Immersive Learning in Virtual Reality

Amelia Ijiri

Kyoto Institute of Technology, Japan

Abstract

The 2020 online pilot of classroom instruction for digitally mediated worlds created interest in online learning environments. One emerging interest is VR education. Subjects such as microbiology, oceanography, and anatomy are engaged due to the use of 3-D objects and presence. By positioning itself in the next wave of virtual reality classrooms, this case study offers constructive and practical analysis for educators designing language learning activities in the metaverse. From the perspectives of an instructional designer, university language instructor, and adult language learner, this paper will address the affordances that work well in virtual reality (VR). Affordances such as virtual field trips (VFT) and using 3-D objects, both as ready-made assets and hand-drawn with tools. We will discuss why they are used and the advantages over a traditional classroom setting. Concrete sequences of learning objectives will offer insights into building a curriculum in a virtual environment. Then we will briefly cover some of the concerns surrounding biometric harvesting for profit. Lastly, there will be take-away solutions such as using VR stations or Web VR (browser-based experiences).

Keywords: *[Virtual Reality, Immersive Learning, Digital Language Learning, VR Education]*

1. Introduction

Virtual Reality (VR) allows us to interact and inhabit worlds in a way that “feels more compelling than any other technology previously devised” [1] (Bailenson, 2018, p.161) and “psychologically more powerful than any medium ever invented and is poised to dramatically transform our lives.” (Bailenson, 2018, p. 89). VR creates a digitally simulated world, sometimes referred to as the Metaverse. The Covid-19 pandemic brought more digital technologies into our lives and a growth in VR for education. As Educators adopting new and emerging technologies to close the lag between our practices and theories for learning and teaching second languages in the digital era, the study of Digital Language Learning (DLL) emerged as an educational practice and field of scientific study. This paper is a broad overview of the benefits of learning in immersive environments and practical guide for implementing VR in a second language learning context.

DLL (Digital Language Learning) is broadly defined as technology-based or technology-enhanced language learning platforms or tools, or the practices of learning using such platforms or tools [2] (Li & Lan, 2021, p.1). Among DLLs, VR technology is of interest because of its significant potential and impact on student learning in many educational contexts (see Li, Legault, Klippel & Zhao, 2020; Liu, Dede, Huang & Richards, 2017). Unlike adding 3D to movies or color to TVs, VR is an entirely new medium with its own characters and psychological effects (Bailenson, 2018, p. 153).

2. VR Affordances

VR’s affordances (features that make the context conducive to learning (Li & Lan, 2021, p. 7), on cognitive, social, and affective dimensions enable first language (L1)- like representations in the second language (L2) using interactive and socially relevant contexts and multimodal, multisensory information (Li & Lan, 2021, p.11). This benefit of VR learning means key language areas of the brain –the contributions of the right hemisphere to learning plays a much more important role than previously

thought in adult L2 learning (Li & Lan, 2021, p. 12) -- are neurally connected to create embodied semantic representations. The embodied cognition hypothesis allows us to see why immersive learning is fundamentally different from traditional classroom-based, translation-based, and teacher-centered L2 learning; in Virtual Reality Environments (VREs) learners can see, point to, pick up, and move objects and simulate the corresponding actions which enable a child-like learning process (Li & Lan 2021, p.1). Educators, researchers, and corporations are considering the best practices for immersive learning in VR.

The Cognitive Affective Model of Immersive Learning (CAMIL) is a proposed research-based theoretical framework for understanding learning in immersive environments. CAMIL identifies presence (the feeling of "being there" [3] (Ijsselsteijn, W., & Riva, G. (2003) and agency (feeling of generating and controlling actions to influence events) [4] (Makransky and Petersen, 2021, p. 943) as the two general psychological affordances of learning in Immersive Virtual Reality (IVR) (Makransky and Petersen, 2021 p. 937.) IVR-based lessons lead to learning outcomes including interest, motivation, self-efficacy, embodiment, cognitive load, and self-regulation. (For more in-depth information, please refer to Makransky and Peterson, 2021.)

How can VR be manipulated to deliver immersive learning experiences? If we are to inhabit new worlds, how should we contextualize them? How can VR be explored for positive, lasting, transformative experiences? This paper considers how educators can create meaningful learning experiences. First, we will discuss two types of VR experiences for the virtual classroom. Another type, CAVE (VR in a room-sized cube), is outside the scope of this paper.

VR purists would argue that presence and immersive learning happen during fully immersive experiences that block out other surroundings while wearing headgear (Bailenson, 2018, p.112). Head-mounted devices (HMD) with 6 Degrees of Freedom (DOF) embody VR's sine qua non, psychological presence, in a way that no other medium can and is more advanced than previous 3 DOF HMDs. Educators have little trouble accepting the original flight simulator as a viable learning application that mediated the risk of training pilots. VR would function in language learner simulations. The learner is in a position of autonomy (also called agency), and although real-world systems are used, the cost of error for participants is low, protecting them from the severe consequences of making mistakes.

Choreographing a flow of experiences [5] (de Frais, p. 1) that create learner autonomy aligns with exploratory learning. Virtual experiences, used by astronauts, soldiers, and surgeons, benefit from life-like experiences that build "muscle memory," an important training program for split-second decisions (Bailenson, 2018, p. 388).

In virtual language learning classrooms, the environment and 3D objects (assets) create an immersive learning experience to elicit presence and autonomy, claiming enhanced learning and increased motivation and engagement [6] (Alizadeh, 2019, p. 23). Educators creating immersive learning environments should decide which 3D environment and 3D objects bring out the most opportunities for language immersion through interest, motivation, self-efficacy, and embodiment. Spatial navigation using Virtual Field Trips (VRT) and Virtual Environments creates an atmosphere in simulated reality in two separate ways, both integral to designing curricula for immersive learning.

3. Immersive learning

Virtual Field Trips (VFT) are 360 high-resolution videos often showing presence through narratives. Placing language learners in fantasy or real landscapes, such as a hotel, airport, or restaurant in the target language's country. Students in HMDs can turn their bodies to see 360 degrees around them. For studying the Japanese language in context, for example, the language needed to order sushi having the ambiance of the environment makes simulation-based experiences quite different from a role play written in a textbook. The video can be paused, questioned, and reflected upon. In virtual field trips, students cannot manipulate the world around them; thus, we can consider this less immersive learning.

3.1 Environments

In Virtual Environments, a world is created or imported from a library into a virtual environment in which the students, as avatars, can walk, jump, and run through the space. Any sounds or lighting must be created. Pre-made environments are available, for example, on the Engage platform. This environment enables student participation and interactive learning using kinesthetic movement to explore and discover.

3.2 Assets

The second tool to create immersive experiences is the use of 3D objects or assets. The manipulation of objects by the learner's VR avatar or having the learners wear haptic gloves, which further give the illusion of touching a virtual object by providing texture and cold/heat –gives students agency and is important for DLL to enable more student participation and interactive learning. (Li & Lan, 2021, p.7). Using the Engage VR platform, importing (bringing 3D objects into the virtual environment) is accomplished by using a virtual tablet accessible on a VR wrist controller. Educators can select from premade 3D objects from a library or create and draw their own. 3D objects make the lesson interactive. Students can enlarge the object to walk through or shrink it to pass to each other. Learning objects that previously were illustrations in a textbook can now be walked through or manipulated. Choreographing a learning sequence to allow exploration by having students touch objects as they experience the language in context is like L1 learning. In a 3D environment, for example, the vocabulary for "dog" will be remembered visually, cognitively, and emotionally, a much richer experience than reading the translation in text. Even with the graphics of today, the experience is believable, and the graphic richness of VR is poised to become even better and more affordable as tech companies enter VR education. With this movement, there are also concerns.

4. Drawbacks and future directions

In conclusion, as broad as the frontier is for VR, so is its potential misuse. Right now, Meta, formerly known as Facebook, is requiring a login to use their commercial, mass-marketed $299 headset, the Oculus Quest 2. Once users are inside the headset, biometric data, for example, eye movement and mannerisms are calibrated to your body. A big data deluge could be harvested and sold to advertisers [7] [8] (Frehlich, 2020, 2021, 25:00). There are significant gaps between the tools that tech companies develop and the needs of learners and instructors (Li & Lan, 2021, p.1), so issues such as for-profit biometric harvesting give pause to some educators. However, some educators would argue that learners' biometrics could also be used positively for personalized learning experiences based on individualized feedback (Li & Lan, 2021, p. 2). As much as good VR could contribute to society, it also has the potential to contribute to physical and mental health issues, detrimental effects on culture, addition to fantasy worlds, porn, and video games (Bailenson 2018, p. 89). Additional concerns for educators are equipment cost and demands on prep time.

Equipment cost and performance are topics educators consider when committing to VR. One solution is to have several HMDs as a learning station (Frehlich, 2021, 30:30) or use Web VR. Web VR lessens the immersion, but learners report less motion sickness and eye strain viewing IVR on their computers [9] (Hawkinson et al., 2021, 46:00). Some VR platforms such as Engage or Frame.io can include both users wearing an HMD and/or participating on a computer. These platforms also have ready-made assets and environments. How DLL –AI, big data, and VR–work to shape language instruction for learners and educators is poised to be one of the pivotal pedagogical discussions of the decade.

References

[1] Bailenson, J. (2018). *Experience on Demand: What Virtual Reality Is, How It Works, and What It Can Do*. [Kindle Version] W. W. Norton & Company.

[2] Li, P., & Lan, Y.J. (2021). Digital Language Learning (DLL): Insights from Behavior, Cognition, and the Brain. Bilingualism: Language and Cognition, 1–18.

[3] Ijsselsteijn, W., & Riva, G. (2003). Being there: The experience of presence in mediated environments.

[4] Makransky, G., Petersen, G.B. The Cognitive Affective Model of Immersive Learning (CAMIL): a Theoretical Research-Based Model of Learning in Immersive Virtual Reality. Educ Psychol Rev 33, 937–958 (2021). https://doi.org/10.1007/s10648-020-09586-2

[5] de Freitas, S. & Neumann, T. (2009) The use of 'exploratory learning' for supporting immersive learning in virtual environments, Computers & Education, 52:2, 343-352 (2009). https://doi.org/10.1016/j.compedu.2008.09.010.

[6] Alizadeh, M. (2019). Virtual reality in the language classroom: Theory and practice. CALL-EJ, 20(3), 21–30.

[7] Levin, A., (2021, March 29) [Lesson: Impossible - An Exploration of Educational Innovation] Agent Craig Frehlich https://lessonimpossible.podbean.com/e/agent-craig-frehlich-virtual-reality/

[8] Frehlich, C. (2020). Immersive Learning: A Practical Guide to Virtual Reality's Superpowers in Education. Rowman & Littlefield.

[9] Hawkinson et al. (2021 Nov 9-11) [Immersive Media Design Showcase] MediAsia2021 - The Asian Conference on Media, Communication & Film (MediAsia) (iafor.org)