Trends and predictions for the future of augmented reality in language learning

Xu hướng và dự đoán về tương lai của thực tế tăng cường trong việc học ngôn ngữ

Le Ngoc Tran
Trường Đại học Bình Dương, Phân hiệu Cà Mau
Email: ngoctran.cm@bdu.edu.vn

Abstract: Augmented Reality (AR) is a cutting-edge technology that seamlessly combines computer-generated elements with real-world environments to create interactive and immersive experiences. Unlike Virtual Reality, which immerses users in a completely synthetic environment, AR superimposes virtual content on the real world, encouraging engagement through real-time interaction and 3D elements. Recent research has shown that augmented reality is effective in education, particularly in language learning, where it improves vocabulary acquisition, motivation, and socio-emotional development. Applications like Mondly AR, which uses speech recognition for interactive conversations, and AR Flashcards, which brings words to life with 3D animations, enhance language comprehension and engagement. AR has several advantages in language learning, including increased interaction, personalized lessons, and self-directed learning support. However, obstacles such as high implementation costs, technological requirements, and curriculum integration remain. Despite these limitations, AR's transformative potential in language education continues to grow, opening the door to more dynamic and learner-centered educational experiences.

Keywords: *Augmented Reality; Benefit; Education; Language learning; Limitations*

Tóm tắt: Thực tế tăng cường (AR) là một công nghệ tiên tiến kết hợp liền mạch các yếu tố do máy tính tạo ra với môi trường thực tế để tạo ra trải nghiệm tương tác và sống động. Không giống như thực tế ảo (VR), vốn đưa người dùng vào một môi trường hoàn toàn nhân tạo, AR chồng lớp nội dung ảo lên thế giới thực, khuyến khích sự tham gia thông qua tương tác thời gian thực và các yếu tố 3D. Nghiên cứu gần đây cho thấy AR có hiệu quả trong giáo dục, đặc biệt là trong học ngôn ngữ, nơi nó giúp cải thiện việc tiếp thu từ vựng, động lực học tập và phát triển xã hội - cảm xúc. Các ứng dụng như Mondly AR, sử dụng nhận diện giọng nói để tạo hội thoại tương tác, và AR Flashcards, mang từ ngữ đến với cuộc sống bằng hoạt hình 3D, giúp nâng cao khả năng hiểu và hứng thú học ngôn ngữ. AR mang lại nhiều lợi ích trong học ngôn ngữ, bao gồm tăng cường tương tác, cá nhân hóa bài học và hỗ trợ học tập tự định hướng. Tuy nhiên, vẫn còn những trở ngại như chi phí triển khai cao, yêu cầu công nghệ và tích hợp vào chương trình giảng dạy. Dù có những hạn chế này, tiềm năng đột phá của AR trong giáo dục ngôn ngữ vẫn tiếp tục phát triển, mở ra cơ hội cho những trải nghiệm giáo dục năng động và lấy người học làm trung tâm hơn.

Từ khóa: *Giáo dục; Hạn chế; Học ngôn ngữ; Lợi ích; Thực tế tăng cường;*

1. Introduction

1.1. Overview of Augmented Reality (AR) technology

The articles referenced in this study were selected through a systematic search of reputable academic databases, including Google Scholar, ResearchGate, and ScienceDirect. The selection process involved using keywords such as "augmented reality in education," "AR for laguague learning," and "applications of AR." Studies were chosen based on their relevance to the filed of education and language learning, prioritizing peer-reviewed journal articles and conference proceedings published in the last decade. Additionally, studies that provided empirical data on the effectiveness of AR in language acquistion were given preference. To ensure credibility, only sources from

recognized institutions and publishers were included.

According to the Oxford Advanced Learner's Dictionary, Augmented Reality (AR) is "a technology that combines computer-generated images on a screen with the real object or scene that you are looking at [1]." The concept of AR dates back to the 1960s when Ivan Sutherland developed the first AR system called the Sword of Damocles, which was a head-mounted display capable of overlaying simple graphics onto the real world [2]. This early system laid the foundation for future AR technologies. In the 1990s, Tom Caudell coined the term "augmented reality" while working at Boeing to describe a system that assisted workers in assembling aircraft components [3]. Over the years, AR technology has evolved with the rise of mobile devices and advanced computing power, leading to applications in gaming, education, healthcare, and e-commerce. The development of AR-based mobile applications, such as Pokémon GO and Microsoft HoloLens, has further popularized AR, making it an accessible tool for various industries [4].

In the article A survey of augmented reality, Azuma defined AR is a variation of a Virtual Environment (VE), or Virtual Reality (VR) as it is more commonly called. VR technologies completely immerse a user inside a synthetic environment and while immersed, the user cannot see the real world around him. In contrast, AR is taking digital or computer generated information, whether it be images, audio, video, and touch orhaptic sensations and overlaying them over in a real-time environment. AR technically can be used to enhance all five senses, but its most common present-day use is visual [5]. Unlike VR, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Azuma established the three main features of AR: (1) AR combines the real world with virtual environments, which allows the user to interact with real-world elements with the use of a technological device, providing them with unique experiences. (2) AR should be interactive in real-time, which means that the user has to be able to change the action and have an impact on the created scene, making the experience more realistic. (3) AR should have 3D elements [5].

In 2017, Martínez et al. explored the use of AR through a mobile app to enhance vocabulary acquisition for kindergarten students, making the learning process more interactive and engaging. The findings revealed the app's effectiveness and emphasized the importance of monitoring students' usage time to maximize benefits. In another study, he evaluated an augmented reality-based educational unit for teaching English vocabulary and grammar. The approach received positive feedback from students and yielded notable improvements in language skills [6].

Tulgar examined the effectiveness of augmented reality in teaching English to young learners. The findings highlighted several advantages, including the activation of multiple intelligence, such as linguistic, spatial, and kinesthetic skills, learning through observation and exploration, better interaction with teachers and peers, enhanced language performance, support for independent learning, and increased student motivation [7].

Redondo et al. studied the role of augmented reality in teaching English as a foreign language to preschool children, focusing on its impact on motivation and socio-emotional development. Compared to the control group, students who used augmented reality showed significant gains in motivation, learning outcomes, and social-emotional relationships [8].

Karacan and Akoglu conducted a review of research on augmented reality as a tool for foreign language teaching. While the findings underscored numerous advantages and learning opportunities, the complete integration of this technology into foreign

language classrooms remains a challenge due to factors such as high implementation costs, lack of teaching training, limited access to AR-compatible devices, and the need for curriculum adaptation [9].

1.2. Applications of AR in various fields.

In many different fields, AR has been used extensively

Education: AR helps students learn through 3D models and interactive simulations, providing richer and more vibrant learning experiences. For example, AR applications like Google Expeditions allow students to explore historical and contemporary locations around the world interactively [10].

Healthcare: AR assists doctors during surgery by providing detailed 3D images of body parts, helping to enhance accuracy and efficiency in patient treatment. Tools like Microsoft HoloLens have been used to create detailed anatomical models in real-time [11] .

Entertainment and Games: AR has changed the way we interact with games and entertainment. Pokémon GO is a prominent example of how AR can create an interactive and rich gaming experience [12].

E-commerce: AR helps consumers try products online before purchasing. Platforms like IKEA Place allow users to preview how to arrange furniture in their homes through 3D images [13].

In the field of language learning, AR is being used to improve the effectiveness and learning experience of learners. AR applications can provide interactive language lessons, helping learners with pronunciation and grammar in an intuitive and vivid manner. For example, the Mondly app uses AR to immerse learners in real-life situations, where they can practice language skills naturally and engagingly [14]. A recent study also shows that the use of AR in language teaching, specifically English, a majority of studies report an improvement in student performance regarding the use of AR as an educational tool in various aspects of the learning process, such as motivation and engagement.

In the present era, teachers are anticipated to create materials aligned with technological advancements to offer students a distinctive learning experience. AR serves as a valuable resource for fostering this type of experience [15],[16]. Recent studies highlighted the effectiveness of using augmented reality in teaching English as a foreign language (TEFL). AR based on mobile applications allows students to learn English in any place and at any time using a mobile device [15]. Researchers emphasized the crucial role of effective English language teaching in achieving better performance in different disciplines. Consequently, they highlighted the importance of improving language instruction skills through using innovative materials such as digitalizing language activities [17]. Digitalization of language materials means making it public for different uses via exploiting modern technology [18].

2. Trends in using AR for language learning

2.1. Case studies and examples

In today's rapidly evolving technological landscape, education is undergoing profound changes driven by the integration of AR. This cutting-edge technology offers fresh perspectives and opportunities, fostering a dynamic and innovative learning environment. The significance of this development lies in AR's ability to enable real-time interaction with virtual objects, pushing the boundaries of conventional education. By creating immersive learning experiences, AR plays a pivotal role in engaging students and enriching their educational journey. It has the potential to spark student interest, encourage active participation, and cultivate critical thinking skills. As such, exploring the impact of AR on education is a crucial endeavor, paving the way for the effective adoption of

modern technologies in teaching and learning processes.

Using AR in English language teaching has been implemented in various applications and curricula. Some typical examples include:

Mondly AR: Used in blended learning environments where students practice speaking and listening exercises in real-time, enhancing pronunciation and conversational skills. Language learning app Mondly has integrated AR to create interactive English lessons. Learners can interact with virtual objects and listen to English phrases pronounced by native speakers, helping to improve language skills through real-world experiences [14].

Figure 1. Illustrating the application of AR in the language learning app Mondly

Metaverse School: An online school uses AR and VR to provide English lessons to students worldwide. Students can participate in virtual classes, where they can interact with teachers and friends in a vibrant 3D environment [19].

Figure 2. Illustrating the use of AR and VR at Metaverse School

AR Flashcards: Implemented in primary school English classes, where teachers use them to introduce new vocabulary in an engaging way, reinforcing learning through visual and auditory cues. This is an English learning tool for children, where the flashcards can "come to life" when scanned with the AR app. Children can see and hear vocabulary simulated vividly, helping them memorize new words more easily [10].

2.2. Benefits of AR in Language learning

The incorporation of AR in language learning presents a wide array of advantages that enrich the educational experience and improve learning outcomes. Below are some of the key benefits:

Enhancing interaction and concentration: AR transforms traditional language learning into an interactive and engaging experience by integrating dynamic elements such as 3D visuals, animations, and interactive tasks. These features encourage learners to actively participate, maintain focus, and sustain interest throughout lessons. Billinghurst and Duenser highlighted that AR fosters higher levels of engagement compared to conventional teaching approaches. This increased interaction can lead to better comprehension and longer retention of language skills [10].

Developing comprehensive language skills: By simulating real-life scenarios, AR allows learners to practice language skills in meaningful contexts. Interactive activities support the holistic development of essential skills such as listening, speaking, reading, and writing. Lin and Chen found that AR significantly enhances learners' language acquisition through immersive practice environments, where students gain exposure to authentic speech patterns and contextual vocabulary use [19].

Personalizing the learning process: One of the most compelling advantages of AR technology is its capacity to tailor lessons to the specific needs and abilities of individual learners. Personalized content not only boosts learning effectiveness but also helps maintain learner motivation. Platforms like Mondly Languages leverage AR to create adaptive lessons, allowing learners to progress at their own pace and focus on areas where they need improvement. This customized approach maximizes retention

and fosters a deeper understanding of the target language [14].

Supporting self-directed learning: AR encourages learners to take an active role in their educational journey. The technology often features gamified elements that reward progress, promoting independent exploration and practice beyond the classroom. This fosters self-directed learning habits, which are essential for long-term language mastery.

Overcoming physical and linguistic barriers: By providing virtual simulations, AR can connect learners with diverse cultural contexts without the need for physical travel. This exposure to different language settings broadens learners' cultural awareness and helps bridge linguistic gaps. For example, AR applications can simulate restaurant orders, travel experiences, or business meetings in various cultural environments, allowing learners to practice practical communication skills [19]. These benefits illustrate the immense potential of AR in revolutionizing traditional language learning and making education more engaging, efficient, and tailored to individual learners. The continued development and integration of AR are likely to further transform the educational landscape.

2.3. Challenges and limitations of AR in language learning

AR in education has numerous benefits, but its implementation faces several challenges. These include high costs, high requirements for technology devices, difficulties in usage and management, technical support and infrastructure, and content availability and curriculum integration [11], [12], [13].

Firstly, high costs include custom application development, purchasing advanced hardware, and continuous updates to software systems. Many educational institutions struggle to allocate sufficient budget for integrating AR into teaching and learning processes, especially in underfunded regions. Additionally, licensing fees for specialized AR software and training expenses further increase financial burdens.

Secondly, high requirements for technology devices, such as high-end smartphones, tablets, or AR glasses, make them inaccessible for some schools and students, particularly in low-income communities. Ensuring compatibility across different operating systems and device models poses technical hurdles for educational institutions.

Thirdly, difficulties in usage and management can result from a lack of technological skills among educators and learners, leading to poor adoption and ineffective use of AR technology in classrooms. Additionally, students may experience initial learning curves when interacting with AR applications, reducing the overall effectiveness of lessons.

Moreover, technical support and infrastructure are also crucial for AR deployment, but unstable internet or limited access to modern technological infrastructure can lead to user frustration and diminished educational value.

Finally, content availability and curriculum integration are also challenges, as AR educational content development often lags behind technological advancements. To overcome these challenges, collaborative efforts among policymakers, technology developers, and educational stakeholders, such as government funding, teacher training programs, and partnerships with technology providers, can help bridge the gap and make AR a viable and impactful tool for modern education.

To overcome these above challenges of AR implementation in language learning, several strategies can be employed. Cost-related barriers can be addressed through government funding, open-source AR platforms, and partnerships with tech companies to provide affordable solutions. Enhancing accessibility involves developing lightweight AR applications

compatible with lower-end devices and implementing web-based AR solutions to reduce hardware dependency. Additionally, training programs for educators and user-friendly interfaces can ease adoption and improve usability. Strengthening infrastructure, such as expanding internet access and optimizing AR applications for offline use, is also crucial. Furthermore, collaboration between educators and developers can enhance content availability and ensure AR-based materials align with standardized curricula. By implementing these solutions, AR can become a more practical and impactful tool for language learning.

3. Predictions for the future of AR in language learning

Here are some forecasts and developments regarding AR applications in education that demonstrate the enormous potential of this technology to improve student learning and maximize instructional strategies [20]:

Enhanced application: More and more teachers are recognizing the benefits of AR, and the adoption of this technology is expected to increase globally.

Integrating Artificial Intelligence (AI) and VR: AR has the ability to combine with AI and VR to create a more immersive and interactive learning experience.

Standardized content development: The popularity of AR could lead to the development of standardized content and curricula for schools.

Enhancing accessibility: AR technology is becoming increasingly accessible and affordable, benefiting many students, including those with disabilities.

Expanding to higher education: AR is expected to be applied more in universities and colleges.

Collaboration with the industry: Educational institutions can collaborate with businesses to provide opportunities for applying AR in practice.

Personalized learning: AR supports customized learning experiences according to the needs and preferences of each student, and it is expected to become increasingly sophisticated.

The future of AR technology in education holds great promise, especially in language learning. With advancements in virtual environments, machine learning, and AI, AR is predicted to play a transformative role in how languages are taught and acquired. Although originally not designed for educational purposes, its integration into language courses is expected to become more seamless. As more language learning apps harness AR capabilities, teachers will need to carefully guide its use to maximize learning outcomes. This emerging trend signals a future where AR becomes a key tool in delivering immersive and personalized language education experiences [9].

A study of Alshumaimeri & Mazher [21], suggested that digital transformation will significantly shape future language learning and teaching environments. Studies indicate that key competencies such as technological proficiency, online environment management, and interactive teaching skills will become essential for language educators. As AR and digital tools continue to evolve, the integration of these technologies is expected to drive innovative teaching practices. Future educational strategies are likely to focus on equipping teachers with the necessary skills to navigate virtual platforms effectively and engage students dynamically. Digital learning units, as highlighted by promising research, may enhance specific competencies like argumentation skills and interactive communication. This signals a growing demand for Open Educational Resources (OER) to support both teacher development and student engagement [21].

As digital literacy levels remain a concern, educational policies are anticipated to prioritize curriculum integration for fostering essential digital skills among students and teachers. Furthermore, multimodal approaches incorporating diverse forms of literacy are

predicted to become more prevalent, promoting higher motivation and academic success in English Medium Instruction (EMI) courses. The importance of understanding digital storytelling, tailored pedagogical strategies, and personalized learning experiences will likely rise as technological advancements reshape educational norms. Teachers will need ongoing training to adapt effectively to this landscape, emphasizing the role of parents and educational institutions in nurturing communicative and digital competencies for the next generation of learners [21].

4. Conclusion

AR is a breakthrough in the education sector, particularly for language learning. By bridging the gap between the digital and physical worlds, AR allows learners to experience dynamic, interactive lessons that boost engagement and motivation, enabling the holistic development of language skills. Tools such as Mondly AR, AR Flashcards, and Metaverse School demonstrate how this technology can make language acquisition feel more natural and memorable by simulating real-world environments.

Despite its advantages, there are challenges to adopting AR in education, such as costs, technical restrictions, and limited content availability. Overcoming these obstacles requires collaborative efforts from educators, policymakers, and technology developers to ensure AR becomes more accessible to learners worldwide. As AR continues to evolve, it offers educators new opportunities to deliver personalized and flexible learning experiences, empowering students to thrive in a technology-driven world.

Looking ahead, AR holds vast potential to transform how English is taught and learned. Its interactive features can enhance vocabulary building, pronunciation practice, and cultural understanding in ways that traditional methods may not fully achieve.

Given its promising benefits, further research and innovation in this field are essential. Developers, educators, and researchers must work together to unlock AR's full potential and ensure it becomes a vital tool for learners seeking to master English and other languages.

References

[1] Oxford University Press, "Augmented reality," *Oxford Learner's Dictionaries*, n.d. [Online]. Available: https://www.oxfordlearnersdictionaries.com/definition/english/augmented-reality?q=Augmented+Reality. [Accessed: Feb. 10, 2025].

[2] I. E. Sutherland, "A head-mounted three-dimensional display," in *Proc. Amer. Fed. Inf. Process. Soc.*, vol. 33, 1968, pp. 757–764. https://doi.org/10.1145/1476589.1476686

[3] T. P. Caudell and D. W. Mizell, "Augmented reality: An application of heads-up display technology to manual manufacturing processes," in *Proc. 25th Hawaii Int. Conf. System Sciences*, vol. 2, 1992, pp. 659–669.

[4] M. Billinghurst, A. Clark, and G. Lee, "A survey of augmented reality," *Foundations and Trends in Human–Computer Interaction*, vol. 8, no. 2–3, pp. 73–272, 2015. https://doi.org/10.1561/1100000049

[5] R. T. Azuma, "A survey of augmented reality," *Presence: Teleoperators and Virtual Environments*, vol. 6, no. 4, pp. 355–385, 1997, https://doi.org/10.1162/pres.1997.6.4.355

[6] A. A. Martínez, J. R. L. Benito, E. A. González, and E. B. Ajuria, "An experience of the application of augmented reality to learn English in infant education," in *Proceedings of the 2017 International Symposium on Computers in Education*, 2017, pp. 1–6. https://doi.org/10.1109/SIIE.2017.8259645

[7] T. A. Tulgar, "In between reality and virtuality: Augmented reality in teaching English to young learners," *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, vol. 41, pp. 356–364, 2019.

[8] B. Redondo, R. Cózar-Gutiérrez, J. A. González-Calero, and R. Sánchez Ruiz, "Integration of augmented reality in the teaching of English as a foreign language in early childhood education," *Early Childhood Education Journal*, vol. 48, no. 2, pp. 147–155, 2020. https://doi.org/10.1007/s10643-019-00999-5

[9] C. G. Karacan and K. Akoglu, "Educational augmented reality technology for language learning and teaching: A comprehensive review," *Shanlax International Journal of Education*, vol. 9, no. 2, pp. 68–79, 2021. https://doi.org/10.34293/education.v9i2.3715

[10] M. Billinghurst and A. Duenser, "Augmented reality in the classroom," *Computer*, vol. 45, no. 7, pp. 56–63, Jul. 2012. https://doi.org/10.1109/MC.2012.111

[11] E. C. Chen and C. J. Lin, "The application of augmented reality in medical education," *Medical Education*, vol. 54, no. 4, pp. 311–321, 2020.

[12] P. A. Rauschnabel, A. Rossmann, and M. C. tom Dieck, "An adoption framework for mobile augmented reality games: The case of Pokémon Go," *Computers in Human Behavior*, vol. 76, pp. 276–286, 2017.

[13] A. Javornik, "Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behavior," *Journal of Retailing and Consumer Services*, vol. 30, pp. 252–261, 2016.

[14] Mondly Languages, "Language learning in augmented reality," 2023. [Online]. Available: https://www.mondly.com/ar. [Accessed: Feb. 10, 2025].

[15] L. K. Lee, C. H. Chau, C. H. Chau, and C. T. Ng, "Using augmented reality to teach kindergarten students English vocabulary," in *Proceedings of the 2017 International Symposium on Educational Technology*, pp. 53–57, 2017. https://doi.org/10.1109/ISET.2017.20

[16] A. I. Suryadi, "Augmented and virtual reality for teaching English to young learners: Practical ideas," in *Proceedings of the Twelfth Annual International Symposium of Foreign Language Learning (The 12th AISOFOLL)*, pp. 100–108, 2021

[17] M. Byram, M. Porto, and L. Yulita, "Beyond teaching languages for communication—Humanistic perspectives and practices," *Languages,* vol. 8, no. 3, Article 166, 2023. https://doi.org/10.3390/languages8030166

[18] Y. Akbana, "The substantial need for digitalizing language teaching methods and materials," in *Digitalizing English Language Teaching*, E. A. Yunus and K. Gülten, Eds. Pegem Academy Publishing Training and Consultancy Services, 2023.

[19] H. C. K. Lin and C. H. Chen, "Exploring the impact of augmented reality on language learning," *Journal of Educational Technology & Society*, vol. 24, no. 1, pp. 33–45, 2021.

[20] PixelCrayons, "The future of AR in education: Predictions & trends for this exciting technology." [Online]. Available: https://www.pixelcrayons.com/blog/dedicated-teams/ar-in-education/#The_Future_of_AR_in_Education_Predictions_Trends_for_this_Exciting_Technology. [Accessed: Feb. 10, 2025].

[21] Y. Alshumaimeri and N. Mazher, "Augmented reality in teaching and learning English as a foreign language: A systematic review and meta-analysis," *World Journal of Advanced Research and Reviews*, vol. 19, no. 1, pp. 1093–1098, 2023. DOI:10.30574/wjarr.2023.19.1.1324

Ngày nhận bài: 11/2/2025
Ngày hoàn thành sửa bài: 18/3/2025
Ngày chấp nhận đăng: 19/3/2025