Creating Effective Virtual Reality Learning Experiences: Lessons Learned

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Abstract: VR is an effective tool that can be used to augment skill-based learning by fully immersing the user in the virtual environment with a hands-on experience. However, there are certain aspects to consider when using VR for training.

1. VR for Training

We belong to age of rapid technological advancements due to which the daily needs of life like clean water, reliable roads, high-quality health care, dependable electricity, telephones, and email etc., have become an inherent and essential part of our lives. However, this easy access to the key elements of daily life had made us complacent and we have turned a blind eye to the needs of the critical infrastructure sector and have started to take it for granted. The impact of the recent global pandemic was massive, and it validated that there is a lack of emergency response preparedness in terms of manpower supply and critical infrastructure security.

The critical infrastructure interdependencies of this sector makes it even more imperative that we focus on the current and future pipeline of talent to ensure the continuous services of these sectors. The pandemic was rude awakening to the fact that we do not have an ample pool of motivated talent for the sector, nor are things in place to create a future talent pipeline. Furthermore, the pandemic and lock downs deprived those employed, from attaining job license required trainings, as these were mostly in-person trainings that could not happen. There was ardent need for an alternative solution of equipping the workforce with the required job essential knowledge and skills. One of the best alternatives found, was to use the new immersive technologies like Virtual Reality (VR), to train the workforce, without need of being in an in-person classroom.

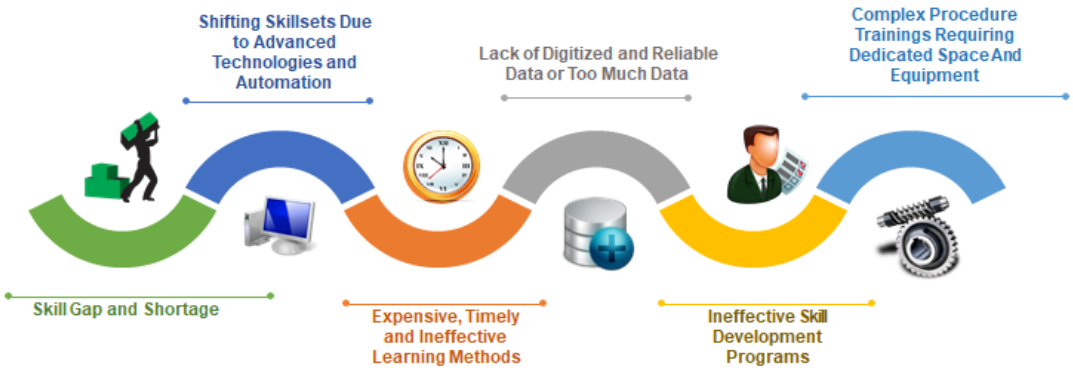
Workforce training on various essential occupational skills is vital to maintain continuity of services provided by the organizations like utilities, transport medical etc. Training albeit a crucial element, has never been an easy task to accomplish. It requires time away from work, expenses like travel, boarding, lodging, etc. Then, the trainee must learn the skill and retain this knowledge for application. This is where virtual reality can bridge the gap by virtue having the trainee fully immersed in the learning environment, anytime and anywhere. It removes the need for travel, boarding, lodging and other expenses, plus the trainee may practice at will, anytime and anywhere.

Another major benefit of using an immersive technology like VR is that it has the ability to rewire the brain along with enhancing neural connections that are needed for learning and memory. This is because when fully immersed in the virtual environment, the learner performs the task as they were meant to be performed in real. This helps in the learner to pick up the skills faster and retain such skill knowledge as well. Three researchers from the University of Maryland, Eric Krokos, Catherine Plaisant, and Amitabh Varshney, conducted a study and concluded that participants scored at least 10% higher in recall ability when trained via a training designed in the VR environment.

Virtual Reality has numerous possibilities (See Figure-1). It provides immense benefit for training in high-risk environments that involve safety and related concerns. In this situation the skill is important, and the lack of proper training skills could be the cause for major issues like, the health of the public due to water contamination. One such environment is the water and wastewater utility sector. Water is life and it has a part in everything we do. From making coffee to cooling reactors, its importance cannot be denied. However not a lot of youth know about, or strive to be in this sector, causing a deficit in future talent (skilled labor) required for continuity of sustainable operations. The ones that are currently employed are either putting in a lot of extra hours or are not properly trained and ready to take on duties without supervision or are retiring.

Sixteenth Conference on Education and Training in Optics and Photonics: ETOP 2021,
edited by A. Danner, A. Poulin-Girard, N. Wong, Proc. of SPIE Vol. 12297, 122971J
© 2022 SPIE · 0277-786X · doi: 10.1117/12.2635556

Figure 1 Situations where VR training is a good option



Assessing this major gap, and wanting to contribute to the solution, XR 2 LEAD was established in 2019. XR 2 LEAD globally provides modeling and simulation solutions using emerging technologies like Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), Machine Learning and AI powered Digital Twins. There are two main areas of focus, one is the utility sector (critical infrastructure), and the other is defense and national security. XR 2 LEAD is a major player in the AR/VR based learning solutions landscape. Despite still being a start-up, XR 2 LEAD has taken on a social impact role at the level of the World Water Council, as a member of the action committee to empower the water sector with best practices being accessible via an international learning platform. As for the defense sector, some of the major projects include a multi-user training simulation to supplement training embassy security agents, an augmented reality medical trainer for mobile devices and currently working with the utility sector to revamp the learning material for licensure examinations.

Developing VR Trainings: Lessons Learned

There are several key lessons learned while designing learning content for VR based trainings. Some of the key factors to take into consideration are:

Lesson 1: Select an appropriate VR environment.
Some of the main aspects to consider when designing a training in VR is the environment. This is the place seen inside the VR headset. It is important that the client understands the importance of moving past the "wow" factor and taking into consideration the main intent of the training and the objectives. A very high fidelity and realistic scenario may be appealing but it would be time and money going to waste if the learning objective does not require it. For example. If the VR simulation is to teach a student on how to fly a drone, then the skills and steps for flight and safety would have precedence over a fancy environment where the drone will be seen. The main point is that VR can be used, but it is adding any value?

Lesson 2: Manage Expectations
When speaking with the client on the VR training aspects, it is imperative to ensure that communication is clear, and they have an idea of what they will receive as an end product. Managing expectations at this stage id very important so they know exactly what will be delivered. At times, the wow factor comes into play and tends to overcast a dark shadow in the main objective of the VR training. It sis important to discuss and prepare the client on what they will receive (e.g., type of headsets) and what they will see and experience.

Lesson 3: Blended Learning Approach
Instructional designers are fully aware of the importance of acquainting the learner with the content and context, before diving into practicing in VR. Since every learner is different, it is important to ensure that the content is available in a variety of formats, to cater to everyone's learning style. Therefore, VR should not be a standalone format for any training. Another aspect is that some may not be comfortable using the VR headset and request an alternative. Others may be weary of the germ factor, especially in COVID times. Others may not want to ruin their hair, make it sweaty or are just not comfortable with this method of learning. There is also the issue of some people getting motion sickness or dizzy from using VR. Therefore, having the content available in a blended learning format can cater to all these issues.

[1] Krokos, E., Plaisant, C. & Varshney, A. Virtual memory palaces: immersion aids recall. Virtual Reality 23, 1–15 (2019). https://doi.org/10.1007/s10055-018-0346-3