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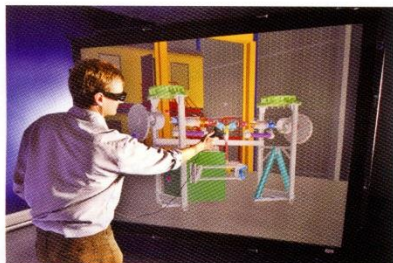


Virtual reality training for oil field workers

BY GARY BEERS • FOR ENERGY PIPELINE

Hands-on, first-person training is a long-standing basis for effectively learning a work assignment. With the recent advances in computer technology, this becomes more certain if the hands are on an electronic device that is the key into work assignments in a variety of simulated situations.

During the past decade, there has been an explosive, diverse boom in providing interactive, electronic environments for learning which can be cast along a continuum (Table 1). One of the obvious advances is the placement of the worker, as an avatar, in a virtual work environment. However, the mixed reality developments for learning environments are laden with promise



for highly-productive training. The reason is that the worker's specific real environment is the foundation for layers of virtual enhancements and, thus, the ability to create custom work situations – both expected and unexpected.

Additional information on mixed and virtual reality learning environments is provided below with examples.

AUGMENTED REALITY

As the worker conducts an assignment in a real environment, overlays of information on key objects and conditions in this environment are seen through computer-aided glasses and the worker

can use this information to adjust his actions in completing the assignment.

While not related to oil fields, an excellent example of how AR works in assisting the pilot of a small plane is available online (<https://glass.aero/>).

AUGMENTED VIRTUALITY

Basically, a computerized image is placed in a real environment which can be seen from any angle by users equipped with special glasses. The image is dynamic and can be modified by the users.

While an example from the oil and gas industry was not located, a popular example from the field of human anatomy can be accessed online (<https://www.youtube.com/watch?v=SKpKlh1-en0>). Also, there is a fun and fantastic example involving a whale hologram leaping out of the floor of a basketball court which is accessible online (<https://www.youtube.com/watch?v=HXymc-X4Cy4>). You may think "Pokémon Go" is an example of augmented reality since these computerized creatures are placed in real environments and can be seen from any angle when located on an iPhone. However, professionals in the field concluded that this application does not meet the technical definition (Pokémon Go isn't real AR but could inspire augmented reality development. W. Mansell, January 4 2017, Technology, International Business Times).

VIRTUAL REALITY

VR training immerses the user, as an interactive avatar, in an animated 3-D replica of actual oil/gas facility with a work assignment (Figure 1) Depending on the assignment, the design, specifications, and status of relevant equipment are shown to aid user decisions to complete the assignment. Incorrect decision result in unfortunate consequences to the avatar.

An example of auditing energy isolation via



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"Lockout-Tagout" training at petroleum facility, using VR, is accessible online (<http://optech4d.com/oil-gas>). Unfortunately, this user needs further training due to loss of his avatar as a result of an incorrect decision.

The value of VR-based training is evident in a study carried out by the National Training Laboratory involving helicopter pilot landing on offshore oil platforms. The study concluded that retention rates

Table 1. Continuum of Learning Environments

Real Environment (R)	Mixed Reality		Virtual Reality (VR)
	Augmented Reality (AR)	Augmented Virtuality (AV)	
Physical environment experienced at a moment in time.	Virtual elements as a, instantaneous, overlay to the viewed real environment	Virtual elements are permanently placed in the viewed real environment.	Viewed digital recreation of real environment.

Based on Milgram's Reality-Virtuality Continuum (1994)

for lecture style learning were at 5 %, reading learning rates were at 10 %, while VR simulation learning retention was at 75 %. After deployment of this training, a major oil company projected a \$2 million savings in logistics savings (<http://optech4d.com/case-study/helicopter-landing-officer-hlo-training-simulator-vr>).

DEVELOPERS, PROVIDERS AND LEARNERS

Three trends emerged in 2000 to 2010 that presently form the basis for the quantum shift to virtual learning and the creation of emerging workforce well-trained to learn through hands-on experiences within artificial settings.

The releases of two VR action games ("Call to Duty" in 2003 and "Minecraft" in 2009), fired the launch of a generation of "gamers" - who developed self-taught skills to understand how to interact with artificial problems and other players in a virtual environment. The growth of this trend is amazing and currently involves about 155 million gamers in the US. In 2016, a study by the Entertainment Software Association reported the following demographics:

- 63 percent of households surveyed include at least one frequent gamer.
- 65 percent of homes own a video game-playing device, while 48 percent own a dedicated game console.
- 47 percent of gamers are between 18 and 49 years old.
- the average guy who plays games is 35 years old; the average woman is 44.

- 59 percent of those who play games on a regular basis are men; 41 % are women.

- the average gamer has been playing video games for 13 years

In 2005, the national Immersive Education Initiative was established with a mission to define and develop standards, best practices, technology platforms, training and education programs, and communities of support for virtual worlds, virtual reality, augmented and mixed reality, simulations, game-based learning and training systems, and fully immersive environments such as caves and domes. This nonprofit held the 2016 national conference in Denver. Examples of institutions offering immersive education opportunities in the Rocky Mountain Region are:

- University of Colorado — Immersive Education (iED) Club with National Park Service.
- Shell 3-D Visualization Center at the University of Wyoming.
- South Dakota School of Mines and Technology.
- Computer Science Department at North Dakota State University.
- Biomedical Engineering at the University of Utah.
- Montana State University

Recently, there are unique facilities focused on immersive technology. For example, Louisiana Immersive Technologies Enterprise is the world's first and only data visualization facility. Numerous commercial companies have focused on providing experiential training in real-time using VR with data-driven applications. Examples of the providers include: EON Reality, FuelFX, GeoSafety, optech4d, PetroEd, TigerGeneral, Siemens, Schneider-Electric, and Honeywell Process Solutions. An introduction to the companies pioneering diverse applications of reality technology is available online at www.realitytechnologies.com/companies. Examples of VR products for training oil field workers include:

- Immersive Training for Oil Rigs (<https://hwd3d.com/blog/3d-interactive-tech-talk-immersive-safety-training-for-oil-rigs-chemical/>)

- » Immersive Simulation for Field Operator Training (<https://www.youtube.com/watch?v=rjULyO9E2vE>)

Oil Companies Need to Optimize Use of Mixed and Virtual Reality Training

The emerging work force is trained to learn under AR/AV/VR environments and can quickly develop the complex expertise that will be useful in their technical jobs in the oil field. The oil and gas industry needs recognize this new workforce resource and develop immersive education programs specific to company facilities and operations.. ♦

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