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Designing Virtual Reality Learning Media To Enrich Early Childhood Learning On Underwater Ecosystems

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Abstract. Indonesia is an archipelago with abundant and beautiful marine resources. This is due to the underwater ecosystem that is still maintained. In order to maintain the underwater ecosystem, it is important to instil awareness to protect the environment from an early age from things that can damage the underwater ecosystem. Therefore, it is important for children to understand the underwater situation so that children know how beautiful and rich in benefits to be enjoyed by the Indonesian people. This makes learning about underwater life necessary for early childhood to enrich their knowledge and understanding. Children cannot yet be invited to think abstractly, so the use of concrete media in order to be able to channel children's imagination into more real things. The learning media used to study underwater ecosystems mostly only use two-dimensional visual media, so children do not feel the real sensation of being under the sea. Therefore, this research aims to develop two-dimensional visual media into virtual reality media. The existence of Virtual Reality learning media is able to provide real information and can interact directly with the marine environment. This research uses design research methods with qualitative analysis that discusses how to design Virtual Reality applications suitable for children aged 5-6 years that can simulate underwater ecosystems. Virtual Reality which is used as an alternative media in learning about marine biota for children is an effort to preserve marine biota in Indonesia.

Keywords: *underwater, Virtual Reality, learning media, Early childhood*

Abstrak. Indonesia adalah sebuah negara kepulauan dengan kekayaan laut yang berlimpah dan indah. Hal tersebut disebabkan oleh ekosistem bawah laut yang masih terjaga. Agar ekosistem bawah laut tetap terjaga pentingnya untuk menanamkan kepedulian untuk menjaga lingkungan sejak dini dari hal-hal yang dapat merusak ekosistem bawah laut. Oleh karena itu, penting bagi anak untuk memahami situasi bawah laut agar anak mengetahui betapa indah dan kaya akan manfaat untuk dinikmati oleh Masyarakat Indonesia. Hal tersebut menjadikan pembelajaran tentang kehidupan bawah laut diperlukan bagi anak usia dini untuk memperkaya pengetahuan dan pemahaman mereka. Anak-anak belum bisa diajak untuk berpikir abstrak, sehingga penggunaan media konkret agar mampu menyalurkan imajinasi anak ke hal yang lebih nyata. Media pembelajaran yang digunakan untuk mempelajari ekosistem bawah laut sebagian besar hanya menggunakan media visual dua dimensi, sehingga anak-anak tidak merasakan sensasi nyata berada di bawah laut. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan media visual dua dimensi menjadi media *virtual reality*. Adanya media pembelajaran *Virtual Reality* mampu memberikan informasi secara nyata dan bisa berinteraksi langsung dengan lingkungan laut. Penelitian ini menggunakan metode penelitian *design research* dengan analisis kualitatif yang membahas bagaimana merancang aplikasi *Virtual Reality* yang sesuai untuk anak umur 5-6 tahun yang dapat mensimulasikan ekosistem bawah laut. *Virtual Reality* yang digunkan sebagai media alternatif dalam pembelajaran tentang biota laut untuk anak-anak merupakan upaya pelestarian biota laut di Indonesia.

Kata Kunci: *Bawah laut, Virtual Reality, Media pembelajaran, Anak usia dini*

Introduction

The National Association for the Education of Young Children (NAEYC) defines early childhood as children aged 0 to 8 years. This age represents a period of growth and development in many aspects of human life (Susanto, 2021). In this process, the appropriate stimulus for children is provided through education.

Early childhood education aims to stimulate and stimulate children's growth and development in physical, motor, cognitive, social, religious, artistic, and language areas (Maghfiroh, 2021). Early childhood education includes media-based learning. The teacher uses learning media as an intermediary to deliver material to students. At this time, learning media is evolving to keep up with the times.

Books have long been a popular learning medium in schools. However, some books only describe the illustrations. Even when pictures are included in the book, they are limited, making it difficult for young children to learn about other objects that are not depicted. As a result, there is a need for innovative learning media. This innovation should be based on aspects of child development such as physical, motor, language, and

social skills. Based on this, there is media that can be used, specifically virtual reality technology.

According to Jamil (Ariatama, et al. 2021), virtual reality is a tool used like glasses to create immersive simulations that allow users to interact while feeling as if they are in a cyberspace environment. Virtual reality also simulates a virtual environment in which users are immersed to the point of feeling "there". (Wohlgenannt, 2020). As a result, by using Virtual Reality learning media, children can directly experience the environment that the teacher is explaining. Virtual Reality images are not limited to two dimensions, allowing children to feel and explore new experiences. In addition, Virtual Reality can encourage children to actively participate and interact with their friends.

Virtual reality is also useful for visiting places that are too far away or impossible to reach in person, such as under the sea. This paves the way for deeper learning and helps students understand abstract concepts in a more concrete way.

According to the Ministry of Education's Learning Resources page, communication technology for conveying information has existed since prehistoric times. Initially, communication relied on grunts and hand signals. Then it evolved into more modern communication equipment.

1. Prehistoric Period (... to 3000 BC)

In prehistoric times, early humans communicated through information on cave walls. They described their hunting experiences and the animals they hunted. They painted pictures to represent the things they wanted to say. Chatter among humans was limited to grunts, sign language, and hand gestures.

2. Historical Period (3000 BC to 1400 AD)

During the historical period, communication technology evolved for the better. The process of drawing on cave walls was still ongoing. However, it developed again by using symbols such as during the life of the Sumerians who used pictograph letters in the 3000 BC era.

Then, in the period of 2900 BC, hieroglyphic letters appeared by the ancient Egyptians. In 1570-1045 BC, the writing system also developed during the Shang dynasty in China. Entering the period of 500 BC, the ancient Egyptians used papyrus trees as paper. Furthermore, Tsai Lun from the Chinese invented paper from bamboo fibers and enabled a printing system using wooden blocks that were incised and smeared with ink.

3. Modern Period (1400 AD - present)

In modern times, communication technology has allowed information to spread very widely. Newspapers, telegraphs, telephones, typewriters, radios, televisions, and the internet were invented to make it easier for people to communicate and deliver information faster.

Method

The investigation into the creation of concept comprehension modules utilizing guided discovery models employs the Design Research methodology. Design Research can be employed for investigations aimed at designing or developing interventions intended to address complex issues within the educational sector (Plomp & Nieveen, 2013). This research employs the Development Study methodology. A development study is an endeavour aimed at formulating design principles to address issues in education and practical fields (Prahmana, 2017). This research establishes a valid and practical module for understanding concepts, enabling subsequent studies to assess its potential impact on the comprehension of mathematical concepts and the validity of the research findings.

Results dan Discussions

A. *Virtual Reality*

Virtual reality, or VR as it is known in Indonesian, is a computer technology that allows users to interact with the environment in a simulated virtual world, making them feel as if they are actually there. The true experience of virtual reality (VR) is enhanced by supporting tools such as VR headsets (useful for monitoring the user's head and seeing the Virtual Reality world), gloves (useful for moving hands and sending information about our movements in the real world to the Virtual Reality world). Several elements in virtual reality complement it, such as:

1. *Virtual world*

Virtual World is the main element, which is a computer-based simulation setting that can create personal avatars so that users can explore the virtual world. Users use avatars in the form of screenplays or scripts.

2. *Immersion*

The second equally significant element is to enable users to experience diverse sensations in the virtual realm as they do in the physical world. Immersion is classified into three categories, specifically:

1) *Metal Immersion*, allows users to engage with reality within a virtual setting.
2) *Physical Immersion,* users can perceive themselves as physically present in a virtual space.
3) *Mentally Immersion,* users experience the sensation of immersion in a virtual setting.

3. *Sensory feedback*

This component transmits the virtual setting to the user's sensory perception. This element enables users to hear, see, and perceive sensations of touch in the virtual domain.

4. *Interactivity*

The final element functions to respond to the user's actions or presence via objects within the virtual setting.

B. Benefits of *Virtual Reality as a Learning Media*

The majority of the learning media used in the Early Childhood Education program is still conventional. Children only see marine life through pictures or interactive videos created using digital media. Thus, using virtual reality as a learning medium is a beneficial innovation for children's learning experiences. Children can have a more realistic experience than if they only see two-dimensional images or videos. One of the advantages of using virtual reality is its potential to improve student learning retention. Virtual reality media includes both visual and audio elements (Elmqaddem, 2019; Sala, 2021). Virtual reality also facilitates learning, eliminating the need for teachers to take students directly to the sea to learn more about marine biota.

C. Drawbacks of *Virtual Reality as a Learning Media*

There are numerous drawbacks to using virtual reality as a means of learning. Specifically, the time allotted for using gadgets in early childhood is extremely limited, as using gadgets for too long can have a variety of negative effects on children's health and emotions. Thus, virtual reality cannot be used for an extended period of time or

frequently enough. In addition to time constraints, a lack of human resources who understand how to use digital media correctly is a barrier to the use of virtual reality as a learning tool. The costs involved are also significant, so not all PAUD can use virtual reality as a learning medium. Limited battery power can also be an issue, as each child will need more than one VR to feel their turn using VR.

D. Aspects of *Virtual Reality Development as a Learning Media*

Virtual reality (VR)-based underwater learning for young children has several important effects on their development. In terms of cognitive development, VR can help children improve their creative and critical thinking skills by allowing them to interact with virtual environments and analyze various scenarios. This makes it easier for them to understand learning concepts and increases their motivation to learn. VR could assist children develop language skills including questioning, recognizing shapes, letters, and colors, and communicating more effectively. Children can practice speaking and interacting with their peers in a virtual environment. In terms of physical-motor skills, virtual reality can help children develop fine and gross motor skills by allowing them to interact with the virtual environment. Children can practice using their hands and feet to interact with virtual worlds.

E. An Overview of the Use of Virtual Reality as a Learning Media

Begin by discussing the underwater world with the children, asking if they have ever seen or imagined what it would be like to explore the seafloor. Ensure that each child has a Virtual Reality headset and that the controllers are properly configured and functional. Select a Virtual Reality scene that depicts an underwater environment, like a coral reef or a sunken ship. Briefly describe the scene to the children, pointing out various features like fish, seaweed, and other marine life. Allow children to explore the underwater scene with virtual reality headsets and controllers. Encourage them to move around, interact with objects, and observe the marine life. As the children explore, offer guidance and ask questions to encourage them to think critically about what they observe. For example, ask them to name various types of fish or describe the colors they see.

Incorporate interactive activities into your lessons to boost engagement and learning. For example, players can collect virtual shells by clicking on them with the controller, feed virtual fish by clicking on them with the controller, or play a game in

which they must find hidden virtual objects underwater. After the interactive activity, ask the children to summarize what they learned and reflect on their experience. Encourage children to share their thoughts and observations about the underwater world, and ask them to describe what they liked best about the virtual reality experience. The use of virtual reality in early childhood can help to increase and channel children's interest in learning, as well as enrich their learning experience by making it more realistic and interactive. Virtual reality can help children understand and remember concepts more effectively. Furthermore, virtual reality can help reduce learning costs while improving children's problem-solving and critical thinking abilities. Thus, the use of virtual reality in early childhood can help to improve learning quality and enrich the learning experience.

Figures

Figure 1. Three-dimensional underwater illustration

Figure 2. Children utilize virtual reality for educational purposes.

Conclusion

Virtual reality, or VR, is a computer technology that enables users to interact with a simulation setting, creating the sensation of being present within that world. Virtual Reality in early childhood offers numerous applications and advantages. An exemplary application of virtual reality is the exploration of the underwater realm. Virtual reality serves as a viable solution for accessing distant or otherwise inaccessible locations, such as underwater environments. This facilitates deep learning and enables students to comprehend abstract concepts more realistically.

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