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Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar
(JPPGuseda)
E-ISSN : 2623-0232
P-ISSN : 2623-0941

Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar (JPPGuseda)

Vol. 08, No. 02, 2025
https://journal.unpak.ac.id/index.php/JPPGuseda/index

Can Virtual Reality (VR) Stimulate Elementary School Students' Interest In Learning?

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ABSTRACT:
This study aims to: (1) describe the utilization of Virtual Reality (VR) media as an effort to enhance students' learning interest at MIM PK Kertonantan, and (2) identify the technical, non-technical, and pedagogical challenges faced by teachers in its implementation. Employing a qualitative approach with a case study design, the research involved one teacher and several sixth-grade students at MIM PK Kertonantan. Data were collected through in-depth interviews, direct observations, and documentation, with validity ensured through source and technique triangulation. Thematic analysis was applied to reveal key themes regarding the impact of VR on learning interest. The findings indicate that VR creates immersive and interactive learning experiences, increasing students' enthusiasm and understanding of the material. However, challenges were also identified, including limited technological infrastructure and insufficient teacher technical skills in operating VR devices. The study concludes that while VR holds great potential in education, optimal implementation requires teacher capacity building and adequate infrastructure support.

Abstrak:
Penelitian ini bertujuan untuk: (1) mendeskripsikan pemanfaatan media Virtual Reality (VR) sebagai upaya peningkatan minat belajar siswa di MIM PK Kertonantan, dan (2) mengidentifikasi kendala teknis, non-teknis, serta pedagogis yang dihadapi guru dalam penggunaannya. Menggunakan pendekatan kualitatif dengan desain studi kasus, penelitian ini melibatkan satu guru dan beberapa siswa kelas VI MIM PK Kertonantan. Data dikumpulkan melalui wawancara mendalam, observasi langsung, dan dokumentasi, dengan validitas dijamin melalui triangulasi sumber dan teknik. Analisis data dilakukan secara tematik untuk mengungkap tema-tema utama terkait dampak VR terhadap minat belajar. Hasil penelitian menunjukkan bahwa penggunaan VR mampu menciptakan pengalaman pembelajaran yang imersif dan interaktif, meningkatkan antusiasme serta pemahaman siswa terhadap materi. Namun, ditemukan pula kendala berupa keterbatasan infrastruktur teknologi dan minimnya keterampilan teknis guru dalam mengoperasikan perangkat VR. Kesimpulan penelitian ini menegaskan bahwa VR memiliki potensi besar dalam pendidikan, namun implementasi yang optimal memerlukan peningkatan kapasitas guru dan dukungan infrastruktur yang memadai.

ARTICLE HISTORY
Received 17-01-2025
Revised 17-06-2025
Accepted 31-07-2025

Keywords : *Virtual Reality, interest in learning, education*

Kata Kunci: *Virtual Reality, minat belajar, pendidikan*

Doi: http://doi.org.....
Please cite this article in APA style as: Nugraini, F.A. & Abduh, M. (2025). Can Virtual Reality (VR) Stimulate Elementary School Students' Interest in Learning?. Jurnal Pendidikan dan Pengajaran (JPPGuseda). 8(2).79-86.

INTRODUCTION

Over the last decade, many significant efforts have been made to integrate new technologies into online education (Han & Resta, 2020). One technology that is now receiving a lot of attention and is considered to have great potential is virtual reality (VR) (Radianti et al., 2020). VR is considered more effective in education because of its flexibility which allows it to be used anywhere as long as it is connected to a network, without being bound by space and time constraints. This network technology is also driving the development of augmented reality (AR) and VR in digital training, reflecting rapid progress in this field (Endarto & Martadi, 2022). Metaverse is increasingly popular, especially in the world of education, where the integration of AR and VR into learning tools digital shows the accelerated development of the metaverse in this technological era. Virtual reality as an innovative learning method is expected to become a major trend in future education, especially in the engineering field (Abulrub et al., 2011). Research shows that learning using VR offers significant advantages over traditional teaching methods (Roussos, 1997). Considering that traditional methods are often considered less effective (Fitriani, 2021) the use of ICT-based technology can be an attractive alternative for students to overcome boredom and improve their learning experience.

Research conducted by Mambu et al., (2019) shows that the use of Virtual Reality (VR) can create a more interesting and motivating learning experience, as seen in the solar system simulation. Another study by Chen et al., (2005) revealed that VR is able to meet students' diverse learning needs. In this context, Cao et al., (2019) argue that the integration of VR in the learning process can provide a more dynamic and rich learning experience, allowing students to explore and experiment directly. This approach is in line with constructivism theory which emphasizes that learning is an active process in which students build new knowledge based on their experiences. Therefore, constructivism theory is very relevant as a theoretical foundation for this learning approach, Rahmanu et al., (2023) In addition, the findings of Merchant et al., (2014) show that VR can increase students' involvement in learning, helping them remember information longer, and reduces boredom. The use of VR in the learning process allows students to be directly involved in a simulated environment that supports exploration and active learning Jin et al., (2022)

Research conducted by Rahmanu et al., (2022) explored the use of virtual reality tools in the context of active learning. This research highlights the application of multimodality and immersive virtual reality based on Indonesian spherical videos as teaching materials for foreign language learners. The research results show that international students believe that a combination of text, audio, video and images can increase their interest in learning Indonesian. The use of multimodality together with SV-IVR is said to be able to increase student learning motivation. Similar research by Rahmanu et al., (2023b) also discusses the use of video-based immersive virtual reality (SV-IVR) technology in learning Indonesian as a foreign language. Their findings indicated that from a behavioral intention perspective, students were highly motivated to use SV-IVR. In the context of classroom learning, Ningsih and Firmansya utilized virtual reality through Google Expeditions videos on YouTube to study descriptive text, where 81.11% of students admitted that the use of virtual reality helped them understand how to write descriptive text. Furthermore, research by Ernawati et al., (2024) emphasizes the importance of training in the use of virtual reality technology in education. This research aims to improve students' skills in developing imagination and creativity through the use of this technology.

In the current technological era, although much research has been carried out regarding the application of virtual reality (VR) in education, there is still little that specifically explores students' interest in learning through Virtual Reality (VR) media at the elementary school level. Research by Demitriadou et al., (2020) and Akman & Çakır, (2023) shows that the use of VR can increase students' interest in subjects such as mathematics at the elementary level. However, this research presents a new perspective by highlighting a more in-depth exploration of the development and use of VR-based 3D media in science learning. For example, Dewi, (2020) researched the development of VR media for the topic "Water Cycle Process" in fifth grade elementary school, which showed that this media was effective in increasing student interest and learning outcomes, as well as providing a positive impact on science learning at the elementary school level.

One of the elementary schools in Kartasura, namely MIM PK Kertonatan, is located in Kertonatan village. This school has Virtual Reality (VR) technology which is used as a learning aid,

a facility that not all schools in the Surakarta residential area have. The presence of VR technology at MIM Kertonathan shows the school's commitment to applying modern technology to support the learning and teaching process. The use of VR also opens up research opportunities regarding the use of Virtual Reality (VR) media on students' interest in learning. Students' learning interest at MIM PK Kertonatan can be analyzed using the concept proposed by Lukmanul (2009), which states that interest is an individual's readiness to actively pay attention and participate in learning activities. Based on observations and information from various sources, the majority of students at MIM PK Kertonatan show great interest in learning, especially those involving technology. This is in line with research conducted by Triarisanti & Purnawarman, (2019) which measured students' interest in learning through aspects such as appreciation, attention, involvement and interest itself.

RESEARCH METHOD

With a case study design using a qualitative approach, this research aims to explore and understand students' perspectives regarding the use of Virtual Reality (VR) media on their interest in learning at MIM PK Kertonatan, Sukoharjo, Central Java. The research subjects consisted of one teacher who implemented VR media during the learning process and several students who participated in lessons utilizing VR technology. The selection of participants was conducted purposively, considering their direct involvement and experience with VR-based learning activities.

Data collection was carried out using multiple complementary techniques to capture rich and holistic information. These techniques included in-depth semi-structured interviews to elicit participants' detailed experiences and perceptions, direct non-participant observation to record the interaction between students, teachers, and VR media in real-time classroom settings, and document analysis involving relevant archives, lesson plans, sound recordings, and photographs that documented the learning process. The interviews were audio-recorded with participants' consent, transcribed verbatim, and supplemented by detailed field notes to ensure accuracy and contextual depth.

The credibility and validity of the findings were enhanced through **methodological triangulation**, involving data collection from different sources (teachers, students, and documents) and employing diverse data-gathering methods. This triangulation process aimed to cross-verify the information obtained, thereby strengthening the trustworthiness of the study.

The data analysis employed a thematic analysis approach, which unfolded through several structured stages: (1) Familiarization with the data, by repeatedly reading and reviewing transcripts and notes; (2) Generating initial codes, by systematically labeling significant features of the data; (3) Constructing potential themes based on patterns emerging from the codes; (4) Reviewing and refining themes, ensuring coherence and relevance to the research focus; (5) Defining and naming themes to capture their essence; and (6) Producing the final report, which integrates thematic insights with illustrative quotes and contextual interpretation.

This research was conducted entirely within the school environment, with the researcher directly engaging in the field to observe and interact with participants. Such immersion allowed for a deeper, contextually grounded understanding of the phenomenon under investigation, while also enabling the researcher to capture the dynamic interplay between technological tools, pedagogical practices, and students' learning engagement in real classroom contexts.

FINDINGS

Virtual Reality (VR) technology was initially developed with the primary goal of creating more immersive and realistic experiences, especially when time constraints and physical distance limit an individual's direct participation in an event or environment. This opinion is in line with Herlangga et al., (2015) who stated that the prototype device called Sensorama, which was developed by Morton Heilig in 1962, became the initial basis for Virtual Reality (VR) technology. Sensorama is designed to create a more immersive film watching experience by involving various senses, such as smell, hearing, sight and touch. Since then, Virtual Reality (VR) technology has continued to develop rapidly and has been applied in various areas of life. Research by Fitriani, (2021) explains that in this era there are many things in schools that need to be digitized. Ponidi & Murhadi, (2020) stated that with digitalization, schools are able to speed up and simplify the transfer of information. According to research by Astuti et al., (2023) by utilizing digital media, children not only get the information they need, but can also communicate better with teachers during the learning process. Thematic analysis of the results of interviews and observations conducted at MIM PK Kertonatan shows clear information, as shown in the image below:

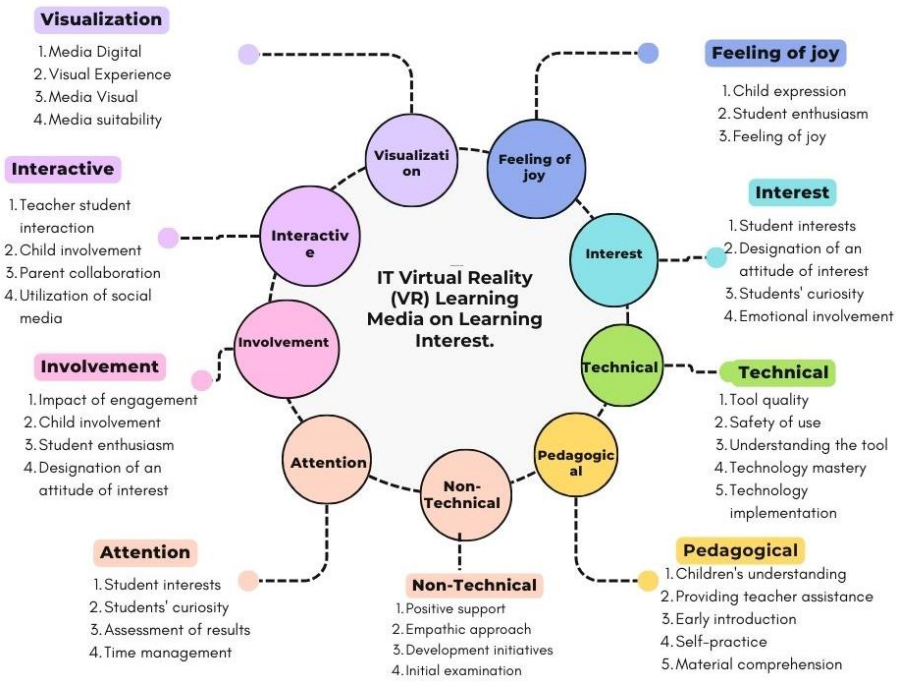


Figure 1.1
Research Findings Result of Thematic Analysis

A. Utilization of Virtual Reality (VR) Media to Increase Students' Interest in Learning at MIM PK Kertonatan

Based on interviews, observations, and documentation, it was found that MIM PK Kertonatan received VR devices from Muhammadiyah University of Surakarta (UMS) as part of technology-based learning development. The teacher, Mr. S, explained that the VR-based learning process followed several stages: selecting appropriate teaching materials, preparing supporting media such as videos or images, providing initial explanations to students, and guiding them in using VR devices.

Observations showed that students appeared enthusiastic and actively engaged when using VR. Several students stated that VR helped them better understand the learning material and made the lessons more enjoyable. Documentation, including photos and field notes, revealed that VR learning fostered active interaction between teachers and students, as well as collaboration among students in small groups.

The use of VR also proved effective in deepening conceptual understanding. According to the teacher, post-lesson evaluations showed better comprehension compared to traditional methods. Furthermore, students expressed increased curiosity and interest in seeking additional information related to the topics introduced through VR.

B. Technical, Non-Technical, and Pedagogical Barriers to VR Utilization

Based on the findings, the main challenges in implementing VR at MIM PK Kertonatan include:

1. Costs and Infrastructure – High costs for purchasing and maintaining VR devices, along with the need for a stable, high-speed internet connection.
2. Teachers' Technical Skills – Some teachers lack experience in using VR and require further training.
3. Limited Devices and Content – A shortage of VR devices means students must take turns, with only about 5 minutes per student, under teacher supervision.
4. Psychological and Cultural Barriers – Concerns about potential side effects such as eye strain and resistance to changing traditional teaching practices.
5. Parental Support – Limited parental understanding of VR benefits, leading to less active support for schools.

6. Educator Support – Although the principal supports VR use, equipment maintenance responsibilities remain with specific teachers, and not all educators are ready to integrate VR into lessons.

DISCUSSION

The findings align with constructivist theories by Vygotsky and Piaget, which highlight the The findings align with constructivist theories by Vygotsky and Piaget, which highlight the importance of active student engagement in the learning process. VR at MIM PK Kertonatan facilitates experiential learning, enabling students to construct knowledge through immersive experiences, consistent with Lv et al. (2017) and Makransky et al. (2019), who found that interactive virtual environments enhance interest, motivation, and conceptual understanding.

Pedagogically, VR supports Bonwell & Eison's active learning approach by fostering higher student participation and collaboration. Field evidence shows that group-based activities combined with VR use lead to more dynamic discussions, reflecting Jamal et al. (2024) who emphasized the value of technology in collaborative learning.

However, the implementation challenges—such as limited devices, inadequate content, and insufficient teacher skills—demonstrate that successful VR adoption depends not only on the technology's capabilities but also on human resource readiness and infrastructure (Radianti et al., 2020; Jensen & Konradsen, 2018). The psychological and cultural barriers observed, particularly among senior teachers, support Rogers' Diffusion of Innovation Theory, which states that adoption is influenced by perceived benefits, compatibility, and complexity.

Parental involvement also emerged as a crucial factor. Limited awareness of VR benefits reduces the likelihood of sustained parental support, echoing Pertiwi & Sutama (2020), who stressed that successful educational technology adoption requires collaboration among schools, teachers, students, and parents.

An additional implication of these findings is the need for integrating VR use into the school's curriculum design rather than treating it as an occasional or supplementary activity. Embedding VR into the formal curriculum can ensure sustained use, facilitate alignment with learning objectives, and encourage teachers to develop lesson plans that maximize the technology's capabilities. This approach reflects the TPACK (Technological Pedagogical Content Knowledge) framework, which emphasizes the integration of technology with pedagogy and subject matter to enhance learning outcomes (Mishra & Koehler, 2006).

Moreover, the social aspect of VR learning warrants further attention. Beyond cognitive gains, VR also encourages peer-to-peer learning, where students explain concepts to each other during immersive activities. This collaborative learning environment fosters communication skills, critical thinking, and empathy — qualities increasingly recognized as essential for 21st-century competencies (OECD, 2018). As such, VR should be considered not only a tool for delivering content but also a medium for cultivating broader socio-emotional skills.

Finally, this study highlights the importance of ongoing professional development for teachers to fully harness the benefits of VR. Short-term training may help teachers operate the devices, but sustained innovation requires continuous skill-building, reflective practice, and sharing of best practices among colleagues. Establishing teacher learning communities focused on educational technology can help address hesitancy, build confidence, and create a culture of experimentation. This aligns with the professional learning community (PLC) model, which has been shown to improve both teaching practices and student outcomes when implemented consistently (DuFour et al., 2010).

CONCLUSION

This research explores the application of Virtual Reality (VR) technology to students' learning interest at MIM PK Kertonatan, Sukoharjo, using a qualitative approach and case study design. In the research process, researchers conducted in-depth interviews, direct observation, and collected relevant documentation to obtain comprehensive data. Research findings show that the use of Virtual Reality (VR) not only makes learning more interesting and enjoyable, but also contributes to increasing students' understanding of the subject matter. During the collaboration between Muhammadiyah University of Surakarta and schools in providing Virtual Reality (VR) devices, it was proven to have a positive impact on the student learning experience at MIM PK Kertonatan. Students

explained that Virtual Reality (VR) technology helped them understand complex concepts better. However, this research also identified several challenges faced in its implementation, such as high costs for Virtual Reality (VR) devices and limited technical skills among teachers. Although Virtual Reality (VR) has great potential to enrich the learning experience, its successful use is highly dependent on adequate infrastructure support and training for teachers to be able to utilize this technology effectively. Therefore, this research confirms that the integration of Virtual Reality (VR) technology in education can be an innovative step to create a more interactive and enjoyable learning environment, as long as these challenges can be overcome properly.

ACKNOWLEDMENT

This research would not have been possible without the support, guidance, and assistance of various parties who have contributed to every stage of the process. Therefore, with full respect and appreciation, I would like to express my deepest gratitude. To my supervisor, who has patiently provided direction, guidance, and motivation throughout the research process. His attentive guidance and deep insight have become the main pillars in completing this final assignment. Constructive encouragement and input have played a major role in supplying the content of this research and ensuring that every step taken is in accordance with high academic standards. To MIM PK Kertonatan, who have sincerely opened the door and provided me with the opportunity to collect data that is very necessary for this research. The assistance provided, from providing access to data sources to support during the information collection process, is very meaningful for the smooth running and success of this research. The collaboration that has been established has provided valuable experience and strengthened the quality of research results. Last but not least, I would also like to express my deepest gratitude to my parents and friends. Their moral support, encouragement, and assistance in various forms have provided tremendous strength and motivation throughout my research process. Their presence at every step, both in joy and sorrow, has been a source of inspiration and encouragement to continue until this research is completed.

This gratitude is a sincere expression from my heart, and I hope that all the assistance that has been given will be rewarded accordingly. Once again, thank you for all the support and assistance that has been given.

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