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A Systematic Literature Review on Augmented Reality in Game-Based Learning for English as a Second Language

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Abstract

This systematic review explores the integration of Augmented Reality (AR) within game-based learning for English as a Second Language (ESL). Based on empirical studies spanning 2020 to 2024 sourced from Web of Science (WoS), Scopus, ERIC, and Google Scholar. The review assesses AR's impact on ESL education. The findings highlight AR's potential to enhance language attainment through mobile applications, fostering learner satisfaction, engagement, and motivation. Additionally, the fusion of game-based learning and AR diversifies learning experiences across subjects, promoting collaboration and communication skills. However, challenges such as technical hurdles, the learning curve for teachers and students, financial constraints, and potential distractions from learning content persist. Despite these obstacles, AR presents promising opportunities for improving ESL learning outcomes. Moreover, it contributes to understanding AR's role in ESL education and underscores the need for further research to address implementation barriers and maximise its educational potential.

Keywords: Augmented Reality (AR), Game-Based Learning (GBL), English Second Language (ESL)

Introduction

The integration of Augmented Reality (AR) and Game-Based Learning (GBL) has significantly transformed educational paradigms, offering interactive and immersive experiences that deeply engage learners (Karacan & Akoglu, 2021). These technologies are particularly advantageous in English as a Second Language (ESL) instruction, addressing challenges like lack of engagement and limited practical application opportunities by providing immersive environments for realistic language practice (Nordin & Omar, 2022). AR creates immersive, interactive environments that enable students to practice language skills in realistic scenarios, enhancing engagement and retention (Huertas-Abril et al., 2021). The synergistic combination of AR and GBL facilitates deeper learning and retention of language skills (Pragasam & Sulaiman, 2023). The Technology Acceptance Model (TAM) helps explain the adoption of ARGBL, emphasizing perceived usefulness and ease of use as critical factors (Abdelmagid, Abdullah & Aldaba, 2021). This study aims to explore the benefits and challenges of incorporating AR in GBL for ESL learners, examining how TAM and educational theories such as social constructivism support this integration.

Literature Review

Augmented Reality

Augmented Reality (AR) integration in education, supported by teachers, significantly enhances learner motivation and knowledge acquisition (Hasbi & Md Yunus, 2021). Furthermore, digital tools are pivotal in language development and skill enhancement (Qureshi et al., 2021). AR enhances the representation of real-world environments, fostering collaborative learning in language classes (Pragasam & Sulaiman, 2023). It facilitates understanding intricate interactions and enhances cognitive skills (Huertas-Abril et al., 2021), while fostering engagement and motivation (Abdelmagid et al., 2021; Lai & Chang, 2021). AR effectively teaches vocabulary and enhances long-term memory retention (Karacan & Akoglu, 2021). However, technical hurdles and potential diversion from learning content pose implementation challenges (Huertas-Abril et al., 2021; Schorr et al., 2024).

Technology Acceptance Model (TAM) Among ESL Learners

The Technology Acceptance Model (TAM) by Davis (1986), as illustrated in Figure 1, explains user acceptance of technology, particularly relevant in integrating Augmented Reality (AR) into ESL learning environments (Haleman & Yamat, 2021). TAM underscores Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as critical factors influencing users' attitudes and intentions towards technology (Davis, 1989; Al-Nuaimi & Al-Emran, 2021). When perceived as valuable and easy to use, learners are more inclined to engage with AR technology (Jang et al., 2021).

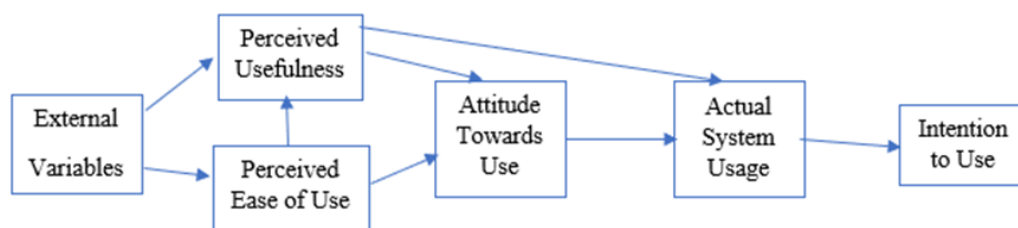


Figure 1. Technology Acceptance Model (Al-Emran 2021 as cited in Davis, 1989)

AR's Perceived Usefulness (PU) lies in its potential to enhance language learning outcomes, providing immersive and contextual experiences (Tsai, 2020). AR facilitates realistic language practice, aiding comprehension of contextual usage and cultural nuances (Huang et al., 2021). Perceived Ease of Use (PEOU) is crucial for AR applications, ensuring intuitive design and user-friendly interfaces (Huang et al., 2021). Peers and educators reinforce learners' intentions, promoting broader acceptance of AR in language learning (Huang et al., 2021).

Augmented Reality In Game-Based Learning Approach On ESL Learners

Game-based learning (GBL) integrates digital video games into instruction, extending game design principles to diverse learning contexts (Alper et al., 2021). Research on AR in GBL for ESL classrooms shows potential (Mohd Nordin et al., 2021). Educational board games with web-based AR significantly improve student engagement (Nordin, Nordin & Omar, 2021; Wang & Khambari, 2020). Game-based AR classrooms foster collaboration, enhance interaction, and provide additional resources (Syafii et al., 2020). Games effectively improve language skills and create dynamic learning atmospheres (Yaacob et al., 2022). GBL assists students in organizing information and achieving learning objectives (Azhar et al., 2022). Integration of the Technology Acceptance Model (TAM) underscores users' perceptions and attitudes towards AR and GBL technologies (Al-Nuaimi & Al-Emran, 2021). Understanding perspectives informs research questions aimed at exploring the advantages and limitations of these methodologies in ESL classrooms.

RQ1: What advantages are observed in the utilisation of AR in GBL within educational settings?

RQ2: What limitations occur in the utilisation of AR in GBL within educational settings?

Methodology

This study employs the PRISMA methodology (Figure 2), which includes identifying relevant articles, screening them, determining eligibility, and finalizing the selection of studies ("Systematic Reviews in Educational Research," 2020). PRISMA enhances the reporting quality of systematic reviews and meta-analyses, especially for assessing interventions (Page et al., 2020).

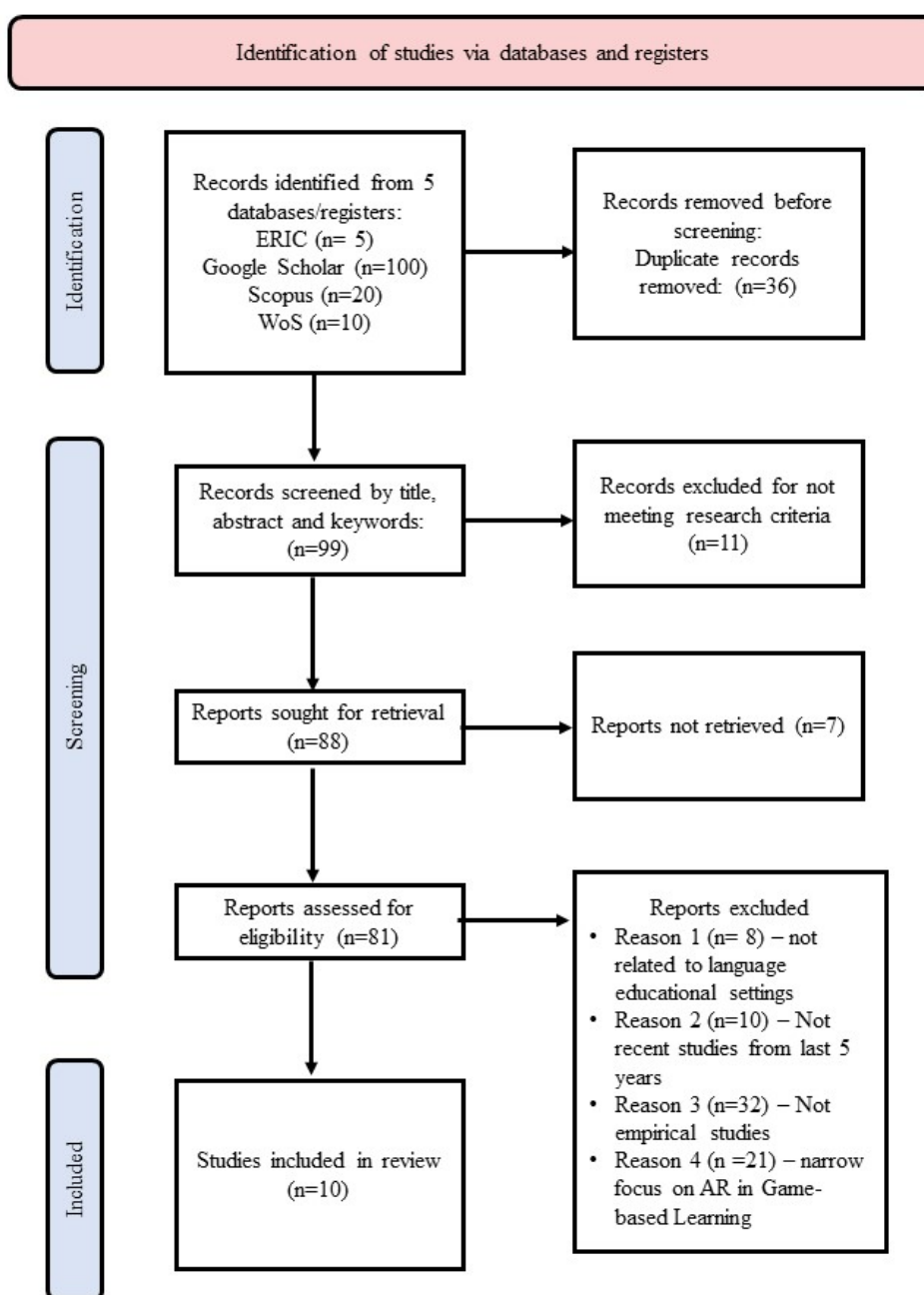


Figure 2. PRISMA diagram

Identification

In the first stage of document selection, a key priority is to ensure inclusivity to maintain the integrity and dependability of the data. To achieve this, up-dated studies published within the last five years (from 2020 to 2024) were selected from four prominent databases: Web of Science (WoS), Scopus, the Education Resources Information Center (ERIC), and Google Scholar. These databases were chosen for their comprehensive coverage across various

disciplines, frequent updates, and robust indexing. The research queries outlined in Table 1 were employed to identify pertinent publications.

Table 1. Search String

Database	Search String
WoS	TS = ((“AR in GBL *” OR “Augmented Reality in Game Based learning*” OR “AR in Gamification*” OR “Game based learning*” OR “AR*” OR “GBL*” OR “AR in education*” OR “GBL in education*”))
Scopus	TITLE-ABS ((“AR in GBL *” OR “Augmented Reality in Game Based learning*” OR “AR in Gamification*” OR “Game based learning*” OR “AR*” OR “GBL*” OR “AR in education*” OR “GBL in education*”))
Google Scholar	(“AR in GBL *” OR “Augmented Reality in Game Based learning*” OR “AR in Gamification*” OR “Game based learning*” OR “AR*” OR “GBL*” OR “AR in education*” OR “GBL in education*”)
ERIC	“AR in GBL *” OR “Augmented Reality in Game Based learning*” OR “AR in Gamification*” OR “Game based learning*” OR “AR*” OR “GBL*” OR “AR in education*” OR “GBL in education*”

Inclusion and Exclusion Criteria

As shown in Figure 1, retrieved records from databases were screened against the inclusion and exclusion criteria and specified keywords (see Table 2). Google Scholar was included for its transparent data curation (Biolcati-Rinaldi et al., 2018), with measures taken to mitigate its limitations while benefiting from its broad coverage (Gusenbauer, 2022). Only the first 100 records were considered. Boolean operators and truncation were used to cover the topic effectively (Carcassi & Sbardolini, 2022). Only empirical studies producing primary data on Augmented Reality (AR) in game-based education were included.

Table 2. Inclusion and exclusion criteria

Inclusion	Exclusion
Empirical studies	Not empirical studies or primary research
A prime focus on AR in Game-based Learning	A narrow focus on AR in Game-based Learning/unrelated to AR in Game-based Learning
Studies from last five years (2020-2024)	Studies are not from last 5 years (2020-2024)
Studies conducted are related to content and language education setting	Studies conducted in other contexts

Screening

After removing duplicates ($n = 36$), the remaining articles ($n = 99$) were screened against the criteria in Table 1. Eleven records were excluded for lacking primary empirical evidence, minimal focus on AR in Game-based learning, or being non-English. Full texts of the remaining articles ($n = 88$) were evaluated for eligibility. Due to financial and technical constraints, 7 publications could not be retrieved, leaving 81 records. Further exclusions included 8 records unrelated to language educational settings, 10 not from recent years (2020-2024), 32 not being empirical studies, and 21 with narrow focus. Ten studies meeting all conditions remained. Researchers collaboratively confirmed that each study addressed the research questions (RQs) in detail and accurately, with reliable evidence. All publications were deemed suitable for further review.

Table 3. Summary of key findings from included studies

Authors	Year	Location	No of Participants	Types of Games and Modal Used	Game Purposes
Videnovik et al.	2020	Macedonia	40 primary students	Mobile AR educational games	An AR educational games that mimic Pokemon Go to support different subjects or integration of different subjects
Wang & Md. Khambari	2020	China	50 vocational college students	Using EasyAR Platform	Learn English sentences expressions by introducing and describing buildings around campus
J. Lee	2020	South Korea	42 undergraduates	"The Secret Investigation" location-based AR mobile game	Problem based learning games that required open-ended answers to support L2 (English Language) learning.
Voreopoulou et al	2024	London	10 in-service english teacher	"LockED in ShakespeARE's Globe Theatre"	Promote deep meaningful learning to offer additional language practice to A2 CEFR level English language learners.
Tobar-Muñoz et al	2023	Colombia	45 undergraduates	Educational video game with AR.	To identify the diversity and richness of the Cauca Department for locals and tourists. To focus on the learning of the Nasa Yuwe language and cultural traditions of the Nasa indigenous community.
Ferdi Çelik & Ceylan Yangın Erşanlı	2022	Turkey	76 high school students	Scavenger hunt AR game	To enhance students' language achievements and attitudes towards learning English
Nordin, Noradila & Wafa Omar	2020	Malaysia	74 undergraduates	REV-OPOLY	To assist undergraduate students' comprehension level
Nor Sanak Mohd Nabil, Hasniza Nordin, & Faizahani Ab Rahman	2023	Malaysia	Two English language teachers	AR applications	To make lessons more engaging while supporting lesson objectives
Hu et al.	2022	China	80 students primary students	Get To Know Your Phonetic Symbols Friends	To investigate the effectiveness of AR application developed on students English pronunciation
Jung-Yu Lai & Li-Ting Chang	2021	Taiwan	First graders. Number not specified.	AR app designed for English vocabulary learning	To improve English vocabulary learning

Data Extraction and Analysis

To enhance the validity and reliability of the study, the data extraction process was carried out using investigator triangulation, involving multiple researchers in the integrative analysis (Bans-Akutey & Tiimub, 2021). Researchers initially skimmed titles, abstracts, introductions, and conclusions to determine relevance to study objectives and research questions (RQs). A detailed examination involved skimming and scanning articles related to keywords and search strings to gather necessary data for the Systematic Literature Review (SLR). Primary themes included AR use in game-based learning in language education, participants, research designs, positive impacts, limitations, findings, and data sources.

Results

RQ1: How is the utilisation of AR in GBL in terms of student engagement, motivation, and learning performance in ESL setting?

Augmented Reality (AR) in Game-Based Learning (GBL) offers numerous advantages for student learning. It enhances engagement by turning educational content into interactive and enjoyable experiences, thereby improving attention, motivation, and knowledge retention (Nordin & Omar, 2022). AR-based games support experiential learning by allowing students to apply theoretical knowledge in practical contexts (Nordin & Omar, 2022). Additionally, AR helps students grasp complex concepts, especially in technology, making them accessible and relatable (Nordin & Omar, 2022). Interesting features like quick revision tools also reinforce learning and aid knowledge retention (Nordin & Omar, 2022).

In ESL classrooms, AR has been found to improve motivation, performance, and satisfaction by making learning engaging (Hasbi & Yunus, 2021; Lai & Chang, 2021). It is particularly beneficial for younger students who thrive in interactive environments. AR supports kinesthetic learning by enabling interactions with virtual objects, enhancing memorization and understanding (Iqbal, Mangina & Campbell, 2019). Educators' high acceptance and perceived usefulness of AR indicate readiness to adopt these tools despite technical challenges (Abdelmagid, Abdullah, & Aldaba, 2021; Huertas-Abril et al., 2021).

AR supports diverse learning activities across subjects such as art, medicine, biology, and science, fostering collaboration and communication among learners (Karacan & Akoglu, 2021; Pragasam & Sulaiman, 2023). Overall, AR integration in education meets the evolving needs of learners, fostering immersive and interactive environments that enhance engagement, motivation, and learning outcomes (Karacan & Akoglu, 2021; Pragasam & Sulaiman, 2023).

RQ2: What are the limitations that occurred in the utilisation of AR in GBL into an educational setting?

The utilisation of Augmented Reality (AR) in Game-Based Learning (GBL) faces several limitations as identified in various studies. The integration of AR in educational settings, particularly for language learning, faces significant technical challenges as highlighted by various studies. Alper et al. (2021) and Hasbi and Yunus (2021) emphasise common technical difficulties such as hardware requirements, software compatibility, and the need for robust internet connections, which are critical barriers to the effective implementation of AR-based learning. Similarly, Wang and Md. Khambari (2020) and Nordin et al. (2021) underscore the importance of robust infrastructure and continuous technical support to address these issues. Karacan and Akoglu (2021) highlight usability issues, such as a challenging learning curve for educators and learners, which hinder the incorporation of AR technologies.

Hasbi and Yunus (2021) along with Huertas-Abril et al. (2021) have pinpointed a significant challenge: the inadequate training and continuous professional growth that obstruct educators' proficient utilisation of AR within educational settings. The resistance exhibited by instructors, as identified by Pragasam and Sulaiman (2023), further complicates the integration of AR tools, particularly among individuals accustomed to conventional teaching methodologies. Additionally, Nordin et al. (2021) highlight the difficulties in seamlessly integrating AR into existing pedagogical frameworks, which can impede the effective delivery of curriculum

content. Other than that, managing a classroom where students are using AR devices can be more complex compared to traditional settings (Nordin & Omar, 2022).

Student engagement represents a pivotal element in the application of AR within academic environments. Pragasam and Sulaiman (2023) underscore that while AR has the capacity to notably enrich engagement in English as a Second Language (ESL) reading classes, it also has the propensity to divert students from their educational goals. This dual aspect of AR's influence on motivation and distraction is reiterated by Lai and Chang (2021), who stress the importance of proficient incorporation to avert AR from evolving into a disruptive element. Wang and Md. Khambari (2020) harmonising AR with educational efficacy.

Discussion

The findings from the literature highlight the significant advantages of integrating Augmented Reality (AR) in Game-Based Learning (GBL) within educational settings, particularly for English as a Second Language (ESL) instruction. This discussion synthesises these advantages through the lenses of the Technology Acceptance Model (TAM) and social constructivism theory, providing a comprehensive understanding of AR's impact on learning.

One of the primary benefits of AR in GBL is its ability to enhance student engagement and motivation. AR-based games capture students' attention more effectively than conventional teaching methods (Nordin & Omar, 2022). The TAM framework supports this, as AR's perceived ease of use and usefulness contribute to its acceptance and integration into classroom activities (Davis, 1989). The high engagement levels observed indicate that students are more likely to participate actively in their learning, which is essential for effective knowledge retention and application (Collie & Martin, 2019).

AR facilitates experiential learning, where students apply theoretical knowledge in practical contexts, thus deepening their understanding of complex concepts (Nordin & Omar, 2022). This approach is particularly effective for students with diverse learning needs, including marginalised students (Stylianidou et al., 2020). Social constructivism theory underpins this advantage by emphasising the role of active, social engagement in the learning process (Vygotsky, 1978). Through AR, students collaboratively explore and construct knowledge, aligning with the constructivist approach.

The use of AR in GBL promotes collaborative learning environments, fostering communication and teamwork skills among students (Pragasam & Sulaiman, 2023). Social constructivism highlights the importance of social interactions in learning, suggesting that students learn more effectively through peer engagement and shared experiences (Vygotsky, 1978). AR-enabled games encourage students to work together, solve problems, and reflect on their learning experiences collectively, thus enhancing their social and cognitive development. The positive reception of AR among educators and students, as indicated by high levels of perceived usefulness and ease of use, is a critical factor in its successful implementation (Abdelmagid, Abdullah & Aldaba, 2021; Huertas-Abril et al., 2021). TAM suggests that these perceptions are crucial for the adoption of new technologies in educational settings (Davis, 1989). Despite some initial technical challenges, the overall readiness to embrace AR tools reflects a growing recognition of their potential to enhance teaching and learning processes.

AR's versatility in supporting various learning activities across diverse educational contexts is another notable advantage (Stylianidou et al., 2020). It has been effectively utilised in subjects such as art, medicine, biology, and science, demonstrating its broad applicability (Karacan & Akoglu, 2021). This versatility makes AR a valuable tool for enriching learning experiences across different domains, fostering interdisciplinary learning and enabling students to draw connections between various fields of knowledge.

Integrating AR in education represents a proactive shift towards meeting the evolving needs of learners in the digital age. By creating immersive and interactive learning environments, AR enhances student engagement, motivation, and learning outcomes (Karacan & Akoglu, 2021; Pragasam & Sulaiman, 2023). This shift aligns with contemporary educational goals such as Sustainable Development Goal 4, National Education Blueprint (NEB) 2013-2025 (MOE, 2013) and Malaysian Teacher Standard 2.0 (Teacher Professionalism Division, 2023).

While the advantages of AR in GBL are evident, challenges associated with its implementation remain. Technical issues, such as the need for adequate hardware and software support, can pose barriers to widespread adoption (Abdelmagid, Abdullah & Aldaba, 2021). Additionally, effective integration of AR requires careful planning and professional development for educators to ensure they are equipped to use these tools effectively.

Conclusion

Augmented reality (AR) in game-based learning (GBL) presents both significant opportunities and challenges. Meanwhile, there are a few hindrances that can be identified during the process of this study. First, the review may be subject to selection bias due to the inclusion criteria set for selecting studies. Although the studies included were from several countries, only studies published in English were considered, which could exclude relevant research published in other languages, leading to a potential bias in the findings. Second, the search strategy implemented has the risk of dismissing relevant studies due to the limitations of access to some databases. This might inadvertently overlook the aspects or main points of an educational intervention due to negligence of negative or smaller effects. Third, the studies included into this review were only from online sources. Further research and reviews can consider the inclusion of printed media and other publications. In conclusion, while AR in GBL offers great potential for enriching educational experiences and outcomes, addressing its limitations is crucial.

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