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Effectiveness of virtual reality media based on local wisdom: Indigenous Baduy Tribe, Kasepuhan Citorek and Kesepuhan Neglasari Banten Indonesia

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Abstract: The application of Virtual Reality media based on local wisdom in learning Natural and Social Sciences for grade IV elementary school students, with an emphasis on the culture of the Baduy Tribe, Kasepuhan Citorek, and Kesepuhan Neglasari in Banten, Indonesia. This study is to assess how virtual reality technology can improve students' understanding and interest in Natural and Social Sciences materials related to local wisdom and customs. The results of the study indicate that the virtual reality media applied is effective in significantly improving students' understanding. The average N-Gain value of 0.85 indicates the success of the media in achieving its goals. It can be concluded that the use of virtual reality not only deepens students' understanding of Natural and Social Sciences topics related to local wisdom, but also motivates them to be more active in the learning process.

Keywords: *Indigenous Baduy tribe, Local wisdom, Virtual reality media,*

1. Introduction

Basic education plays an important role in building the foundation of children's knowledge and understanding of their environment. In the context of learning natural and social sciences, incorporating local wisdom and local culture not only enriches students' learning experiences but also helps them understand and appreciate their cultural heritage. One innovative approach that can be used virtual reality technology. Introduction basic education plays an important role in building the foundation of children's knowledge and understanding of their environment. In the context of learning natural and social sciences, incorporating local wisdom and local culture not only enriches students' learning experiences but also helps them understand and appreciate their cultural heritage. One innovative approach that can be used is virtual reality technology. Virtual reality technology provides an immersive experience, allowing students to "feel" various aspects of culture and traditions directly even though they are far from the location (Calvert & Abadia, 2020). Research on the use of virtual reality media has been widely conducted, such as by (Purwanti et al., 2022) who stated the importance of virtual simulation in nursing education as an effective tool to prepare students to face challenges in the clinical world. (Khodabakhshian et al., 2024) aims to identify the challenges faced in implementing virtual reality applications for communication training, as well as documenting the limited literature on the use of virtual reality in communication training that can help answer future research questions. (Gelmini et al., 2021) while virtual reality has been shown to be effective in skill acquisition, further research is needed to evaluate and regulate the use of this technology in various procedures within interventional radiology. In general, there is a consensus that virtual reality can enhance conceptual understanding and provide significant benefits in teaching. (Asmirajanti & Tamly, 2024) virtual reality not only serves as a tool to understand learning materials, but also provides an immersive simulation experience to enhance students' clinical knowledge. (Sholihin et al., 2020) technology provides an immersive experience, allowing students to "feel" various aspects of culture and traditions directly even though they are far from the location (Calvert & Abadia, 2020). Research

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on the use of virtual reality media has been widely conducted, such as by (Purwanti et al., 2022) who stated the importance of virtual simulation in nursing education as an effective tool to prepare students to face challenges in the clinical world. (Khodabakhshian et al., 2024) aims to identify the challenges faced in implementing virtual reality applications for communication training, as well as documenting the limited literature on the use of virtual reality in communication training that can help answer future research questions. (Gelmini et al., 2021) while virtual reality has been shown to be effective in skill acquisition, further research is needed to evaluate and regulate the use of this technology in various procedures within interventional radiology. In general, there is a consensus that virtual reality can enhance conceptual understanding and provide significant benefits in teaching. (Asmirajanti & Tamly, 2024) virtual reality not only serves as a tool to understand learning materials, but also provides an immersive simulation experience to enhance students' clinical knowledge. (Sholihin et al., 2020) This study aims to evaluate Virtual Reality -based learning media for teaching business ethics, (Lee et al., 2009) that the virtual reality desktop learning program has a positive effect on students' academic achievement and perceptions of learning quality and satisfaction, (Fitria, 2023) shows that AR and virtual reality are solutions for teachers and students as media in the teaching and learning process (Sudipa et al., 2022), (Monita & Ikhsan, 2020) virtual reality is suitable for use in science learning, (Zulherman et al., 2021) that the development of virtual reality-based learning media on Human Anatomy material for grade V of elementary school can improve learning outcomes. With virtual reality, students can explore culture, customs, and social environments virtually, giving them a deeper and more interactive understanding of the material being studied. In Indonesia, Banten province has several indigenous communities that are rich in local wisdom, such as the Baduy Tribe, Kasepuhan Citorek, and Kesepuhan Neglasari. Each of these communities has unique traditions and cultural values, which can be integrated into the education curriculum, especially in science learning in elementary schools. However, the main challenge is how to convey and display this cultural richness effectively to students, especially with geographical and resource limitations. Research on local wisdom has been widely conducted, such as by (Nasrah & Siraj, 2023) The importance of this research is because schools need a school culture model based on local wisdom values in realizing character education. (Chairiyah, 2017) through local wisdom values is to form qualified and professional teachers, (Chaer et al., 2021) efforts to preserve various elements of local wisdom, traditions, and local institutions, including norms, customs, and culture, can function effectively in education. (Nurjannah et al., 2019) Local wisdom education is needed as an effort so that students are able to explore regional potential based on their respective local wisdom. Global-minded education directs students to be able to think globally related to the world, especially in the realm of education. (Darmadi, 2018) Local wisdom education is part of the culture of a society that cannot be separated from the language of the society itself. Local wisdom is passed down from generation to generation through word of mouth. Local wisdom is found in folklore, proverbs, songs, and folk games. (Rahim et al., 2022) Local wisdom is a noble cultural value that must be integrated into education. (Fairus et al., 2024) describe how local wisdom which is the identity and identity of the nation is integrated into learning in elementary schools. (Imron et al., 2023) utilize cultural wisdom, (Imron et al., 2023) integrate local wisdom values in learning (Irwan et al., 2019) suggest using local wisdom in teaching to preserve culture and shape the identity and character of the nation. This article aims to examine the effectiveness of using local wisdom-based virtual reality media in science learning for grade IV elementary school students. this study will assess how virtual reality technology can enhance students' understanding of local wisdom and cultural traditions and identify challenges and opportunities in its implementation. it is hoped that the integration of virtual reality in learning can enrich students' learning experiences and support the preservation of local wisdom in the digital era.

2. Literature Review

Learning media is anything that can channel messages, stimulate thoughts, feelings and willingness of communication between educators and learners. The message conveyed in the development of learning media should be related to the values of the surrounding environment (local wisdom) (Aditama et al., 2023). Local wisdom exists in folklore, proverbs, songs, and folk games. Local wisdom as a

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knowledge discovered by certain local communities through a collection of experiences in trying and integrated with an understanding of the culture and natural conditions of a place (Pandanwangi & Nuryantiningsih, 2018). To develop character education learning media used research and development. IPAS learning model based on Local Wisdom assisted by Virtual Reality Media is to carry out as far as possible inquiry activities.

3. Methods

This study adopted a mixed approach to assess the effectiveness of Virtual Reality media that focuses on local wisdom in learning Natural and Social Sciences in grade IV elementary schools. The purpose of this study was to evaluate the effectiveness of Virtual Reality media at the elementary school level and to conduct observations, provide questionnaires or respondents from users, both to students and teachers. Data collection was carried out through multiple-choice tests which were divided into two stages: pre-test before students used the learning media, and post-test after using Virtual Reality media based on local wisdom. Data from the pre-test and post-test were analyzed using SPSS to calculate N-Gain, which is used to measure the effectiveness of learning media in improving students' understanding of Natural and Social Sciences material. The N-Gain score can range from -100% to 100%, with the medium N-Gain category being in the range of 0.30 <g <0.70. A positive score indicates an increase in understanding after the intervention, while a negative score indicates a decrease. After data collection was completed, a t-test was conducted to assess the effectiveness of the learning model. This t-test is used to determine whether there is a significant difference between the average pre-test and post-test scores after the implementation of learning media. If the p-value of the t-test is smaller than the specified significance level (usually 0.05), then the null hypothesis (H0) will be rejected and the alternative hypothesis (H1) is accepted, indicating a significant difference between the scores before and after the implementation of local wisdom-based Virtual Reality media. The effectiveness of the developed learning materials can be measured by comparing the results of the pre-test and post-test scores. The results of the pre-test and post-test were analyzed using a paired sample t-test. Data analysis was carried out by comparing pre-test and post-test data using the paired sample t-test formula. (Arikunto, 2013).

Table 1.
N-gain effectiveness interpretation categories.

Percentage (%)	Interpretation
<40	Not effective
40 - 55	Less effective
56 - 75	Quite effective
>76	Effective

Table 2.
Distribution of N-gain scores.

Scores N-gain	Category
g>0,7	High
0,3≤g≤0,7	Medium
g<0,3	Low

Observations were also conducted during the learning sessions to record the level of student engagement and response to the use of virtual reality. A questionnaire was designed to measure students' understanding of the science and science materials and their interest in virtual reality-based learning. Interviews with teachers aimed to obtain feedback on the effectiveness and challenges of using this technology in the classroom. Data from interviews and observations were analyzed qualitatively to identify key themes related to students' and teachers' experiences with virtual reality technology and challenges faced during implementation.

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Data from the questionnaire were analyzed quantitatively to assess the increase in students' understanding of the science and science material and changes in their interest in learning. The results of the analysis were used to assess the extent to which virtual reality media based on local wisdom can improve students' understanding and engagement in science and science learning. Based on the findings, this article provides recommendations for the development and implementation of virtual reality in the education curriculum as well as suggestions to overcome the challenges identified during the study.

The qualitative approach is well suited to explain the dynamic process of transformational leadership and how it affects lecturers' motivation and performance. In addition, this approach allows for a more in-depth analysis of the dimensions of transformational leadership such as Charismatic Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration applied by deans in both universities.

4. Process and Results

The results of this study provide a deep understanding of the effectiveness of Virtual Reality media based on local wisdom in learning Natural and Social Sciences in grade IV of elementary school. The main findings of this study are as follows:

Figure 1.
Photo with students and teachers after learning with virtual reality media.

Testing the understanding of science learning through multiple-choice tests is a very important evaluation in science learning because it is able to measure students' understanding of the material in depth. This test provides an accurate picture of the extent to which students understand the learning material. This information helps instructors or educators identify areas that need to be clarified or emphasized further in subsequent learning.

Table 3.
N-gain test results.

	N	Minimum	Maximum	Mean	Std. deviation
N-Gain_skor	30	0.67	1.00	0.8513	0.08915
N-Gain_persen	30	66.67	100.00	85.1272	8.91530
Valid N (listwise)	30				

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Based on the results of the analysis above, it can be concluded that the research on the development of Virtual Reality media based on local wisdom is effectively used at SDN Jatimulya 1, Lebak Regency, this can be proven by the N-gain test results of 0.85 which is greater than 0.06. Furthermore, the T-Test calculation was carried out to determine how much improvement occurred.

Table 4.
T-test results.

		Mean	N	Std. deviation	Std. error mean
Pair 1	Pre-Test	46.3333	30	7.53536	1.37576
	Post Test	91.8333	30	4.99713	0.91235

Based on the table 4, it can be concluded that the average pre-test was 46.33, while the post-test was 91.83, which means that there was an increase in students' science learning outcomes of 45.5. Thus, the Virtual Reality learning media used has succeeded in achieving the desired level of effectiveness or even exceeding the established standards. This shows that the learning media is considered successful in the context of the evaluation given. Based on the results of the t-test conducted with the data in the table above, the calculated t value was 22.480, while the t-table value was 2.045. Because the calculated t value is greater than the t-table, it shows a significant increase in the average value of local wisdom-based science learning outcomes with virtual reality from pretest to posttest. This finding is in line with previous studies showing that technology can improve cognitive, affective, and social skills, as well as provide an effective learning environment by reducing cognitive load and positive learning values. The application of Virtual Reality technology in science learning can significantly improve learning outcomes.

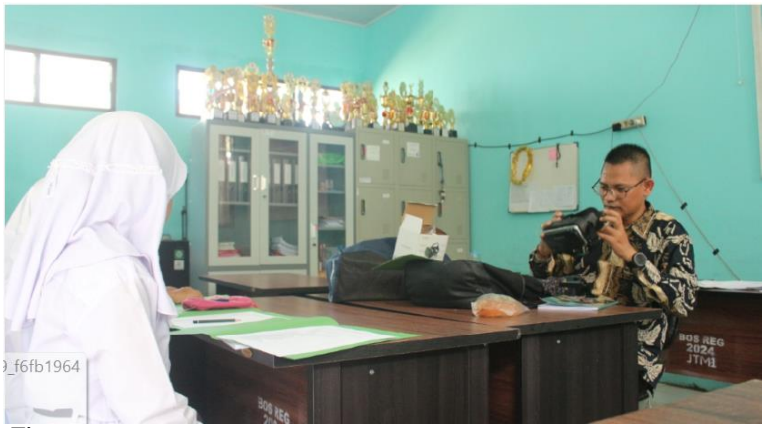

Figure 2.
Interviews with students and teachers.

Observations and questionnaires showed that students showed high engagement and greater interest when using virtual reality in learning. They felt that the virtual experience made the science and natural sciences materials more interesting and easier to understand compared to conventional learning methods. Quantitative data indicated a significant increase in students' understanding of science and natural sciences topics related to local wisdom. Tests conducted before and after the implementation of virtual reality showed that students' average scores increased substantially after participating in the learning session using virtual reality. Students reported that virtual reality provided a more interactive and immersive learning experience, allowing them to "experience" firsthand various aspects of the culture and customs of the Baduy Tribe, Kasepuhan Citorek, and Kesepuhan Neglasari. They felt more connected to the material and better understood the cultural context being taught. Interviews with students revealed that they felt more motivated and inspired to learn more about local wisdom after using virtual reality. They also expressed a desire to see more cultural materials in virtual

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reality format. Teachers acknowledged that virtual reality was an innovative and fun learning approach, but they also noted several challenges, such as the need for additional training to operate virtual reality technology and the readiness of infrastructure in schools. Teachers identified several obstacles in implementing virtual reality, including limited devices and the need for technical support and better curriculum integration to maximize the benefits of using virtual reality in learning. The use of virtual reality has proven effective in integrating local wisdom into the science curriculum. Students not only understand the material being taught but also appreciate the cultural values conveyed. Based on the research findings, it is recommended that schools consider adopting virtual reality as a learning tool by paying attention to teacher training and providing adequate infrastructure. In addition, it is necessary to develop more relevant and high-quality virtual reality content to support the successful implementation of this technology.

4.1. Charismatic Influence

In the Charismatic Influence dimension, deans in both universities succeeded in building trust and loyalty of lecturers through strong role models. The deans showed high integrity and commitment in carrying out leadership duties, thus creating a positive and conducive work environment for improving lecturer performance. The findings suggest that the dean's charismatic behavior not only strengthens interpersonal relationships but also becomes an important foundation in building confidence among lecturers. The dean at the Faculty of Economics and Business, Prof. Dr. Hamka Muhammadiyah University actively serves as a positive behavioral model for lecturers. Through ethical and transparent decision-making, the dean succeeded in creating a work atmosphere filled with mutual trust. Similarly, at Trilogy University, the dean consistently demonstrated inspirational leadership through concrete actions that encouraged lecturers to work harder and more efficiently.

5. Conclusion

The conclusion of the results of the evaluation of science and technology learning involving a test of the level of understanding, namely the N-Gain test, shows that the science and technology learning model based on local wisdom with virtual reality is effectively used in learning in elementary schools. The analysis of competency test scores showed a significant increase from pre-test to post-test, with an average N-Gain score of 0.85 higher than the reference value. These results confirm that the learning media has succeeded in achieving its objectives. In addition, the average percentage value of N-Gain also exceeds the reference standard which shows the effectiveness of the learning media and its overall application. The implications of this model can help strengthen cultural identity and local values among students. They learn to appreciate their own cultural heritage and develop a sense of pride in the unique aspects of their culture. This model tends to emphasize experience-based learning, where students not only learn about local wisdom values theoretically, but also through direct experience or simulations presented by this Virtual Reality technology can make learning more interesting and relevant for students. The integration of virtual reality in science learning has been proven to deepen students' understanding of local wisdom and cultural traditions, as well as increase their motivation to be more active in learning. virtual reality technology provides a more interactive and immersive experience, allowing students to access and experience cultural content that is difficult to reach with traditional learning methods. However, the implementation of virtual reality faces several challenges, such as the need for adequate teacher training and appropriate technological infrastructure. These challenges need to be overcome to maximize the benefits of virtual reality in education. The use of virtual reality based on local wisdom has a positive impact on basic education by offering a more in-depth and contextual learning experience. These implications include increasing cultural understanding among students, which can strengthen their sense of identity and appreciation for their cultural heritage. In addition, virtual reality as an educational tool supports more innovative and adaptive learning methods in the digital era. However, the effectiveness of virtual reality implementation shows that technical readiness and teacher training are crucial factors for the integration of this technology into the education curriculum. Schools need to plan and prepare technical and logistical aspects so that the use of virtual reality can be carried out effectively.

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