Letter to the Editor

Mobile Applications for Learning with Children with Autism Spectrum Disorder Based on Augmented Reality: A Brief Bibliometric Analysis

Aplicaciones móviles para el aprendizaje con niños con trastorno del espectro autista basadas en realidad aumentada: un breve análisis bibliométrico

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Dear Editor:

Autism Spectrum Disorder (ASD) has long been a growing challenge for health and education worldwide [1][2]. The World Health Organization (WHO) estimates that one in every 100 children has this diagnosis, necessitating the development of new support strategies in therapeutic and educational contexts [3]. In this regard, emerging technologies such as Artificial Intelligence (AI), Virtual Reality (VR), and Augmented Reality (AR) are gaining increasing relevance. AI refers to computer systems designed to perform tasks that normally require human intellectual skills, such as recognition and prediction. VR immerses the user in completely digital environments, while AR superimposes virtual elements on the real world to enhance interaction. Among these, AR-based mobile applications have emerged as innovative tools that combine virtual environments and real-world elements to enhance the learning and social skills of children with ASD [4].

These applications, designed to improve attention, communication, and interaction, offer immersive experiences that facilitate the understanding of concepts and promote the development of adaptive behaviors [5]. Their implementation responds to the need for learning personalization and leverages the accessibility of mobile devices to ensure greater reach.

Recent research has provided evidence of the benefits of AR for children with ASD [4]. For example, improved information retention and interaction skills compared to traditional methods have been demonstrated [6]. Furthermore, these tools are part of a broader field of innovative educational technologies, in which AI provides adaptive responses, VR provides fully simulated environments, and AR enriches real environments with interactive layers. Together, these technologies seek to generate inclusive learning environments, adapted to the cognitive diversity and unique needs of each student [7].

The integration of mobile applications with AR in the learning of children with ASD represents an interdisciplinary approach that links computer science, engineering, medicine, and the social sciences. This paradigm promotes the creation of sustainable and scalable environments that transform the use of technology into a therapeutic and educational resource [8].
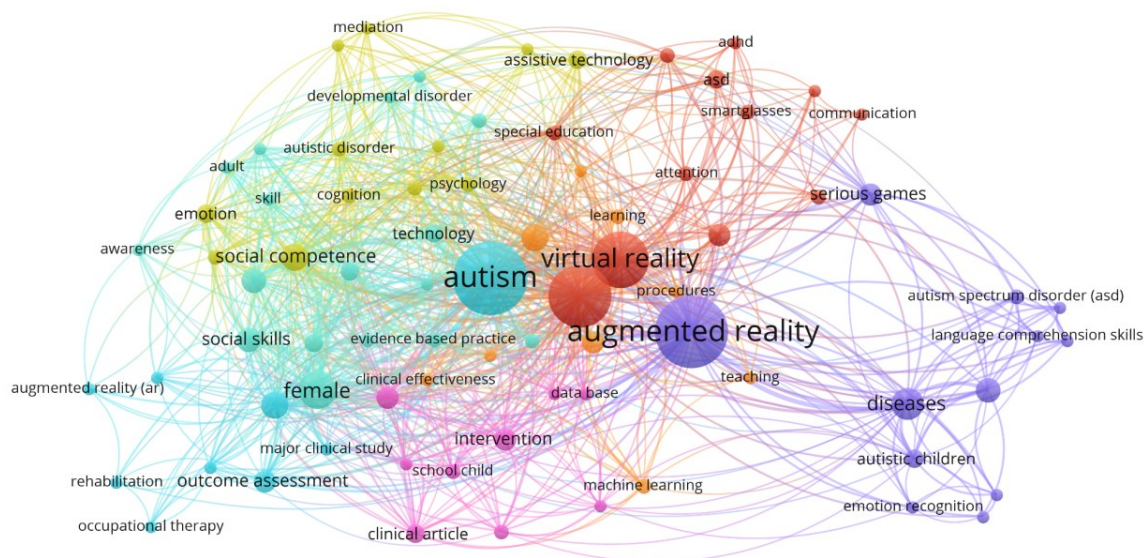
Figure 1. Co-occurrence of keywords.

According to the Scopus and PubMed databases, considered relevant and prestigious in the scientific community [9], six main research areas were identified: Computer Science, Engineering, Medicine, Psychology, Health Professions, and Nursing. The bibliometric review from 2014 to 2024 reported a total of 51 documents, mostly original articles and systematic reviews. The most frequent keywords were "Autism," "Augmented Reality," "Virtual Reality," "diseases," and "social skills" (Figure 1).

Therefore, research on AR-based mobile applications has established itself as a key component for educational and therapeutic innovation in children with ASD. However, it is important to note that many studies present methodological limitations, such as small sample sizes, heterogeneity in interventions, and technological barriers that hinder their large-scale implementation. These limitations should be considered to guide future research and strengthen intervention strategies based on emerging technologies. This warrants continued attention in this field, ensuring the design of more inclusive, effective, and scientifically supported solutions.

Additional information

Conflicts of interest: The authors declare that they have no conflicts of interest.

Author Contributions: MMPC: Participated in the conception and design of the study, data collection, and manuscript drafting. CMI: Participated in data analysis and interpretation, manuscript drafting, and approval of the final version. SRC: Participated in study supervision, manuscript drafting, and approval of the final version.

Data availability: Not applicable.

References

1. Yu Y, Ozonoff S, Miller M. Assessment of Autism Spectrum Disorder. Assessment. 2024;31(1):24–41. DOI: 10.1177/10731911231173089.
2. De Lima TA, Zuanetti PA, Nunes MEN, Hamad APA. Differential diagnosis between autism spectrum disorder and other developmental disorders with emphasis on the preschool period. World Journal of Pediatrics. 2023;19(8):715–26. DOI: 10.1007/S12519-022-00629-Y.
3. World Health Organization. World Health Organization. [cited 2025 Sep 2]. Autism. https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders
4. Lledó GL, Lledó A, Gilabert-Cerdá A, Lorenzo-Lledó A. The use of augmented reality to improve the development of activities of daily living in students with ASD. Education and Information Technologies. 2022;27(4):4865–85. DOI: 10.1007/S10639-021-10805-8.
5. El Shemy I. Language Learning with Mobile Augmented Reality and Artificial Intelligence for Children with Autism Spectrum Disorder. Proceedings of Interaction Design and Children. 2022;658–61. DOI: 10.1145/3501712.3538827.
6. Jafari E, Talebi-Abatari Z, Zadeh MR, Firoozabad VS. The Effect of Augmented Reality on the Level of Attention of First Elementary Students in the Course of Experimental Sciences. Journal of Educators Online. 2023 May 1;20(3). DOI: 10.9743/JEO.2023.20.3.20.
7. Patino DHC, Munoz L, Villarreal V, Pardo C, Nunez I, Navarro N, et al. AutismAR Discovery: Evaluation of an Augmented Reality Application to Support the Learning

of Children with Autism Spectrum Disorder in Panama. Revista Iberoamericana de Tecnologias del Aprendizaje. 2024;19:296–305. DOI: 10.1109/RITA.2024.3466171.

8. Tan Y, Xu W, Li S, Chen K. Augmented and Virtual Reality (AR/VR) for Education and Training in the AEC Industry: A Systematic Review of Research and Applications. Buildings. 2022;12(10):1529. DOI: 10.3390/BUILDINGS12101529.

9. Stuart DB, Petersen D. Citation Analysis and Medical Reference: PubMed, Web of Science, and Scopus. Journal of Electronic Resources in Medical Libraries. 2022;19(4):121–6. DOI: 10.1080/15424065.2022.2150352.