Extended reality (XR) in language learning: Developments and directions

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Introduction

Recent years have seen growing interest in extended reality (XR) in education, covering the spectrum from virtual reality (VR) to augmented reality (AR), and including mixed reality (MR) which is sometimes understood as equivalent to AR and sometimes as equivalent to XR. VR offers potential for contextualized, interactive learning embedded in fully digitally simulated environments (Lan, 2020a). AR offers similar learning potential but embedded in real-world environments overlaid with digital data. In a broad definition, AR refers to the dynamic presentation of contextually relevant information and communication channels in a real-world setting, while in a narrow definition, it refers to the direct superimposition of these channels on our perceptions of the real-world setting, with the broad and narrow definitions increasingly merging as the technology advances (Pegrum, 2021). It is important to note that while AR most commonly adds digital data to our perceptions, it may also digitally hide real-world data from our perceptions, and in fact it can do both at the same time (Wen et al., this issue). Depending on the hardware used, XR interfaces may currently be experienced less immersively and directly (e.g., on the screen of a smartphone) or more immersively and directly (e.g., through a headset), with an apparent move towards greater immersiveness and directness. Today’s discussions of XR may well connect in time with technology industry proposals for a worldwide metaverse.

Evidence has already begun to emerge of the language learning value of VR (e.g., Alfadil, 2020; Lan, 2020b; Lan et al., 2015), with research suggesting that social interaction in immersive VR is particularly effective in improving learning outcomes (e.g., Li & Lan, 2022). Evidence has also begun to emerge of the language learning value of AR (e.g., Chang et al., 2022; Parmaxi & Demetriou, 2020), with one notable early trend being towards the deployment of AR language learning trails grounded in digitally supported real-world immersion (e.g., Pegrum, 2019a, 2019b). However, with a number of studies suggesting that XR benefits some aspects of language learning more than others (e.g., Reinders et al., 2015; Wang, 2017; Wang et al., 2020; Wen et al., this issue), much more research is needed into what kinds of content and tasks lend themselves to XR approaches, as well as which learners stand to benefit most (Buchner & Kerres, 2023; Hockly, 2019; Lan, 2020a). One area of particular interest is applications of XR for learners with special educational needs (e.g., Lan, 2020b; Lan et al., 2018; Lan et al., in press). Another notable research area is students’ own creation of XR content or contexts to develop their agency and autonomy, and to support their own and others’ learning (e.g., Pegrum, 2019b; Yeh & Lan, 2018; Yeh et al., 2018).

Some benefits may vary as we move along the XR spectrum. VR may have a role to play in supporting telecollaboration, COIL (collaborative online international learning) or VE (virtual exchange) projects, such as by facilitating negotiation of meaning through embodied L2 communication (Chen & Sevilla-Pavón, 2023), by enriching digital storytelling exchanges between distant students and, broadly, by helping students build intercultural awareness and empathy for diverse others (Godwin-Jones, this issue; Taguchi, this issue). It may also have practical advantages over AR in an era of remote teaching and learning such as during the COVID-19 pandemic (Kukulska-Hulme, 2021). AR, by contrast, may help students leverage
the linguistic richness of everyday urban landscapes where multiple languages and dialects are in play, and where translanguaging may come to the fore; but it may also hide real-world distractions to focus students’ attention more narrowly on key information. Other benefits, perhaps intertwined with challenges, may be common to the whole XR spectrum: 3-dimensional multimodal immersive texts add considerable complexity to the creation, interpretation, and exchange of meanings we are used to in 2-dimensional multimodal texts, thereby both fostering and necessitating students’ development of new literacies such as immersive literacy or, more specifically, XR literacy (Pegrum et al., 2022).

In this Issue

Given the recent excitement around the potential of XR for language learning, it was perhaps unsurprising that our call for papers in October 2021 led to the submission of 41 abstracts. However, after a rigorous review process, only two empirical papers have been included in this special issue. It seems that although the use of XR in language learning is a hot issue, there is still a lack of empirical research with solid theoretical foundations and multifaceted supporting evidence. The two empirical articles are accompanied by an extensive review of the spectrum of XR for language learning in Robert Godwin-Jones’ regular Emerging Technologies column.

The first paper focuses on AR annotations and filters. In Restructuring Multimodal Corrective Feedback Through Augmented Reality (AR)-enabled Videoconferencing in L2 Pronunciation Teaching, Wen, Li, Xu, and Hu describe the development of a multimodal corrective feedback model for pronunciation which captured and juxtaposed learners’ articulations of target sounds with videos of native speaker articulations. Taking into account multimedia design principles (see e.g., Mayer & Fiorella, 2022), the model utilized AR filters to reduce extraneous cognitive load by hiding inessential facial movements, as well as AR annotations to focus learners’ attention on essential movements. In comparing an experimental group of university-level Chinese learners of English with a control group taking an offline multimedia corrective feedback class, the authors found that the experimental group improved significantly more in producing the English dark /l/ consonant, which is challenging for L1 speakers of Mandarin; they suggest that this shows AR for subtraction of unnecessary information may be “the best addition to L2 learning” (p. 99). At the same time, they found that the control group improved their auditory identification of the dark /l/ as well as the dental fricatives /ð/ and /θ/ more than the experimental group, showing that different teaching modes are appropriate for different tasks, and indicating that AR cannot necessarily be expected to serve all language learning purposes. Despite some technical and other issues, students reported that the AR model helped them focus their attention and improved the efficiency of their learning.

The second paper focuses on immersive VR. In Using Immersive Virtual Reality for the Assessment of Intercultural Conflict Mediation, Taguchi describes the use of 360-degree videos accessed on VR headsets to develop US university students’ intercultural competence, with a specific focus on intercultural conflict mediation. Following a pre-task where students observed a conflict in a 360-degree video and attempted to mediate it on the spot, they engaged in two conflict mediation classes, and then repeated the VR task with a different 360-degree video. Significant improvements were observed from pre-task to post-task on the five dimensions of social initiative, empathy, perspective-taking, solution, and clarity in discourse. Importantly, student survey responses indicated that they generally found the immersive VR realistic and lifelike, and that it evoked feelings of discomfort and intensity; this prompted them to engage in mediation, putting newly learned skills into practice in the post-task. Unlike more traditional questionnaire-based approaches to intercultural competence, immersive VR allows for situated learning experiences and performance-based assessments. However, as one student noted, the mock nature of the activity reduced her potential anxiety in carrying out the task, leading the author to remind us that “virtual reality is only realistic, and it is not real” (p. 124). The author concludes that VR simulations may provide practice opportunities in such a way as to support the eventual transfer of learning to real-life settings.

In his Emerging Technologies column, entitled Presence and Agency in Real and Virtual Spaces: The Promise of Extended Reality for Language Learning, Robert Godwin-Jones presents a broad survey of
current uses as well as the potential and limitations of XR for language learning. AR, he notes, is more accessible than VR because it can simply be accessed on today’s widely available smartphones, but its main educational usage remains vocabulary learning or guided tours. More interactive options include learning trails or location-based gaming, with students typically responding positively to the opportunity to co-construct AR experiences. VR has developed in several waves, with the most recent wave, encompassing today’s multimedia roleplay and vocabulary apps, unfortunately lacking the collaborative and creative ethos of earlier waves. Godwin-Jones goes on to illustrate some of the potential of VR for personalized, constructivist development; collaboration; experiential learning through simulations; virtual exchange and cultural learning; kinesthetic learning; and supporting students with special needs. There is clearly scope for educational projects which more fully explore the language learning potential of both AR and VR, emphasizing agency, presence and copresence, and creativity within complex linguistic settings. There is equally scope for research studies with larger numbers of participants and longer durations. The future may well belong to mixed reality devices which allow a blending of AR and VR, with generative artificial intelligence (AI) offering some promise for less scripted chatbot interactions and more personalised, adaptive learning.

Conclusion

We hope that the current small but informative issue will spur more researchers to conduct studies in the emerging area of XR in language learning. In particular, we hope to see studies built on clear theoretical foundations and grounded in extensive reviews of the existing literature. Empirical studies are needed based on solid research designs which go beyond the collection of self-report data, and which involve randomized controlled trials with multimodal evidence to improve their validity and broaden their applicability. Moreover, studies are now needed with larger groups of learners and over longer durations than we have seen in much of the early educational XR research. It is already apparent that AR and VR are not appropriate for all aspects of language learning, but in areas where they can make an impact—from teaching pronunciation through to honing intercultural competence—their potential benefits may be substantial for a wide range of learners with a wide range of needs. Importantly, given the emergence of generative AI and its likely impact on language education, educators and researchers may wish to consider the possibility of judiciously combining XR and AI to produce effective and varied language learning experiences and prepare learners for future workplaces.

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