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Reconnecting relationships through technology

Language learning and virtual reality: A scoping review

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This paper describes the rationale, process and results of a scoping review of journal articles researching aspects of language learning and the use of Virtual Reality (VR) from 2020 onwards. Twenty-four articles were chosen for data extraction, including five previous systematic reviews. The analysis confirmed that VR has a positive effect on the motivation of language learners to study but there is less clear-cut support for specific language gains. The most frequently mentioned language target is vocabulary acquisition, and although VR certainly facilitates initial vocabulary learning there is less evidence of long-term retention of new lexis. This scoping review has helped to focus the next stage of this VR project on working with students in the long term on improving specific speaking skills and to clarify the most appropriate pedagogical strategies for the use of VR for language learning.

Keywords: virtual reality, scoping review, language learning, higher education, K-12

Introduction

Virtual Reality (VR) has been used in a variety of forms in education for a number of years. Examples include game-based learning in the virtual worlds of Minecraft, storytelling and empathy education through immersive documentaries such as Anne Frank House, and collaborative learning using social platforms such as Spatial. These different forms of VR vary in how immersive they are but all attempt to transport learners to another world in which to explore, discover and learn. As a result of the COVID-19 pandemic, VR was a ready alternative to face-to-face lessons and could even be used to replace study abroad as travel was so limited (Liu & Shirley, 2021). Within this context, from April 2021 until February 2022, the two presenters undertook a small longitudinal pilot study with five students to investigate how different types of VR could be used for self-directed learning and what language teachers needed to know in order to use VR successfully in their practice (Cowie & Alizadeh, 2022). The pilot study revealed the positive impact of VR on engaging students in self-directed learning and enhancing their communication and collaboration in group activities as found through focus group interviews. Despite the benefits, full immersion VR using Meta Quest 2 head mounted displays caused certain degrees of cybersickness in the participants. As a result, the pilot study was continued with WebVR, first using Mozilla Hubs and Spoke to create and co-explore VR and later using Thinglink to create 360 degree tours. The next stage is to transfer these lessons to a larger group of students and try to establish what exact teaching practices are most effective for language learning using VR. As preparation for this it was decided to carry out a scoping review of previous research involving VR and language learning to gather evidence from the literature and identify research gaps.

Although education for the most part is back to face-to-face in many parts of the world, VR and other immersive technologies can play a significant part in connecting to peers and teachers beyond classroom borders, for example in hybrid settings. In addition, such technologies are still relevant in the post-pandemic world as they transform the learning experience beyond merely connecting remote learners and teachers. VR, for instance, can create authentic contexts that help learners establish improved awareness and understanding of the target language community and culture and takes them a step further to negotiate their identity and maintain their motivation, thus facilitating self-regulation and goal achievement in the learning process (Oyserman et al., 2017). Given this background, it is essential to keep exploring the potential of new technologies such as VR.

Previous systematic reviews of VR and language learning (8, 13, 14, 15, 16 in Appendix A) have included research from 2008 until 2021. Not surprisingly, in view of the rapid changes during that period in VR, there are wide variations in results. Perhaps the most obvious is the changing nature of VR from early virtual worlds such as Second Life (13) and various games (15) to virtual tours such as Google Earth (8). One omission appears to be the lack of reference to recent collaborative applications such as Engage or Mozilla Hubs. On the other hand,

there are a number of consistent trends: research participants tended to be university students in an English as a Foreign Language (EFL) context and the most common language target is specific vocabulary acquisition. The various reviews cited the immersion and multimodal context that VR provides as reasons for facilitating vocabulary learning and retention; however, there were few longitudinal studies that assessed more permanent language gains. Finally, research findings focused on the affective domain provide some evidence that VR is enjoyable and motivating and can be a tool to stimulate interest in language learners. It was suggested that future research needs to focus on larger sample sizes (15), longer term treatments and more attention paid to pedagogy (8, 16); that is, what kind of approaches will be most effective in teaching languages using VR. With these lessons as background, a scoping review was undertaken to answer the two following research questions:

1. What are the findings of previous studies regarding the impact of VR on language learners' psychological and emotional states (for example, engagement, motivation and anxiety)?
2. What are the findings of previous studies regarding the impact of VR on language learning outcomes?

Procedure

Research papers on VR and language learning from 2020 onwards were searched for on Web of Science, Scopus and ERIC. The search string included terms related to VR, WebVR and their variations as well as language learning and its variations in both K-12 and higher education, yielding an initial pool of 37 articles (See Appendix B). Those articles were then screened for language of writing, duplication, topic relevance and quality, which left a final pool of 24 articles for full text review (see Appendix A). Five of the 24 journal papers (8, 13, 14, 15, 16) were systematic reviews. The remaining 19 participant studies were conducted in various countries including *Taiwan* (2, 4, 9, 10, 19, 20, 24), *China* (5, 12, 18, 23), *United States* (1, 7), *Australia* (22), *Cyprus* (11), *Hong Kong* (3), *Iran* (6), *Italy* (17), and *Japan* (21). As the frequency counts show, researchers in Asian countries were found to have the highest number of publications on VR and language learning which probably reflects the growing VR market in the region (Report Ocean, 2022). Six out of 19 papers were published in *Computer Assisted Language Learning* (Q1 journal). Most of the studies used a mixed methods approach to research collecting both quantitative and qualitative data from participants. All the studies reviewed except for one (3) were conducted in a foreign language setting as opposed to a second language setting, with the former referring to a learning context where the target language is not spoken in the learners' out-of-class environment. On the contrary, study 3 took place in a Chinese-as-a-first-language context with secondary school students. In addition, all studies but two (7, 21) were focused on developing learners' language skills for general purposes. Studies 7 and 21, however, were conducted in English-medium instruction settings focusing on technical vocabulary and content knowledge acquisition combined with general linguistic skills.

Results

Research Question 1: Psychological and emotional states

The reviewed studies focused on differing affective factors including engagement, motivation, enjoyment, satisfaction, confidence, and enthusism. The collective findings almost unanimously confirm students' general positive views toward VR assessed through self-report questionnaires and/or interviews. The one exception (24) reported that students felt anxious using VR, although that could be explained by the fact that the specific VR application used was not interactive and communicative activities, which students said caused anxiety, were not carried out within the application itself. One consistent result, echoing the previous systematic reviews, is that VR is enjoyable and motivating for students (2, 5, 6, 7, 10, 18, 20, 21, 22, 23) especially for students who may initially not be that interested in language learning or confident in their linguistic skills (5, 6), although some researchers warned of the influence of the novelty effect of learning with a new fun tool (20, 23). In addition, two studies also found evidence supporting the positive impact of VR on willingness to communicate (6, 24) and learner autonomy (24). The impact of VR on fostering cultural awareness and intercultural competence was the focus of three of the research papers reviewed (6, 9, 18), all of which provided evidence in support of VR to deepen cultural understanding. This observation corroborates previous findings regarding the power of VR as the 'ultimate empathy machine' (Barbot & Kaufman, 2020). In addition, as with previous studies, there was evidence of the potential that VR has to decrease anxiety, particularly for public speaking (4, 23), to facilitate critical thinking (10), and that students are less distracted (24). However, one study comparing VR and mobile apps (11) found that although VR scored highly for engagement it was not significantly different to mobile apps.

Research Question 2: Language learning outcomes

The scoping studies examined a number of different language learning outcomes such as grammar (24), writing structure (23), writing skills (3, 9, 10), pronunciation (24), listening comprehension (5, 19) and speaking (4, 5, 6, 7, 9, 10). In addition to these areas, two studies also looked at the impact of VR on willingness to communicate (6, 24), one at learner autonomy (24), and one on improved knowledge sharing as part of intercultural competence (18). The most common target areas, echoing the findings of the previous five systematic reviews, were those of vocabulary acquisition (2, 5, 7, 11, 17, 20, 24) and speaking (4, 5, 6, 7, 9, 10). Overall, there was relatively little evidence that the use of VR promoted language gains with the exception of short-term vocabulary retention. Instead there was more support for students finding VR fun, enjoyable and motivating but these positive feelings were not consistently linked with successful language learning outcomes.

Other findings

In addition to providing data to answer the two research questions, the scoping review also revealed a number of other relevant results that we would like to briefly mention. One striking, and somewhat worrying, finding was the low quality of a number of papers (six out of 37). The writing in these papers was disorganized, unclear and very difficult to understand. As a result, these were excluded from the final list. Although this finding is not directly related to our research agenda, we think that it is worth noting that although a number of papers had significant language issues that made them difficult to understand they were still published in Q1 journals. A second trend was the continuation of frequently changing definitions and terms connected to VR. This is partly the result of VR being an ever-widening field with new applications appearing all the time, but also appears to reflect the lack of consistency in research terms. Thirdly, some studies claimed to have adopted a mixed-methods research approach evaluating learning outcomes by comparing pre- and post-test scores and students' learning experience using questionnaires; whereas in reality their evaluations were entirely subjective and based on learner self-reports for both affective aspects of the learning experience and language gains. In addition, when assessed according to the SAMR Model (Puentedura, 2013), a significant number of the studies did not go beyond augmentation and failed to create transformative learning experiences. Finally, the review was extremely useful in identifying a future research agenda for the use of VR and language learning. Areas to focus on include the lack of studies on the long-term effects of VR with large groups of learners; the need to widen the target language outcomes and to identify what teaching approaches work best with those targets. Some of these areas, including the lack of longitudinal studies on VR and language learning and an overemphasis on vocabulary learning gains, have been highlighted in previous systematic reviews (8, 13, 14, 15, 16) but there is still a research gap as shown by our review which covers recent articles published from 2020 to 2022.

Conclusion

The two presenters carried out a scoping review of 24 journal papers published since 2020 on VR and language learning. An analysis of these papers confirms that VR is clearly engaging and motivating to language students and can decrease language learning anxiety. This is an important aspect in such a performative subject: as well as knowledge of a language, students need to practice various skills in order to become proficient and being relaxed and motivated should help this process. Regarding language knowledge, it is also clear that, because of its multimodal and immersive nature, VR can be extremely helpful in aiding short-term vocabulary acquisition. However, the papers have less evidence regarding other longer-term language outcomes achieved in regular classroom contexts. It is concluded that future research needs to examine what specific teaching approaches for the use of VR are most suitable for long term language skill development, and in what ways VR can be used for language teaching in genuinely transformative ways rather than substituting or augmenting existing pedagogy.

As future work, the researchers plan to run an experimental study to assess the impact of VR on learners' general business English skills. As the scoping review results indicate, most studies involve short-term interventions and some fail to objectively measure language learning gains based on pre- and post-test scores. To avoid these pitfalls, a longitudinal study with control and experimental groups will be planned to evaluate the effect of VR on learners' affective states such as motivation and engagement and their business English learning gains. The study is planned to last over ten weeks with approximately 30 participants in each group. As shown in the literature (Cowie & Alizadeh, 2022; Rebenitsch & Owen, 2016), VR headsets are not comfortable to wear over long stretches of time and can cause cybersickness and other health issues. To avoid these problems that can negatively affect research findings, the researchers will use a 3D VR environment that works on PC browsers.

Acknowledgement

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Appendix A

Articles reviewed:

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Appendix B

Search terms:

(WebVR OR Web-based VR OR Web-powered VR OR Web VR OR Desktop VR OR 2D VR OR Web-based virtual reality OR Web-powered virtual reality OR Web virtual reality OR Desktop virtual reality OR 2D virtual reality OR Immersive web OR Metaverse OR Metaverse-based OR Metaverse-powered OR Immersive learning) AND (Language learning OR Second language OR Foreign language OR Language learner OR Language education OR Language teaching)