Simulations can range from low-fi, such as a mannequin, to high-fidelity computer software, such as flight simulation. Ziv (2003) classifies medical simulations into five increasingly technical environments:

1. **Low Tech** – models or mannequins
2. **Standardized patients** – actors trained to role-play with doctor trainees
3. **Screen Based Programs** – software designed to train and assess clinical knowledge and decision making
4. **Complex Task Trainers** – software programs that include high-fidelity visual, audio, touch cues, and actual tools similar to a virtual reality
5. **Realistic Patient Simulators** - computer driven, full length mannequins with simulated anatomy and physiology

High tech simulation in the medical industry has become mainstream with the advent of computer driven mannequins (Nosta, 2013). Google glass can now be used to communicate between a top surgeon and a classroom of students remotely, all hands free (Nosta, 2013).

Simulations do not have to contain technology or immerse the student in a virtual reality; deep learning can still occur in low tech but well designed simulations (Misfeldt, 2015; Richards, 2015). A debriefing after the simulation activity can lead to deeper knowledge and understanding (Richards, 2015). The addition of simulations to the many layers of teaching enhances deep learning, but does not replace the teacher; in fact, the teacher is able to focus on more critical thinking concepts and less “nuts and bolts” of how to accomplish a task (Nosta, 2013).

When designing with a simulation as a pedagogical model, it is important to keep in mind the objectives of the training and specific outcomes which can be accomplished. Once outcomes are determined, consider how to “break” or “fix” the problem, and then design for interaction across the spectrum. Combine small activities into a large library to accomplish a larger goal.

Lo-fi simulations, such as practicing on a mannequin, have been used for medical training for centuries (Weintrab, 2015; Ziv, 2003). Simulation training is absolutely imperative in high-risk operations such as flight, military, and medical training (Ziv, 2003; Westerdahl, 2016). Within the military, simulations are used for combat training (Davies, 2016). There is an increase in the call for simulations in teacher training over the last decade.
Simulations

Scenario

Students at a small school in the town of Broughal, Ireland, recently visited a historical landmark for a field trip. They walked around, took notes, and learned about the Clonmacnoise medieval monastery. Then they went back to the classroom and rebuilt the landmark using OpenSim (OpenSimulator) software. Students rebuilt the McCarthy tower, the various buildings, and became intimately familiar with the site in the process. OpenSim is similar to Second Life software, except that it is free and open source. Anyone can create a virtual environment by installing OpenSimulator on their server, configuring it, and then using the software to build their own world. Students took two weeks to build the field trip location with the help of MissionV, an Irish company that provides training and resources for students to create an immersive virtual reality in the classroom. At the end of two weeks of building, their mentor brought an Oculus Rift into the classroom and students were able to walk around and interact with the world they had built. Students were absolutely blown away by the amazing recreation of the site and the massive size of the buildings they had created. As MissionV takes its virtual reality building platform into multiple classrooms, more and more teachers and students are noticing the motivational and deep learning outcomes of creating and then playing in a virtual simulated environment. Students showed intrinsic interest in the process and asked if they can continue to build over the summer. Students had to research the historical site and then work together as a class to build out each section, which involved project management and organizational skills. Students were tasked with performing and filming a re-enactment of a Viking raid on the monastery as their final project. Digital characters had to be designed for the possible avatars to fight each other. Each building had to be reconstructed using geometry to build to scale. Students then had to write a script, practice, perform, and record their re-enactment utilizing their digital characters, similar to an animated movie. The project combined history, geometry, problem-solving, creativity, technology, writing, performing, and visual design skills into a 21st century assignment. Although the virtual environment is not currently connected to other environments, eventually this will also be a possibility for the MissionV classroom. The potential for an interactive simulation of an environment is immense in the world of teaching and training!(Sources: Buckley, 2014; Korolov, 2014; MissionV website at http://www.missionv.ie/about-us/background)

How effective is it?

Simulations have been shown to be effective in controlled study environments. For instance, students showed a significant increase in deep understanding from a simulation game about water conservation (Nussbaum, 2015). The use of simulations in the medical classroom has shown an increase in proficiency while minimizing complications (Westerdahl, 2016). Students who built and deployed a flight simulation apparatus self-reported enhanced team work and communication skills (Aji, 2015). Simulations are realistic, but not always complete. In one study, students who learned with a simulation had a deeper level of understanding, but the control group put forth greater effort and felt more competent (Nguyen, 2015). Although simulations are not real, students consider them to be “realistic” and will transfer knowledge as if the scenario is a part of the real world (Pfefferova, 2015). It is important to put the simulation into context and debrief afterwards in order to make sure transfer occurs accurately (Richards, 2015).

What are the implications for instructional design?

With the advent of virtual reality and the low cost of the Google Cardboard, there is great potential in the training industry for simulations. Industry wide, corporate training hasn’t generally implemented virtual reality because of the large cost in developing a virtual reality environment (Hall, 2016). However, high risk industries have been using simulations for years. Simulations can include a basic walk through of a remote location to a complex order of tasks which emulate a real environment. Utilize a simulation when you have a need to teach a high-risk subject area, you wish to immerse your learners in an alternate environment, or you have a list of tasks which are accomplished through certain steps. Consider using a virtual reality based simulation when you want learners to be “wowed” by the content and to be deeply engaged. Use simulations when one instance is not enough and an action needs to be repeated several times to reach mastery. Simulations can lead to learning outcomes such as mastery of an activity, deep learning of difficult concepts, and internalization of information. Learning technologies include virtual reality software and hardware, e-learning tools, and high tech reactive equipment. Those who can determine a list of activities and develop a simulation library in an industry first to market will find great potential for success.
Simulations

Bibliography:


Simulations

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