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Exploring the Role of Virtual Reality (VR) and Augmented Reality (AR) in Language Learning

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ABSTRACT

The integration of Augmented Reality (AR) in language education offers unique opportunities to enhance second language acquisition by providing immersive, contextual, and interactive learning experiences. This paper reviews empirical research on the use of AR in second-language teaching, focusing on its potential to create authentic learning environments, improve learner engagement, and facilitate better language proficiency and communication skills. Despite the strong interest in AR technology, limited research explores its application in language learning contexts. This review aims to fill this gap by synthesizing existing studies, discussing the benefits and challenges of AR in language education, and proposing directions for future research. The findings suggest that AR can significantly contribute to more effective and engaging language learning, though issues such as high production costs and technological barriers need to be addressed.

Keywords: Augmented Reality, Language Acquisition, Immersive Learning, Language Proficiency and Interactive Learning.

INTRODUCTION

The duteous combination of VR and language learning can create a high natural in educational platforms and contributes to learning in every respect. Nonetheless, the current research on language learning is far from enough. In light of this, when learners are in an AR environment, exploring real-world contexts, they may have better opportunities to gain more effortless and environmental experience and a superior understanding of the input and can also be more advantaged in terms of language proficiency and communication [1, 2]. Despite the strong potential and the great interest in this technology, relatively very limited research yet explores the use of AR in a language context. Would AR create a more authentic environment for task-based language learning? What changes can AR bring to language teaching and learning? This paper will provide an extensive review of empirical findings for AR in second or foreign-language teaching draw direction for future language research establishing AR and envision the future of AR in foreign-language teaching and education [3]. The use of various technologies, including virtual reality (VR) and augmented reality (AR), has become widespread in both education and foreign language education because of the multiple affordances and potential benefits they offer. The use of both VR and AR in foreign language teaching and learning has long roots. The recent advancements in sophisticated technology have paved the way for a new phase, providing more opportunities for learners to experience the real world in a virtual environment [4]. There is a common consensus in the literature that learning a language in context facilitates much-needed vocabulary and grammar acquisition for students learning English as a Foreign Language [5]. Researchers have claimed that language is not only a collection of vocabulary and syntax; it is the product of meaning, which comes from human movements, actions, reactions, and body language. The combination of man-environment interaction has triggered increasing interest not only among students but also among learning specialists and experts

[6]. A language-learning environment that is ready to use as quickly as possible and requires no technical skills from the learner can facilitate and simplify the acquisition of new knowledge, and this is where VR/AR comes in. Besides discussing the advantages and disadvantages of using VR/AR in language education, this review paper will also further explore the relevance of these two technologies in language education and provide some guidelines to teachers hoping to use VR/AR [7]. The paper concludes with an analysis of existing problems relating to the use of VR/AR and presents some suggestions for the enhancement of language-learning software involving these two technologies. In summary, this review paper aims to contribute to language education at all levels by raising awareness of the role of VR/AR in utilizing current and future technologies more effectively. Language education has been shown to benefit considerably from the use of technology. The affordances provided by technology can facilitate learners in the development of the necessary language-related competencies [8, 9]. Not only can learners gain access to additional input, but their opportunities for output can also be increased. Beyond that, the computer environment and game playing in particular have been noted for the affective advantage they bring: the fun and motivational aspects of using technology can encourage learners, consciously or otherwise, to dedicate time to the task of language learning. Technological innovation continues to bring a variety of modern technologies to education - including language education - primarily in the form of VR (Virtual Reality) and AR (Augmented Reality) [10].

Understanding Virtual Reality (VR) and Augmented Reality (AR)

A considerable number of studies on VR/AR in education conclude that higher motivation and satisfaction of learning through its immersive characteristics. Moreover, AR's potential to align learning settings with natural experience and assist the learners' cognitive processes provided the trend to research the expected AR increase. However, high production costs and time intensiveness are the reasons behind the low implementation rate in regular language teaching by educators. Furthermore, there is ample agreement among educators that implementing technology is scandalizing without embedded context [11, 12]. Virtual reality (VR) and augmented reality (AR) together constitute two modern simulated learning experiences, which offer interactive, three-dimensional environments to the user. While there exists a multitude of studies exploring the integrative role of VR/AR for language learning, there is limited evidence of empirical results of virtual reality and/or augmented reality integration in authentic language lessons. The specific VR engrosses the user's consciousness in its computer-generated 3D environment, whereas AR enhances this reality with superimposed computer-generated data on top. VR and AR conducive qualities, such as the potential and opportunity to provide experiential learning and thus create contextual knowledge, motivate their integration in the language-learning process [13].

Key Technologies and Platforms

VR, AR, and MR as the main representatives of xR technology can be combined with the techniques of artificial intelligence (AI), big data (BD), intelligent voice recognition (IVR), the Internet of Things (IoT), the fifth generation (5G) of mobile communication, and human-computer interaction (HCI), etc., which can then enhance the engagement and interaction of learning content and thus improve learning quality. Nowadays, most xR platforms have integrated most of these advanced technologies and are more and more popular in various studies, exhibitions, and applications [14]. These kinds of newly-built platforms can either use built-in devices or update old VR or AR systems, depending on VR and AR glasses, smart mobile phones, and other electronic hardware/software devices or combine with the Cloud, Internet, sensors, etc to make learning more convenient, practical, and realistic than ever, and can also provide better building and management experiences for language learners and teachers [15]. In this research, we will explore the role of xR technology as an intelligent platform and its impact on language learning. Immersive technologies such as VR and AR can provide users with a high-quality presence and a high level of interactivity, allowing them to efficiently manipulate objects and experience virtual environments. VR and AR have been increasingly integrated into the fields of education and training. VR, AR, and mixed reality (MR), which is a combination of AR and VR, cover a wide range of platforms, which can be described as "xR." The development of VR technology promotes the research and application of virtual worlds (VW) in the teaching environment [16].

Applications of VR and AR in Language Learning

Language Experiments Space is a virtual reality language lab. This uses a social virtual reality application that provides immersive 3D contexts and the possibility of presenting various research tasks based on psychology and language. This system was introduced for the PupilLab study to investigate the role of word content and syntactic complexity and how these factors interact with visual context during sentence understanding. The study indicates that the use of VR in psycholinguistic and sentence comprehension research is highly realistic and highly controlled. Penn Language In Context, Penn Labs is a class

developed by Swarthmore College using virtual reality technology. This class is called Foreign Language Learning through Virtual and Augmented Reality [17]. The ideas behind VR and AR language teaching programs have been discussed in several public media. For example, Oculus Languages is a free game in the Oculus Store that teaches foreign languages through real-life scenarios. It is suitable for students from elementary school to the university level. And then, Mondly is a new VR language learning app, which places the importance of speech recognition on learning a new language [18]. With Mondly's VR language learning app, users can chat with life-like virtual personalities. Users are made to use the words, that they don't know, the app will operate its special chatbot Tarek, which will provide users with the correct responses. Users will gradually become familiar with Arabic, which is unknown to them. Not only this, the user's progress is at the same rate of time. This app saves a lot of time and gives them the environment to explore the real world [1, 19]. To study the effect of Virtual Reality Headset (VRAI) on English memorization, Mengyu et al. investigated the influence of virtual reality in English memorization and found that virtual reality sixth sense colors did significantly better in both short-term and long-term memory tasks. There are many applications of VR and AR in language learning and teaching. Some of the virtual reality language tools that are currently used in global education are V/A Headset, Google Expeditions, VR smartphone applications, web-based VR tools, and various domain-specific software. EON Reality Education provides great educational VR technology and services [20, 21]. Moreover, Immerseum U is a language learning and cultural program that provides environments that can be used to train language skills and understanding of different cultures using virtual reality. Rosetta Stone VR provides a 3D interface for its language learning products in a conversational context with audio and video. This is especially suitable for middle school students and secondary school students.

Immersive Language Learning Experiences

The findings of these studies suggest that VR and AR can support effective language learning. VR/AR's unique characteristics enable technology-enhanced L2 learning to instill authenticity, socialization, personalization, and immersion [22, 23]. The strengths in VR/AR, such as interaction between real people and artificial characters, personalization of learning materials, cognitive engagement, foreign language anxiety regulation, and culture exploration, provide additional language learning input and practice for language learners. Immersive is often associated with VR because users can dive into a virtual environment and interact freely with objects, characters, and settings. Several commercially available and prototype language learning VR/AR applications can offer an immersive experience to users. Chinese language learners, for example, are capable of developing communicative competence and sociocultural competence, higher-order thinking modes, intercultural understanding, and cultural intelligence through virtual field trips and collaborative activities [24]. These studies suggest that VR can offer the 'next best thing' to real life and it allows learners to immerse themselves in a medieval or 360-degree panoramic view environment surrounding the targeted culture effectively [25].

Vocabulary Acquisition and Retention

Google Glass has rich resources aimed at English lessons for students in small classroom environments. With the help of Google Glass, students will more readily complement sentences and improve their pronunciation by having an immersive English learning experience. Using VR, Chu et al. found that there was no one-size-fits-all for new vocabulary learning [26, 27]. Traditional and immersive methods may either help new words' immediate recognition or delay retention. Since improved EG's immersive impact on new word recognition, VR might be an effective tool for promoting instant retention of newly learned words. The chances of experiencing vocabulary in VR were unlimited and need to be researched further. To deepen learning, it is assumed that repeated exposure would be beneficial. The authors reported that traditional language learning has low vocabulary retention rates, while repeated exposure to the vocabulary may improve retention. With AR word practice, students can be motivated to learn through the lenses of a smartphone or tablet [28]. Tap to help remember will be initially motivated, and rewatching motivation may be decreased by tapping. Real-life objects and rich external resources are advantages of AR word practice. In a second language, vocabulary acquisition is one of the biggest challenges for foreign students, and word memorization is also very important.

Benefits and Challenges of Integrating VR and AR in Language Learning

Second, it allows learners to visualize the structure of language and have the virtual construct become a concrete object that can be manipulated. For explicit learning, students can practice grammar rules by using hand movements and creating prepositions of place and sound as they build words, phrases, and sentences associated with these rules, providing students with more practice in language structure [29]. Grammar lessons can cover verb tenses, verb forms, parts of speech, subject/verb agreement, sentence structure, and punctuation. In the case of vocabulary, students can see real objects and relate them to specific words in the target language. The visual abilities and cognitive processes in the construction and

interaction of the objects have been attributed to improving retention and recall [30]. First, VR and AR allow students to be physically immersed in an environment where "real" physical actions can occur. The sense of immersion is increased through the creation of avatars, which are visual representations of oneself in the virtual or augmented space. Learners can interact and communicate meaningfully with one another without being in the same physical space. This also allows students to use the foreign language more extensively, intensively, and naturally. There is a strong sense of presence which removes the sense of 'classroomness and distantness' associated with traditional classroom spaces [31]. By being in a VR environment, the students can easily practice and increase interaction, comprehensibility, and accuracy in a more meaningful manner. Also, the VR and AR environment enables students to have fun as they learn, and this can increase learners' motivation. The benefits of using VR and AR in L2 learning can parallel the benefits of incorporating other technologies. For example:

Advantages of VR and AR in Language Learning

Augmented and mixed reality share the advantages of AR but additionally can offer real-world object interaction that sets them apart and can alleviate any qualms a teacher might have about moving a particular lesson from the physical classroom to the digital realm [32, 33]. With AR and MR, we can furnish students with real-world experiences related to abstract concepts, potentially allowing for better understanding and retention of the material. These kinds of headsets also enable the students to observe similar events (related to course activities and exercises) in their actual physical environment (house, garden, playground, etc.) and to obtain corresponding visual information in the virtual environment as well [34, 35]. The use of virtual reality in education has become a common practice and the costs of VR devices are becoming more affordable; thus, the number of educational VR applications has increased dramatically. One advantage of VR in education is the use of 3D data sets which usually is not possible using traditional 2D monitors, but nowadays it is made possible using VR headsets. For 3D data visualization, by using such kinds of headsets or other gadgets, students can easily understand the data and apply their knowledge effectively [36, 37].

Limitations and Considerations

Further, we have identified the sample's general limitations and potential and suggested further research to resolve these limitations in our study. Second, even though VR establishes a stage that is less exposed to the user's actual environment, we realize that concerns about technological barriers, which can trigger simulator disease, should be taken into consideration because achieving 3D immersion is challenging, even for games and other simple applications [38, 39]. What most of the applications do is maintain a separation between what the learner sees or hears and the rest of the interactive input of the SLT, regardless of the medium. Currently, it would likely work best for AR-assisted SLT to enable users to modify one of these inputs (e.g., taking the voice and providing speech intelligibility improvement in bothersome environments; enhancing differentiated, associated audio descriptions; providing additional scenario-based language learning scenarios) than entirely removing the input and replacing it with immersive 3D space interaction that is stimulating but currently entropic [40, 41]. Once effective AR glasses are manufactured, further research in this study will provide more answers to these and other questions on VR and AR disadvantages and supremacy. However, our research, results, and limitations in this study have several significant implications for the theory and practice of language learning within both VR and AR environments. First of all, as already mentioned, the number of participants was unfortunately quite limited. Our sample was convenient, so there may be concerns regarding the general proposition of our claims [42, 43]. However, despite the small overlay of our participants' linguistic and mechanical skills, our results were significant, partially confirming other research that graduated mechanical measures are quite significant for getting long-term benefits for learning performance improvement rather than linguistic skills. In general, more comprehensive, longitudinal research in real learning environment studies is needed to compare the overall results between VR and AR available functions in operation with common SLT functions and thus obtain more nuanced insights into their characteristics in terms of language learning [44, 45].

Future Directions and Implications for Language Learning

Certainly, considering the advantages of VR/AR in the language learning process, the relation becomes more important [46]. However, a lack of studies also arises. It is recommended that future researchers investigate the role of AR/VR in three basic language skills by integrating different types of simulations and methods [47]. They can also contribute by examining the emotional, cognitive, and social development that can be fed to the players with AR/VR technologies used in foreign language education. Moreover, the beneficial, challenging, and uncanny aspects of AR/VR technologies are worth considering in the search [48]. Despite the growing interest in VR/AR educational tools, studies concerning immersive multimedia learning are still limited because most studies have only focused on one aspect of

the learning environment [49]. Also, the rise of AR/VR product sales and the increasing amount of research on these areas, it demonstrates the acceptance of these advanced technologies in the world. It can be said that the companies involved in the language learning process are likely to integrate these technologies into educational materials as new explorations are carried out in the literature because they have realized the positive differences it can make [50].

CONCLUSION

This review highlights the promising potential of AR technology in revolutionizing second language acquisition by providing immersive, interactive, and contextual learning experiences. While AR has been shown to enhance language proficiency, engagement, and contextual understanding, its adoption is hindered by high production costs, technological barriers, and limited empirical research. To fully realize the benefits of AR in language education, future studies should focus on large-scale, longitudinal research, explore diverse language skills integration, and address technological and cost-related challenges. By advancing research and application, AR can become a transformative tool in language education, paving the way for more effective and engaging learning experiences.

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