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Systematic Literature Review : Trends in the Application of Augmented Reality in Science Education in Elementary Schools from 2020 to 2025

H. W. Ramdhani[1] *, S. Susilogati[2], B. Subali [3], N. Widiarti [4]
[1,2,3,4] Primary Education, Postgraduateschool, Universitas Negeri Semarang
**Corresponding Author. Email: haniwijilramdhani@students.unnes.ac.id Phone*:+6285640364750*

Abstract

This study aims to analyze research trends in the application of Augmented Reality (AR) in Science Learning in Indonesian elementary schools from 2020 to 2025. Using a Systematic Literature Review (SLR) approach, this study collected, reviewed, and analyzed 26 empirical studies obtained from Google Scholar, Scopus, and Publish or Perish databases. The analysis employed PRISMA guidelines to ensure transparency and reliability in article selection, followed by bibliometric mapping using VOSviewer to identify research clusters, keyword relations, and thematic trends. The results indicate that AR has been widely developed in various forms, such as e-modules, flashcards, flipbooks, and mobile applications, enhancing students' conceptual understanding, critical thinking, creativity, and motivation. Most studies adopted Research and Development (R&D) and experimental designs, focusing on science topics like the human body, earth layers, and water cycles. The findings reveal a growing trend in integrating AR to create interactive and contextual learning aligned with the Merdeka Curriculum's goals. However, challenges remain, including unequal access to devices, limited teacher training, and non-standardized assessment instruments. Overall, the study concludes that AR offers significant potential to improve the quality of elementary science education by visualizing abstract concepts, fostering engagement, and supporting 21st-century learning competencies.

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1. INTRODUCTION

In today's world, which is highly dependent on technology, this has become an important part of everyday life, including the learning process. Information and communication technology continues to develop rapidly and affects various areas of human life, including education. (Meslilesi et al., 2017). Educational technology plays a role in improving educational productivity, providing individualized learning, enhancing learning abilities, and enabling the widespread distribution of quality education (Jusman & Usman, 2025). Research reveals that students are more interested in digital learning media such as video animations, interactive simulations, and educational games, thereby improving their understanding (Mardiana et al., 2025). Integrating computer technology and the internet into the education system can be an effective way to improve the learning process (Ratnawati et al., 2024). In an international context, integrating information and communication

technology (ICT) into elementary school curricula poses significant challenges for teachers in developing countries, particularly in terms of facilities and training (Murithi & Yoo, 2021). With the help of technology, learning using media can be easier and more practical in various ways, using the same electronic devices, such as laptops, projectors, or Chromebooks (Ummah & Mustika, 2024).

Teachers use technology-based learning media to make the learning atmosphere more interactive, innovative, and encourage student creativity (Fitri et al., 2024). The development of Android-based multimedia learning shows that digital media can increase student active engagement in the learning process (Izhar et al., 2023) . Digital media in learning not only helps the learning process but also provides opportunities for students to learn about and use technology in learning. (Maisarah et al., 2023).

An evaluation of teachers' digital literacy in several provinces in Indonesia shows that teachers have sufficient technological and digital ethics competencies, but their proficiency in evaluating digital content is still low (Zulaikha et al., 2025) In addition, the use of technology in learning provides opportunities for teachers to improve their digital literacy experience and skills by conducting learning activities with students in the classroom (Ummah & Mustika, 2024). Using technology in learning media is also an effective way to improve the quality of learning experiences through innovative learning activities that are tailored to students' learning styles. One example One example is science learning, known as IPAS (Ilmu Pengetahuan Alam dan Sosial) in the Indonesian curriculum, in elementary schools (Ummah & Mustika, 2024).

Science learning plays an important role in providing knowledge and skills to students so that they can understand and interact with their surroundings (Fitri et al., 2024). However, on the other hand, Based on the description, this study addresses three core research questions: (1) What are the 2020–2025 research trends of AR in elementary science education? (2) What are the dominant focus topics, development models, and learning approaches used? and (3) What research gaps exist based on the bibliometric analysis? Consequently, this study aims to analyze these trends, identify methodologies and key topics using VOSviewer, and discover existing research gaps. The results are expected to serve as a valuable reference for educators and researchers in developing interactive, contextual AR-based learning media tailored to elementary school students. Subject learning in elementary schools still faces many challenges. Images are often unclear or too small, hindering students' optimal understanding (Cahyani et al., 2025). The development of website-based interactive multimedia for natural resource materials has proven effective in increasing students' learning independence (Pastika et al., 2025).

Learning media that rely solely on textbooks and student worksheets are not effective in helping students understand abstract and complex material. Interactive PBL-based learning media on the characteristics of living things for elementary school students have been proven to improve students' ability to understand abstract and complex concepts (Fajar et al., 2023). The use of unvaried learning methods and media causes many students to find it difficult to understand the subject matter, so that their learning outcomes have not reached the minimum standard of mastery (Dewi et al., 2024). Educators find it difficult to present material visually or interactively in a way that can stimulate students' interest (Savitri & Meilana, 2022). Teachers today are faced with the demand to master four competencies: digital skills, digital culture, digital ethics, and digital security as requirements for 21st-century learning (Isrok'atun et al., 2022). This shows the need for innovation in learning media to make it more interactive and support students' understanding of the material being delivered.

To address these issues, technological advances can be utilized in teaching and learning activities. For example, augmented reality technology can be used to develop the learning process (Sahronih et al., 2023). Interactive digital learning media design training programs for elementary school teachers improve their capacity to develop media that suits the needs of students in the digital age (Lailiyah et al., 2024). Augmented Reality (AR) is a technology that can combine two- or three-dimensional virtual objects into the real world, then display or project them directly and in real time (Setyawan et al., 2019). Its advantage is its attractive visual display, as it can display 3D objects and their movements that look like they are in the real world (Savitri & Meilana, 2022). Teknologi Augmented Reality technology in science learning has been proven to be able to display three-dimensional objects in real-time and facilitate student interaction, thereby providing a more in-depth learning experience (Rohmani et al., 2024). Augmented Reality also supports collaborative learning, as students can work in groups to explore 3D objects and discuss the concepts being studied, thereby enhancing social interaction and communication skills (Lesmana et al., 2023). Bibliometric analysis shows that digital literacy has become a fundamental component of education in Asia, and the trend of related publications has increased rapidly in recent years (Laksana et al., 2025).

Based on the description, this study addresses three core research questions: (1) What are the 2020–2025 research trends of AR in elementary science education? (2) What are the dominant focus topics, development models, and learning approaches used? and (3) What research gaps exist based on the bibliometric analysis?

Consequently, this study aims to analyze these trends, identify methodologies and key topics using VOSviewer, and discover existing research gaps. The results are expected to serve as a valuable reference for educators and researchers in developing interactive, contextual AR-based learning media tailored to elementary school students.

2. LITERATUR REVIEW

2.1 Augmented Reality in Science Education

Augmented Reality (AR) is a technology that combines virtual objects or digital information with the real-world environment and enables users to interact with them in real time. In science education, AR provides opportunities to present learning materials through three-dimensional visualizations and interactive objects. This technology is particularly relevant to science learning because many concepts involve abstract structures or processes that are difficult to observe directly. By presenting these concepts in a more concrete and interactive form, AR can support students' understanding and engagement in learning (Setyawan et al., 2019; Zufahmi et al., 2025).

The application of AR in elementary science learning has been developed for various topics, including the human body, ecosystems, and the structure of the Earth. Setyawan et al. (2019), for example, developed AR-based science learning media for sixth-grade elementary students and found that the media was considered feasible and could help students understand the learning material. Similarly, Rusli et al. (2022) developed an AR application for learning human hand structures and demonstrated its potential to support interactive learning among elementary school students. Previous research has also indicated that AR-based learning media can improve students' conceptual understanding (Masruroh et al., 2023).

Despite its potential, the implementation of AR in elementary science learning may face several challenges. Malihah (2024) identified limitations in technological devices, teacher readiness, and the availability of appropriate AR content as challenges in its implementation. Therefore, the use of AR should not be viewed merely as the addition of technology to learning, but should be integrated with appropriate learning strategies, available facilities, and curriculum objectives to ensure that it effectively supports students' science learning.

2.2 Augmented Reality and Conceptual understanding

Conceptual understanding refers to students' ability to interpret, classify, compare, explain, and apply Conceptual understanding is an important component of science learning because students need to understand scientific concepts and the relationships between them rather than merely memorize information. It refers to students' ability to interpret, classify, compare, explain, and apply concepts. In this context, Augmented Reality (AR) can support students' conceptual understanding by presenting abstract objects and processes through three-dimensional and interactive representations. Through interaction with virtual objects, students can observe and explore scientific concepts in a more concrete and meaningful way.

The potential of AR to support conceptual understanding is supported by empirical research. Masruroh et al. (2023) found that the use of AR-based learning media significantly improved students' conceptual understanding, with the average score increasing from 50.65 in the pretest to 76.48 in the posttest. The study also reported a moderate improvement based on the N-Gain score. Similarly, Zulfa et al. (2025) found that the use of AR media had a positive effect on students' conceptual understanding in IPAS learning at the elementary school level. These findings are consistent with the systematic literature review conducted by Siki and Leba (2025), which showed that AR-based learning media can support elementary students' understanding of science concepts by providing visualization and interactive learning experiences.

Therefore, AR has the potential to help students connect abstract scientific concepts with concrete visual representations. By allowing students to observe and interact with learning objects, AR can provide learning experiences that are more meaningful and support the development of conceptual understanding in elementary science learning.

2.3 Augmented Reality as Learning Media

Learning media are tools that facilitate the delivery of learning content and support the achievement of learning objectives. The development of information and communication technology has encouraged the use of interactive digital media in learning. In this context, Augmented Reality (AR) can function as learning media by combining digital information with the real-world environment and allowing students to interact with virtual learning objects.

Between 2020 and 2025, AR has been developed in various forms, including e-books, e-modules, flipbooks, flashcards, digital comics, and mobile applications. Nafi'ah and Asih (2024) developed AR-based learning media using the Assemblr Edu platform for teaching the Earth's layers and found the media to be feasible for elementary school learning. Similarly, Fauni and Isdaryanti (2025) developed an AR-assisted

flipbook for teaching the human respiratory system. These studies indicate that AR can be integrated into various learning media to provide more interactive and visual learning experiences.

AR-based learning media can also support students' learning processes. Setiawan et al. (2023) found that AR-based learning media influenced students' science process skills. However, its implementation may face challenges related to device availability, teacher readiness, and the suitability of AR content with the curriculum (Malihah, 2024). Therefore, the development of AR learning media should consider usability, accessibility, curriculum relevance, and students' characteristics. Overall, AR has potential as an innovative learning medium for presenting science concepts in a more visual, interactive, and contextual manner.

3. RESEARCH METHOD

This study uses a Systematic Literature Review (SLR) method that is designed comprehensively and structurally to collect, review, and analyze various previous studies on the application of Augmented Reality (AR) technology in sciences learning at the elementary school level. The Systematic Literature Review method is a rigorous method used to search for, assess, and combine all existing studies on a particular topic. (Rusyati et al., 2025).

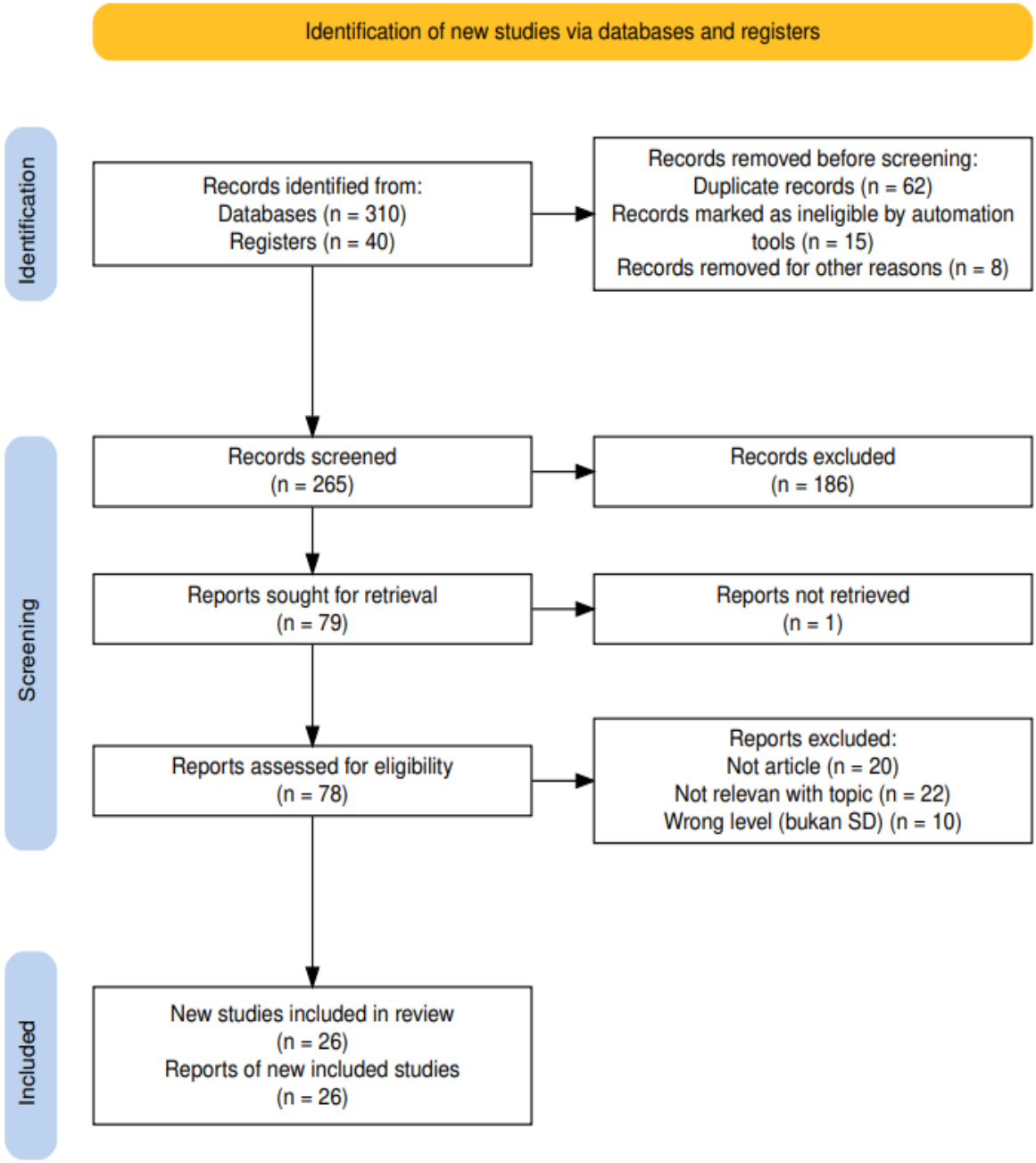
The research process began with a search for scientific articles through three main databases, namely Google Scholar, Scopus, and Publish or Perish. The keywords used in the search included: “Augmented Reality,” “Elementary School,” and “Science Learning.” The article search was limited to scientific publications between 2020 and 2025, from both national and international journals, to ensure that the results obtained were up-to-date and relevant to current developments in learning technology.

The article selection stage was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which aim to ensure a transparent, systematic, and replicable reporting process for other researchers. This approach was chosen to provide a comprehensive, transparent, and unbiased synthesis of previous research findings on Augmented Reality learning in the context of primary education in Indonesia. At this stage, the inclusion criteria included articles that were the results of empirical research, focused on the application of AR in science education at the elementary school level, and were available in full text. Meanwhile, the exclusion criteria included articles that were not scientific research papers (not articles), did not correspond to the specified education level (wrong level), and articles that were not fully accessible (full text not accessible). After going through all stages of selection—identification, screening, eligibility, and inclusion—a total of 26 articles were obtained that were suitable for further analysis.

The analysis stage was conducted using two main approaches, namely bibliometric analysis and content analysis. Bibliometric analysis used VOSviewer software to map keyword connections, research development trends, and produce visualizations of topic networks that were the focus of the study. Furthermore, content analysis was conducted to examine the characteristics of the research, objectives, methodologies used, forms of AR implementation, and key findings in science learning in elementary schools. The synthesis of the results of these two analyses provides a comprehensive understanding of the direction of research development and identifies research gaps that still have the potential to be developed in the future.

The article selection process in this study is visualized through the PRISMA flow chart as shown in Figure 1. At the identification stage, 350 documents were found, consisting of 310 documents from the database and 40 documents from the register. Furthermore, 265 documents were selected at the screening stage, and 186 documents were excluded because they did not meet the initial relevance criteria. A total of 79 reports were then reviewed further, but 1 report could not be accessed, so 78 reports were assessed at the eligibility assessment stage..

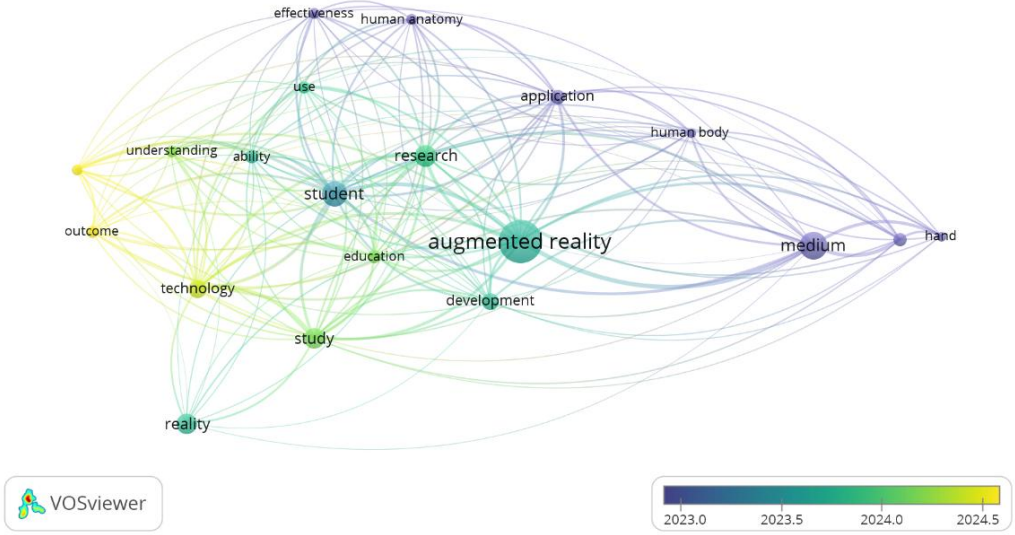
This PRISMA flowchart serves to provide transparency in the literature selection process, ensuring that the studies included are relevant and of sufficient quality, and to improve the reliability and validity of the research results.



Picture 1. Prism Flowchart

4. RESULT AND DISCUSSION

The VOSviewer software was then used to analyze the results of article searches obtained through the Google Scholar, Scopus, and Publish or Perish databases. This was done to find keyword relationships in research on the application of Augmented Reality (AR) in science learning in elementary schools. Keyword co-occurrence analysis was performed to identify relationships between topics, map research trends, and identify major clusters developing in the field of research. The bibliometric map shows the most common and frequently appearing keywords, as well as the relationships between themes that indicate the direction of recent research. With this information, we can better understand the research topics that have been studied extensively and discover areas of research that can still be explored. Particularly, recent studies highlight the profound impact of AR on science learning outcomes, distinguishing between its implementation as a stand-alone digital tool and its integration within broader pedagogical frameworks or physical media. Figure 2 shows the results of mapping these keywords and research clusters.



Picture 2. Bibliometrik VOSviewer

The results of the bibliometric analysis above show a map of keywords related to the application of Augmented Reality in elementary school learning. The keyword augmented reality appears to be the largest node and is located at the center of the network, indicating that this topic is the main focus of the publications evaluated. Other keywords closely related to the main topic, such as students, education, applications, technology, and development, also appear. This map shows a number of interrelated thematic clusters. Keywords such as understanding, ability, and results indicate that the green-yellow cluster focuses on improving student understanding and ability. This shows that research on augmented reality (AR) in science education not only emphasizes the use of augmented reality (AR)-based media, but also evaluates how the use of AR affects student learning outcomes. The blue-purple cluster shows the relationship between AR topics and specific applications in specific materials, such as the human body and human anatomy, which are part of science education materials. A literature review of the use of AR in elementary school thematic learning found that this technology can not only improve students' conceptual understanding and motivation, but also bridge abstract learning materials to make them more concrete through interactive visualization (Zilaturrohmah & Fathi, 2024) The overview of research developments from 2023 to 2025 is provided by a color scale based on overlay visualization. Blue keywords such as medium and hand dominate early-stage research (2023), which focuses on the development and design of AR media. Yellow keywords such as technology, understanding, and results indicate a more modern research trend (2024–2025) that emphasizes how effective the use of AR is in improving student learning and achievement. The development of AR-based teaching materials to improve early reading skills in elementary schools shows that this media has moderate to fairly high effectiveness in improving children's reading skills (Elvani et al., 2025). In addition, the emergence of the keywords research, study, and effectiveness indicates that AR studies in learning are increasingly directed towards evaluative research that measures the benefits of AR applications in science learning. The high connectivity between keywords shows that research in this field is developing multidimensionally, involving aspects of learning media, pedagogy, cognitive development, and technological innovation. A literature review on the effectiveness of AR in science learning in elementary schools shows that although AR provides an interactive learning experience, there are obstacles such as device limitations, low teacher readiness, and a lack of AR content that is suitable for the curriculum (Malihah, 2024).

Overall, this map illustrates that the application of AR in science education in elementary schools currently leads to: (1) optimization of interactive media and visual learning aids, (2) improved student understanding of concepts, and (3) development of research based on the effectiveness of technology use in the context of elementary education. These findings provide an important basis for identifying opportunities to develop AR media that are more oriented towards learning outcomes and meaningful learning experiences for elementary school students.

A bibliometric analysis of articles discussing the application of Augmented Reality (AR) technology in Natural and sciences learning in elementary schools from 2020 to 2025 produced a distribution of scientific publication contributions that showed the level of influence of each article based on the number of citations. Table 1 displays the results of the article citation ranking. These results are used as a basis for identifying research trends, researchers who have made the greatest contributions, and the direction of research development in this field.

Table 1. Article Ranking Based on the Number of Citations

No.	Researcher (Year)	Article title	Main fidings
1	Rusli et al, (2022)	Augmented reality for studying hands on the human body for elementary school students	The Augmented Reality-based "AR Learning Hand Parts" application effectively helps elementary school students understand the parts of the human hand interactively and improves their analytical skills.
2	Pamorti et al (2024)	Effectiveness of Augmented Reality Based Learning Media to Improve Critical Thinking Skills on IPAS Material	AR-based learning media helps improve students' critical thinking skills in learning IPAS subjects. The test results show a significant difference between classes that use this media and those that do not, with an N-Gain score of 56.52, which is classified as quite effective.
3	Masruroh et al (2023)	Effectiveness of Augmented Reality-Based Learning Media on Students' Conceptual Understanding	Augmented Reality (AR)-based learning media effectively improves students' conceptual understanding. The paired t-test results showed a significant difference between the pretest and posttest, with an N-Gain of 0.54 (moderate category), excellent learning implementation (98.33%), and positive student responses (81.56%).
4	Dewi et al (2024)	The Effect of Augmented Reality Media on the IPAS Learning Outcomes of Fifth Grade Elementary School Students	Augmented Reality (AR) media had a significant effect on the IPAS learning outcomes of fifth-grade students, with the average score of the experimental class (81.59) higher than that of the control class (75.45), and the t-test results (t-count 2.337 > t-table 1.685) showed a significant difference.
5	Nafi'ah & Asih (2024)	Assemblr Edu Learning Media Based on Augmented Reality to Improve Learning Outcomes of Grade V Elementary School Students	Augmented Reality-based learning media using the Assemblr Edu platform for teaching the structure of the Earth's layers has been deemed feasible and effective for use. Test results show high feasibility ratings from media experts (87.5%), subject matter experts (70.8%), teachers (91.25%), and students (95%), and N-Gain shows a feasible category for improving student learning outcomes.

Based on the analysis of research data presented in Table 1, published between 2020 and 2025, it can be concluded that the use of Augmented Reality (AR) in science learning in elementary schools continues to experience significant development, both in terms of media design, learning effectiveness, and student

competency outcomes. Most studies highlight similar problems, namely that science education is still dominated by conventional methods, making it difficult for students to understand abstract concepts and participate actively in the learning process. This has encouraged the development of various interactive learning media that utilize AR technology to provide more contextual and engaging three-dimensional visualizations.

The use of Augmented Reality (AR) technology in science education in elementary schools has experienced rapid development in recent years (Rusli et al., 2022). This technology was chosen because it is able to make abstract objects more real and easier for students to explore. (Istmadelia & Tyas, 2024). A number of systematic studies show that AR integration strengthens concept visualization and increases student motivation in science learning (Zufahmi et al., 2025). AR research trends have largely focused on science materials that require visualization of human anatomy, such as the respiratory system (Fauni & Isdaryanti, 2025). In addition, media development has also been carried out extensively on blood circulation system materials due to the complex nature of the material (Rahman & Setyasto, 2025). Geosphere learning, such as the structure of the earth, also utilizes AR technology to make it easier for students to understand its constituent layers (Ramdhani, 2025). Empirical examples show that AR combined with specific teaching strategies in geosphere material also improves learning outcomes, although teacher readiness and good curriculum integration are still required. (Faria, 2024). Water cycle material is also a focus of research because the process is dynamic and difficult for students to observe directly (Listiani & Paramartha, 2025). On the other hand, science material related to the environment and ecosystems has also been developed in the form of AR modules to make learning more interactive (Ulfah, 2022). In addition, international research indicates that Augmented Reality is also effective in improving digital literacy and educational inclusion among elementary school students (Arrasyafitri et al., 2024).

The variety of AR media developed demonstrates the creativity of researchers in providing innovative learning media (Nafi'ah & Asih, 2024). AR-based flashcards have been proven to help students in the process of recognizing concepts through 3D visual objects that appear from markers (Uliana et al., 2025). AR flipbooks have become an alternative to developing digital media that is more interactive than regular textbooks (Cahyani et al., 2025). E-books enriched with AR provide a more immersive reading experience for elementary school students (Andini & Setyasto, 2025). AR-assisted digital comic media can be used to improve students' understanding of concepts (Mukti & Isdaryanti, 2025). According to bibliometric analysis, AR elementary school research is not only focused on media development, but also its effectiveness and the development of students' critical thinking (Zufahmi et al., 2025). The use of AR mobile applications facilitates student access to learning outside the classroom environment (Rusli et al., 2022). AR-based e-learning media emphasizes concept exploration through the integration of interactive visuals in online platforms (Rahman & Setyasto, 2025). In addition, AR educational cards are designed to increase student engagement through simple game-based learning (Uliana et al., 2025). Furthermore, cross-subject studies have found that AR/VR has a positive impact on STEM learning outcomes, although challenges such as teacher readiness and equipment remain (Jiang et al., 2025). However, recent studies remind us that the success of AR depends primarily on technological readiness and teacher training (Zhang & Yao, 2025).

Most AR studies use the ADDIE development model as a systematic approach to media development (Istmadelia & Tyas, 2024). The Borg & Gall model is used to ensure the feasibility of the media before it is widely implemented (Andini & Setyasto, 2025). Classroom action research utilizes AR to gradually improve the quality of learning through action cycles (Ramdhani, 2025). Experimental research is conducted to test the effectiveness of AR media on learning outcomes quantitatively (Dewi et al., 2024). A quasi-experimental approach is used to observe improvements in basic skills such as deeper conceptual understanding (Zulfa et al., 2025). The literature study method was also used to map the potential of AR technology in science learning broadly (Nurfadilah, 2025). Needs analysis is also an important part of ensuring that the media is suitable for the characteristics of elementary school students (Ulfah, 2022).

The application of AR has been proven to increase motivation to learn because it provides a more enjoyable learning experience (Listiani & Paramartha, 2025). Systematic research shows that AR-based educational games can encourage active engagement and conceptual understanding among elementary school students (Rohmani et al., 2025) . Critical thinking skills also improve because AR encourages students to explore information independently (Pamorti et al., 2024). In addition, experimental research shows that AR facilitates improvements in science process skills, especially when tailored to students' cognitive styles (Setiawan et al., 2023). Student creativity develops through interaction with visual objects designed in 3D form (Sianipar et al., 2025). AR helps increase adversity quotient because it provides interesting and non-monotonous learning challenges (Uliana et al., 2025). AR media has been proven effective in improving understanding of concepts that were previously difficult to understand through conventional methods (Masruroh et al., 2023). AR also significantly improves learning outcomes based on pretest and posttest analysis (Najib & Suprihatiningrum,

2025). Beyond cognitive aspects, AR supports the development of tolerance through the contextual visualization of cultural diversity (Nurfadilah, 2025).

In general, the novelty of the research lies in the development of AR media tailored to the characteristics of science materials, such as the water cycle, the human skeleton, the layers of the earth, and ecosystem concepts that were previously difficult to visualize. The implementation of AR in flipbooks, Earth Cards, and e-modules also points to innovation in the direction of hybrid learning that combines print and digital media. These findings are in line with the demands of the Merdeka Curriculum, which emphasizes active, experience-based learning that is relevant to the context of students' lives. Analysis of research trends also reveals that elementary school AR research is increasingly focused on media development and students' critical thinking skills (Lestari & Rohmani, 2024). Thus, the review results show that AR is one of the potential solutions in improving the quality of science learning in elementary schools, both in terms of cognitive, affective, and higher-order thinking skills.

5. CONCLUSION

Based on the results of the review and analysis of the articles studied, it can be concluded that the use of Augmented Reality (AR) in science education provides significant benefits, contributing significantly to improving the quality of the learning process and outcomes for elementary school students. AR is able to visualize abstract concepts in a more concrete way, helping students understand the material in depth, and this technology helps increase student participation in the learning process. In addition, this technology has also been proven effective in developing students' critical thinking skills, learning motivation, and problem-solving abilities through more interactive and contextual learning experiences.

In terms of research direction, publication trends show a strong increase throughout 2023–2025 with a focus on AR integration in various forms of learning media such as e-modules, flipbooks, flashcards, and mobile applications. The most dominant research model is Research and Development (R&D) with expert validation and pretest–posttest testing of students. However, some studies still have limitations such as small sample sizes, devices that are not yet widely available in schools, and assessment instruments that are not yet standardized.

Thus, the use of AR needs to be further developed through capacity building for teachers, more methodologically robust long-term research, and the provision of adequate digital facilities in elementary schools. Strengthening the implementation of AR in science, technology, engineering, and mathematics (STEM) education is expected to support the vision of the Merdeka Curriculum in creating active, contextual, and student-centered learning to face the challenges of the 21st century.

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