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Game on! Digital Gaming and Augmented Reality/Virtual Reality in Language Learning

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ABSTRACT

Digital games have become an important educational tool for learning and teaching. The development of such games has advanced from 2D, desktop-based technologies to 3D, augmented reality (AR) / virtual reality (VR)-based technologies. Yet digital game-based language learning (DGBLL) with AR/VR has only recently started to be investigated, owing to the emerging availability of these new technologies. This position paper begins with a short review of the educational benefits of DGBLL, followed by a discussion of the use of AR/VR in language learning. To illustrate the potential use of AR/VR in DGBLL, recent empirical studies are reviewed. Based on this analysis, a new model for integrating AR/VR in DGBLL is proposed. The paper ends with suggestions for how DGBLL with AR/VR technologies can be used in future educational endeavors.

KEYWORDS

AR, Digital Game-Based Language Learning, Model, Suggestions, VR

INTRODUCTION

The digital gaming industry is booming, as highlighted by the World Economic Forum (Read, 2022). Several factors are driving this trend, including the ability of digital games to relieve stress and anxiety during the COVID-19 pandemic, the increasing number of digital game championships, and the widespread use of mobile devices among the younger generation across the globe (Read, 2022). In language learning, digital game-based language learning (DGBLL) is particularly useful in promoting learners' linguistic acquisition, with benefits ranging from increased motivation for learning to facilitated reading comprehension and improved short-term memory (Xiong et al., in press; Zou et al., 2021). When properly guided by teachers, learners can develop their linguistic knowledge and skills within context-aware, multimodal, and interactive environments (Hung et al., 2018).

A recent review by Xu et al. (2020) found that a significant proportion of DGBLL studies have been conducted in the United States or Taiwanese contexts. In contrast, other educational settings have rarely been investigated. This gap may be attributed to varying social tolerances toward digital

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games in education in different settings. Considering that commercial games often include the use of deadly weapons, violence, and foul language (Reinhardt, 2019), it is understandable that language teachers exercise caution when implementing DGBLL.

To ensure a positive and rewarding DGBLL experience, Dixon et al. (2022) argue that several variables need to be considered. These factors include the purpose of a game (entertainment vs. education), teacher prompts, interactions among players (single vs. multiplayer), and the inclusion of linguistic input and output. However, previous research has largely centered on traditional 2D games. Thus, there is a pressing need to explore the potential of 3D games in DGBLL, given the advancements in immersive technologies such as augmented reality (AR) and virtual reality (VR) (Wu et al., 2024b). With the evolution of AR and VR, the educational landscape has been presented with new opportunities for more immersive and engaging learning experiences. 3D games, when integrated with these technologies, have the potential to offer a more realistic and interactive environment for language learners. This development could enhance their motivation (Lee & Ahn, 2024).

To keep pace with these social and technological developments, DGBLL requires significant change. Yet achieving such change is a daunting challenge for language teachers and learners without appropriate guidance and sufficient support (Peterson & Jabbari, 2022). This is the starting point for this position paper. Specifically, we wish to generate insights to help guide language teachers, educators, and researchers concerning how best to leverage AR and VR when applying DGBLL.

DIGITAL GAMEPLAY AND LANGUAGE LEARNING

Digital gameplay has emerged as an innovative and engaging approach to language learning (Peterson & Jabbari, 2022). An important reason for its popularity in education is the alignment of social interaction in gameplay with key constructs in mainstream learning theories. In particular, sociocultural theory (SCT; Vygotsky, 1978) emphasizes that learning is fundamentally a social process, and that knowledge is constructed through interaction with others within a cultural context. Since digital gameplay is often undertaken via multiplayer mode and features collaborative tasks that require players to work together, achieve common goals, negotiate meanings, and share strategies, it is well suited to help language learners advance their acquisition and use of the target language through communicative and collaborative activities (Jabbari & Eslami, 2019).

Studies have demonstrated the potential of digital gameplay in language learning. For example, massive multiplayer online games enable players to engage in identity play, allowing them to practice the language by taking on different roles in an environment that is less anxious and more fun than traditional classrooms (Reinhardt, 2019). Therefore, this way of learning can increase learners' language proficiency and confidence. Additionally, games can promote the development of both receptive and productive language skills (Aydın & Çakır, 2022; Jabbari & Eslami, 2019). For receptive skills, exposure to new vocabulary in a digital gaming context aids the memorization and understanding of new words. In addition to vocabulary learning, reading fluency and comprehension skills can be advanced thanks to in-game instructions, narratives, or dialogues (e.g., Tan & Tan, 2020). For productive skills, digital multiplayer games can simulate conversational situations, providing a platform for learners to interact with other players and thus practice their speaking skills (Reinders & Wattana, 2015a). Moreover, some games simulate real-life scenarios where language is used, such as ordering food in a restaurant or navigating a foreign city, providing practical language skills that can be applied in the real world (Zou et al., 2021). Moreover, a recent study by Wu et al. (2025) highlights the role of games in advancing English language learners' incidental acquisition of English swear words. Learners in this study viewed games as essential in shaping their identity as proficient and trendy language users.

Digital games can also enhance learners' metacognitive skills, including problem solving and critical thinking abilities, which are essential for language learning (Lee, 2022). Furthermore, the interactive nature of games can stimulate cognitive functions like memory and attention, aiding

language retention and recall (Patra et al., 2022). Learners' interaction and engagement with digital games can also contribute to increased motivation and improved language skills. For instance, research shows that students who engage in game-based learning are often more enthusiastic and persistent in their language studies, owing to the immersive and interactive nature of games. Completing levels and earning rewards can also make the learning process more engaging and enjoyable (Whittaker et al., 2021).

However, although digital gameplay has the potential to augment student learning, teachers need to ensure that digital games are educationally relevant, effectively assess language learning outcomes, and determine how to integrate game-based tasks into the existing curriculum (Mayer, 2014). Since many educators may be unfamiliar with digital game-based learning tools, they are hindered in facilitating and maximizing their educational benefits in language learning (Rüth et al., 2022). According to Gee and Hayes (2011), as games are predominantly designed for entertainment purposes rather than educational objectives, it may also be challenging for teachers to adequately assess content appropriateness and cultural relevance when integrating digital games into language teaching and learning.

To summarize, digital gameplay holds much promise for language learning, potentially creating interactive and engaging learning environments. However, while the potential of digital games to enhance language acquisition has theoretical and empirical support, challenges relating to educators' competencies and the features of digital games must be addressed to maximize their educational impact.

AR/VR AND LANGUAGE LEARNING

AR and VR technologies provide unique opportunities for creating engaging learning environments. AR overlays digital information into the real world, enhancing the user's perception of reality (Zhang et al., 2020). In contrast, VR can create immersive virtual environments, allowing users to experience and interact with a computer-generated world (Wu et al., 2023). Both technologies have been applied in various educational settings, offering novel ways to present content and engage students (Lee et al., 2024; Pegrum & Lan, 2023).

From a theoretical perspective, the convergence of psychology, educational technology, and educational theories drives the development of AR and VR in language education. Specifically, as AR and VR experiences are often immersive and engaging, learners' motivation can be increased, and their affective filter (i.e., anxiety or negative emotions) can be reduced. Moreover, AR and VR can create authentic sociocultural interactions and provide a platform for learners to engage in meaningful communication (Wu et al., 2024b). These capabilities resonate not only with Vygotsky's (1978) SCT and zone of proximal development but also with connectivism (Zhang et al., 2020). Specifically, these theories jointly emphasize how technology creates new opportunities for interactive and collaborative learning within networked environments, emphasizing that the ability to access and synthesize information from networks is more critical than merely possessing information.

One of the primary benefits of AR and VR in language learning is increased student engagement and motivation, with previous research showing that the interactive and immersive nature of these technologies can make learning more enjoyable and stimulating (Ustun et al., 2022). For example, AR applications can transform traditional vocabulary exercises into interactive scavenger hunts (Godwin-Jones, 2016), while VR can immerse students in virtual learning environments where they must use the target language to find, negotiate, and solve problems (Wu et al., 2024b).

In addition, AR and VR can offer rich contextualized learning experiences that are often missing from traditional language education. These experiences involve placing students in realistic scenarios where they can practice language skills in relevant contexts (Li et al., 2023). Previous studies show that such contextualized practice can improve language retention and help students apply their skills more effectively in real-world situations (Chen & Yuan, 2023). In addition, Wu et al. (2024a) discussed

the unique benefits of promoting feedback practice within the AR/VR contexts. They proposed a model for teachers and educators that includes presence, engagement, honesty, and synchronism.

Another potential benefit of AR and VR is these technologies' simultaneous engagement of multiple senses, which can contribute to multisensory learning. Specifically, AR and VR learning environments can incorporate visual, auditory, and kinesthetic elements, providing a more holistic learning experience (Xu et al., 2022). Research suggests that this multisensory approach can enhance comprehension and memory retention. This feature is especially helpful for language acquisition, as it mirrors the natural way people learn languages through immersion and interaction (Ferrari et al., 2022).

However, despite the potential benefits, integrating AR and VR into language learning is challenging. One significant barrier is the cost of AR and VR hardware and software, which can be prohibitive for some educational institutions, especially in disadvantaged areas (Al-Ansi et al., 2020). Additionally, there is still a need for more robust and user-friendly AR/VR applications specifically designed for language learning. Another challenge is the need for adequate training for teachers and administrators to enable them to effectively integrate AR and VR into their teaching practices (Familoni & Onyebuchi, 2024). According to Fransson et al. (2020), teachers are responsible for not only using AR and VR technologies but also facilitating AR and VR experiences to meet learning objectives. Administrators are vital in providing the necessary infrastructure, resources, and support for AR and VR applications. Therefore, investing in technology and providing staff training to support interactive, collaborative, and autonomous learning are prerequisites (Alalwan et al., 2020).

DGBLL IN AR/VR CONTEXTS

As previously discussed, digital games and AR/VR offer significant potential benefits for language learning. As DGBLL and AR/VR share common features such as interactivity, authenticity, and contextual awareness, situating DGBLL in AR/VR contexts is a promising approach to enhancing language learning and teaching. Reflecting this, *Innovating Pedagogy 2024*, a series of annual reports on teaching, learning, and assessment for an interactive world, forecasts that when DGBLL is applied with technologies such as AR and VR, "the potential for immersive educational experiences is vast… immersive pedagogies are likely to become widely adopted across the curriculum" (Kukulska-Hulme et al., 2024, p. 48). Against this backdrop, this section aims to provide examples of recent studies that highlight related educational benefits and challenges.

Over the past five years, many studies have illuminated the benefits of using DGBLL in AR contexts in terms of linguistic, cognitive, and psychological development. For example, in a study conducted by Lee and Park (2020), the AR app *7scenes* was employed. The study highlighted the role of contextualization that features authentic, collaborative, and visualized modes of learning, leading to development not only in learning outcomes but also in motivation, autonomy, and engagement. Similarly, Taskiran (2019) explored the psychological impact on Turkish students when using AR in language learning activities. The study suggested that playing four AR games in *AURASMA* (an AR platform) increased the students' language learning enjoyment and motivation.

However, it is essential to note that not all studies have yielded favorable results for such AR-based DGBLL. By comparing the learning effects of AR-based DGBLL with that of a pen-and-paper game, Lee (2022) discovered that the Korean research participants preferred the pen-and-paper learning mode, although DGBLL was deemed useful in facilitating language learning. It seems that whether DGBLL with AR is successful depends on factors such as the specific game design. A good example of game design in AR-based language learning is Wen's (2021) recent study. It utilized *ARIS* (Augmented Reality for Interactive Storytelling, a tool to promote language learning through AR) and *HP Reveal* (an AR app that blends the real world with interactive content) to support elementary learners in Singapore in generating AR learning artifacts. Compared to the control group, which followed traditional learning methods, students in the AR group performed better in terms of cognitive engagement in vocabulary learning, and they expressed greater interest in the self-generated AR

artifacts. This study shows the importance of learner agency while acknowledging the significance of teacher guidance.

Among various types of AR games, role playing games with captivating storylines and interesting characters are the most popular. According to Wang et al. (2018), this type of game motivates learners to explore and participate, which are crucial activities for effective learning. Many role-playing games require players to make strategic decisions and navigate complex scenarios. These challenges foster critical thinking and problem solving skills, which are essential for academic and real-world success (Franco & DeLuca, 2019). Moreover, as Sourmelis et al. (2017) pointed out, many role-playing games involve teamwork and collaboration, where players must work together to achieve common goals. This characteristic can help students understand the importance of cooperation, communication, and leadership in a team setting. Concerning language learning, this type of game could provide a realistic context for using the target language, improving both speaking and listening skills by encouraging active participation and interaction with others (Yen et al., 2015).

As with the use of AR, the application of VR to DGBLL has been increasingly recognized as an effective means of enhancing language learning across the world. We now discuss several recent studies that highlight the educational potential of this approach from various perspectives. By adopting a quasi-experimental approach, Alfadil (2020) examined the impact of a VR game, *House of Languages,* on Saudi Arabian students' English vocabulary acquisition. Results demonstrated that the interactive nature of the game led to increased motivation, confidence, and engagement during the learning process. Specifically, the multisensory learning experience especially enhanced eye contact and enabled "learning it by living it" (p. 9), resulting in students' deeper understanding of the taught words. Similarly, in Australia, Chen et al. (2020) conducted a study to examine the impact of *Second Life* on students' spoken language proficiency. They found that incorporating real-life task design in VR significantly improved students' speaking performance. They also highlighted the important role of task design in DGBLL in VR, concluding that tasks should provide experiential and engaging learning experiences that enhance learners' motivation. In South Korea, with the assistance of *Immerse* (a live VR language learning platform), Lee et al. (2024) reported that 3D VR games engaged primary school pupils "behaviorally (live), affectively (play), and cognitively (learn) in learning" (p. 10531).

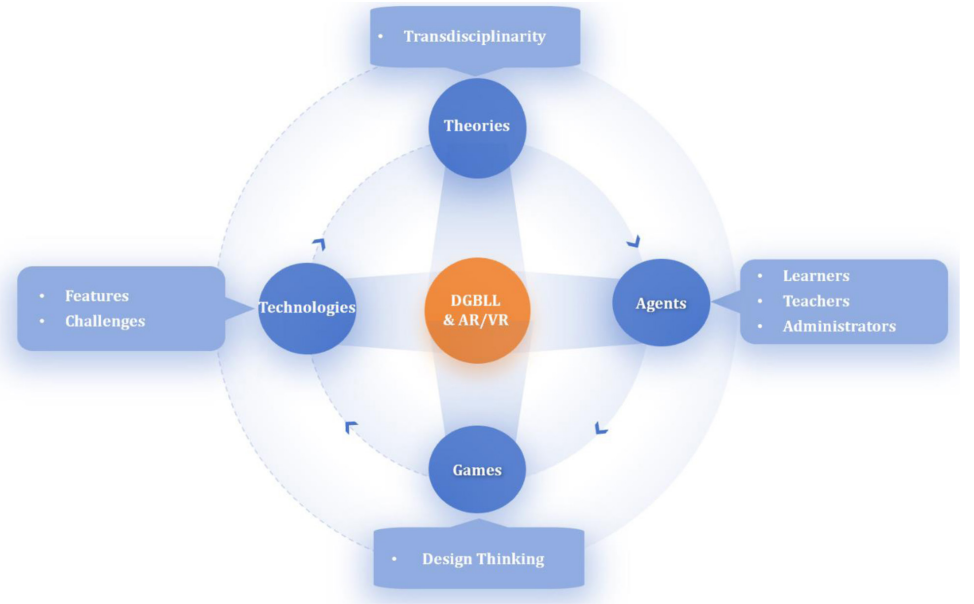
In an English for Specific Purposes course, Wu et al. (2023) implemented a content and language integrated learning approach to training Chinese nursing students' surgical knowledge and linguistic skills. With a fully virtual surgical room and a role-play game design, *Modern Operation Room* enabled students to play the role of a nurse and assist a non-player-character doctor and a nurse supervisor (played by another student) in completing surgeries. During the game, they were required to perform specific actions and interact with their peers. A notable finding from this study was that the nursing students experienced reduced anxiety owing to the game-based nature of the learning environment. In traditional internships at real hospitals, they often felt immense pressure to avoid harming patients and making potentially fatal mistakes. However, with DGBLL allied with VR, they reported feeling more at ease, as they could practice as much as they needed until they felt confident that they had mastered the required skills. Even when they made mistakes, they could redo the task without any adverse consequences. This aspect of VR-based learning is particularly advantageous, as learning anxiety is a common issue among students worldwide, particularly those from exam-oriented cultures like South Korea and China.

Finally, in terms of special education, Lan et al. (2024) demonstrated how children with attention deficit hyperactivity disorder can benefit from this new way of learning. Their study revealed that children with attention deficit hyperactivity disorder were able to improve their Mandarin communication skills through this innovative learning approach. Specifically, the children enjoyed the authentic, user-friendly, and useful nature of DGBLL in VR. Furthermore, the study pointed to high retention of learning outcomes of more than one month, suggesting the great potential of this technology for language learning among children with special educational needs.

A MODEL FOR AR/VR DGBLL

Based on the preceding discussion, this section proposes a tentative model, shown in Figure 1, for the use of DGBLL with AR/VR by teachers and educators. The model consists of four components: theories, agents, games, and technology.

Figure 1. A model of digital game-based language learning (dgbll) with augmented reality / virtual reality (AR/VR)



Theories

The utilization of technology in language learning has often been criticized for its lack of theoretical foundations (Hubbard & Colpaert, 2019). As discussed, SCT and constructivism have been employed in implementing DGBLL. According to Zhang et al. (2020), these theories are also well suited to supporting the pedagogical design of AR-enhanced language learning. In addition, we recommend the consideration of embodied cognition (Wilson, 2002) when using AR/VR in language education. This is a newly adopted theory in the field of AR/VR, but it has had major implications for educators and researchers. The theory posits that the human body and mind are not separate entities but are instead a bodily interaction that supports the development of human cognition. When situated within an AR/VR setting, learners are more likely to engage in learning because of their physical interactions with the environment, which reduces cognitive resources and reinforces learning (Sullivan, 2018).

In line with Wu et al. (2024b), we recommend that teachers and educators adopt an informed decision making approach to AR/VR DGBLL, incorporating various theories and concepts. These theories should not be limited to those arising from linguistics but should also encompass psychology, education theory, and computer science. Colpaert (2018) defines this approach as transdisciplinarity; it involves applying different technologies to language education conceptually and practically. For example, when teaching elementary students, teachers are advised to consider language acquisition theories and educational psychology theories related to children and their knowledge and experience with technology. This holistic approach should be the guiding principle for implementing DGBLL with AR/VR. Without a well-grounded theoretical framework, the effective implementation of AR/VR technologies in language education may be compromised.

Agents

Considering the agent is another vital dimension of ensuring the successful implementation of AR/VR DGBLL. These agents can be learners, teachers, and even school administrators. Since emerging technologies such as AR and VR, as well as innovative ways of learning like DGBLL, are relatively novel to these educational stakeholders, it is no surprise that studies have shown both positive responses (e.g., excitement) and negative responses (e.g., anxiety) to them (e.g., Lee & Wu, 2023; Reinders & Wattana, 2015b). For learners, "[t]he quality of the game experience is central to student acceptance" (Godwin-Jones, 2016, p. 14), along with other factors such as their prior user experience, peer collaboration, teacher scaffolding, and cost-effectiveness. For teachers, a combination of technological, pedagogical, and content knowledge, equipment access, technology support, peer support, school leadership, and parents' expectations jointly shape their attitudes and teaching practices (Jang et al., 2021). School administrators are often influenced by broader factors, including national policies, societal norms, laws and regulations, school funding, and parental requirements.

While prior experience has been recognized as an essential factor in influencing learners' and teachers' adoption of new technologies and pedagogical approaches, Blume (2020) discovered that ineffective use of DGBLL can actually result in worse learning outcomes than not using it. Following Chik (2013), we would like to caution that "personal experience can serve as the starting point of pedagogical exploration, rather than an end point" (p. 164). Hence, emphasis should be placed on developing the digital literacy of learners and teachers. Though digital literacy has been widely studied in language education, its definition has not been agreed upon. Hafner et al. (2015) proposed a five-dimensional model of digital literacy, encompassing doing, meaning, relating, thinking, and being. Similarly, Pegrum et al. (2022) presented a digital literacy framework, including communicating, informing, collaborating, and (re)designing. These models and frameworks can serve as valuable guidance for school administrators and teacher educators in providing tailored training to teachers to enhance their knowledge and practices and their ability to effectively implement DGBLL with AR/VR.

Technologies

It is crucial to consider the features or affordances (new opportunities created for learning) of AR/VR technologies when supporting DGBLL. The section titled "AR/VR and Language Learning" examined several prominent features of these emerging technologies, such as interactivity, feedback, and adaptability. To support learners and teachers in embracing DGBLL with AR/VR, some key questions need to be addressed by teachers. These include the following:

- Why is it desirable to incorporate AR/VR-empowered DGBLL in the classroom?
- What unique benefits can AR/VR offer to student learning?
- What are the potential challenges?
- Is the selected AR/VR software suitable for fulfilling my students' learning needs?
- How can I help my students become comfortable using AR/VR DGBLL?

According to Tang and Hew (2019), when choosing technological tools, teachers should consider at least two key constructs, namely usability and utility. "Usability" refers to how easy it is to utilize the technology, considering factors such as accessibility, cost, technical support, interface design, and integration into existing learning systems. For example, technical support from companies is vital, as there is often a lack of mutual understanding between educational users and technicians. Thus, Zhang et al. (2020) rightly suggest that a robust communication community should be created among educational users and designers to update and improve the technology to provide a more conducive learning environment.

"Utility" refers to the functionalities required for engaging in learning activities. Different features of AR/VR can be of use depending on different learning needs. For example, the multimodal

and multisensory aspects of these technologies can significantly benefit learners who struggle with conventional paper-based instruction. Another example is the immersive learning opportunities provided by engaging in AR/VR games to extend learning opportunities (e.g., visiting an ancient dynasty) and their potential to promote inclusive and equitable education (Di Paolo et al., 2023).

Games

As previously mentioned, one of the longstanding challenges of DGBLL is the lack of customized learning, i.e., learning content and pathways that are tailored to individual learners according to their different needs, proficiencies, etc. Games need to be adapted for educational purposes and settings by considering the specific needs of learners and teachers. Design thinking, a concept first discussed by Peter Rowe in 1987 and originating from architecture, may offer practical insights to address this issue. Specifically, design thinking is "both a process and a mindset" (Luka, 2014, p. 65) that emphasizes student agency and the application of advanced thinking skills to identify and solve real-world problems through design activities (Kimbell, 2012). By moving away from the traditional teacher-fronted, monomodal textbook learning approach, design thinking empowers students to actively engage in the learning process and apply their knowledge behaviorally, affectively, and cognitively (Luka, 2014).

Design thinking can apply to both student learning and teaching processes. To maximize the potential of design thinking in education, the Institute of Design at Stanford (Plattner, 2010) proposed five key phases of design thinking: 1) empathize, 2) define, 3) ideate, 4) prototype, and 5) test. Table 1 (Plattner, 2010) explains the phases by providing examples within the AR/VR context of DGBLL. It is important to note that although the table presents the model in a linear manner, the five phases should be approached iteratively.

Table 1. Five-phase model of design thinking

Interactive phase	What	How	An example of DGBLL with AR/VR
Empathize	To gain an understanding of the cognitive and emotional challenges that students may face in their learning journeys	Observe the behavior of students during their learning activities; Conduct surveys and interviews to gather insights into their specific learning needs	Daphne (pseudonym), a language teacher, has noticed the issue of decontextualization in her classroom teaching. She actively observes her students' participation and performance during their learning activities. Additionally, she conducts surveys and interviews with her students to gain a deeper understanding of their specific learning challenges.
Define	To produce a problem statement by making the outstanding learning problems clear	Synthesize significant challenges reported by learners	On the basis of careful observations and valuable feedback from her students, Daphne meticulously evaluates and identifies the critical hurdles that her students face in language learning. By considering their perspectives and experiences, she determines that providing immersive and contextualized learning is the most significant challenge requiring attention.
Ideate	To brainstorm a list of possible solutions to address the targeted learning challenges	Combine ideas from learners, teachers, educators, and other educational stakeholders	On the basis of the problem statement in Phase 2, Daphne actively invites students and fellow teachers to explore potential solutions for the challenges of DGBLL with AR/VR. During the discussion, they delve into the reasons behind opting for these technologies, explore ways to implement them effectively, and assess the specific benefits they can offer in overcoming the challenges previously identified.

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Table 1. Continued

Interactive phase	What	How	An example of DGBLL with AR/VR
Prototype	To generate solutions or create artifacts based on ideation	Build the artifacts with users in mind	After brainstorming solutions, Daphne has several options: 1) Design learning activities based on commercially available games, which requires careful planning and organization; 2) Select an AR/VR platform such as *CoSpaces*, to develop a game that caters to her students' learning needs; or 3) most ideally, co-design an AR/VR game with a gaming company by specifying her students' learning requirements regarding technology, pedagogy, and psychology. The decision should be made on the basis of an evaluation of the educational resources available to Daphne.
Test	To test the proficiency of the prototype	Engage learners through hands-on experience and comparative analysis of different prototypes	The students and Daphne implement DGBLL and provide feedback on benefits and drawbacks for educators to understand the merits and shortcomings of the games and how they can be better integrated into the classroom/curriculum.

Note. DGBLL = digital game-based language learning . AR= augmented reality. VR= virtual reality .

In conclusion, we encourage readers to consider the four constructs from Figure 1 when approaching DGBLL within AR/VR contexts. It should be remembered that the model is by no means a panacea for learners and teachers. However, it can be viewed as a springboard from which various educational stakeholders can work collaboratively to identify or, if possible, develop AR/VR games that address the specific requirements of language learners. More importantly, this process should not be a one-time experiment but should be an ongoing and continuously revisited process.

FUTURE DIRECTIONS

We live in an era of swift technological advancement. AR and VR are no longer used separately but are being merged within the broad concept of the metaverse. We thus invite teachers, educators, researchers, and designers to envisage the future of DGBLL with AR/VR through the new lens of the metaverse.

The concept of the metaverse, known for its immersive and interactive nature, with the support of AR and VR, holds immense potential. Although this concept is currently being overshadowed by the growing popularity of generative artificial intelligence (GAI), both governments and companies across the globe continue to invest in and develop new virtual worlds as a means to extend human experiences. For example, Shanghai recently announced a three-year strategy to support the growth of the metaverse with the assistance of GAI. Similarly, educators have started to explore the collaborative potential of GAI and the metaverse (e.g., Lv, 2023).

In a recent position paper, Wu et al. (2024b) proposed that DGBLL should be regarded as a crucial pedagogy to facilitate effective student learning within the metaverse. This assertion is based on the alignment between key features of DGBLL and the affordances provided by the metaverse. However, they also emphasize the need for thorough evaluations of both the technology and the pedagogy. They caution that such evaluations are essential "since games have long been deemed as serious distractions in examination-oriented cultures" (p. 50).

In conclusion, this paper provides valuable insights into the potential of applying DGBLL with AR/VR. Referring to Chik (2013), who concluded that "[p]erhaps some of the most interesting developments in computer-assisted language learning in the next years will center on the roles of digital gaming" (p. 838), it is evident that the landscape has indeed evolved in this predicted direction over the past decade. Moreover, while we have seen a wealth of research in DGBLL, various emerging technologies are continuing to open up new avenues for exploration. Building on Chik's foresight, it is our hope that this paper will serve as a source of inspiration and spark further discussions on the application of DGBLL with these innovative technologies.

CONFLICTS OF INTEREST

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