Augmented Reality in English Language Teaching: A Literature Review on Catering to Diverse Learning Styles

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ABSTRACT

In contemporary educational contexts, the application of Augmented Reality (AR) in English Language Teaching (ELT) has gained significant attention. Thus, the aim of this literature review is to investigate the benefits of AR in accommodating diverse learning styles and individual learner needs within ELT. AR's multisensory features cater effectively to visual, auditory, and kinesthetic learners, enhancing engagement and motivation while promoting inclusivity. For visual learners, AR offers interactive visuals and 3D models; auditory learners benefit from pronunciation guides and immersive dialogues, while kinesthetic learners engage through hands-on interaction with virtual elements. The analysis, grounded in the Universal Design for Learning (UDL) framework, highlights AR's potential in providing equitable learning opportunities. This review synthesizes current research and intends to offer insights to educators and developers who want to utilize Augmented Reality to design language learning experiences that are effective, engaging, successful, and inclusive. It synthesizes current research findings to achieve this goal.

Keywords: Augmented Reality (AR), English Language Teaching (ELT), Diverse Learning Styles, Learner Needs, Inclusive Design, Universal Design for Learning

Introduction

The term *Learning styles* are defined as the naturally varying tendencies of people in perceiving, processing, and retaining information (Dunn & Dunn, 1993). Since then, several distinguished descriptive models have emerged to visualize the spectrum of learners' comprehension approaches. The patterns of learning styles can be classified into a limited number of groups. Students acquire knowledge by visual, auditory, or kinesthetic means, with varied levels of efficacy. It is crucial to acknowledge the diverse range of students in the English classroom in order to implement suitable strategies to support their individual needs and facilitate their success, as it can help develop students' learning and motivation.

As such, the current surge in promoting inclusivity in education, specifically in designing an optimal learning environment that caters to the requirements of all learners, is closely connected

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to addressing the problem of intrinsic learning styles. When striving for inclusion, educators must guarantee equal access to knowledge and learning opportunities for all students, regardless of their backgrounds, skills, or preferences in the classroom (UNESCO, 2005). To achieve that objective, it is necessary to have instructions and materials that can be easily adjusted to meet the specific requirements of the learners (Tomlinson, 2014).

Technology has become a transformative force in addressing these diverse learning needs in modern educational contexts. Digital tools and platforms allow educators to design interactive, personalized, and engaging experiences that cater to individual learner preferences. The integration of technology in ELT enhances accessibility, promotes inclusivity, and supports language acquisition through immersive and interactive approaches (Chen, 2020; Kukulska-Hulme & Shield, 2008). In response to said demands, Augmented Reality (AR) technology arises as an auspicious instrument to improve learning by integrating digital content into our physical environment (Dunleavy et al., 2009). AR generates interactive and immersive experiences for users as it fuses virtual objects, information, or multimedia with reality (Azuma, 1997). It thus provides a distinctive approach to accommodating a variety of learning styles when the users perceive the real world with supplemented visuals and audio, in contrast to Virtual Reality (VR), which simulates entirely new environments (Milgram & Kishino, 1994).

Several studies have looked at the potential of AR in the classroom to improve language instruction and student performance (Klopfer et al., 2002; Wu et al., 2013). Using AR, field educators may immerse students in a more realistic setting where they can practice using real language, which is sure to pique their interest (Cheng & Tsai, 2013). Nevertheless, a number of research studies (Economides et al., 2020; Li & Wong, 2021; Liu et al., 2023b) fail to address higher-order cognitive abilities such as reading comprehension, writing ability, and intercultural competency in favor of assessing lower-order language skills, such as vocabulary development.

Also, upon most parts of modern life being incorporated with technology that is media-incentivized, consensus believes it is not viable to promote a unitary product design philosophy, as the ways men acquire assistance naturally vary (Abascal & Nicolle, 2005; Ladau, 2021). Against such a backdrop, AR's interactive and multimodal experiences have the potential not only to avoid this but also to greatly improve the inclusion of users. However, up until this point, ELT research has either focused on very narrow AR applications or used very small sample sizes (e.g., groups of college students) to investigate the effects of AR, leaving a vast array of situations unexplored. Possible applications include bringing together students of wildly varying ages, ethnicities, and socioeconomic statuses, as well as those from quite diverse classrooms (Pachler et al., 2010; Yen et al., 2013). Thus, a gap remains in understanding the use of AR for inclusive learning.

Therefore, this literature review aims to fill the void by investigating the existing research on integrating AR in ELT; in particular, the study focuses on how AR can help promote inclusivity in classroom practices. The current study hopes to provide a comprehensive view of the field by applying the theoretical frameworks of Universal Learning Design and examining previous studies' empirical results and recommended practices. Besides, studies related to technology integration should regularly be updated due to the rapid advancement in the field; therefore, this paper aims to present the updates from recent studies. Overall, this literature review paper hopes to provide education stakeholders with a more nuanced understanding of using AR effectively to create meaningful language learning experiences.

Literature Review

Definition and Conceptualization of AR in the Context of Language Learning

The integration of digital technology in ELT has made the revolution of well-tested and used English Language Teaching (ELT) methodologies possible. The learners' engagement, accessibility, and personalization have been enhanced by technologies and educational tools (Kukulska-Hulme & Shield, 2008). However, AR has become popular among these technologies due to its immersive and interactive learning environments that address different learning needs (Dunleavy et al., 2009). AR adds virtual objects, sounds, and multimedia into physical locations to bring the real world to life (Azuma, 1997; Milgram & Kishino, 1994). This contextual blending means learners have chances to practice language skills in real situations, through which motivation and learning anxiety (Chang et al., 2020; Huang et al., 2021) could be reduced.

Klopfer's (2008) current conception of AR can be paraphrased as the blending of the real world with additional information relevant to the real world. It does this by generating sounds and projecting images into the user's field of vision. Sannikov et al. (2015) and Liu et al. (2023a) later affirm AR's evolvement, with games of educational values on mobile devices becoming its fertile ground.

In teaching and learning languages, stacking layers of virtual elements over reality has helped engage and motivate learners (Wedyan et al., 2022; Min & Yu, 2023; Liu et al., 2023a), although how it does this remains vague. An indication is Liu et al. (2023b)'s report of the enjoyment and fulfillment of students being facilitated by AR, which is concluded from self-reports that may be under social desirability bias. Thus, approaches with a higher degree of objectivity may be required to investigate and solidify future findings, namely methods like physiological indicators of engagement.

Studies on AR in ELT emphasize its potential to enhance various language skills, including vocabulary acquisition, listening comprehension, and speaking proficiency (Chen, 2020; Yulian et al., 2022). For instance, AR's visual and auditory elements help learners comprehend abstract concepts more effectively by providing contextual and multimodal inputs (Liu et al., 2023a). Kinesthetic learners benefit from AR's interactive features, such as manipulating virtual objects and participating in gamified learning tasks (Iqbal & Campbell, 2021).

Literature offers more evidence of AR's ability to enable authentic learning. This is seen with AR used via mobile devices (Lee & Park, 2020; Pellas et al., 2019) as the added visuals, texts, and sounds onto reality embed contextual information into learners' daily lives. Interacting with those elements gives users a deeper situated learning of language (Chang et al., 2020; Liu et al., 2023a). What is also reduced is learning anxiety. Thanks in part to AR's playfulness and immersiveness, these elements invite learners to explore, actively participate in the scaffolding activities, and take risk-free initiatives to learn (Huang et al., 2021). That said, stand-alone reports from Chang et al. (2020) and Liu et al. (2023a) still do not sufficiently contribute to AR-based situated learning, and the causal link between such capacity and the improvement of students' language proficiency remains to be explored in future research using randomized controlled trials or other more rigorous method designs.

Language skills are the next dimension in AR's assistive capacity. Empirical tests of AR integration point to improved vocabulary (Huang et al., 2021), listening and speaking (Chang et al., 2020) as well as reading (Yulian et al., 2022; Şimşek & Direkçi, 2023) and academic writing (Lin et al., 2020). That said, the applied scopes of these findings are partially undermined when many of them are reached through investigating specific AR applications or

limited learner populations. To give evidence, Huang et al. (2021)'s experimental group was a small sample size of university students learning vocabulary with AR, while Chang et al. (2020)'s setting was set in a junior high school, where learners were taught and examined in their listening and speaking skills only. Results of the applicability of AR in ELT need to be equally evident in alternative age groups (Bistaman et al., 2018), proficiency levels, and other educational situations.

UDL has a conceptual basis to contextualise AR as a means to foster inclusivity in ELT. In providing different means of representation, engagement, and expression, AR allows the learner who prefers and is able to represent, engage with, or express themselves in one of these ways (Hall et al., 2012). For example, AR's 3D animations and diagrams are great for those who are visual learners, audio guides and dialogues help auditory learners and environments that allow kinesthetic learners to promote physical interaction and exploration (Iqbal & Campbell, 2021; Chen, 2020; Wu, 2019).

However, there are challenges to implementing AR. Access to AR technology is limited, plus teachers and teachers in general are not well trained, and there is no culturally responsive content in the curriculum (Lee & Park, 2020; Manna, 2023). In addition to this, it is possible that the novelty effect experienced when using AR may diminish over time, and attending to sustaining efforts to integrate AR meaningfully into the curriculum (Deterding et al., 2011).

Although the benefits of engagement and engagement of AR for language learners are well documented, deeper investigations of AR directives included in AR experiences that maintain engagement and inclusion of language learners are needed. For example, the causal relationship between AR's immersive features and long-term language proficiency has not been researched (Marrahí-Gómez & Belda-Medina, 2022). Furthermore, research especially related to the employment of AR for different demographies and dissertations about the longitudinal AR impacts are very limited (Pachler et al., 2010; Fombona et al., 2017).

Finally, in sum, AR is beneficial to ELT due to its ability to improve levels of engagement, motivation, and skills, but more work still needs to be done to conceptualise AR as an inclusive tool to support the diversity of learners' needs.

Theoretical Foundations - Universal Design for Learning

In response to *learning styles,* the Universal Design for Learning (UDL) stands as an inclusive approach that assists all students in varied modern classrooms. It is applied when research, development, technology, and educational practice are directed toward a course, helping it strategically anticipate all possible requirements of students and then extending the planning process to include the whole scope of a classroom. Rose and Meyer (2002) see it as an attempt to escape the discrepancy between the growing diversity of the students and the standardized curriculum that would not lead to the desired academic improvements.

The UDL framework is demonstrated as growing from understanding brain development, learning, and digital media (Rose & Meyer, 2002) and comprises three principles. These principles emphasize the importance of offering many options, specifically for representation, action, and expression, as well as engagement (Meyer et al., 2014).

The first principle emphasizes the importance of presenting information and knowledge through various methods (e.g., representation) to enable students to acquire, process, and integrate materials effectively (Meyer et al., 2014). This approach is based on the understanding that students may face disparities in their comprehension processes due to auditory, visual, linguistic, cultural, or cognitive limitations. As a result, no single method of representation suits

all learners, making the availability of choices an essential element in inclusive education (CAST, 2018).

Equally significant is the second principle, which advocates for a diverse array of instructional strategies and thus allows students multiple ways to demonstrate their understanding of the material (Hall et al., 2012). In its rationale, certain pupils would sufficiently articulate their knowledge in written form but struggle with verbal expression, while others encounter the opposite challenge. These variations often stem from differences in physical capabilities, language proficiency, or distinct learning strategies. Since a fixed, imposed set of expected demonstration approaches will not be ideal for all learners, offering a broad spectrum of possible actions ensures that educational practices accommodate diverse needs and foster equitable opportunities for student success.

The third concept, "provide multiple means of engagement," refers to the need to offer a variety of choices to enhance student motivation (Hall et al., 2012) and attention during learning (Meyer et al., 2014). The fundamental premise of this notion caters to learners' emotional circumstances in the learning process, which several sources, including neurological factors, cultural influences, personal significance, subjectivity, and knowledge background, may influence. Certain learners have a strong inclination towards novelty and spontaneity, while others harbor a dislike for new experiences and tend to be apprehensive, preferring a more predictable routine. Some learners want to work alone, while others enjoy collaborating in groups. It is necessary to offer many alternatives to encourage and boost the interest of students since there is no one method that can motivate or improve the engagement of all learners (CAST, 2018).

From the principles of UDL, integrating AR into ELT promises to improve inclusivity, making it more accessible and engaging for all learners (Rose et al., 2018). In summary, the evidence points to AR capabilities aligning with UDL principles. AR ushers in more inclusive and learner-centered ELT by offering representation, engagement, action, and expression channels. It also pushes motivation, participation, and learners' ownership of knowledge (Meyer et al., 2014).

Previous Studies & Research Gap

As stated earlier, the documented benefits of AR for learner engagement, motivation, and practical language skills (Huang et al., 2021; Chang et al., 2020) still raise questions about how the tool might be leveraged to its full potential for varied learning preferences and thereby promote inclusivity in the ELT landscape. Such inclusiveness needs to extend to wider age groups, cultures, and educational settings (Pachler et al., 2010; Yen et al., 2013).

While emerging research has begun to recognize AR's potential for inclusive learning, a scarcity in more holistic investigations remains, namely in terms of implementation challenges, technological accessibility, teacher training, and pedagogical design (Kukulska-Hulme & Shield, 2008; Manna, 2023; Qiu et al., 2023). This is hindering evidence-based guidelines and good practices to integrate AR effectively into diverse ELT contexts.

Based on this observation, the current study is diving deeper to shed light on AR's full capacity in ELT. We hope that future research areas can be identified that would maximize the technology's potential of enabling inclusive and effective language mastery.

Research Questions

To fulfill the purpose of the study, the research sought to answer the following research questions:

1. How does AR cater to diverse learning styles in the context of ELT?
2. What strategies can be employed to design AR experiences that are inclusive of individual learner needs?

Methods

Design of the Study

A systematic literature review serves as the basis for this study to analyze how Augmented Reality (AR) incorporates different learning styles and individual learner interests and thus enhances the process of Inclusive English Language Teaching (ELT). A systematic review is particularly suitable for synthesizing existing evidence and providing comprehensive insights on a particular topic. This method involves the systematic analysis of peer-reviewed studies so as to ensure the inclusion of high-quality research and facilitate pattern, gap, and trend identification in the literature (Popay et al., 2006).

The essence of this methodology is based on the exact objectives of the study. The systematic review integrates more than one source of finding to provide answers to broad questions on how AR fits with Universal Design for Learning (UDL) principles and the readiness of the UDL to support inclusivity in various educational environments. Moreover, this approach to researching AR technology and its potential in the ELT field is appropriate due to the fast development of AR technology and timely coverage of its applications.

Data collection & analysis

This stage begins as authors sift through various academic databases extensively. Through Google Scholar, ERIC, JSTOR, and the Web of Science, various combinations of keywords and terms related to the theme of interest are selected: "augmented reality," "English language teaching," "learning styles," "inclusive design," "personalized learning," and "language acquisition."

Studies were further filtered with specific criteria, as shown in Table 1.

After the screening process comes thematic analysis, which requires in-depth reading to extract recurring patterns and insights from reports that align with this literature's investigative goals. The information was then categorized so that the following core themes emerge:

- AR's capacity towards Learning Styles: authors discovered findings into how AR caters to different preferences (e.g., visual, auditory, kinesthetic) (Chen & Tsai, 2013; Huang et al., 2020). These eventually indicate that the tool can be particularly effective for learners long acquainted with multimodal inputs and experiences (Wu et al., 2013).

- AR's design strategies for inclusivity: The literature enumerates the considerations that went into building AR experiences that ensure its accessible, personalized, flexible, and culturally responsive uses, friendly to the diverse types of learners (Ke & Hsu, 2015; Martín-Gutiérrez et al., 2015). They include adjustable difficulties, optional interaction modalities, and cultural sensitivity in content and design (Zhao et al., 2018).

After this rigorous screening process, the existing literature is analyzed comprehensively. Key

insights are revealed, along with evidence-based practices and areas where further research can be fruitful. The authors believe that our work has given us a deeper understanding of how AR can transform language learning.

Table 1.

Inclusion and Exclusion Criteria for Study Selection

Criteria	Inclusion	Exclusion
Focus	Studies explicitly address the use of AR in ELT and its relation to learner needs.	Studies do not explicitly address the use of AR in ELT and its relation to learner needs.
Publication Type	Peer-reviewed journal articles, book chapters, conference proceedings, and credible reports from recognized organizations.	Non-peer-reviewed articles, opinion pieces, blog posts.
Publication Date	Published within the last ten years (2014-2024)	Studies published before 2014
Language	Published in English.	Published in languages other than English.
Methodology Quality	Empirical studies with clear methodology and significant findings; rigorous qualitative, quantitative, or mixed methods studies.	Studies with unclear methodology, low-quality, or inconclusive findings.
Relevance	Directly relevant to research questions/themes: learning styles, learner needs, inclusivity, and strategies.	Indirectly related or irrelevant to the core themes of the review.

Findings

The literature from this review gives a fulfilled response to the research questions. It signifies AR's potential and how its designs can elevate individuals of varied learning orientations.

AR and Diverse Learning Styles

AR's multisensory feature deeply resonates with learners, and data support this claim. Visual, auditory, and kinesthetic incorporations within AR represent versatile learning modalities, making it inclusive for language learners of varying preferences.

Visual learners who favor visual information may find AR images beneficial. Several studies conclude that comprehension and retention are better when AR's 3D animations make abstract concepts tangible and interactive (Kalyuga, 2009; Chen, 2020). For instance, vocabulary lessons are brought to life as AR allows learners to manipulate virtual objects associated with the words at hand. This approach makes learning more engaging and helps learners establish stronger connections between words and their meanings.

Auditory learners who thrive through listening and verbal communication may also find great help in AR's audio features, namely pronunciation guides, dialogues with real-time feedback, and interactive conversations with virtual characters. Combined, these facilitate realistic yet repeated opportunities for learners to practice their listening and speaking skills (Pasfield-

Neofitou, 2014; Wu, 2019), perhaps surpassing the restraints of real-life conversations.

Iqbal and Campbell (2021), corroborating with the findings of Huang et al. (2021), believe kinesthetic learners, who learn best through hands-on experiences, are enabled to move and interact extensively thanks to AR environments. What caters to them are AR games with challenges such as letting learners search for items, map out the simulated space, or find answers to language-based puzzles.

AR also accommodates those with reading/writing or global/analytic preferences. Their favored text-based information is a simple addition for AR alongside visual and auditory content, reinforcing their understanding through different modalities, like writing exercises and quizzes (Lin et al., 2020).

Kalyuga (2009) adds that AR offers choices when presenting information. Global learners want to show the big picture before focusing on details, so AR's templates of overarching context and visual overviews help them the most. In adjacent, analytic learners tend to break down information into smaller components, which augmented interactive features enable them to do structurally. This is done with virtual tasks that require step-by-step analyses of information and attention to specific details.

Inclusive AR Design Strategies

The second investigative question that gives attention to inclusive AR design strategies is well addressed in the literature, most of which build their theories upon the Universal Design for Learning (UDL) framework. The literature believes AR can effectively implement the UDL principles of emphasizing multiple means of representation, action, expression, and engagement (CAST, 2018), thus benefiting teachers, administrators, and institutions in developing pedagogical strategies. That said, a more thorough examination recognizes potential strengths as well as limitations in these claims.

Firstly, the praises towards AR for its multiple means of representation, while tangible, may be overstated. The AR system can offer various visual elements such as 3D models, animations, and diagrams, which are claimed to make complex concepts sufficiently illustrious for visual learners (Chen, 2020). Similarly, auditory learners seemingly gain from audio narration, pronunciation guides, and interactive dialogues (Wu, 2019), and textual inputs adhere to those who prefer reading and writing (Lin et al., 2020). Moreover, culturally considerate designs with relevant imagery and perspectives are believed to enable more seamless learning (Lee & Park, 2020). However, the effectiveness of these multimodal approaches in genuinely enhancing learning outcomes across diverse learner profiles is often concluded upon anecdotal evidence, and empirical findings remain under-researched (Beetham & Sharpe, 2019; Meyer et al., 2014; Puentedura, 2013).

Secondly, AR is lauded for enabling flexibility for learners to interact and varied means to express their understanding, supposedly empowering multiple communicative styles (Huang et al., 2021). An example is when AR language learning apps may give different choices for vocabulary practices: saying words out loud, writing them down, or manipulating virtual items. However, such flexibility might not automatically translate to better learning outcomes. The extent to which these varied formats genuinely accommodate individual learning differences without overwhelming learners or diluting the learning focus requires further scrutiny (Hattie, 2009; Kirschner et al., 2006).

Thirdly, AR's immersive and interactive nature is often cited as inherently fostering engagement. While gamification elements like points, badges, and leaderboards (Liu et al., 2023a) are designed to motivate learners, the long-term effectiveness of such engagement strategies is

questionable. The novelty of AR may wear off, and reliance on gamification can lead to superficial engagement rather than deep, meaningful learning (Deterding et al., 2011; Nicholson, 2015). Personalized feedback and exploration of personal interests are posited to enhance ownership and autonomy (Lee & Park, 2020), yet these benefits are contingent on the quality and relevance of the feedback and the genuine alignment of content with learners' interests (Hattie & Timperley, 2007; Black & Wiliam, 1998).

Personalization in learning and teaching is heralded as a crucial benefit of AR. Differences in learners' needs and preferences can ostensibly be addressed through choices in interaction modes and activities (Liu et al., 2023b). However, implementing such personalization while ensuring effectiveness and practicality in the confines of the course is a complex, if not relatively infeasible, endeavor. To explain, it is essential that accessibility to features like captions, alternative input methods, and clear navigation (Wedyan et al., 2022) must be granted in a balanced manner, yet these solutions are rarely implemented with such calibrations in mind, potentially leaving AR's inclusiveness less fulfilling for some learners than others (Burgstahler, 2015; Seale, 2013).

In summary, despite the literature highlighting the potential of inclusive design in ushering in effective AR experiences for language learning, such a claim warrants a critical perspective. Adhering to UDL principles, personalizing content, ensuring accessibility, and incorporating flexibility and cultural responsiveness are promising strategies. However, the actual efficacy of AR in fostering genuinely inclusive and equitable language learning environments remains to be conclusively demonstrated. More rigorous, longitudinal research is needed to substantiate the optimistic claims made about AR's impact on education (Aguayo et al., 2017; Lin & Lan, 2015).

Discussion

AR and Learning Styles

This review contributes to earlier investigations of AR in English Language Teaching (ELT). Those findings assert its prospective enhancement of learners' capacity to engage in, to be incentivized by, and to become proficient in certain language skills (Economides et al., 2020; Chang et al., 2020; Garzón & Acevedoet, 2019; Cai et al., 2022; Liao et al., 2024; Wedyan et al., 2022). This review, on the other hand, broadens and exhausts the available reports, discerning AR's accumulated benefits for myriad learning styles thanks to its emphasis on inclusive design. The review does so by synthesizing overlooked evidence on the diverse needs of learners that AR designs can cater to in terms of personalization, accessibility, and cultural responsiveness. It unequivocally demonstrates the promises AR has towards ELT, that is, making the field more inclusive through adhering to various learning preferences.

AR's multisensory approach resonates with different ways students learn. 3D animations are useful to visual learners, as they provide better comprehension and recall (Kalyuga, 2009; Chen, 2020). Talking Aupair serves as a pronunciation guide and an interactive dialogue for auditory learners, thereby giving them sharpened listening and speaking proficiency (Pasfield-Neofitou, 2014; Wu, 2019). Huang et al. (2021) state that 'Kinesthetic learners tend to learn more effectively through hands-on interaction with virtual objects and environments. Furthermore, AR supports various ways of information and interaction from people with reading and writing and global and analytic preferences (Lin et al., 2020). These findings show that AR provides a more personalized and effective learning experience for each student because AR is an offer offering AR to each student (Akçayır & Akçayır, 2017; Bacca et al., 2014).

Inclusive Design Strategies

The review also makes reference to AR's appropriateness with the UDL based on a framework that emphasizes the creation of inclusive learning environments that can serve all learners' needs (CAST, 2018). By following the norms of the UDL personalization principle, we analyze the content elements to support learners' preferences to implement and customize the content difficulty, interaction modes, and activities per the individual requirements (Liu et al., 2023a). The ability to optimize interactions and ensure that all learners participate is very important. Moreover, FLP and cultural sensitivity are incorporated into AR, to avoid the learners' nonwestern orientation (Huang et al., 2021; Lee & Park, 2020). To help make AR accessible for physically challenged learners, also initiatives have been taken. Moreover, they include caption providing, alternative input methods providing, and user-friendly navigation features (Wedyan et al., 2022; López Belmonte et al., 2019). They also make it only more likely that AR will be a means of enabling equitable access to learning opportunities in a variety of educational settings.

Additional Emerging Themes

Beyond addressing the research questions, several additional themes emerged from the analysis. One prominent theme is the growing role of AR in fostering intercultural competence. Liu et al. (2023b) found that AR-based instruction led to such an affordance being better developed than under traditional teaching. This AR's ability to promote understanding and communication across contexts is worth putting in more effort to seek further insights. A stronger grasp is equally needed for the long-term effects of AR on language outcomes and its mix with broader pedagogical philosophies. Promising evidence for AR's short-term benefits has been provided, but longitudinal studies to assess its sustained impacts are scarce (Fombona et al., 2017). Additionally, it remains obscure how AR can be effectively integrated with other technologies and instructional methods to further the outcome of comprehensive and holistic language learning (Dunleav et al., 2009). Another significant factor influencing the success of AR implementation is learners' technology self-efficacy. As highlighted by Do et al. (2024), learners with higher self-efficacy in technology are more likely to engage effectively with digital tools. Addressing this aspect through training and supportive environments can mitigate barriers to AR adoption and ensure more equitable learning outcomes.

Consequently, the research findings show that AR effectively enhances more favorable and efficient ELT. The above aspects further substantiate the claims on how AR enables learners of varying attributes to meet their language learning needs through learning modalities, personalization, and UDL principles. This type of empowering is particularly crucial in ELT, primarily due to the fact that students′ diversity levels are frequently high, and specific traditional approaches are insufficient to address their requirements. However, the successful implementation due to the necessary balancing of the pedagogical affordances or design, its technological availability, and the preparation of teachers (Belda-Medina & Calvo-Ferrer, 2022; Li & Wong, 2021; Qiu et al., 2023). Thus, future studies should focus on exploring the learning potential of AR as well as the practices of utilizing this tool in educational settings for teachers and heads of educational institutions that would help avoid ineffective and unequal use of the tool in different contexts for the ELT (Ibáñez & Delgado-Kloos, 2018).

Pedagogical Implications

Substantial attention has been placed on applying AR as a tool in contemporary language learning, corroborating findings from previous reviews (Bower et al., 2014; Akçayır & Akçayır, 2017). This literature synthesizes reported benefits of recent AR in accommodating diverse

learner needs within the context, those that are gained with the utilization of the framework of UDL.

Given the proven effectiveness of AR in our findings, it can be indicated that the trend towards their adoption in classrooms is imminent, and such is an appropriate tendency to enhance learning outcomes. To accommodate this shift, instructional materials should be made more compatible with these technologies. With various pedagogical approaches implemented, such as self-directed learning and task-based learning, the designs and developments of AR can help to further integrate itself into the curriculum. For instance, Hsu (2019) found that students experienced higher engagement in self-directed AR activities, suggesting that self-control in terms of learning pace can increase motivation. Adjacent to this, institutions must ensure comprehensive training for teachers and students so that AR tools are effective in classrooms (Huang et al., 2021). As Ly (2024) emphasizes the multifaceted roles of teachers in promoting learner-centered environments, it is imperative to equip educators with the skills needed to integrate AR technologies into their teaching strategies. This preparation will ensure that AR adoption aligns with pedagogical goals and enhances learning outcomes.

Research Implications

This review further establishes the benefits of AR beyond learning engagement and motivation in the process of acquiring language, signifying how important it is to design inclusive experiences for students. What can be drawn from the review is that this tool is predominantly tested with vocabulary learning, leaving a blind spot for its potential synergy with grammar and listening mastery (Economides et al., 2020). Our in-depth literature analysis has demonstrated this technology's efficacy, especially its interactive nature, in facilitating grammar and listening skills development through conversational practice with virtual entities (Chang et al., 2020; Huang et al., 2020). The integration of blended learning methodologies has demonstrated the potential to enhance flexibility and accessibility in English language teaching (Tran, 2024). However, it also highlights the need for comprehensive preparation, particularly regarding learners' readiness and technical competencies. These factors align with the challenges identified in the adoption of AR technologies, where successful implementation hinges on students' familiarity and comfort with technological tools. Future studies should continue with the exploration of more factors from AR that accumulate positive perceptions of students, teachers, and administrators, or in other words, elements that facilitate satisfaction, enjoyment, as well as measurable results. While engagement levels with AR tools have been acknowledged, quantitative studies are recommended to measure these effects more comprehensively.

Additionally, the recognition of AR's potential to foster intercultural competence (Liu et al., 2023b) warrants further research to answer the "how" question. AR-based instruction has indeed been shown to sharpen intercultural competence better than conventional methods. However, this aspect of AR's impact on cultural understanding and communication skills should be explored in greater depth. Furthermore, longitudinal studies to assess the long-term effects of AR on language learning outcomes through varied alternative instructional methods are also needed (Fombona et al., 2017).

Thus, this review enriches knowledge about AR's opportunities in ELT, the grounded approach to its inclusion for people with disabilities, AR's expansiveness toward various language skills, and the opportunities for its further development. In this case, when adopting the inclusive design principles and the use of appliances that may apply, one is able to use AR to enhance effective, accessible, and inclusive learning from the aspects of language learning with the overall learning needs of every learner.

Conclusion

This review highlights the transformative potential of Augmented Reality (AR) in English Language Teaching (ELT), particularly in promoting inclusivity and addressing diverse learning needs. The findings demonstrate that AR's multisensory approach effectively caters to visual, auditory, and kinesthetic learners, providing enhanced opportunities for engagement and personalized learning experiences. Through alignment with Universal Design for Learning (UDL) principles, AR fosters accessibility, cultural responsiveness, and equitable participation for learners of varying attributes and abilities. Additionally, AR's ability to reduce learning anxiety and improve motivation through interactive and gamified elements further underscores its value as a pedagogical tool.

Despite these benefits, challenges such as technological accessibility, teacher preparedness, and the long-term sustainability of AR's engagement effects remain top areas for further investigation. Notable gaps in the literature include the limited exploration of AR's impact on higher-order cognitive skills, its integration with other instructional technologies, and its potential to foster intercultural competence.

Previous studies show that the integration of inclusive design is vital for increasing the benefits associated with AR. Some of the main approaches that can be adopted include individualization, availability, permeability, and cultural sensitivity, which are necessary to adopt suitable and acceptable AR approaches for learners. However, when using such approaches, educators should adhere to the UDL principles to provide students with joyous, inclusive, and accessible experiences within AR contexts. Some advantages for learners derived from current AR studies and the existing research environment encompass the beneficial effects of those principles.

However, some disadvantages still exist that need to be taken into consideration. Therefore, more quantitative and follow-up studies are needed to establish the long-term impact of AR on other overall language learning achievements as well as other less explored skills. New investigations can establish ways of effectively promoting the use of AR in context with other approaches and materials that can make the learning process diverse and encompassing. Future studies should also investigate the broad impact of AR in relation to student groups that exhibit different learning styles. The attainment of such knowledge assists in the development of enhanced and particular AR interventions.

All in all, evidence demonstrates that AR has the enormous capacity to introduce alterations in the ELT context, derive the process from learner-centered analysis, embrace equality, and enhance learner outcomes. Moving beyond the limitations above and expanding the exploration of AR potentials will help researchers and educators pave the way towards a better future of foreign language learning.

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