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Trends in the Use of Virtual Reality in Elementary School Learning (2019–2025): A Systematic Review

Bintan Jahara[1] ✉, Aviatul Janah[2] , Resa Nurtiara[3], Liliani Yulviya Dewi S [4], Caroline Octavia [5], Yuyun Dwi Haryanti[6], Fareea[7]

[123456]Universitas Majalengka,
Jl. K.H. Abdul Halim No. 103, Majalengka, Jawa Barat 45418, Indonesia
[7]Lasbela University of Agriculture, Water and Marine Sciences
Main Regional Cooperation for Development Hwy, Uthal, 90150, Pakistan
✉Corresponding Author: bintanjahara091@gmail.com

Abstract
This study was conducted in response to the increasing integration of digital technology in elementary education in the era of Society 5.0, which requires learning approaches that foster the development of 21st-century skills, particularly critical thinking, creativity, and problem-solving skills. One technology with the potential to address this need is Virtual Reality (VR), which provides immersive, interactive learning experiences that can enhance students' engagement and understanding. This study aims to analyze research trends and the effectiveness of Virtual Reality-based learning media in elementary schools. A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 guidelines. Literature searches were conducted using the Scopus and Google Scholar databases via the Publish or Perish (PoP) application, covering publications from 2019 to September 2025 [R1]. Of the 454 identified articles, 20 studies were selected through systematic screening and eligibility criteria. The findings indicate a significant increase in VR-related publications in 2023 and 2024, with most studies published in reputable international journals. VR is predominantly applied in science subjects; however, its use has expanded to other areas such as English, arts, religious education, social studies, and physical education. Overall, VR-based learning has been shown to improve students' conceptual understanding, learning motivation, engagement, immersive experiences, and 21st-century skills. Therefore, Virtual Reality has strong potential to enhance the quality of elementary school learning and is consistent with the principles of the Merdeka Curriculum [R1].

Keywords: Virtual Reality, elementary school learning, Educational Technology

Tren Penggunaan Virtual Reality dalam Pembelajaran di Sekolah Dasar: Tinjauan Literatur Sistematis

Abstrak
Penelitian ini dilaksanakan sebagai respons terhadap meningkatnya integrasi teknologi digital dalam pendidikan sekolah dasar pada era Society 5.0, yang menuntut pendekatan pembelajaran yang mampu mengembangkan keterampilan abad ke-21, terutama berpikir kritis, kreativitas, dan kemampuan pemecahan masalah. Salah satu teknologi yang berpotensi menjawab kebutuhan tersebut adalah Virtual Reality (VR), karena mampu menghadirkan pengalaman belajar yang imersif dan interaktif sehingga dapat meningkatkan keterlibatan dan pemahaman siswa. Penelitian ini bertujuan untuk menganalisis tren penelitian dan efektivitas penggunaan media pembelajaran berbasis Virtual Reality di sekolah dasar. Metode yang digunakan adalah Systematic Literature Review (SLR) dengan mengacu pada pedoman PRISMA 2020. Pencarian literatur dilakukan melalui basis data Scopus dan Google Scholar menggunakan aplikasi Publish or Perish (PoP) pada rentang tahun 2019 hingga September 2025. Dari 454 artikel yang teridentifikasi, sebanyak 20 artikel dipilih melalui proses penyaringan dan uji kelayakan secara sistematis.Hasil kajian menunjukkan adanya peningkatan signifikan publikasi terkait VR pada tahun 2023 dan 2024, yang sebagian besar dipublikasikan pada jurnal internasional bereputasi. Penggunaan VR paling banyak ditemukan pada mata pelajaran IPA, namun telah berkembang ke bidang lain seperti bahasa Inggris, seni, pendidikan agama, IPS, dan pendidikan jasmani. Secara umum, pembelajaran berbasis VR terbukti meningkatkan pemahaman konseptual, motivasi belajar, keterlibatan siswa, pengalaman imersif, serta keterampilan abad ke-21. Dengan demikian, VR memiliki potensi yang kuat untuk meningkatkan kualitas pembelajaran di sekolah dasar dan sejalan dengan prinsip Kurikulum Merdeka.

Kata kunci: *Realitas Virtual*, pembelajaran sekolah dasar, Teknologi Pendidikan

INTRODUCTION

Entering the era of Society 5.0, technology has become an integral part of human life, including in education. In this phase, technological advances are used not only to increase industrial efficiency but also to improve the overall quality of life through a human-centered approach.

Dang & Bui, (2025) explain that the concept of Society 5.0 emphasizes the convergence of cyberspace and physical space to create a more inclusive and sustainable society. Therefore, in the context of education, this development demands a learning process that is not only oriented towards knowledge transfer but also fosters critical, collaborative, and creative thinking skills through the use of technology (Putra & Pratiwi, 2020).

Consequently, digital transformation presents both challenges and opportunities for teachers and students to explore more innovative, adaptive learning methods that meet the demands of 21st-century skills. 21st-century skills, which encompass the 4Cs (Critical Thinking, Creativity, Collaboration, and Communication), are urgently needed to prepare a generation capable of adapting to rapid changes in the digital era (Bitar & Davidovich, 2024). Therefore, one form of implementation of digital transformation in education that has been trending in recent years is the use of Virtual Reality (VR) media. This medium can create an immersive experience that makes students feel like they are in a virtual world (Azmi et,. al 2024).

Anggara (2021) demonstrated that the integration of VR in third-grade science learning significantly increased students' conceptual understanding by up to 24%. significantly higher than e-learning and conventional learning methods. This finding is in line with (Raharjo et al., 2023) implemented VR and found an increase in science literacy of over 70%. Integrating VR into STEAM learning allows students to explore interdisciplinary concepts through immersive and interactive problem-based projects, fostering a more holistic understanding. However, the increasing number of VR research projects in elementary education has not been accompanied by studies that thoroughly examine the types of VR, the focus of the materials used, and how these implementations impact actual curricular contexts such as the Independent Curriculum.

Despite the growing body of research on Virtual Reality in education, several previous systematic literature reviews have primarily focused on VR implementation in general educational contexts or at the secondary and higher education levels (Radianti et al., 2020; Mckechnie & Wilson, 2021). These reviews mainly discuss technological affordances, learning outcomes, and design principles of VR-based learning without providing a specific focus on elementary school settings. Moreover, limited attention has been given to analyzing research trends, types of VR applications, subject-specific implementation, and their alignment with current curricular frameworks, particularly within the context of elementary education and the Merdeka Curriculum. Therefore, a comprehensive and up-to-date systematic review that specifically examines the trends and effectiveness of VR use in elementary school learning remains necessary.

Therefore, the purpose of this study is to obtain a comprehensive overview of the trends, development directions, and effectiveness of Virtual Reality (VR) use in elementary school learning. This study is expected to clarify the most relevant forms of VR implementation, the most widely developed learning materials, and the factors influencing its success in learning. Furthermore, the researcher used the Systematic Literature Review (SLR) method because it provides a systematic, structured, and transparent analysis of various previously published research findings. Ivania (2023) Through this approach, researchers can identify patterns, research gaps, and opportunities for developing VR-based innovations that have not been widely explored in the literature. Thus, this research is expected to make a significant contribution to the development of academic discourse and learning practices that meet the demands of the digital era.

METHODS

This study used the Systematic Literature Review (SLR) method with reference to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. This approach is considered appropriate for systematically identifying, classifying, and analyzing research trends and findings related to the use of VR in elementary education.. The PRISMA procedure consists of four stages: identification, screening, eligibility, and inclusion (Ringo, Siringo, 2025). This method allows researchers to rigorously select literature and obtain valid and replicable analysis results. A schematic of the research steps can be seen in Figure 1.

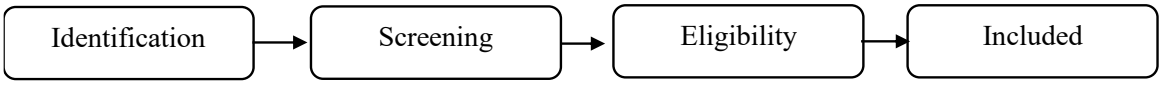

Figure 1 PRISMA Research Steps

Identification

In this step, a literature search was conducted through the Scopus and Google Scholar databases to obtain relevant publications regarding the use of Virtual Reality (VR) in learning in elementary schools. Scopus was chosen because it provides internationally reputable scientific articles, while Google Scholar was used as a complement considering that research on VR media in elementary schools is still limited in Scopus. The search was conducted using the Publish or Perish (PoP) application, covering publications from 2019 until September 2025. Various combinations of keyword sequences were used to find relevant information in article titles, abstracts, and keywords (see Table 1).

Table1. Search Strategy

Keywords	Database	Number of Articles
Virtual Reality* OR VR media* OR immersive learning* AND elementary school* OR primary education*	Google Scholar	200
Virtual Reality* OR Elementary School*	Google Scholar	200
Virtual Reality* OR VR media* OR immersive learning* AND Primary education* OR education technology*	Scopus	54
Total Number of Articles		**454**

After the literature collection process, 54 articles were retrieved from the Scopus database and 400 from Google Scholar, for a total of 454. All of these articles were then imported into the Covidence application for systematic screening.

In the search stage, the Publish or Perish (PoP) application was used to search for articles by combining various relevant keywords. The wildcard symbol "*" was used to expand the search to various forms of words derived from the same root, for example, "learn" includes both learning and learners. The "OR" operator was used to find articles containing one of the keywords, while "AND" was used to combine several keywords so that the search results only displayed articles containing all of these terms together. This combination of symbols helped produce a comprehensive, accurate, and relevant search, focusing on the research focus on the use of Virtual Reality in learning in elementary schools. The use of logical operators like this is also recommended in scientific literature searches because it can increase the efficiency and accuracy of the data selection process (Sukmawati et al., 2023).

Screening

Once the identification process is complete, the next step is screening, where the collected literature is screened to ensure that the articles meet the inclusion and exclusion criteria. (Table 2)

Table2. Eligibility Criteria

Criteria	Inclusion	Exclusion
Publishing Range	2019-2025	< 2019
Document Type	Articles, conference proceedings	Books, book chapters, or reports not published in journals
Accessibility	Downloadable articles	Articles that cannot be downloaded
Instructional Media	Virtual Reality Digital Learning Media	Non-digital learning media
Material	All materials available in Elementary School	Learning materials that are not included in the Elementary School curriculum
Language	English	Besides English
Level	Elementary school	Focus on junior high, high school, or college level.

Eligibility

At this stage, articles that successfully pass the screening process undergo a more in-depth review by reading the entire text. This step aims to produce a more detailed assessment of the quality and relevance of the articles, ensuring that each article meets methodological standards.

Included

Articles that passed the eligibility step were analyzed in this step to draw conclusions about trends and the effectiveness of VR use in elementary schools. The entire selection process is illustrated in the PRISMA flowchart (Figure 2).

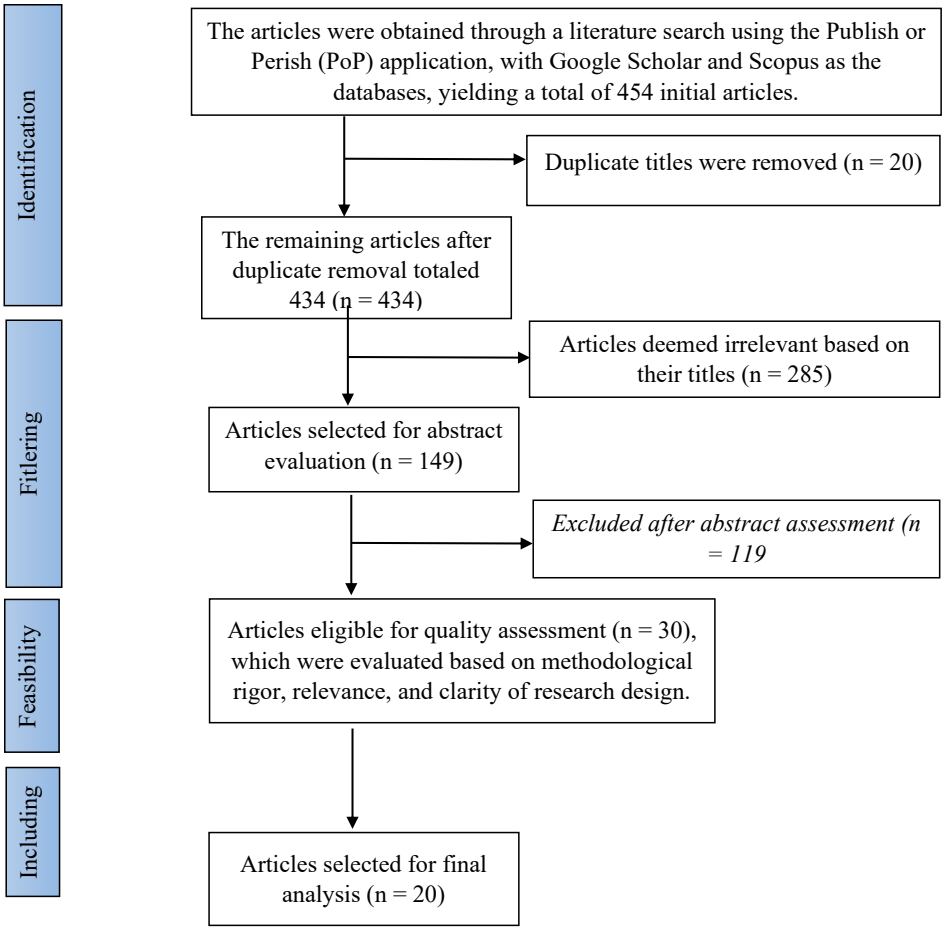

Figure 2. *Flowchart Preferred Reporting Items for Systematic Review and Meta-Analysis* (PRISMA)

RESULTS AND DISCUSSION

A literature review was conducted on 20 articles related to the theme of this research. The following is a list of articles reviewed in Table 3.

Table 3. Article Analysis Results

Year of publication	Name of Journals	Kode jurnal	Digital Object Identifier (DOI)	Type of publisher
2021	Jurnal Teknologi Pendidikan	**A1**	10.21009/JTP2001.6	Sinta 2
2023	Cogent Education	**A2**	10.1080/2331186X.2023 .2196896	Q2
2025	JPP (Jurnal Pendidikan dan Pembelajaran)	**A3**	10.17977/um047v32i22025p6111-119	Sinta 3
2019	Taylor & Francis	**A4**	10.1080/10494820.2019.1587469	Q1

Year of publication	Name of Journals	Kode jurnal	Digital Object Identifier (DOI)	Type of publisher
2025	Jurnal Edutech Undiksha	**A5**	10.23887/jeu.v13i1.93087	Sinta 2
2022	MDPI Journals	**A6**	10.3390/systems10040104	Q2
2022	Education Research International	**A7**	10.1155/2022/4811544	Q3
2023	Jurnal Nasional Pendidikan Teknik Informatika :JANAPATI	**A8**	10.23887/janapati.v12i3.69620	Sinta 2
2023	Jurnal Pendidikan Islam 9	**A9**	10.15575/jpi.v9i2.20567	Q1
2021	MDPI Journals	**A10**	10.3390/su14031246	Q1
2024	Education and Information Technologies	**A11**	10.1007/s10639-024-12853-2	Q1
2022	Journal of Educational Computing Research	**A12**	10.1177/07356331211068207	Q1
2023	Jurnal teknologi pendidikan	**A13**	10.21009/jtp.v25i2.36106	Sinta 2
2024	Education and Information Technologies	**A14**	10.1007/s10639-024-12766-0	Q1
2019	*Khazanah Informatika* adalah jurnal ilmiah di bidang ilmu komputer dan informatika.	**A15**	10.23917/khif.v5i2.8194	Sinta 2
2024	MDPI Journals	**A16**	10.3390/su16104092	Q1
2024	MPPKI (Media Publikasi romosi Kesehatan Indonesia)	**A17**	10.56338/mppki.v8i2.6598	Q4
2024	Edu Sportivo: Indonesian Journal of Physical Education /	**A18**	10.25299/esijope.2024.vol5(1).14354	Sinta 2
2023	Jurnal Pendidikan Indonesia	**A20**	10.23887/jpiundiksha.v12i3.60735	Sinta 2
2023	Computers & Education: X Reality	**A21**	10.1016/j.cexr.2023.100010	Q1

Trends in Virtual Reality research in Elementary Schools.

Based on the analysis of relevant articles presented in Table 3, there are research graphic results with a range of article searches from 2019 to 2025. (Figure 3)

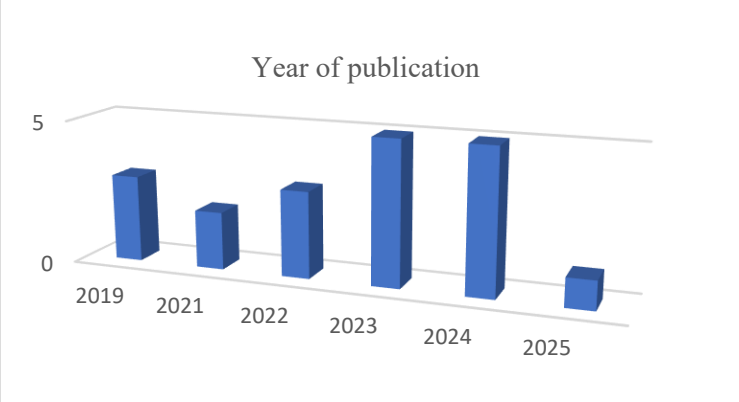

Figure 3. Year of publication

The publication year chart shows a fairly consistent increase in research on the use of VR in elementary school learning. Publications began appearing in 2019, then increased in 2021 and 2022. The most significant spikes were seen in 2023 and 2024, each of which recorded the highest number of articles within the analysis period.

These findings indicate that VR is increasingly attracting attention from researchers in the field of elementary education.and is beginning to be positioned as a potential technology to support learning processes at the elementary school level. The decline in publications in 2025 is primarily attributable to the fact that the year is not yet complete, resulting in incomplete data coverage.

Second, in the publisher type graph shown in (Figure 4), there is a tendency that most articles are published in reputable international journals, especially those in the Q1 category

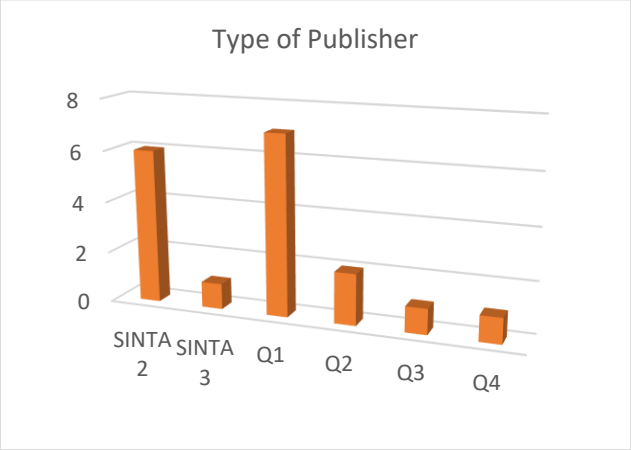

Figure 4. Type of publisher

This pattern indicates that articles related to the application of Virtual Reality (VR) in learning are more frequently published in highly reputable journals. Category Q1 dominates with around seven publications, followed by Sinta 2 with six. The dominance of these two categories indicates that VR research is published in journals with high standards of quality and scientific visibility. In contrast, publications in categories Q2, Sinta 3, and Q3–Q4 journals are much less frequent, with a frequency of around one publication or even less.

The third result in the material results graph (Figure 5) shows that Natural and Social Sciences (IPA) subjects occupy the largest portion. The graph shows that the majority of articles analyzed position VR as a medium to aid exploration of scientific phenomena, such as changes in the state of objects, the solar system, ecosystems, the structure of living organisms, and even experimental simulations that are difficult to conduct in the classroom. The dominance of IPA in the graph indicates that VR is considered most relevant for supporting learning based on observation, experimentation, and scientific visualization.

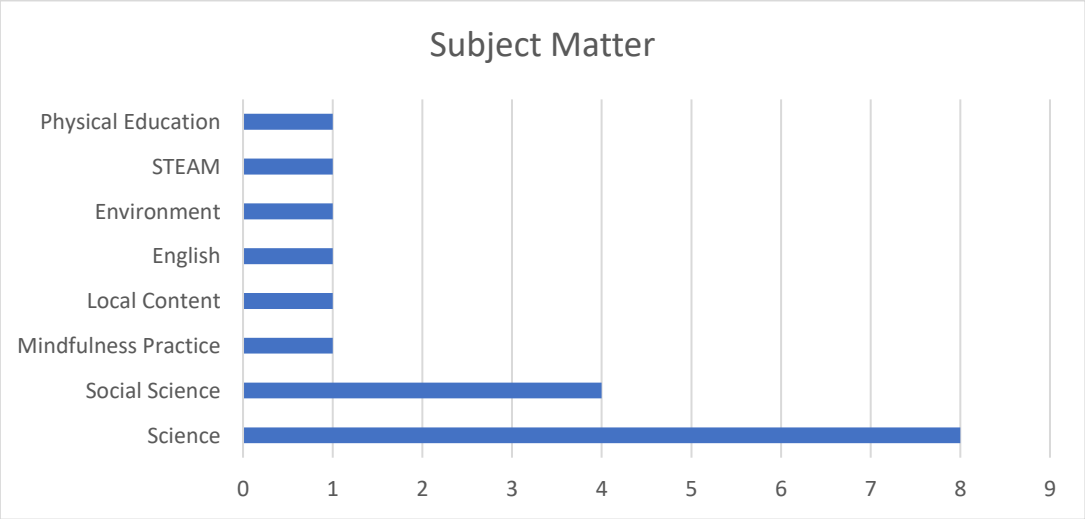

Figure 5. Subject Matter

In addition to science, the graph also shows the distribution of research in several other subjects, albeit at a lower frequency. Subjects such as Arts and Culture, English, Geometry, Mathematics, Local Content, Islamic Religious Education, and Physical Education, Sports, and Health (PJOK) are listed as fields that have begun to adopt VR, although the number is not as large as science. This pattern indicates that while VR has broad potential across various disciplines, its use is still concentrated in fields that most require visual representation and interactive simulation.

Main findings in research on virtual reality-based learning media in elementary schools

The main results of each study relevant to the objectives of this study are shown in Table 2. In general, these comparative studies reveal that Virtual Reality-based learning media in elementary schools continues to show consistent findings that this immersive technology is effective and able to strengthen the quality of the learning process through increased engagement, conceptual understanding, and deeper learning experiences (Tarng et al., 2022). This finding aligns with the current view that immersion-based learning experiences can improve attention, motivation, and material absorption at the elementary level (J. Laine et al., 2023). The following are the results of the analysis of 20 relevant journal articles (Table 4)

Table 4. Analysis Results

Article Title	Material	Journal Code	Contents
Application of Electronic Learning by Utilizing Virtual Reality (VR) and Augmented Reality (AR) Methods in Natural Sciences Subjects (IPA) in Elementary School Students Grade 3 (Anggara, 2021)	Science	A1	This study developed e-learning-based science instruction for third-grade elementary school students utilizing Virtual Reality (VR) and Augmented Reality (AR). Using e-learning alone without teacher involvement only increased student understanding by 8%, while conventional methods increased it by 12%, while the hybrid method combination increased understanding by 24%.
Primary school students' experiences of immersive virtual reality use in the classroom (J. Laine et al., 2023)	Science	A2	VR technology increases learning motivation and helps deepen students' understanding of the material.
Integrating virtual reality into interactive learning media for improving science (Putri et al., 2025)	Science	A3	Conceptual understanding increased (N-Gain 63.85%), visual-audio was excellent, media was practical, increased learning motivation, and supported independent learning.
Integrating spherical video-based virtual reality into elementary school students' scientific inquiry instruction (Wu et al., 2021)	Science	A4	SVVR significantly improved learning outcomes and problem-solving skills. Students with low learning attitudes experienced greater improvements.
Virtual Reality-Based Learning Media for Food Chain Adventures to Improve Students' Science Learning Outcomes (Widyaningrum & Yulianto, 2025)	Science	A5	There is a significant effect of VR use on learning outcomes (sig. 0.000). N-Gain = 0.5756 (moderate/effective category).
Effectiveness of Virtual Reality on Attention Training for Elementary School Students (Tarng et al., 2022)	Mindfulness Practice	A6	Both groups improved significantly in attention, but VR was more effective than computerized APT.
The Feasibility of Enhancing Environmental Awareness using 3D Virtual Reality in the Primary Education (Sulisworo et al., 2022)	Science	A7	Improve understanding of animals, motivation, interest in learning, immersion, and help teachers choose VR-based strategies.

Article Title	Material	Journal Code	Contents
Implementation of Virtual Reality Museum Lontar Prasi Bali As a Cultural Education Media (Aditama et al., 2023)	Local content	A8	Increase students' knowledge, interest, and understanding of Balinese Lontar Prasi culture.
Advancing Educational Practices: Implementation and Impact of Virtual Reality in Islamic Religious Education (Asril, 2023)	PIE	A9	Improve students' understanding as well as motivation and interest in learning.
Research on Art Teaching Practice Supported by Virtual Reality (VR) Technology in the Primary Schools (Hui et al., 2022)	Art and culture	A10	VR significantly improves understanding of art materials.
The effect of integrating STEAM and virtual reality using PjBL on scientific literacy in elementary schools (Winarni et al,. 2024)	Science	A11	Increase overall scientific literacy (>70%).
The Effects of Virtual Reality Infused Instruction on Elementary School Students' English-Speaking Performance (Wu et al., 2022)	English	A12	Significant improvements in grammar, vocabulary use, and learning independence.
Virtual Reality-Based Learning about 'Animals Recognition' and Its Influence on Students' Understanding (Sukmawati et al., 2023)	Science	A13	Improve students' understanding of animal concepts (effective), motivation, activeness, and participation.
Effects of virtual reality technology on primary school students' creativity performance (Oubibi, et al, 2024)	Arts and Culture	A14	Enhance creativity, learning engagement, mental flow, and aesthetic appreciation.
A Virtual-Reality Edu-Game: Saving The Environment from the Dangers of Pollution (Mawsally et al,. 2019)	Environment	A15	Increases understanding of pollution and solutions; more interactive than traditional methods.
The Effects of an Immersive Virtual-Reality-Based 3D Modeling Approach on Creativity and Problem-Solving (Chen et al., 2024)	STEAM	A16	IVR increases creativity, problem-solving skills, and reduces cognitive load.
Virtual Reality for Traffic Safety Education in Elementary Schools (Erviana, 2025)	Social Science	A17	VR was declared feasible, received positive responses, was interactive, fun, and increased understanding.
Exploring the impact of interactive virtual reality on motor skills (Utamayasa & Mardhika, 2024)	Physical Education	A18	VR improves basic motor skills, confidence, and movement accuracy.
The Effect of Using Virtual Reality Media on the Geometric Skills of Elementary School Students (Kenedi et al., 2023)	Geometry	A19	VR significantly improves geometric abilities (visual, verbal, logical, applicative).

Article Title	Material	Journal Code	Contents
Effectiveness of Introducing Virtual Reality to Elementary School Students' Moral Education (Shim, 2023)	Social Science	A20	VR significantly increases moral sensitivity but does not have a significant impact on moral judgment.

Discussion

Research on the use of Virtual Reality (VR) in elementary school learning has shown significant growth over the years, both nationally and internationally. In the early stages, research focused heavily on developing VR-AR-based media for elementary science learning, as conducted by Anggara (2021), which shows that the combination of hybrid learning with VR–AR improves student understanding by up to 24%, significantly higher than conventional methods. Entering 2022–2023, VR research is widely published by various reputable publishers such as MDPI, Springer, and national journals, with a wider scope of material, for example, increasing student motivation and immersive experiences in science learning (J. Laine et al., 2023), increasing environmental literacy (Widyaningrum & Yulianto, 2025), as well as local cultural education through VR museums (Aditama et al., 2023) In 2024–2025, research trends will increasingly shift towards Independent Curriculum-based learning and strengthening 21st-century competencies through VR, such as improving science literacy, STEAM, moral education, environmental awareness, and arts and physical education (Raharjo et al., 2023).

In terms of material coverage, VR research is not only dominant in science, but also expanding into science, culture, religion, art, English, and physical education learning. In the science cluster, VR media has been shown to significantly improve understanding of scientific concepts, such as a 63.85% increase in N-Gain in the development of interactive VR by Putri et al (2025), improving problem-solving through SVVR (Integrating Spherical Video-based VR), as well as improving effective science learning outcomes in various contexts (Widyaningrum & Yulianto, 2025). In the socio-cultural and religious context, VR has been shown to increase understanding of local culture. (Aditama et al., 2023). strengthening Islamic Education learning and increasing moral sensitivity (Asril, 2023), Even in the arts and creativity cluster, VR has been shown to increase students' creativity, engagement, and mental flow (Hui et al., 2022). Meanwhile, in the PJOK group, VR provides a safer and more enjoyable motor experience (Utamayasa & Mardhika, 2024). The increasing variety of materials demonstrates that VR is not just a visual technology, but also a multi-sector pedagogical platform that can be integrated into almost any subject.

The increased effectiveness of VR in learning was consistent across all 20 studies. VR was shown to significantly increase student motivation, interactivity, and immersion, as demonstrated by Erviana (2025) From a cognitive aspect, VR enhances conceptual understanding in science through 3D visualization, simulation of real environments, and exploratory experiences (Sukmawati et al., 2023). The overall findings indicate that VR not only provides an engaging learning experience, but also has a holistic impact on the cognitive, affective, motor, and social aspects of elementary school students.

Although the reviewed studies generally report positive effects of Virtual Reality (VR) on elementary school learning, several implementation challenges can be identified from the analyzed articles. The effectiveness of VR-based learning appears to be highly dependent on teacher involvement and instructional integration, as shown by Anggara (2021), where VR-supported learning combined with teacher guidance produced significantly higher learning gains than VR-based e-learning without direct facilitation. In addition, studies on immersive VR environments indicate that while immersive experiences enhance engagement and problem-solving skills, they require careful instructional design to prevent cognitive overload among younger learners, particularly those with lower learning readiness (Tarng, 2024; Laine et al., 2023). Furthermore, some articles imply practical constraints related to the feasibility of VR implementation in elementary schools, including the need for appropriate technological infrastructure and teacher readiness to align VR activities with learning objectives and curriculum demands (Widyaningrum & Yulianto, 2025). These findings suggest that despite its strong pedagogical potential, the successful implementation of VR in elementary education requires adequate teacher competence, instructional planning, and institutional support.

CONCLUSION

Based on a Systematic Literature Review (SLR) of 20 scientific articles, this study concludes that the use of Virtual Reality (VR)-based learning media in elementary schools shows a consistent upward trend

from 2019 to 2025 and is effective in improving the quality of education across various educational contexts. The results of this study provide a comprehensive overview of research trends, development trajectories, and the effectiveness of VR utilization in elementary schools. The findings demonstrate that VR positively influences students' conceptual understanding, learning motivation, engagement, and immersive learning experiences, particularly in science, as well as in social studies, cultural studies, religious education, the arts, language, and physical education. VR-based learning also supports the development of 21st-century skills such as critical thinking, creativity, and problem-solving, which align with the principles of the Merdeka Curriculum.

From a practical perspective, teachers can utilize VR to visualize abstract concepts, create exploration-based learning experiences, and foster active student engagement while considering learning objectives and student characteristics. At the institutional level, effective implementation requires adequate technological infrastructure, continuous teacher professional development, and systematic integration of VR into the curriculum to ensure sustainable use.

Despite these contributions, this study has limitations, as the reviewed literature was primarily sourced from Scopus and Google Scholar. Therefore, future research is recommended to expand data sources to include databases such as Web of Science, ERIC, Dimensions, and DOAJ. In addition, future studies should focus on longitudinal experimental research to examine the long-term effects of VR-based learning on elementary students' cognitive, affective, and skill development. Further research is also encouraged to develop and evaluate VR-based learning media that incorporate local wisdom and contextual cultural content, in order to enhance relevance and acceptance in diverse elementary school settings.

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