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UTILIZING AUGMENTED REALITY TO ENHANCE STUDENTS' CONTEXTUAL UNDERSTANDING IN HISTORY LEARNING: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT
History learning in secondary schools is still dominated by conventional approaches that emphasize rote memorization of facts, making it difficult for students to deeply understand historical contexts. Augmented Reality (AR) has emerged as an innovative solution that offers immersive and interactive learning experiences. This study aims to systematically examine the use of AR in history education and its contribution to enhancing students' contextual understanding. Using a Systematic Literature Review (SLR) approach, this research analyzes 50 scholarly articles retrieved from electronic databases such as Scopus, Web of Science, and Google Scholar. Bibliometric analysis was conducted using VOSviewer software to map keywords, temporal trends, and main topic clusters related to AR, history learning, and contextual understanding. The findings reveal two major clusters in the literature: a pedagogical cluster focusing on historical understanding and a technological cluster highlighting AR development. Additionally, temporal trends show that topics such as "augmented reality" and "development" have become central in recent publications (2023–2024), indicating a growing interest in the use of AR in education. However, there are still research gaps regarding the implementation of AR to foster historical empathy and its application at the elementary education level. This study concludes that AR holds significant potential to enhance contextual understanding in history education, but its effectiveness greatly depends on well-structured instructional design and proper curriculum integration. Therefore, the development of instructional models that balance cognitive and affective aspects through AR-based approaches is essential.

INTRODUCTIONS

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History education at the secondary school level in Indonesia remains predominantly characterized by conventional approaches that emphasize the memorization of facts and dates, without providing in-depth context to historical events (Agustina et al., 2023; Aman, 2019). As a result, students struggle to connect historical material with real-life experiences and everyday situations. For example, students tend to recall historical events as isolated pieces of information, without understanding the cause-and-effect relationships or the relevance of those events within current social and cultural contexts (Y.-S. Chou et al., 2024; Kropman et al., 2023). This situation is exacerbated by the lack of interactive learning resources and the limited integration of technology in history instruction (Akram et al., 2022; Alenezi et al., 2023). Consequently, students' interest and understanding of history remain low, leading to suboptimal learning outcomes. This phenomenon highlights the urgent need for innovation in both the methods and media of history education that can enhance student engagement and contextual understanding (Almusaed et al., 2023; Moseikina et al., 2022; Zen & Ariani, 2022).

A number of studies have shown that the use of technology in education can enhance student engagement and understanding (Juuti et al., 2021; Nkomo et al., 2021; Yu et al., 2022). However, in the context of history education, there remains a gap in the effective application of technology to improve students' contextual understanding (Ciriza-Mendívil et al., 2022; Fatmawati, 2025). For instance, a study by AlGerafi et al., (2023) found that the use of Augmented Reality in history learning can enhance students' cognitive abilities, but did not specifically examine its impact on contextual understanding. Similarly, research by Remolar et al., (2021) indicated that Augmented Reality can increase student engagement in history education, yet it did not explore in depth how this technology influences historical contextual comprehension. This gap highlights the need for more focused research on how Augmented Reality can be effectively utilized to improve students' contextual understanding in history learning.

This study aims to systematically examine existing research on the use of Augmented Reality in history education. Specifically, it seeks to identify the contributions of Augmented Reality in enhancing students' contextual understanding in history learning. In addition, this study also aims to map trends, methodologies, and key findings from previous studies related to Augmented Reality and history education. Thus, this research is expected to provide comprehensive insights into how Augmented Reality can be effectively utilized in history learning to improve students' contextual understanding.

Given the fact that history education in schools remains conventional and lacks the integration of modern technology, along with the existing gap in the literature regarding the use of Augmented Reality to enhance students' contextual understanding, this study is deemed essential (Sutimin, 2025). By systematically reviewing previous studies, this research aims to uncover empirical evidence on the effectiveness of Augmented Reality in history education. The hypothesis proposed in this study is that the use of Augmented Reality in history learning can improve students' contextual understanding by providing immersive and interactive learning experiences, enabling students to relate historical content to real-life contexts. This study is also expected to offer practical recommendations for educators and curriculum developers on how to effectively integrate Augmented Reality technology into history education.

LITERATUR REVIEW

Conception 1: The Concept of Augmented Reality

Augmented Reality (AR) is a technology that integrates digital elements into the physical environment in real time, creating an interactive experience that enhances users' perception of the real world (Arena et al., 2022; Dargan et al., 2023). In educational contexts, AR is used to add visual, audio, or other data to the learning environment, thereby helping students grasp abstract concepts in a more concrete manner (Tan et al., 2022; Turan & Atila, 2021). This

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technology enables the delivery of more engaging and immersive instructional content, increasing student involvement in the teaching and learning process. Consequently, AR holds the potential to be an effective tool for improving the quality of education across various academic levels.

In practice, the use of AR in education can be categorized based on the mode of interaction and its intended purpose. One common classification includes marker-based AR, which uses visual markers to trigger the display of digital content; location-based AR, which utilizes geographic data to present information; and projection-based AR, which projects images onto real-world surfaces without the need for additional devices (Mendoza-Ramírez et al., 2023; Syed et al., 2022). Additionally, there is superimposition-based AR, which replaces the original view of an object with a digitally enhanced version. Each of these categories has specific applications in educational settings, allowing educators to select the most suitable type of AR according to their instructional goals and students' needs.

Conception 2: The Concept of History Learning

History learning is an educational process aimed at developing students' understanding of past events, as well as their ability to analyze and interpret historical information (Abbas et al., 2023; Firmansyah, 2024). This process involves not only the mastery of historical facts but also the development of critical thinking skills, such as the ability to evaluate sources, understand cause-and-effect relationships, and identify changes and continuities throughout history. Therefore, history learning plays a crucial role in shaping students' historical consciousness and their capacity to relate past events to present-day contexts.

History learning can be implemented through various approaches, including content-based learning, which focuses on mastering facts and chronology; inquiry-based learning, which encourages students to pose questions and conduct investigations; and project-based learning, which involves students in collaborative activities to explore historical topics in depth (Darmayanti et al., 2024). Additionally, approaches to history learning can also be classified according to their thematic focus, such as political, social, economic, or cultural history. Each of these approaches offers different ways of understanding and interpreting historical events, enabling students to gain broader and deeper perspectives (Supardan, 2024).

Conception 3: The Concept of Contextual Understanding

Contextual understanding refers to an individual's ability to interpret information by taking into account situational context, environmental factors, and personal experiences (Lysova et al., 2023; Metsäpelto et al., 2022). In the educational context, contextual understanding enables students to connect learning materials with real-world situations, thereby enhancing the relevance and meaning of what they learn (Marougkas et al., 2023; Rahmawati et al., 2022). This approach is grounded in constructivist theory, which posits that learning occurs effectively when students can relate new information to their existing knowledge and experiences (Robertson et al., 2024). Thus, contextual understanding is essential for creating meaningful and lasting learning experiences.

Contextual understanding in learning can be manifested through various strategies, such as problem-based learning, which presents real-life situations for analysis; project-based learning, which engages students in tasks relevant to everyday life; and experiential learning, which allows students to learn through direct involvement in specific activities (Adnani, 2024). In addition, the use of technology such as Augmented Reality can enrich contextual understanding by providing simulations and visualizations that closely resemble real-life experiences (Anwar et al., 2025; Crogman et al., 2025; Suhendar et al., 2023). By integrating these strategies, educators can create learning environments that effectively support the development of students' contextual understanding.

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METHOD RESEARCH

This study focuses on the phenomenon of students' low contextual understanding in history learning at the primary and secondary education levels. Although Augmented Reality (AR) has been introduced as an educational innovation, its application in history education remains limited and has not been fully explored. A study by Zhang et al (2022) indicates that AR has the potential to enhance student engagement and understanding through interactive visualization; however, its implementation in the context of history requires further investigation. Therefore, this study aims to identify and analyze relevant research on the use of Augmented Reality in history education and its impact on students' contextual understanding.

This research adopts a Systematic Literature Review (SLR) approach to collect and analyze relevant literature. Primary data consist of journal articles discussing the application of Augmented Reality in history learning, while secondary data include books, research reports, and other scholarly sources related to the research keywords: "Augmented Reality," "History Learning," and "Contextual Understanding." The SLR approach enables the researcher to systematically identify, evaluate, and synthesize findings from various studies in order to gain a comprehensive understanding of the topic. This methodology also assists in identifying research gaps and provides direction for future studies.

Theoretical Framework

This study is grounded in three main theories: Constructivist Theory by Jean Piaget and Lev Vygotsky, the Multimedia Learning Theory by Richard E. Mayer, and the Cognitive Load Theory by John Sweller. Constructivist Theory emphasizes that learning is an active process in which students construct understanding through experience and interaction with their environment. In the context of Augmented Reality, students can construct historical knowledge through visual and interactive exploration. The Multimedia Learning Theory posits that learning is more effective when information is presented both visually and verbally, which aligns with the features of Augmented Reality that combine text, images, and audio. Meanwhile, the Cognitive Load Theory highlights the importance of managing mental workload in the learning process; Augmented Reality can help reduce this load by presenting information in an intuitive and contextual manner.

Research Process

The research process began with the formulation of specific research questions regarding the impact of Augmented Reality on contextual understanding in history learning. The researcher then developed a Systematic Literature Review (SLR) protocol, which included a literature search strategy, inclusion and exclusion criteria, and data analysis methods. Literature was retrieved from electronic databases such as Scopus, Web of Science, and Google Scholar using a predetermined combination of keywords. Once relevant studies were identified, the quality of the studies was assessed, data were extracted, and a systematic analysis was conducted to synthesize findings across the selected studies. This process followed the PRISMA guidelines to ensure transparency and replicability in the research.

Data Analysis Technique

The data analysis in this study employed a content analysis approach to identify patterns, themes, and relationships within the reviewed literature. Each study was evaluated based on specific criteria, such as research objectives, methodology, key findings, and relevance to the topic of Augmented Reality in history education. The collected data were then categorized and analyzed to reveal common trends, research gaps, and practical implications.

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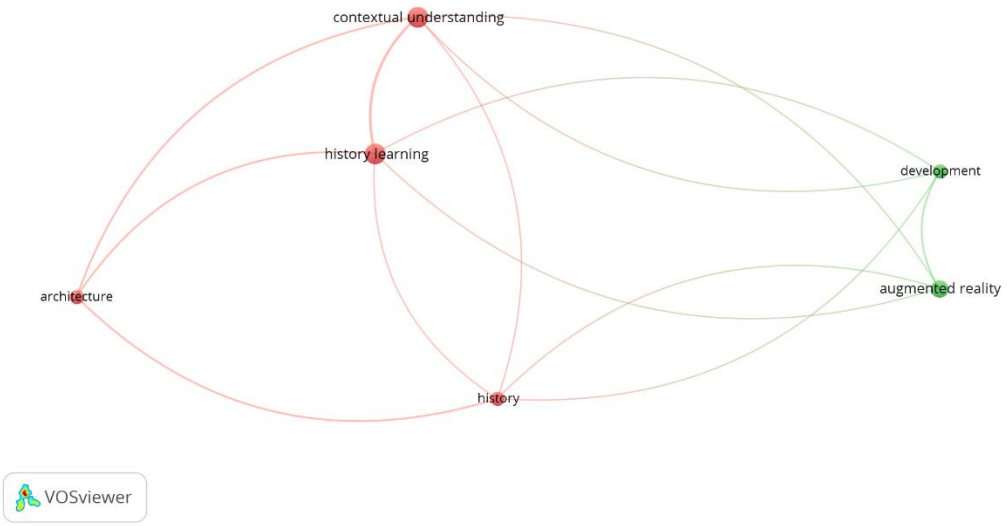
This approach enabled the researcher to develop a comprehensive and evidence-based synthesis of how Augmented Reality is utilized to enhance students' contextual understanding in history learning.

RESULT AND DISCUSSIONS

Keyword Mapping and Topic Clusters (Network Visualization)

Based on the keyword mapping results using VOSviewer, as illustrated in Figure 1, two dominant clusters emerge from the literature data related to the use of Augmented Reality (AR) in history education. The first cluster (in red) consists of the keywords contextual understanding, history learning, history, and architecture. This cluster represents a research focus emphasizing pedagogical and cognitive aspects of history learning, in which contextual understanding serves as the core of students' historical meaning-making. The connections among keywords in this cluster appear dense and demonstrate a high level of co-occurrence, indicating that these studies intensely integrate deep approaches to understanding historical context.

Figure 1. Network Visualization



The second cluster (in green) consists of the keywords augmented reality and development. These keywords are associated with technological innovation and the development of AR-based instructional content. The connecting lines between the two clusters particularly between augmented reality and contextual understanding indicate a significant correlation between the integration of AR technology and the enhancement of students' ability to understand historical contexts visually and interactively. Overall, the network structure supports Mayer & Johnson (2008) principle in the Multimedia Learning Theory, which asserts that the effective integration of verbal and visual information can enhance students' comprehension and information retention (Mayer & Johnson, 2008).

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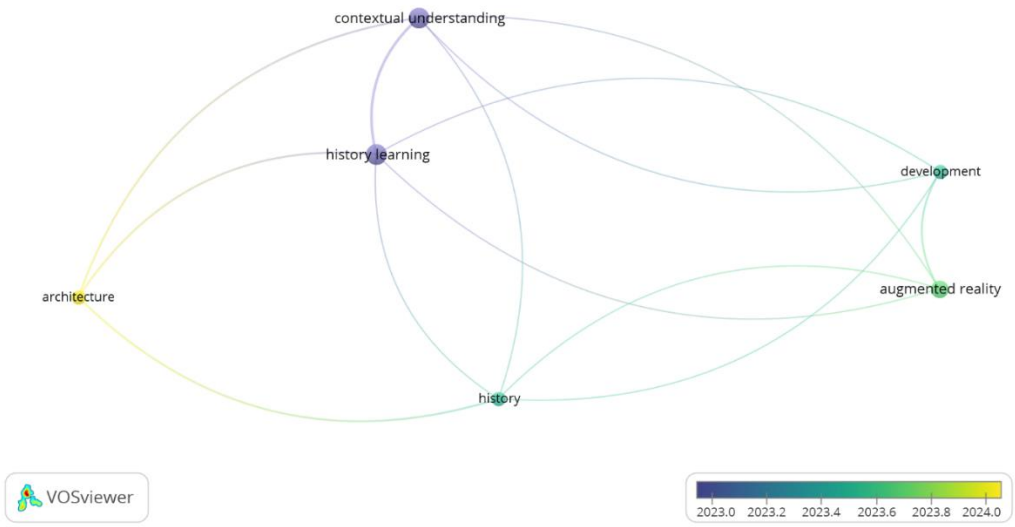
Temporal Analysis and Topic Development (Overlay Visualization)

The temporal visualization using VOSviewer overlay, as shown in Figure 2, reveals the dynamics of keyword development over the period 2023-2024. Dark purple indicates keywords that appeared earlier, while light green represents more recent keywords. It can be observed that keywords such as history learning, contextual understanding, and history emerged earlier and are well-established topics discussed in previous studies. In contrast, augmented reality and development appear in the green spectrum, indicating that these terms have begun to receive increased attention in the literature from 2023 onward.

Figure 2. Overlay Visualization



This temporal shift reflects a change in research focus from traditional text-based approaches toward digital innovation and the use of visual technologies. The integration of AR in history education is no longer seen merely as a supplementary tool, but is increasingly positioned as a core pedagogical strategy to bridge contextual understanding. These findings indicate that the direction of research development is moving toward exploring visual solutions to address the lack of historical empathy and structural understanding among school students. This aligns with previous studies suggesting that AR technology provides deeper learning experiences through simulation, animation, and spatial interaction (T. Chou et al., 2021).

Identifying Research Gaps and Practical Implications

Although the network visualization and temporal trends indicate positive developments, the analysis also reveals several research gaps. First, the keyword architecture, which has only recently emerged and remains loosely connected to the main cluster, suggests a new area for exploration. This may refer to the design of virtual structures or content architecture within AR that has yet to be thoroughly examined in the context of history education. Second, the limited strong connections between development and students' affective aspects (e.g., historical empathy) indicate

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that current research still tends to focus more on technological development rather than its emotional and reflective impact on students' learning experiences.

These findings imply that while AR has been employed to enrich historical visualization, the development of structured instructional models that utilize AR to foster contextual understanding and historical empathy remains largely unexplored. Therefore, future research should focus on developing AR-based history curricula that comprehensively incorporate narrative, cognitive, and affective dimensions. Teachers must also receive specialized pedagogical training in applying AR not only in terms of technical operation, but also in instructional design grounded in learning theories.

CONCLUSION

This study presents a systematic review of the literature concerning the use of Augmented Reality (AR) in history education and its contribution to enhancing students' contextual understanding. Through a Systematic Literature Review (SLR) approach and bibliometric visualization using VOSviewer, the findings reveal that the application of AR in history education has experienced significant growth, particularly over the past five years. This is reflected in the increasing number of publications focusing on the integration of immersive technologies in the teaching and learning process. Keyword mapping shows that AR is no longer perceived merely as a visualization tool, but as a crucial component in reconstructing more meaningful history learning experiences. In other words, AR can bridge the gap between abstract historical narratives and tangible realities that are easier for students to comprehend.

The overlay trend visualization indicates a surge of research interest in AR integration for history education beginning in 2023, with a primary focus on digital content development and enhancing student learning experiences. Nevertheless, the analysis also reveals several research gaps, particularly in connecting technological development with students' affective outcomes, such as historical empathy and contextual awareness. Additionally, topics such as digital content architecture design in AR and its application at the elementary education level remain underexplored. Thus, there is a need for more comprehensive and interdisciplinary research approaches to fully explore AR's potential in history education not only from a technical standpoint but also from a pedagogical perspective.

The conclusion of this study affirms that AR is a promising educational innovation for improving students' contextual understanding of historical material. However, its implementation effectiveness highly depends on well-structured instructional design and professional support from educators. Therefore, an AR-based instructional model for history education must be specifically designed to foster both cognitive and affective student engagement in a balanced manner. Future research is also recommended to evaluate the long-term impact of AR on learning outcomes and to explore collaborations among technology developers, educators, and historians in designing relevant and context-rich AR content. With targeted efforts, AR can evolve from being a mere visualization aid to a transformative pedagogical medium for the future of history education.

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