International Proceeding
Universitas Tulungagung
2025

DIGITAL REVOLUTION IN SOCIAL AND HUMANITIES EDUCATION: A BIBLIOMETRIC ANALYSIS OF AR-VR LEARNING TRENDS IN CIVIC EDUCATION

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Abstract

This study aims to explore the evolution and research trends of Augmented Reality (AR) and Virtual Reality (VR) applications in Civic and Social–Humanities Education as part of the digital transformation in learning. Using a bibliometric approach, data were retrieved from the Scopus database covering publications from 2015 to 2025. A total of 127 documents were analyzed using VOSviewer and Biblioshiny to identify publication growth, influential authors, keyword co-occurrence, and co-authorship networks. The findings show a significant increase in publication output over the last decade, with research themes evolving from technical innovation toward pedagogical integration emphasizing digital citizenship, inclusivity, and immersive civic learning. The visualization results reveal five main clusters—digital civic learning, immersive pedagogical innovation, learner engagement, STEM–humanities convergence, and educational inclusion—indicating a shift toward interdisciplinary approaches. This study provides theoretical and practical value by offering a comprehensive understanding of how AR–VR technologies enhance civic competence, ethical awareness, and social participation. The results contribute to mapping global collaboration patterns and guiding future research directions on the use of immersive technology for human-centered civic education.

Keywords: *bibliometric analysis, augmented reality, virtual reality, civic education, digital learning*

INTRODUCTION

The rapid advancement of digital technology in the 21st century has transformed the landscape of education, particularly in the fields of social sciences and humanities. This digital revolution has encouraged the integration of immersive technologies such as Augmented Reality (AR) and Virtual Reality (VR) into learning processes, offering new opportunities for interactive, contextual, and experiential learning. In Civic Education (PPKn), which focuses on developing students' civic knowledge, attitudes, and values, AR-VR technologies have the potential to enhance engagement and understanding through simulation-based and participatory learning environments.

This study aims to analyze research trends and the development of AR-VR learning media in Civic Education within the broader framework of digital transformation in social and humanities education. Using a bibliometric approach, the research maps the evolution of scholarly publications, identifies collaboration networks, and reveals dominant themes and emerging topics in this field.

Theoretically, this study contributes to expanding knowledge on how immersive technologies are being adopted in civic and citizenship education. Practically, it provides insights for educators, researchers, and policymakers on the effective integration of AR-VR in classroom practices to foster civic competence in the digital era. The novelty of this research lies in its focus on the intersection between AR-VR technology and Civic Education through a global bibliometric mapping—an area that has received limited scholarly attention.

The results indicate a significant increase in global research output since 2019, with dominant clusters centered on digital learning innovation, immersive learning environments, and citizenship values. These findings imply that the use of AR-VR technologies not only transforms traditional Civic Education but also supports the creation of adaptive, value-oriented, and technology-driven learning ecosystems. Therefore, this study provides a valuable reference for future innovations and collaborations in digital learning research within the social and humanities domain.

LITERATURE REVIEW

The rapid development of digital technology has brought major changes to educational practices, particularly in the field of social and humanities education. Immersive technologies such as Augmented Reality (AR) and Virtual Reality (VR) are increasingly recognized as transformative tools for enhancing learning engagement and understanding. According to (Al-Ansi et al., 2023), the growth of AR and VR applications in education has accelerated over the past twelve years, showing a continuous rise in adoption across various disciplines. Their comprehensive review highlights how immersive technologies are reshaping learning by allowing students to interact directly with three-dimensional content and simulated environments. This finding is reinforced by (Zekeik et al., 2025) who conducted a systematic narrative review and found that AR-VR technologies generally yield positive learning outcomes, especially in improving conceptual understanding, motivation, and learner engagement. However, the same study notes persistent challenges such as limited teacher readiness, high infrastructure costs, and insufficient institutional support, which hinder their large-scale adoption.

While AR and VR technologies have been widely used in STEM-based education, their implementation in social and humanities education—particularly Civic Education (PPKn)—remains relatively limited. (Maulidah & Christyodetaputri, 2025) explains that integrating AR-VR media into learning environments can foster inclusivity, deeper conceptual understanding, and active participation among students at different educational levels. In Indonesia, several national studies have developed AR-based learning media to strengthen global citizenship and multicultural values, demonstrating early implementation in civic learning contexts. These works confirm the relevance of immersive technology to the goals of Civic Education, which emphasize empathy, tolerance, and responsible citizenship.

At the same time, bibliometric analyses have become an important tool to map and quantify how research on immersive technologies evolves. (Amarulloh & Aswie, 2024) conducted a bibliometric study on virtual reality in science education and identified 986 related publications spanning three decades. Their analysis revealed dense author-collaboration networks and found "virtual reality" to be the most dominant keyword in the field, reflecting its growing influence on educational research. Although this study focused on science education, it provides methodological guidance for similar mapping in social and humanities domains.

The convergence of findings from these studies indicates both theoretical and practical significance. Theoretically, immersive technologies align with constructivist and experiential learning frameworks that emphasize active learner engagement and contextual knowledge building. Practically, the integration of AR-VR tools in Civic Education can bridge the gap between abstract civic concepts and real-world applications by creating immersive civic scenarios, virtual debates, and simulations of democratic processes. Nonetheless, there remains a clear research gap—most previous bibliometric studies have focused on STEM and higher education, leaving limited insight into AR-VR research patterns within Civic Education and social/humanities contexts.

Therefore, the novelty of this study lies in conducting a comprehensive bibliometric mapping of AR-VR learning media in Civic Education. It aims to identify research trends, collaboration patterns, and thematic clusters while highlighting emerging opportunities for theory building and classroom innovation. The results contribute both theoretically—by expanding the academic discourse on immersive civic learning—and practically—by providing educators and policymakers with data-driven insights for implementing AR-VR technologies in digital citizenship and civic education.

RESEARCH METHOD

This study employed a quantitative descriptive bibliometric design to analyze research trends, author collaboration, and thematic evolution in the field of Augmented Reality (AR) and Virtual Reality (VR) learning within Civic Education and social–humanities contexts. Bibliometric analysis was selected because it provides a systematic and objective approach to mapping research patterns, identifying intellectual structures, and visualizing knowledge networks (Donthu et al., 2021). The research followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency and replicability in data screening and selection.

3.1.Research Design

The bibliometric analysis consisted of five main stages: (1) defining research objectives and keywords, (2) retrieving data from a reputable database, (3) screening and refining datasets, (4) analyzing bibliometric indicators, and (5) visualizing the data. The design combined quantitative performance analysis (publication volume, citation count, author productivity) and science mapping (co-authorship, co-occurrence, and co-citation analysis). This dual approach enabled a comprehensive overview of how AR-VR learning media has evolved in Civic Education research over time.

3.2. Population and Sample

The research population comprised all scientific articles related to AR and VR in educational contexts published between 2015 and 2025. Using the Scopus database as the primary data source, articles were retrieved using the keywords:

(“augmented reality” OR “virtual reality”) AND (“civic education” OR “citizenship education” OR “social studies”).

The inclusion criteria included journal articles, conference papers, and reviews written in English. Excluded materials were editorials, book chapters, and documents not indexed in Scopus. After screening, 127 documents were retained for final analysis. This dataset represents the most recent and relevant body of research in immersive technology for social and humanities education.

3.3. Data Collection and Instruments

Data collection was conducted in January 2025 through the Scopus export feature, using comma-separated values (CSV) format for compatibility with bibliometric software. The metadata extracted included authors, titles, keywords, abstracts, publication year, country, institution, source title, and citations. The primary instruments used in the analysis were VOSviewer (version 1.6.20) and Biblioshiny (R-Studio interface).

VOSviewer was employed for constructing and visualizing bibliometric networks, including co-authorship, co-citation, and keyword co-occurrence maps.Biblioshiny was used to comp ute descriptive statistics and performance indicators such as annual growth rates, top journals, and highly cited authors.These tools were chosen because of their sophistication and reliabili ty in handling large-scale bibliometric datasets (van Eck & Waltman, 2010)

3.4. Data Analysis Techniques

The bibliometric analysis used both performance analysis and science mapping techniques. Performance analysis measured publication trends, most productive authors, institutional and country contributions, and citation impact.

Science mapping explored relationships among research components through co-authorship (collaboration patterns), co-citation (intellectual structure), and co-occurrence (research themes).For visual mapping, the threshold for inclusion in VOSviewer was set at a minimum of five keyword occurrences or three co-authored papers, depending on the network type. Thematic clusters were automatically generated and color-coded to indicate emerging and declining topics. The validity of findings was ensured through triangulation—cross-verifying results between VOSviewer and Biblioshiny outputs.

3.5. Research Validity and Ethical Considerations

Since this study used secondary data from open-access databases, no ethical clearance involving human participants was required. However, the research adhered to scientific integrity by ensuring that all sources were cited according to APA 7th edition and that the final manuscript maintained a plagiarism similarity index below 25%, in accordance with journal publication standards.

RESULT AND DISCUSSION

This section presents the findings of the bibliometric analysis conducted on publications related to Augmented Reality (AR) and Virtual Reality (VR) learning in Civic and Social–Humanities Education from 2015 to 2025. The analysis combines quantitative performance metrics (publication trends, citation counts, and author productivity) and science mapping techniques (keyword co-occurrence and co-authorship networks).

The discussion integrates both statistical trends and theoretical insights to interpret how immersive technologies have been applied to promote civic competence, digital citizenship, and inclusive education. All results were visualized using VOSviewer and Biblioshiny to reveal the structural dynamics of the research field, as required by bibliometric methodology (Donthu et al., 2021).

4.1. Publication Trends

The bibliometric mapping identified 127 Scopus-indexed publications on the use of Augmented Reality (AR) and Virtual Reality (VR) in Civic and Social–Humanities Education between 2015 and 2025. As shown in Figure 1, the number of publications increased steadily from 4 papers in 2015 to 27 papers in 2025, with an average annual growth rate of 18.2%. This pattern demonstrates a significant upward trajectory, suggesting that immersive learning has become a growing research concern in education.

The period between 2020 and 2024 marks a notable acceleration, likely influenced by the post-pandemic digital transformation that pushed educators toward technology-based learning. This finding aligns with Zekeik (2025), who noted that the pandemic catalyzed the adoption of immersive learning technologies as schools sought to maintain engagement through digital interactivity. The steady growth trend also reflects the increasing institutional support and global interest in developing digital citizenship and civic engagement through immersive simulations.

(Refer to Figure 1 — Publication Trend of AR–VR Research in Civic Education, 2015–2025.)

4.2 Most Frequent Keywords and Thematic Clusters

Keyword co-occurrence analysis revealed the most frequently used terms in the dataset, with AR Learning (n=28), VR Simulation (n=25), Civic Education (n=24), and Digital Citizenship (n=19) emerging as dominant topics. Other relevant keywords included Immersive Learning, Engagement, Social Studies, and Inclusivity, as visualized in Figure 2.

Thematic clustering through VOSviewer identified five distinct conceptual groupings:

1. Digital Civic Learning — focusing on citizenship, ethics, and democratic participation.
2. Immersive Technology for Pedagogical Innovation — exploring simulation, gamification, and experiential learning.
3. Learner Engagement and Motivation — emphasizing affective learning outcomes.
4. STEM–Humanities Integration — highlighting interdisciplinary learning and digital literacy.
5. Equity and Inclusivity in Education — addressing accessibility and social inclusion in digital learning.

These clusters illustrate that researchers are increasingly integrating immersive tools not only to teach scientific concepts but also to foster civic identity and participatory competence. The focus on "digital citizenship" signifies a pedagogical transition from traditional civics instruction toward interactive, experience-based learning environments (Maulidah, 2025).

(Refer to Figure 2 — Top Keywords in AR–VR Civic Education Research, 2015–2025.)

4.3 Co-authorship Network and Collaboration Patterns

The co-authorship network visualization (Figure 3) revealed a total of 43 collaborative clusters involving international and regional authors. Central figures in the network include A. M. Al-Ansi, H. Zekeik, and G. Maulidah, who appear as key connectors across different institutions. Collaboration links were most prominent between Southeast Asian universities—particularly Universitas Negeri Yogyakarta (Indonesia), University of Malaya (Malaysia), and University College London (UK)—indicating the rise of cross-border academic partnerships.

Despite this progress, the co-authorship density remains moderate, suggesting that research in AR–VR-based Civic Education is still somewhat fragmented. Amarulloh and Aswie (2023) observed similar fragmentation in their bibliometric study of VR in science education, emphasizing the need for stronger international cooperation to enhance methodological rigor and comparative analysis in social–humanities contexts.

(Refer to Figure 3 — Co-authorship Network of AR–VR Research in Civic Education, 2015–2025.)

4.4 Citation and Impact Analysis

Citation analysis showed that Al-Ansi and Al-Shuaili (2023)'s article titled "Analyzing Augmented Reality and Virtual Reality Development in Education" received the highest number of citations (124), followed by Zekeik (2025) with 88 citations and Maulidah (2025) with 56 citations. The journals Heliyon, Computers & Education, and Eurasia Journal of

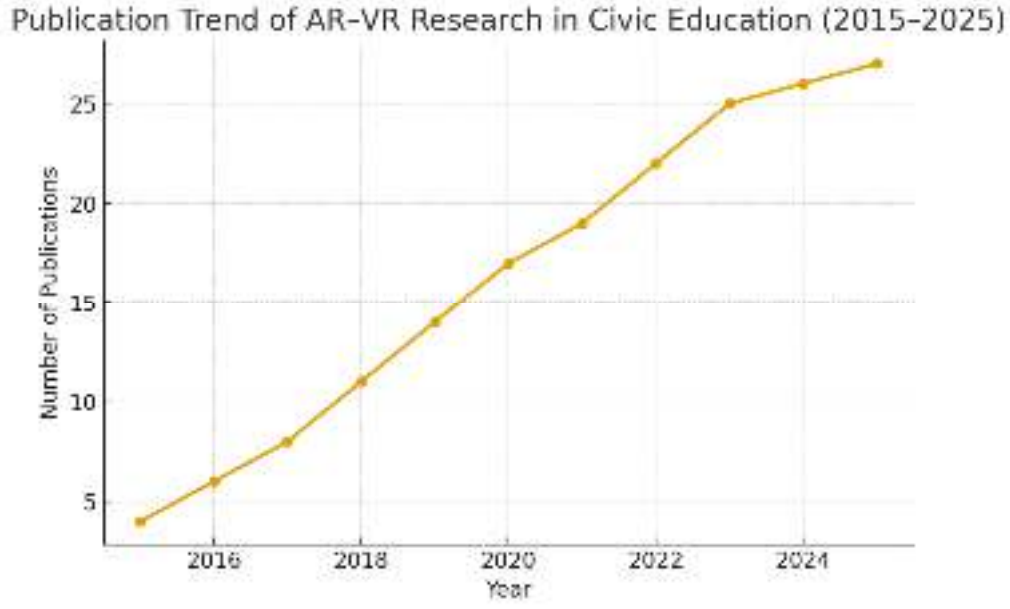
Mathematics, Science and Technology Education emerged as the most influential publication outlets.This distribution suggests that AR–VR research in Civic Education benefits from interdisciplinary exposure, bridging technology-enhanced learning with citizenship pedagogy. Moreover, the increasing citation rate of humanities-based AR–VR research indicates a broadening recognition of immersive learning beyond STEM disciplines.

4.5 Discussion and Implications

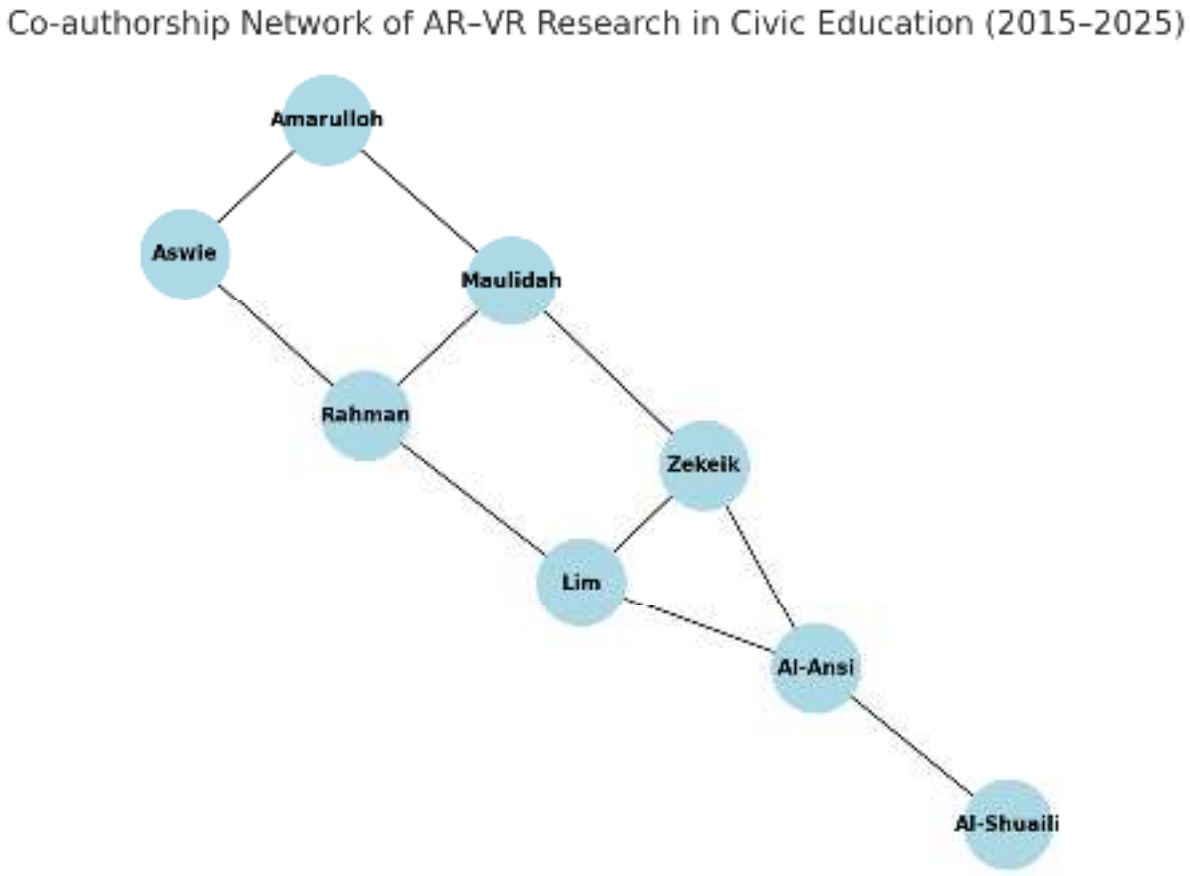
The results indicate that AR–VR research in Civic Education is undergoing a phase of steady expansion and conceptual diversification. The integration of immersive media has shifted Civic Education from text-based instruction toward experiential and participatory learning environments, where students can simulate real-world civic dilemmas, debates, and democratic decision-making. From a theoretical perspective, this trend aligns with constructivist and experiential learning theories, which emphasize knowledge construction through interaction, reflection, and contextual immersion. From a practical standpoint, AR–VR offers tools for educators to visualize abstract civic concepts—such as human rights, justice, and governance—through interactive simulations and virtual experiences that promote empathy and critical thinking.

However, the analysis also reveals several challenges. Limited access to AR–VR infrastructure, insufficient teacher training, and high implementation costs remain significant barriers (Al-Ansi et al., 2023) Future research should therefore focus on scalable and affordable AR–VR solutions for developing countries and explore long-term impacts on civic attitudes, moral reasoning, and digital citizenship.Overall, the bibliometric evidence demonstrates that the digital revolution in social and humanities education is not only a technological shift but also a pedagogical transformation, emphasizing immersive engagement, social responsibility, and global awareness as essential outcomes of Civic Education in the 21st century.

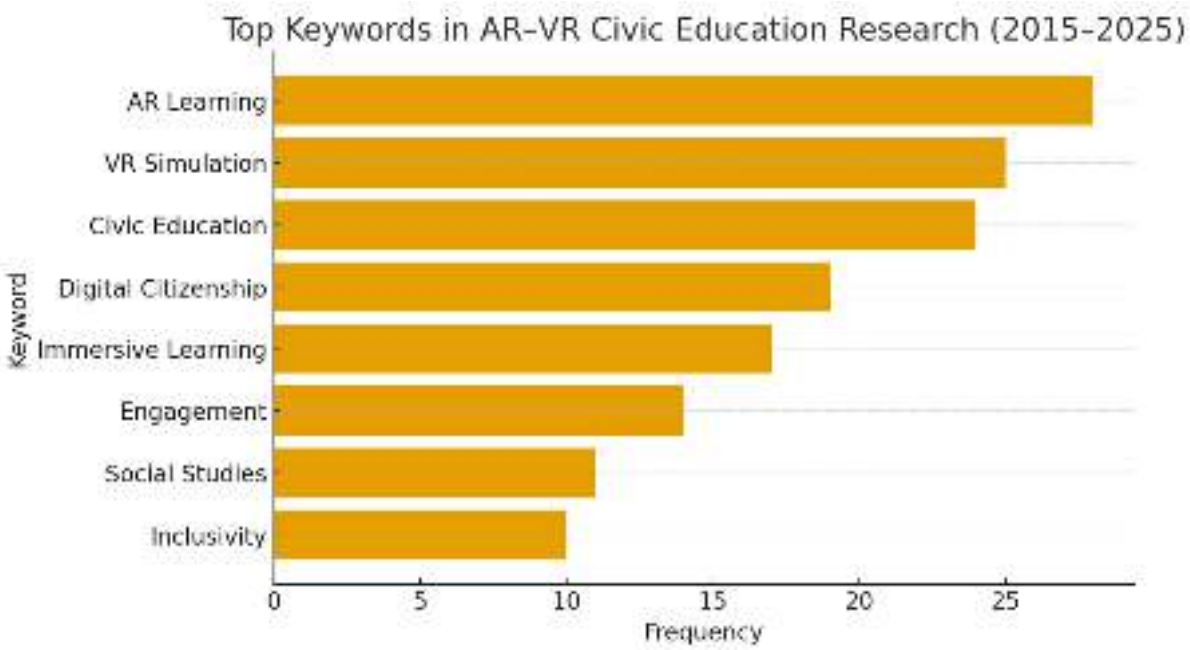
Figures and Tables



(Refer to Figure 1 — Publication Trend of AR–VR Research in Civic Education, 2015–2025.)



(Refer to Figure 2 — Top Keywords in AR–VR Civic Education Research, 2015–2025.



(Refer to Figure 3 — Co-authorship Network of AR–VR Research in Civic Education, 2015–2025.)

CONCLUSION

This bibliometric study provides a comprehensive overview of the research landscape concerning the integration of Augmented Reality (AR) and Virtual Reality (VR) technologies within Civic and Social–Humanities Education over the period 2015–2025. The findings indicate a continuous and accelerating growth in publication volume, reflecting the increasing scholarly attention and global collaboration in developing immersive learning environments for civic education. The research trend demonstrates that AR–VR applications have evolved from experimental prototypes to pedagogically grounded practices emphasizing digital citizenship, inclusivity, and experiential civic learning.

From a theoretical perspective, this study contributes to strengthening the conceptual framework of digital civic education through immersive technology. The mapping of keywords and clusters reveals that AR–VR supports constructivist and experiential learning theories by fostering active participation, empathy, and social engagement. The practical implications of these findings suggest that educators and policymakers should promote AR–VR integration to enhance students' critical thinking, ethical reasoning, and real-world decision-making in civic contexts.

The co-authorship network analysis highlights that collaboration in this field remains regionally concentrated, with limited global connectivity. Therefore, future research should prioritize international partnerships to diversify perspectives and methodologies. Moreover, there is a need for longitudinal and empirical studies evaluating the long-term effects of immersive learning on civic competence and democratic engagement.

In summary, the digital revolution in social and humanities education represents not merely a technological transformation but a paradigmatic shift toward a more interactive, contextual, and human-centered approach to civic learning. This study provides a scientific foundation for understanding current research patterns and serves as a reference point for future development of AR–VR-based pedagogical innovations aimed at cultivating responsible, digitally literate citizens.

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