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Augmented Reality in Child Education: A Bibliometric and Trend Analysis of Global Research (2015–2025)

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Abstract: This study aims to bibliometrically analyze publication trends, collaboration patterns, and research development directions regarding Augmented Reality (AR) in children's education. Data was obtained from the Scopus database on July 16, 2025 with the keywords "augmented reality, education, learning, teaching", which resulted in 178 initial documents and, after going through the exclusion inclusion screening process, were selected into 71 articles. All data were verified and analyzed using VOSviewer through citation map construction, keyword visualization, author collaboration, and publication distribution by journal, institution, and country. The results show that publications on AR in children's education increased significantly in the period 2015–2025, with a peak in 2024, as well as emerging research hotspots in interactive learning activities, language learning, early childhood education, and support for children with special needs such as Autism Spectrum Disorder (ASD). The collaborative analysis confirms the major contributions of Asian countries, particularly Indonesia, Turkey, Malaysia, and Taiwan, in the development of this literature. Overall, the findings confirm that AR plays an important role in increasing children's motivation, engagement, concept understanding, and social-emotional interaction, although they still face obstacles in the form of limited infrastructure, digital literacy of educators, and lack of longitudinal research. Therefore, further research with a more rigorous design, more diverse participants, and a focus on sustainability and curriculum integration is needed to optimize the implementation of AR as a pedagogical innovation in children's education.

Keywords: Augmented Reality, children's education, bibliometrics, Scopus, research trends

Introduction

In the last three years, the use of Augmented Reality (AR) in children's education has shown a consistent acceleration due to its ability to provide immersive, interactive, and contextual learning experiences that facilitate the understanding of concepts from an early age (Avasthi, 2024; Merchán, 2025; Nirmala, 2024; Özel, 2025; Shazali, 2023; Simşek, 2024; Su, 2022). In line with the child-centered learning paradigm, AR encourages increased attention, engagement, and motivation to learn through the integration of spatial visual content and participatory scenarios that are close to the child's experience (Amara, 2023; Aslam, 2025; Azhar, 2025; Lyu, 2024; Scott, 2025; Urooj, 2024). Its application also extends to various domains of language literacy, science, mathematics, and basic cognitive skills with evidence of increased retention, comprehension, and knowledge transfer to new situations (J. Chen, 2023; Fakih, 2023; Farraj, 2025; Rassy, 2023; Salim, 2025). At the same time, the digital transformation of education requires personalized, adaptive, and inclusive learning, so that AR becomes a strategic medium to bridge the needs of the curriculum with the learning characteristics of the digital generation (Farraj, 2025; Kleftodimos, 2023; Zhang, 2023).

Empirically, recent studies show that AR improves a child's conceptual understanding, intrinsic motivation, and quality of social-emotional interaction through a safe and targeted hands-on experience (Amara, 2023; Lee, 2023; Li, 2023; F. Lu, 2023; Noh, 2024; Wang, 2024). This effect is strengthened by a learning design that combines educational games, participatory design, and stages of learning strategies such as PQRST, so that the child's cognitive and metacognitive processes are guided but still provide room for exploration (Amara,

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2023; Azhar, 2025; Hsu, 2023; X. Hu, 2025; Kamarudin, 2023; Lyu, 2024). Technical advancements ranging from affordable mobile devices, more reliable markers/trackers, to easy-to-develop 3D content drive scalability and ease of implementation in the real world (Lyu, 2024; Scott, 2025; Sheena, 2023; Zhou, 2024). In addition, AR opens up more equal learning opportunities through content differentiation and multimodal support, so that children's diverse needs and learning styles can be better accommodated (Acuña, 2023; Chen, 2023; Gravett, 2022; Sheena, 2023).

From a practical perspective, educators' readiness in activity design, digital literacy, and AR-based assessments is a key factor so that pedagogical benefits are truly utilized and aligned with curriculum goals (Bigonah, 2024; C. H. Chen, 2025; You, 2025; Kayyali, 2025; Nagpal, 2023). A comprehensive evaluation framework combining indicators of learning outcomes, processes, and user experience is needed to more reliably map the effects of AR across contexts and groups of learners (Alswailem, 2024; Aslam, 2025; Fakih, 2023; S. J. Lu, 2020). The bibliometric review and topic mapping also emphasized research hotspots in activity design, engagement, and performance-based assessment, while showing room for strengthening aspects of sustainability and curriculum integration (Chow, 2024; Gusteti, Musdi, Dewata, Fauzan, et al., 2025; Kulkarni, 2024; Öztürk et al., 2024; Pranckut, 2021). Thus, the next research agenda needs to emphasize longitudinal studies, school-scale adoption strategies, and ethical governance of children's data privacy, so that AR integration truly has a sustainable and equitable impact (Carless, 2020; Herodotou, 2020; J. Hu, 2021; Torppa, 2020).

Method

This study uses a bibliometric approach to analyze trends, collaborations, and research developments regarding AR in children's education (Bahrun & Wildan, 2022; Frank & Maggio, 2022; Gusteti, Musdi, Dewata, & Rasli, 2025; Gusteti, Musdi, Dewata, Fauzan, et al., 2025; Hwang, 2021; Setiakarnawijaya et al., 2024; Yolandini et al., 2023; Y. Yu et al., 2020). Data obtained from Scopus on July 16, 2025 with the keywords "augmented reality, education, learning, teaching" in the title, abstract, and publication keywords, resulting in 178 initial documents. Next, screening was carried out with inclusion criteria: Scopus indexed journal articles, in English, relevant to AR topics in education, have gone through peer-review, and were published in the period 2015–2025. Documents in the form of preprints, conference abstracts, and non-peer-reviewed articles were eliminated. After the screening process, 71 articles were obtained that were eligible for further analysis.

The next research process includes verifying the completeness of metadata (author name, affiliation, keywords, publication source, and year of publication) to ensure the validity of the data. The selected articles were then analyzed using VOSviewer 1.6.20 through the stages of data extraction, cleanup, network construction, and visualization. Analysis was carried out on publication distribution, author and institutional collaboration, country distribution, and keyword maps to identify research hotspots. Overall, the study follows three main phases, namely the Scanning Phase, the Eligibility Phase, and the Analyzing Phase, which ensure that only relevant and high-quality articles are included in the analysis (Hammer, 2024; Hanji, 2024; Herwin, 2023). With this methodology, the research is able to uncover the dynamics of global publication of AR in children's education while providing direction for further research (Chow, 2024; Hwang, 2021; Jazm et al., 2022; Richmond, 2024; Passas, 2024; S. Yu & Mu, 2022).

Search Procedure

The first step in this study is to search literature through the Scopus database on July 16, 2025, using the keywords " augmented reality, education, learning and teaching" applied to the title, abstract, and publication keywords. This search yielded 178 documents, covering various types of publications such as journal articles, conference papers, and reviews. However, due to the combination of keywords used, some publications with more specific terms, may not be netted in this analysis.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published in the Scopus indexed journal	Publications that have not reached the final publication stage (e.g., preprints or conference abstracts)
Articles that have gone through *a peer-review process*	Articles that don't go through *the peer-review process*
Articles in English	Articles published in languages other than English
Articles that discuss Augmented Reality, education, learning and teaching.	Articles that are not relevant to Augmented Reality, education, learning and teaching.
Articles published in the 2015-2025 time frame	Articles published before 2015 or after 2025

Bibliographic Screening

After identifying all documents obtained from the Scopus database, a screening process is carried out based on inclusion and exclusion criteria to ensure the quality and relevance of the articles used in the analysis. This

screening aims to ensure that only articles that meet academic standards, are relevant to the research topic, and are within the specified time range are included in the study.

The selection of English language articles is based on the wide acceptance rate in the global academic community as well as its dominance in various bibliometric databases. However, this approach has the potential to exclude relevant studies published in other languages. After going through the screening process, the number of articles analyzed was filtered into 71 publications published between 2015 and 2025. This selection process is carried out to ensure that the analyzed documents meet strict academic standards and have high relevance to the research objectives.

Bibliographic Completeness

This stage is done to ensure that the metadata on each selected document is recorded completely and readable properly. This verification process includes checking important bibliographic elements such as the author's name, affiliated institution, keywords, and publication source, to ensure compatibility with bibliometric software such as VOSviewer. Incompleteness or illegible metadata can interfere with the accuracy of mapping and visualization of scientific networks, so such documents should be excluded from the subsequent analysis process.

Bibliometric Analysis

The final stage in the methodology of this study is a bibliometric analysis conducted using the VOSviewer software version 1.6.20. The selection of VOSviewer was based on its ability to comprehensively visualize bibliometric data and identify patterns and trends of Augmented Reality (AR) research in the context of mathematics education. The analysis was carried out through several main stages, namely: (1) Data extraction from the Scopus database in CSV/RIS format, (2) Data cleansing and validation, (3) Data import into VOSviewer for bibliometric network construction, (4) Visualization and interpretation of the network based on keywords, institutional collaboration, and publication dynamics, and (5) Validation of results by comparing the resulting thematic patterns with findings in the previous literature. The results of the visualization contribute to uncovering the structure of global collaboration and identifying key trends in AR research in the realm of mathematics education over the past decade.

Research Process Flow Diagram

Figure 1 shows the stages of the document selection process in this study which consists of three main phases: *Scanning Phase*, *Eligibility Phase*, and *Analyzing Phase*. This process began with the collection of data from the SCOPUS database, resulting in a total of 178 documents that entered the initial stage of screening. In the *Scanning Phase*, inclusion and exclusion criteria were applied, so that 9 documents were eliminated. Furthermore, 169 documents entered the *Eligibility Phase*, and through a further evaluation process, as many as 71 documents that were considered the most relevant were selected for further analysis in the *Analyzing Phase*. The documents selected in the final stage are very relevant studies to be analyzed bibliometrically.

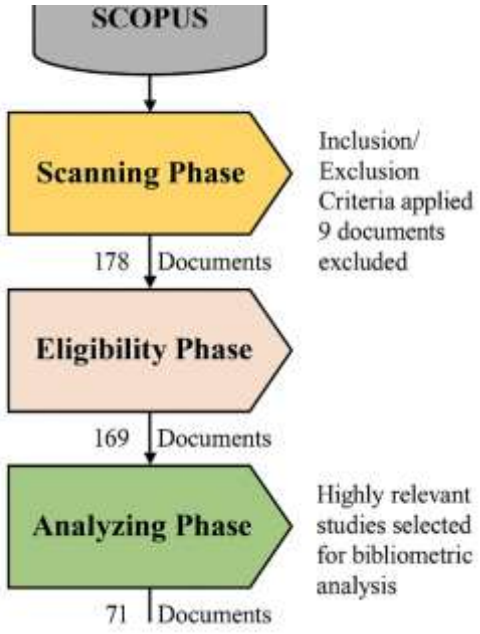

Figure 1. Four-Stage Data Extraction and Filtration Process Flow Diagram (Vedula, 2024)

This process guarantees that only studies that fit the inclusion criteria are included in the analysis, resulting in more structured findings that are in line with the research objectives. The visualization of the flow helps clarify the direction and trends of research regarding the use of AR in the field of study being explored.

Result and Discussion

Number of Documents Found and Filtered

The initial search yielded 178 documents deemed relevant to the research topic regarding AR. After going through a screening process based on certain criteria, including the selection of document types that only include journal articles, the number of documents that meet the inclusion criteria shrank to 71. As shown in Figure 1, these results reflect that the topic of AR has attracted considerable interest in academia, with a number of scientific publications selected and published in the span of 2014 to 2025.

Analysis by Document Type

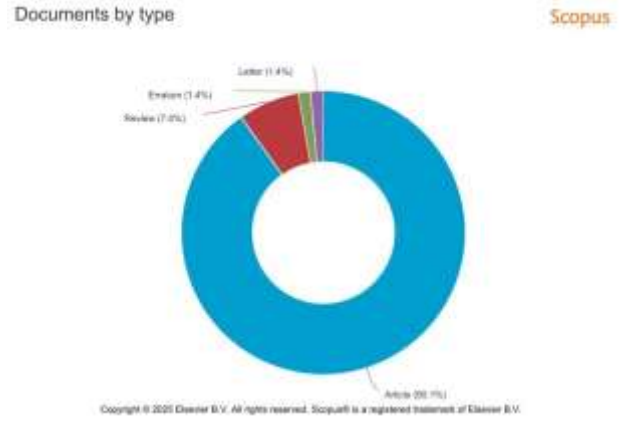

Figure 2. Document Type

Figure 2 shows the proportion of document types used in the analysis. Most publications in the form of research articles, which account for 90.1% of the total documents, indicate that the main focus of this study rests on the results of original research. In addition, documents in the form of review articles accounted for 7.0%, while erratum and letter types contributed 1.4% each. This composition indicates that bibliometric analysis is carried out primarily on the basis of scientific articles that have passed the peer-review process, which is generally considered the most credible source of reference in academic publications.

Publication Trend Analysis per Year

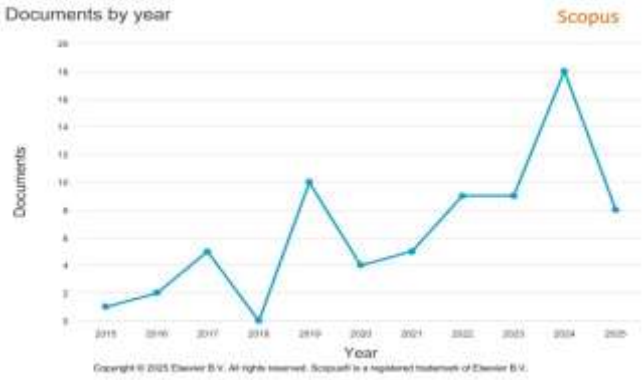

Figure 3. Publication Trends from 2015 to 2025

Figure 3 illustrates the dynamics of the number of publications analyzed in the period 2015 to 2025. Overall, the trend shows fluctuations from year to year, with an upward trend in recent years. The peak of the number of publications was recorded in 2024, reaching 18 documents, which signifies a significant increase in research interest in this topic. 2019 and 2022 also showed relatively high publication activity. Meanwhile, 2018 recorded the least number of documents. These findings indicate a growth in academic interest in the study theme over the past decade.

Analysis Based on Journal Sources

Figure 4 shows the distribution of publications per year based on relevant scientific journal sources. From the graph, it can be seen that the International Journal of Advanced Computer Science and Applications is one of the dominant sources, with the highest number of publications recorded in 2022. In addition, Sustainability Switzerland shows an upward trend in the period 2023–2024, while Interactive Learning Environments recorded two publications in 2025, making it the journal with the highest contribution of the year. Some other journals, such as the British Journal of Educational Technology, Education Sciences, and Universal Access in the Information Society, contribute consistently lower numbers of publications. This variation reflects the diversity of publication channels used in the study of related topics.

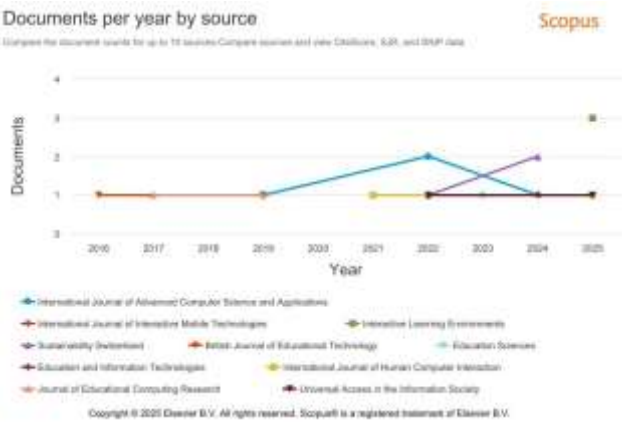

Figure 4. Analysis Based on Journal Sources

Subject-Based Analysis

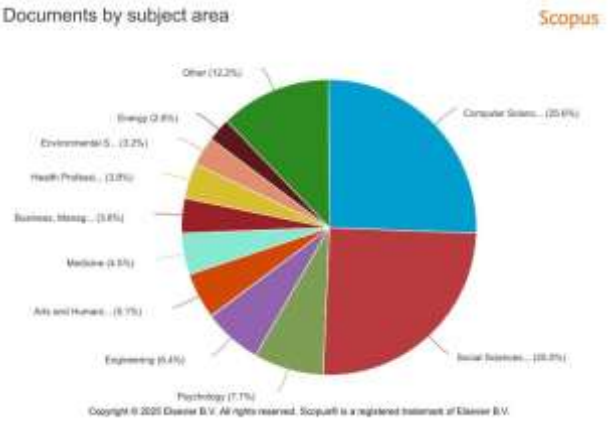

Figure 5. Distribution of Research Subjects

Figure 5 presents the distribution of documents by the scientific areas identified in this study. Computer Science and Social Sciences are the two most dominant

fields, accounting for 25.6% and 25.0% of total publications, respectively. This is followed by Psychology (7.7%), Engineering (6.4%), Arts and Humanities (5.1%), and Medicine (4.5%), which also show active involvement in related research. Several other fields, such as Business and Management, Health Professions, Environmental Science, and Energy, showed lower but still significant contributions. Meanwhile, the Other category (12.2%) represents documents from interdisciplinary fields or those that are not specifically classified. These findings suggest that the issues examined in this study include a broad cross-disciplinary approach, with a major emphasis on technological and social aspects.

Analysis by Institution

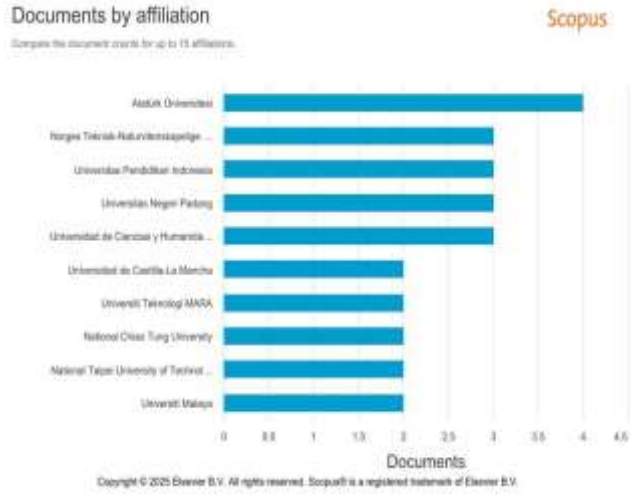

Figure 6. Analysis by Institution

Figure 6 shows the contribution of publications by author's affiliated institution. Atatürk Üniversitesi became the most prolific institution in this context, with a total of 4 documents. Several other institutions show relatively high levels of contribution, each with 3 documents, such as the Norges Tekniske-Naturvitenskapelige Universitet, the University of Education Indonesia, the State University of Padang, and the Universidad de Ciencias y Humanidades. Meanwhile, institutions such as Universidad de Castilla-La Mancha, MARA University of Technology, National Chiao Tung University, National Taipei University of Technology, and University of Malaya recorded 2 documents each. This distribution reflects the active involvement of institutions from different countries in the development and publication of related studies.

Analysis by Country

Figure 7 shows the number of publications categorized by the author's country or region of affiliation. Indonesia was recorded as the largest contributor with 12 documents, indicating the high level of participation of Indonesian academics in related studies. In the next position are Turkey (9 documents), Malaysia (7 documents), and Taiwan (6 documents), which also show an active role in the production of scientific literature. Several other countries such as Spain, Australia, India, Peru, and Saudi Arabia each contributed between 4 to 5 documents, while China recorded 3 documents. This variation in number reflects the spread of research contributions globally, with the dominance of the Asian region.

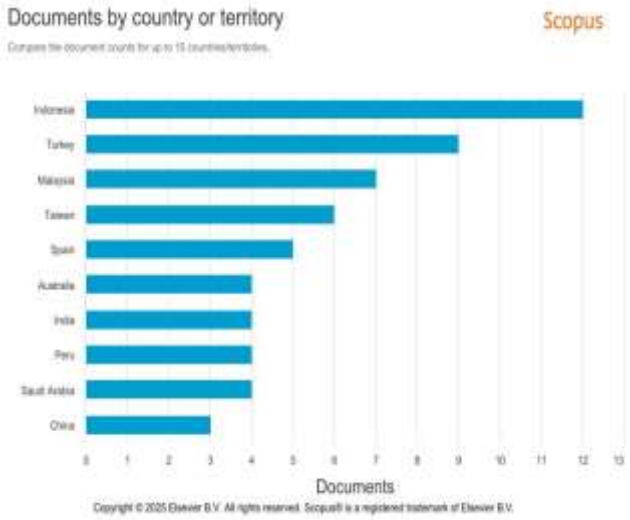

Figure 7. Document Distribution by Country

Analysis Based on Keywords

Figure 8 shows a visualization of a keyword network map using VOSviewer which illustrates the relationship between terms in research related to augmented reality in the field of education. The keyword "reality" is the central and most dominant one, showing its role as the main link between clusters. The blue cluster emphasizes on aspects of technology and AR-based learning such as augmented reality technology, learning activities, and real world; the red cluster focuses on the use of AR for children with special needs, especially autism spectrum disorder and autistic children; The green cluster represents experimental research in early childhood education with the keywords test, control group, posttest pretest, and early childhood education; Meanwhile, the yellow cluster highlights the role of parents, learning models, and the integration of mobile applications and games in supporting children's learning. The close relationship between the clusters shows that AR research in education not only highlights the technological aspect, but also involves pedagogical dimensions, family support, special needs, and overall learning evaluation.

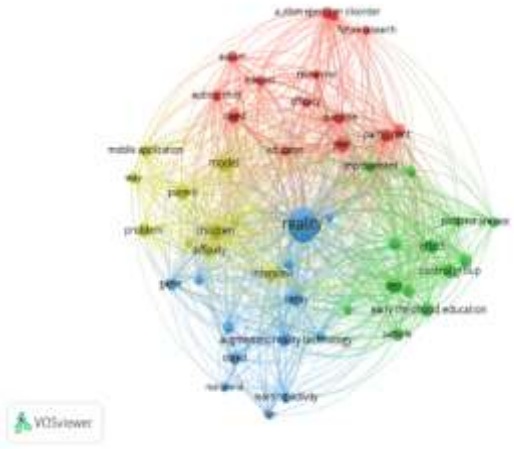

Figure 8. Keyword Visualization

Figure 8 shows a visualization of a keyword network using VOSviewer with "learning activity" as the dominant keyword that is the center of connectivity between terms. The blue cluster focuses on technological aspects such as augmented reality technology, objects, real world, fun, and knowledge that support the creation of interactive learning activities; The green cluster focuses on learning evaluation through tests, effects, samples, early childhood education, and posttest pretests; The red cluster highlights the linkage of educators with language learning as part of the implementation of learning activities; Meanwhile, the yellow cluster connects children, models, parents, problems, and games that reflect the role of the family environment and innovative learning media. This visualization emphasizes that research related to augmented reality in education is centered on how the technology is used to create learning activities that are meaningful, fun, and measurable in effectiveness.

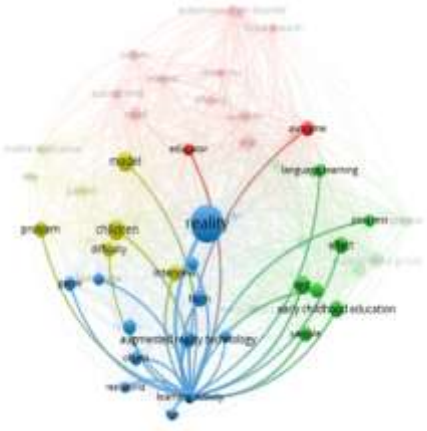

Figure 9. Keyword Visualization

Overall, Figure 9 provides a broad overview of augmented reality research trends in education with the main keywords reality connecting various clusters ranging from technological aspects, special needs, learning evaluation, to the role of parents and learning media. Meanwhile, Figure 9 is more specific in the research's focus on "learning activity" as the center of connection, emphasizing how augmented reality is used to create interactive, fun, and effective learning activities, as well as studied from the pedagogical side, evaluation of outcomes, and support of the learning environment.

Analysis of Collaboration Between Authors

Figure 10 shows a visualization of a collaboration network between authors using VOSviewer, where nodes represent authors and connecting lines indicate cooperation in publications. There are two main clusters: the red cluster involving authors such as Saqalli M.T., Aqlan A., Banire B., Salim S.S., and Shah A., and the green cluster which includes Khowaja K., Al-Thani D., Abdelaal Y., and Bahameish M.. Relationships in the red cluster appear to be closer with a strong intensity of collaboration among the authors, while the green cluster shows a network that is more connected in a limited but consistent scope. The existence of a connecting line between clusters shows that some authors, such as Khowaja K. and Al-Thani D., are bridge authors who link cross-group collaboration. This visualization shows that research in this area develops through two main interconnected research groups, with important collaborative contributions to expanding the publication network.

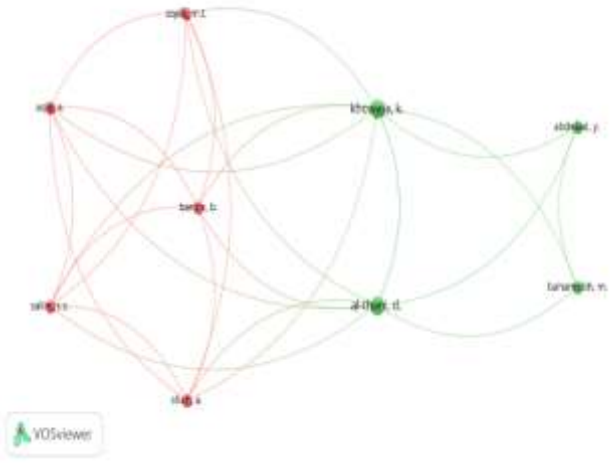

Figure 10. Author Collaboration.

Table 2. Most-Cited Articles on Augmented Reality in Child Education (2015–2025)

Author(s)	Article title	Number of citations	Journal Name	Key Findings/Recommendations
Yilmaz (2016)	Educational magic toys developed with augmented reality technology for early childhood education	235	Computers in Human Behavior	EMT with augmented reality were well received in early childhood education, engaging teachers and children through 3D experiences. While interaction was high, cognitive outcomes were limited, suggesting future designs should enhance questioning, collaboration, and broader application.
Lu & Liu (2015)	Integrating augmented reality technology to enhance children's learning in marine education	202	Environmental Education Research	An AR-based marine learning program was designed for primary students in Taiwan, integrating physical and virtual materials to teach marine ecology and water resources. The quasi-experimental study with 51 students showed high satisfaction, effective knowledge gains, and improved performance among low achievers.
Redondo et al. (2020)	Integration of Augmented Reality in the Teaching of English as a Foreign Language in Early Childhood Education	102	Early Childhood Education Journal	This study evaluated the use of AR in early childhood education for learning English as a foreign language. A quasi-experimental design with 102 pupils showed that AR significantly enhanced motivation, learning outcomes, and socio-affective relationships compared to the control group.
Che Dalim et al. (2020)	Using augmented reality with speech input for non-native children's language learning	102	International Journal of Human Computer Studies	The study found that pre-service science teachers held positive attitudes toward AR, viewing it as useful, easy to use, and effective for making abstract concepts more engaging. TAM analysis confirmed attitude as the strongest predictor of intention to use AR, leading to recommendations for integrating AR into teacher education, developing user-friendly content, and exploring long-term impacts on teaching and learning.
Safar et al. (2017)	The effectiveness of using augmented reality apps in teaching the english alphabet to kindergarten children: A case study in the state of Kuwait	101	Journal of Educational Computing Research	The study showed that AR apps significantly improved kindergarten children's recognition and pronunciation of the English alphabet compared to traditional methods, with higher post-test scores and greater engagement. Teachers reported that AR captured attention, boosted motivation, and supported interactive learning, leading to recommendations for integrating AR into curricula, providing teacher training, and examining long-term literacy impacts.
Chen & Chan (2019)	Using Augmented Reality Flashcards to Learn Vocabulary in Early Childhood Education	100	Journal of Educational Computing Research	This study compared AR flashcards with traditional flashcards in teaching animal vocabulary to 98 kindergarten children in Macau. Results showed that both methods significantly improved vocabulary learning with no major difference in effectiveness, though children enjoyed AR activities and teachers noted some implementation

Author(s)	Article title	Number of citations	Journal Name	Key Findings/Recommendations
				challenges.
Khowaja et al. (2020)	Augmented reality for learning of children and adolescents with autism spectrum disorder (ASD): A systematic review	97	IEEE Access	The review found that AR shows strong potential to support children and adolescents with ASD, especially in social skills, emotion recognition, and daily functioning, with most studies reporting increased motivation and engagement. However, limited sample sizes and methodological variations highlight the need for more rigorous, large-scale, and long-term studies to strengthen evidence and enhance AR's educational impact for the ASD population.
(Moorhouse et al., 2019)	An experiential view to children learning in museums with Augmented Reality	84	Museum Management and Curatorship	The study revealed that early childhood teachers viewed AR as engaging and effective, helping make abstract concepts more concrete while boosting student motivation and participation. Despite challenges like limited resources and training, the findings recommend teacher professional development, infrastructure support, and AR integration into curricula to foster meaningful learning.
Cheng & Tsai (2016)	The interaction of child-parent shared reading with an Augmented Reality (AR) picture book and parents' conceptions of AR learning	69	British Journal of Educational Technology	This study examined child–parent shared reading with AR picture books using sequential behavioral analyses and parental conceptions of AR learning. Findings revealed varying parental roles: some saw AR as disruptive or a substitute for reading, while others viewed it positively for fostering motivation and deeper understanding, leading to a proposed framework for AR shared reading.
Calle-Bustos et al. (2017)	An augmented reality game to support therapeutic education for children with diabetes	64	Plos One	The review showed that combining AR with gamification enhances student engagement, motivation, and learning across subjects and levels by offering immersive and personalized experiences. However, challenges like limited access, lack of training, and scarce long-term evidence highlight the need for teacher training, curriculum-aligned content, and longitudinal studies to ensure sustainable impact.

Table 2 summarizes the ten most cited articles related to the use of AR in children's education published in the 2015–2025 period. The table contains important information such as the author's name, article title, number of citations, journal name, as well as the main findings and recommendations of each study. The number of citations listed demonstrates the global scientific impact of these articles, while also confirming their important role in shaping the current understanding of the application of AR in education.

The article with the highest citations is Yilmaz's work entitled Educational Magic Toys developed with augmented reality technology for early childhood education (235 citations), which emphasizes the effectiveness of AR in creating interactive and engaging learning, although it still needs reinforcement on cognitive achievements. Other studies with a high number of citations, such as the study of Lu & Liu (202 citations) and Redondo et al. (102 citations), show the contribution of AR in improving motivation, learning

outcomes, and social-emotional relationships, particularly in the context of language learning and marine education. The research of Safar et al. (101 citations) and Chen & Chan (100 citations) also provides empirical evidence regarding the potential of AR in improving letter recognition and vocabulary skills in early childhood.

In addition, a systematic review by Khowaja et al. (97 citations) highlighting the use of AR in children with ASD, as well as Calle-Bustos et al.'s (64 citations) research related to AR based gamification, expanded the scope of AR applications into the realm of inclusive education and educational therapy. Other contributions, such as the research of Moorhouse et al. (84 citations) and Cheng & Tsai (69 citations), highlight teacher perceptions and child-parent interactions in the use of AR, as well as identify opportunities and challenges in its implementation.

Overall, the articles in Table 2 show that AR consistently increases student engagement, motivation, and interaction, although there are still constraints related to resource availability, teacher training, and long-term evaluation. This emphasizes the importance of further research and content development so that the potential of AR can be utilized optimally in various educational contexts of children.

Conclusion

This study shows that the use of AR in children's education has increased significantly in the period 2015–2025, with a surge in publications in 2024. Bibliometric analysis of 71 selected articles confirms that AR not only plays a role as a technological innovation, but also as a pedagogical medium that is able to increase students' motivation, involvement, concept understanding, and social-emotional interaction. The results of the study also show that AR is widely applied in various domains, ranging from language learning, science, literacy, to inclusive education for children with special needs. Keyword mapping shows the research focus on learning activities, the integration of AR in early childhood learning, and its application to special contexts such as ASD and child parent shared learning. Meanwhile, the analysis of the collaboration between the authors and the institution shows that there is an international research network that is growing, with large contributions from Asian countries such as Indonesia, Turkey, Malaysia, and Taiwan. Although the results of studies consistently support the effectiveness of AR in improving the quality of children's learning, there are several obstacles that are still faced, including limited resources, teacher training, technical challenges, and limited long-term evidence on its effectiveness. Therefore, further research is recommended to adopt a more rigorous design, involve more diverse participants, and focus on sustainability and curriculum integration so that the potential of AR can be maximized in various contexts of children's education. This study concludes that the use of AR in children's education in the period 2015–2025 has shown a significant increase with a major contribution to motivation, engagement, and understanding of learning concepts, both in the context of language, literacy, science, and inclusive education such as ASD. However, the limitations of the research are still seen in aspects of the relatively small sample size, methodological variations, limitations in teacher training, access to infrastructure, and lack of longitudinal evidence regarding long term impacts. Therefore, future studies are recommended to use a more rigorous research design, involve more diverse participants, provide training and infrastructure support for educators, and develop AR content that is aligned with the curriculum so that the implementation of AR can be sustainable, inclusive, and have an optimal impact in improving the quality of children's learning.

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Author Contributions
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