



The rise of immersive learning

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I have given a few keynote addresses on immersive learning and I noticed that there is so much hype about the benefits of this emerging technology that users may be over-buying into the possibilities. This article is a summary of my talks and hopefully provides some clarity and pragmatic thoughts on the application of immersive technologies from the perspective of learning and teaching.

Growth of Immersive Technology

A quick survey of the immersive technology industry reveals the extensive growth potential. It is little wonder that this industry is in hyper-optimism mode. Gartner leads the pack rating immersive technology or experience as a top 10 strategic technology.

In the Future of Work survey conducted by the World Economic Forum, almost 60% of companies surveyed indicated the likelihood of adopting immersive technology by 2022.

Looking at the number of launches in the immersive technology space in the first six months of 2019, it is not difficult to understand the hyper-optimism in immersive learning. Perhaps, arguably the most exciting new development is the launch of Microsoft's HoloLens 2. Purportedly to be a quantum leap from its first iteration, HoloLens 1, Microsoft is positioning this new device for industrial training and institutional learning.

Then there is Magic Leap, touted as Microsoft's potential contender in the mixed reality space. While it has some uniqueness, the start-up seems unclear about its development plans and how it will take on the tech behemoth, Microsoft.

And there is Nreal, a start-up that came out of nowhere (actually, they are from China). The device looks sleek, light-weight and seemingly easy to access. The feedback from the various tech observers has been largely positive. I find the value proposition of tethering to the users' mobile phone to access immersive content on the phone a big plus. I did not have the opportunity to have hands-on experience with this device and I have been asking my friends in the immersive tech industries for their feedback. This is another newcomer on my watch list.

Just in case you get too carried out by the glitzy new techs, let's stay focused on our discussion on whether these techs really help in learning. But first of all, let's clarify all the terminologies – VR, AR, MR and now there is XR (goodness!).

The Science of Immersive Learning

Before we get into the hard science of learning, let's clear the confusion of the various immersive technologies. It does not help those who are new in this field and who are bombarded with all these terms. Milgram and Kishino (1994) were the first to describe Mixed Reality as involving the blending of real and virtual worlds somewhere along the "reality-virtuality continuum" (RV) which connects completely real environments to completely virtual ones. Virtual Reality (VR) uses technology to immerse a person in a completely computer-generated world and remove them from reality. In this way, VR is different from its cousin, Augmented Reality

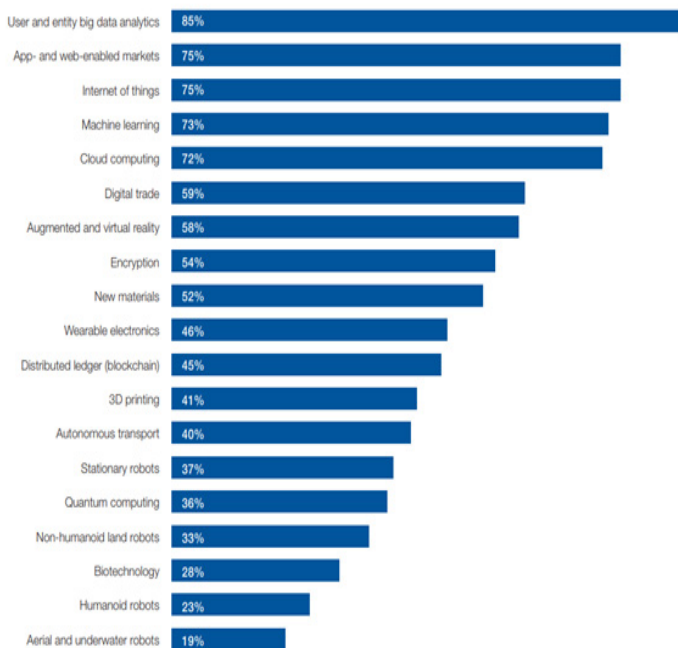


Figure 1: Technologies by proportion (Milgram & Kishino, 1994).

(AR), which aims to seamlessly superimpose virtual imagery over a user's view of the real world. I think this continuum sufficiently clarifies the myriad of terms in the market and should put to bed the description of immersive technology.

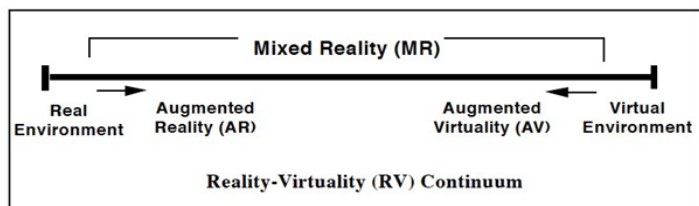


Figure 2: The reality-virtuality continuum (Milgram & Kishino, 1994).

The science behind the effectiveness of immersive learning is two-pronged – the sense of **presence and cognitive embodiment**.

The Sense of Presence or the feeling of being in the Virtual Environment is a complex mental mechanism that is strongly linked to our emotional reasoning abilities. Barfield et al. (1995) define presence as “the participant’s sense of ‘being there’ in the virtual environment” while Lombard & Ditton (1997) propose to interpret presence as “a perceptual illusion of non-mediation”; presence is what happens when the participant ‘forgets’ that his perceptions are mediated by technologies. Rita Lauria (1997) suggests an iteration with psychological knowledge and philosophic analysis: “psychology is the physics of VR in the sense that the virtual environment is manufactured towards creating a cognitive state”. Simply put, the sense of presence in the virtual environment enables the person to be “fully” and “deeply” absorbed in the virtual environment.

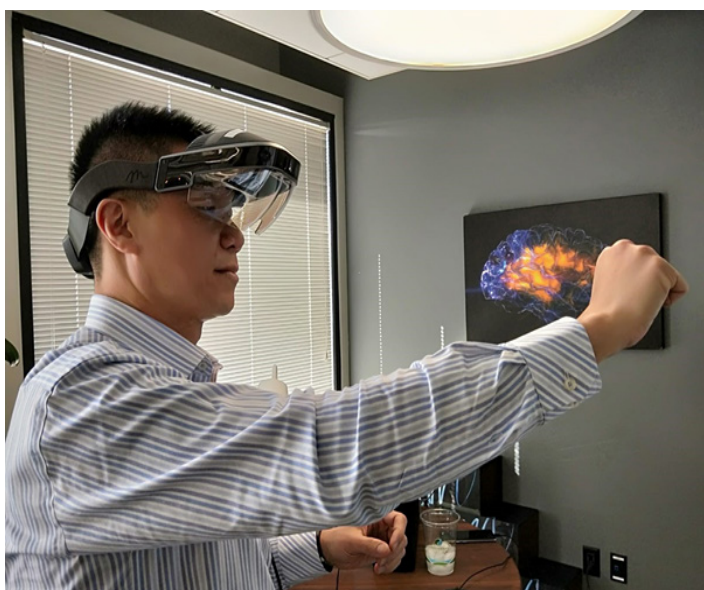


Figure 3: The author in a virtual environment.

The second tenet is the sense of embodiment. Embodiment is the representation of knowledge and concepts through bodily activity, and it is a potent force for learning (Abrahamson & Lindgren, 2014; Alibali & Nathan, 2012; Glenberg, Gutierrez, Levin, Japuntich & Kaschak, 2004; Goldin-Meadow, 2009). There is an increasing body of literature focusing on instructions that integrate meaningful connections between bodily movements with learning in various domains (Liden, Kastens & Christensen, 2011).

Developments in embodied learning are further supported by the emergence of immersive technologies that are compatible with natural movements such as gestures, touch and body positioning. Research indicates that these immersive technologies bear great potential in enhancing learning (Chang, Lee, Wang and Chen, 2010; Johnson-Glenberg, Birchfield and Uysal, 2009; Hughes, Stapleton, Hughes & Smith, 2005).

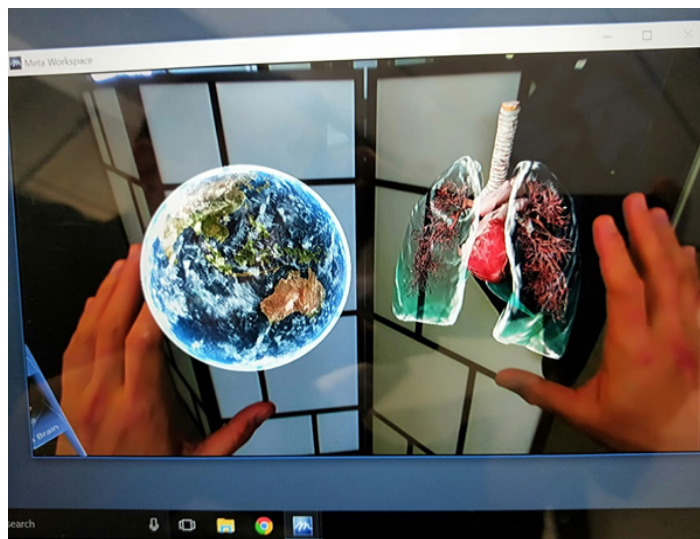


Figure 4: The author's view of the virtual environment

While there is still a lot of work to be done in the research in immersive learning, we have the assurance that immersive learning is backed by real science. When the technology is appropriately utilised by an experienced learning designer, I think immersive learning can yield much more than just better learners' engagement in class.

The Learning Design of Immersive Learning

There are many different types of pedagogies that could drive the use of immersive technologies for effective learning. I can think of Place-based Learning, Scenario-based Learning, Project-based Learning and many more. For this article, I am focusing on Situated Learning because it lends itself to both industry training and learning in Higher Education. Dede (2009) asserts that immersion is a subjective impression that one is participating in a comprehensive, realistic experience. Therefore, immersion in a digital environment can enhance learning in three ways:

- Multiple perspectives
- Situated learning
- Transfer

Multiple perspectives

The immersive digital environment can be developed to toggle between different views. The ability to change one's perspective or frame of reference is a powerful means of understanding a complex phenomenon (Dede, 2009).

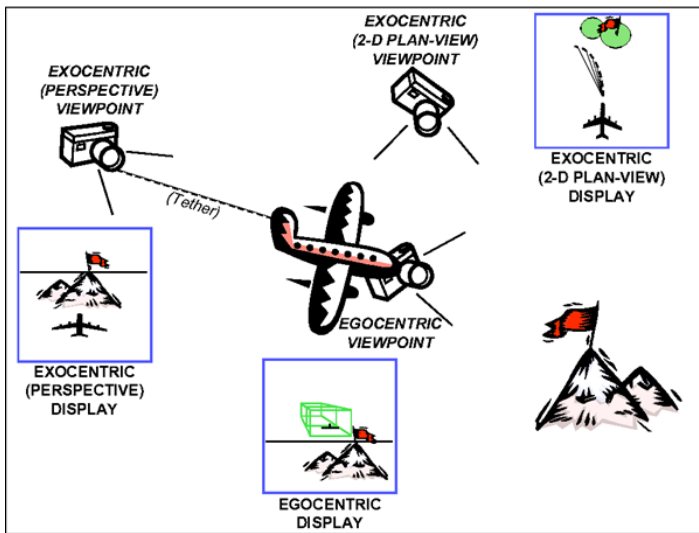


Figure 5: Multiple perspectives (Foyle, Andre, & Hooley, 2005).

Situated learning

Situated learning requires authentic contexts, activities, and assessment coupled with guidance from expert modeling, mentoring, and "legitimate peripheral participation" (Clarke & Dede, 2007). Situated learning is a powerful pedagogy seldom used in classroom instruction because arranging complementary, tacit, relatively unstructured learning in complex real-world settings is difficult. However, immersive interfaces can draw on the power of situated learning by enabling digital simulations of authentic problem-solving communities in which learners interact with other virtual entities (both participants and computer-based agents) who have varied levels of skills.

Transfer

Transfer is the application of knowledge learned in one situation to another situation and is demonstrated if instruction on a learning task leads to improved performance on a transfer task, ideally a skilled performance in a real-world setting (Mestre, 2002)

Immersive Learning is Expensive?

'An organisation needs to put up a substantial amount of investment to start immersive learning' – this is but a myth that some immersive technology vendors like to sell. There is a full spectrum of learning solutions available to users. One can start with VR360 images and videos coupled with educational apps that enable annotation of content for learning. That's a low cost way to get started and this option even allows learners to demonstrate their learning by creating VR360 content. More importantly, we need an appropriate pedagogical framework to guide the use of immersive technologies like any other educational technologies. Our learning design team has recently designed a pedagogical framework and developed VR360 content for our courses. The following diagram sums up the possibilities.

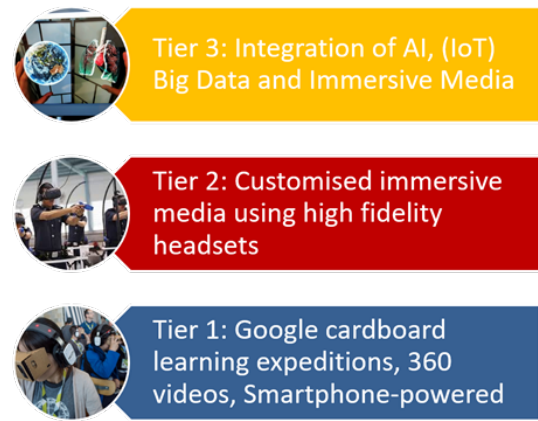


Figure 6: A pedagogical framework for immersive technologies.

Conclusion

While I am excited about the possibilities that immersive technologies offer to improve learning, like any technologies, they have to be used with great care in order to ensure that they really support learning. Also, a learning designer seldom just uses one technology to accomplish the desired learning outcomes. Creating contents for immersive learning is not always expensive and does not necessarily require complex coding. There are low-cost, scalable alternatives that teachers/trainers can create on their own without coding, while there are also highly sophisticated 'Ironman-type' high tech solutions.

In explaining what is possible for the future, I tend to use the Ironman analogy to explain this - Tony Stark (Ironman) can become the legendary Ironman because he puts together a spectrum of technologies. Chief of them is Jarvis (his Artificial Intelligence) that helps him to manage multiple tasks. Similarly, there is potential in integrating immersive technologies with IoT, Big Data Analytics and AI to produce learning outcomes that is previously not attainable. For me, I am most happy to bring together a multi-disciplinary team to make this happen when the opportunities arise.

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