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ENHANCING ELEMENTARY SCHOOL STUDENTS' ENVIRONMENT AWARENESS THROUGH VIRTUAL REALITY BASED IMMERSIVE LEARNING EXPERIENCES

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Abstract

This study aimed to investigate the potential of virtual reality (VR) technology in enhancing environmental awareness among elementary school students. The theme was focused on animals in their natural habitat to provide an immersive learning experience. The method involves designing and implementing a VR-based curriculum for a group of fifth-grade students in Yogyakarta, Indonesia, using the Meta Quest 2 (formerly the Oculus Quest 2) and student worksheet developed with a Problem-Based Learning model. The curriculum includes interactive modules that allow students to explore different animal habitats and engage in virtual field trips to wildlife reserves. The VR environment allowed students to explore different animal habitats and engage in virtual field trips to wildlife reserves. The results show that the VR has potential effect on students' environment awareness, as well as their engagement and interest in learning about the natural world. This study suggests that the use of VR technology in elementary school classrooms has the potential to enhance students' learning experiences, promote environment awareness, and inspire future generations to become responsible stewards of the planet.

Keywords: Virtual reality, elementary schools, environment awareness, animal habitats, immersive learning experience.

1 INTRODUCTION

Virtual reality (VR) technology can revolutionise how we learn and experience the world around us. In recent years, educators have explored using VR in the classroom to create immersive learning experiences that engage students and enhance their understanding of complex concepts [1]–[3]. VR in education is still in its infancy, and new applications and methods for using the technology are being developed constantly. As VR technology continues to evolve and become more accessible, educators and researchers will have the opportunity to explore new ways of using it to enhance student learning and engagement. It makes it an exciting area of research with considerable potential for innovation and discovery [4]–[6].

The research novelty of using VR in education lies in its potential to create immersive and engaging learning experiences beyond what can be achieved through traditional teaching methods [7], [8]. VR technology allows students to explore and interact with complex concepts and environments that would otherwise be difficult or impossible to experience in the classroom. This approach is still a relatively new field, and much research is needed to understand its potential benefits and limitations fully [9]–[11]. However, the study mentioned in the article provides evidence of the positive impact that VR can have on students' environmental awareness and engagement.

The impact of VR usage on the learning experience can be significant. VR technology can create immersive and engaging learning experiences that help students better understand complex concepts and environments [12], [13]. VR captures students' attention and make learning more fun and interactive. It can create a sense of presence and involvement, making students feel like they are a part of the learning experience. Research has shown that VR can improve retention rates by providing students with a more memorable and engaging learning experience [14]. VR helps students visualize and interact with abstract concepts, making them easier to remember. VR creates personalized learning experiences tailored to individual students' needs and interests [7], [15]. It helps keep students engaged and motivated and provides them with a more effective learning experience. The impact of VR usage on the learning experience is positive, with the potential to enhance engagement, retention, understanding, personalization, and accessibility. However, it is essential to note that the effectiveness of VR in education is still being studied, and it is necessary to use it appropriately and thoughtfully to maximize its benefits.

The study focused on animals in their natural habitat, using VR technology to provide an immersive learning experience for fifth-grade students. The curriculum included interactive modules that allowed students to explore different animal habitats and engage in virtual field trips to wildlife reserves. The study aimed to investigate the potential of VR technology in enhancing environmental awareness among elementary school students. The goal was to promote environmental awareness and inspire future generations to become responsible stewards of the planet.

2 METHODOLOGY

10 The study aimed to investigate the potential of VR technology in enhancing environmental awareness among elementary school students. The researchers designed and implemented a VR-based curriculum for fifth-grade students to achieve this. The method involved using The Meta Quest 2 (formerly the Oculus Quest 2) VR headset and student worksheets. This study was conducted on upper elementary school students (4th and 5th grades) at a public elementary school in Yogyakarta, Indonesia.

The VR-based curriculum consisted of interactive modules that allowed students to explore different animal habitats and engage in virtual field trips to wildlife reserves. The students wore The Meta Quest 2 VR headset, which provided an immersive and engaging experience. The headset was preloaded with educational VR content designed to support the curriculum.

13 The curriculum was delivered over the course, with students engaging in VR-based learning activities during their regular class time. The curriculum was designed to be interactive, with students actively participating in the learning experience through exploration and engagement with the virtual environment. In addition, the student worksheets were developed using the Problem-Based Learning (PBL) model. This model is a student-centred approach to learning that encourages students to actively engage in the learning process by identifying and solving real-world problems.

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24 The worksheet activities were designed to guide students through the PBL process, which involved several stages, including problem orientation, problem organization, investigation, analysis, and evaluation of problem solutions. Each stage of the PBL process was carried out by students in groups, allowing for collaborative learning and the development of problem-solving skills. Using the PBL model in conjunction with the VR-based curriculum, students applied what they learned in the virtual environment to real-world scenarios and developed a deeper understanding of the material. The combination of VR technology and the PBL model provided an engaging and practical learning experience for the students, promoting active learning and problem-solving skills. This worksheet was designed to encourage students to reflect on their learning experiences and to apply their knowledge to real-world scenarios. The students completed the worksheets during and after the completion of the VR-based curriculum.

3 RESULTS

3.1 Learning Preparation

To ensure that students could fully benefit from the VR-based curriculum, they were given an introductory session to familiarize themselves with the VR technology (See Figure 1). During this session, the teacher guided the students through operating The Meta Quest 2 VR headset, such as how to put it on properly, adjust the settings, and navigate through the menus. Furthermore, the teacher explained to the students how to use the provided student worksheets. The worksheets were designed to help students reflect on their learning experiences and apply what they learned to real-world scenarios. The teacher instructed the students to complete the worksheets as they progressed through the VR-based curriculum. By providing an introductory session and instructions on using the student worksheets, the teacher ensured that the students were prepared to fully engage in the VR-based learning activities and maximise the experience.



Figure 1. Preparation activities: Introductory session

3.2 Learning Activities

Students were grouped and assigned activities during the learning sessions according to their respective worksheets (See Figure 2). Each student was allowed to use The Meta Quest 2 VR headset to explore and engage with the virtual animal habitats. The VR-based curriculum covered various topics related to animals, such as their habitats, movements, physical characteristics, sounds, and accompanying text explanations. The VR technology allowed students to move freely between different animal habitats and observe them at their own pace.



Figure 2. Working on group following the worksheet

The observations made by the students during their VR-based exploration were then used to complete the worksheet activities. These activities were designed to help students reflect on their observations, deepen their understanding of animal habitats, and apply what they learned to real-world scenarios.

1 By working in groups and engaging with the VR-based curriculum, students learned in a more immersive and interactive way. The VR technology provided a unique and engaging learning experience that allowed students to explore and observe animal habitats in ways that would not have been possible with traditional classroom methods. Overall, using VR technology in the classroom gave students a more engaging and practical learning experience.

3.3 Learning Outcome

The figure shows that students described the characteristics of animals after engaging in VR-based observations. VR technology allowed students to immerse themselves in virtual animal habitats, making it easier for them to observe and understand the physical characteristics and behaviours of the animals. Figure 3 and Figure 4 describe the activity to identify the animal characteristics. They write it after observing in the VR.



Figure 3. The assignment to identify the animal characteristics after using VR

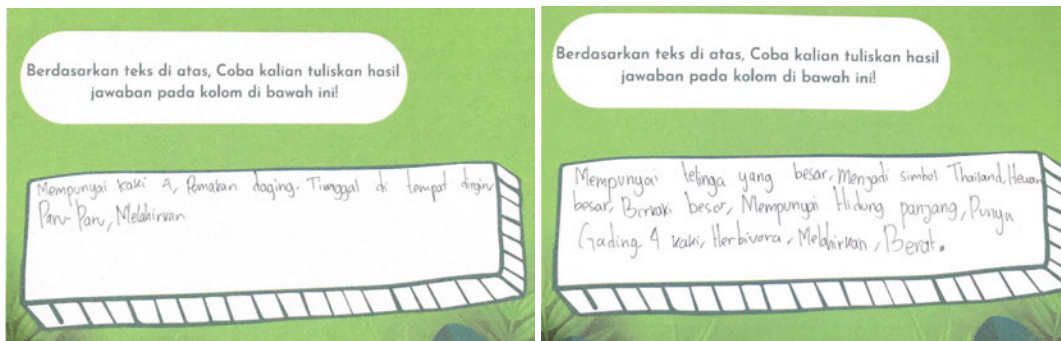


Figure 4. Student answer based on the observation in the VR

During this learning experience, students discovered new vocabulary words related to animal characteristics and habitats they had not previously encountered. It helped to reinforce their understanding of animals and their environments (See Figure 5 left). Furthermore, through the PBL model, students were encouraged to identify various problems related to wildlife conservation and develop alternative solutions from their perspectives (See Figure 5 right). It allowed them to think critically about the impact of human activities on the environment and create a sense of responsibility towards protecting and preserving wildlife.

Temuan kosa kata baru beserta maknanya :			No. Faktor	
No.	Kosa kata baru	Makna		
1.	Sub-Species	Kelompok kecil	1.	Cagar Alam diperbaiki.
2.	Berhimpitan	Berkelompok	2.	Mengasih ke Makanan Hewan yang benar.
3.	Cagar Alam	Tempat hewan langka	3.	Memperbaiki hutan gundul/Reboisasi.
4.	Desadasi	kehilangan	4	Biarkan Hewan Beradaptasi.
5.	Critical Endangered	kritis	5	Tidak memburu.

Figure 5. The others student's outcome: new vocabulary and finding the solustions

The combination of VR technology and the PBL model provided a unique learning experience that enhanced students' knowledge of animals and their habitats and developed their critical thinking and problem-solving skills. By empowering students to take an active role in environmental conservation, this learning experience has the potential to inspire future generations to become responsible and environmentally conscious global citizens.

4 DISCUSSION

The results showed the improvement in students' environmental awareness, engagement, and interest in learning about the natural world. The students who participated in the VR-based curriculum showed a deeper understanding of environmental issues and were more likely to express a desire to protect the planet. Through the use of VR-based observations and accompanying worksheet activities, students

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22 were able to deepen their knowledge and understanding of animal habitats. The combination of VR technology and the PBL model provided a practical learning experience that allowed students to apply what they learned in the virtual environment to real-world scenarios. The results suggest that the use of VR technology in the classroom has the potential to enhance student's learning experiences and promote environmental awareness. By providing an immersive and engaging learning experience, VR technology inspires future generations to become responsible stewards of the planet.

14 The use of VR technology in the classroom has several advantages. It allows students to experience environments and concepts that may be difficult or impossible to replicate in a traditional classroom setting [16], [17]. It helps to create a more engaging and immersive learning experience that captures students' attention and motivates them to learn [12]. VR technology created simulations that allow students to experiment with complex ideas and concepts in a safe and controlled environment.

14 The use of VR technology in the classroom has its challenges. One of the main concerns is the cost of implementing VR technology in schools. VR headsets and other equipment can be expensive, and not all schools have the resources to invest in this technology. Additionally, there may be concerns about the potential for distraction or disorientation when using VR technology, which could lead to reduced learning outcomes. Despite these challenges, this study's results suggest that using VR technology in elementary school classrooms enhanced students' learning experiences, promote environmental awareness, and inspire future generations to become responsible stewards of the planet. As technology continues to develop and become more accessible, more and more schools will likely begin incorporating VR into their curricula [18]–[20]. It has the potential to transform education and help prepare students for the challenges of the 21st century.

1 The results of this study can be explained using several educational theories. The combination of constructivist, social constructivist, and experiential learning theories provided a robust framework for creating compelling and engaging learning experiences using VR technology in the classroom. The use of VR technology in this study aligns with the principles of constructivism, which posits that learners construct their understanding of the world based on their experiences and interactions with their environment [1], [21]. Through the immersive and interactive learning experience VR technology provides, students actively engage with the material and construct their knowledge of animal habitats and conservation.

17 The use of the PBL model aligns with the principles of social constructivism, which emphasizes the importance of social interaction and collaboration in learning. Through working collaboratively in groups, students could share their ideas, build on each other's knowledge, and develop a shared understanding of the problems and solutions related to wildlife conservation [22], [23]. The results of this study can be explained using the concept of experiential learning, which suggests that learning occurs through a cycle of concrete experiences, reflective observation, abstract conceptualization, and active experimentation [24], [25]. Through the VR-based observations and accompanying worksheet activities, students could engage in each stage of this cycle, from experiencing the virtual animal habitats firsthand to reflecting on their observations to applying their knowledge to real-world problems.

5 CONCLUSIONS

27 This study highlights the potential of VR technology to enhance environmental awareness among elementary school students. By designing and implementing a VR-based curriculum focused on animal habitats, the study demonstrated that students could improve their knowledge and attitudes towards the natural world. The results showed that students could engage with the material, learn new vocabulary, identify problems related to wildlife conservation, and propose alternative solutions. The use of VR technology in the classroom has the potential to provide an immersive and interactive learning experience that can enhance students' engagement, interest, and understanding of complex concepts related to the environment. As educators continue to explore the potential of VR technology in the classroom, further research is needed to assess the long-term impact of VR-based learning on student achievement and engagement. Nonetheless, this study provides a promising indication of the potential of VR technology to promote environmental awareness and inspire future generations to become responsible stewards of the planet.

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