that can be the focus of evaluation, namely cognitive, affective, and psychomotor aspects. In the cognitive dimension, the use of virtual reality (VR) offers an immersive and interactive learning experience, presenting a number of important benefits for students (Bawanch and Almanshan, 2023). The technology allows students to access information through realistic simulations and visualizations, creating a more engaging and interesting learning environment (Zhou et al., 2022). The use of VR also allows students to establish an emotional connection with the subject matter. The use of VR in the cognitive dimension not only improves students' understanding of difficult concepts but also opens the door for deeper exploration and more meaningful learning experiences (Tchao et al., 2023). The use of VR provides opportunities for students to be more actively involved in the learning process, stimulate curiosity, and develop a more holistic understanding of the subject matter (Sariy et al., 2018).

In addition, the learning experience through VR can also stimulate students' motivation to achieve higher goals (Paxinou et al., 2019). In an affective context, VR creates high emotional engagement as students can interact with the learning content directly (Zhang et al., 2019). This engaging learning experience not only creates a positive bond between students and learning materials but also stimulates students' curiosity and passion for learning (Lamb et al., 2022). Emotionally engaged students tend to be more motivated to understand and explore further (Hanifah and Purwanti, 2022). Stimulation of curiosity through direct interaction with subject matter in a VR environment can be a catalyst for increasing student motivation. By stimulating students' emotional aspects, VR can motivate them to invest more time and energy in learning so as to guide them towards higher achievement (Tchao et al., 2023).

In terms of psychomotor skills, VR can improve students' practical and application skills (Wang et al., 2019). Through interactive simulations, students can immerse themselves in tasks or situations that demand a physical response, strengthening the connection between theory and practice (Hanifah and Purwanti, 2022). The ability of students to respond directly to virtual stimulus creates a more practicing and engaging learning experience (Senisum et al., 2022). The importance of VR in the psychomotor context also lies in its ability to create holistic and integrated learning (Reen et al., 2021). By bringing together theory and practice in a comprehensive learning experience, students can develop a deeper and more applied understanding of the skills they are learning (Lamb et al., 2022). By embracing cognitive, affective, and psychomotor dimensions, VR can be an effective tool to improve students' learning outcomes and stimulate their interest in learning.

### ***Digestive System Material***

Digestive system material is one of the biological materials that is difficult for students to understand because it is abstract, cannot be observed directly, and is complex (Yoe et al., 2022). This material discusses the structure and function of organs in the digestive system, as well as complex processes such as mechanical and chemical digestion that occur in the body (Tapia et al., 2019). Students often face difficulties in visualizing and understanding the processes that occur

in the human body, which can affect their learning motivation and learning outcomes (Feijo et al., 2020).

In understanding digestive system material, teachers have a key role in presenting information in a clear and interesting way (Zumbach et al., 2019). The use of diverse teaching methods, such as anatomical models, graphic visualizations, or practical demonstrations, can help students understand these complex concepts (Tapia et al., 2019). Emphasizing student engagement through discussions, interactive questions, or small research projects can also improve students' understanding of digestive system material and increase their interest in the biological processes that occur in the body (Yoe et al., 2022).

In addition, the application of technology in learning, such as the use of virtual reality (VR) animations or simulations, can be an effective means to help students visualize the digestive process in greater depth (Wang et al., 2019). VR can provide an immersive experience that allows students to "infiltrate" the body and witness the digestive process in a way that is not possible in traditional learning environments (Tapia et al. 2020). In this way, the digestive system material is not just theoretical information but becomes a more vivid and meaningful learning experience for students.

## **Conclusion**

Implementation of virtual reality (VR) media Virtual reality (VR) media has opened the door to new opportunities in the world of education with its potential in learning, especially in learning material that is abstract or difficult to see directly, such as digestive system material which discusses the digestive organs and bioprocesses that occur in the body. The implementation of VR in learning can overcome difficulties in visualizing and understanding the processes that occur in the human body, so that it can improve students' skills regarding material that influences learning motivation with their abilities. The interactive, visual, and sensory affordances offered by VR technology not only increase student engagement but also help improve long-term retention of information. Increasing student engagement means increasing students' intrinsic motivation. Through increasing learning motivation, effective use of VR can lead to better learning outcomes. The use of VR makes a positive contribution to the overall student learning experience. Implementation of VR media can improve student learning outcomes from cognitive, psychomotor and affective aspects.

## **Acknowledgments**

The researcher would like to thank the lecturers of the Biology Education International Research Review course at Postgraduate School, Indonesia University of Education, for their useful suggestions to improve the manuscript.

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