Use of Computer Simulations in Distance Education

Computer simulations are essentially representations of real-life systems, situations, or processes modeled for virtual exploration. Simulations can provide students with the means to explore environments that would otherwise be prohibitive, due to factors such as cost, safety, or proximity. Because simulations allow exploration and experimentation, they are more widely being used in Distance Learning, providing students an opportunity for experiential education. According to Heinrich, students exposed to experiential education retain 90% of what they learn (though, I believe this study may be flawed, if it is the same study Dr. Beatty mentioned earlier this semester). Regardless of the numbers, it seems that experience does play a large role in learning and retention, and computer simulations are one way to make experience possible in a distance learning setting.

How Simulations are Being Used Today

Simulations have many applications in today's distance learning environments. In researching this topic, I had the opportunity to read about many case studies, including situations such as:

- Open University (UK) students interacting with a "multimedia computer simulation" offering students an opportunity to participate on a software development team in a realistic workplace setting.
- Computer simulations using Java applets meant to teach nuclear power plant operations (*Chernobyl*), Web based fire safety strategies (*C3 Fire*).
- Computer simulations utilizing teleconferencing intended to involve medical students in activities where the effects of their actions would be seen in real-time, allowing them to explore cause-and-effect relationships.
- Use of virtual reality to treat individuals with phobias, such as arachnophobia.
- An infant simulator (*Baby Think It Over*) intended to teach teens about the responsibilities associated with parenthood.

I also had an opportunity to speak with someone I know who is working on a Master's Degree in Environmental Engineering through National University, a completely online University and Program. Todd mentioned that all of his "labs" are virtual. He appreciated the technology, and felt that according to his real-world experience, the lessons provided feasible substitutes for the environments

that were being simulated. His complaint, however, involved lack of support when problems arose in the virtual environments. When a problem arose, he sometimes had to wait several days before his instructor would reply to his email. Todd's classes all start and end depending on his own schedule, so he is not in a collaborative environment with other students—there is no social element built into the program.

Problems with Simulations

Simulations do not stand alone

Todd's experience exemplifies findings highlighted by Les Lunce in his article entitled Computer Simulations in Distance Education. In this article, the author states "research has shown that, without coaching, the learner gains little from 'discovery learning' from computer simulations." Other case studies have backed up this claim with findings demonstrating that in order for simulation to be applied successfully, it must coexist with coaching, open communication, and feedback. Furthermore, a study by Min concluded that without these supplemental elements, the results of computer simulation could actually lead to ineffective practice.

Simulations are subject to designer bias

Another problem with simulation involve designer bias. According to B.J. Fogg, in his book Persuasive Technology, "although simulations can be informative, engaging, and persuasive, nothing guarantees that they are accurate. The rules built into the system may not be based on the best knowledge of cause-and-effect relationships, but rather on the bias of the designer (Fogg 67)." The author also states "when absorbed in a simulation, people can easily forget that the outcomes are determined by rules defined by human beings who may have injected their own biases into the simulation. The natural inclination is to accept the simulation as true and accurate".

How Simulation has Proven Effective

According to the case studies read in both the Lunce article, and the Fogg's Persuasive Technology, overall students found value in their experiences with simulations, including feedback that involved satisfaction due to immediate feedback, and inclusion of real-world situations. Students tend to enjoy the high level of interactivity that is involved in simulation, which, if nothing else, may positively impact students' motivation to study.

Additionally, case studies have shown that students who used computer simulations scored higher on practical examinations than students who did not. These students returned to the material frequently to work on their skills, and additionally were shown to retain more of what they learned than students who did not participate in the simulations. These successes once again appear to relate directly to the experience principal of education. While early DE may have had unique challenges when it came to applying experiential elements to the curriculum, computer simulation opens up a world of possibilities.

One specific example of a successful use of simulation is the case study referred to early regarding the use of simulation to treat an individual who suffers with arachnophobia from the University of Washington. In this particular study, the subject (whose moniker was Little Miss Muffett) wore a head-mounted display, which immersed the user in a virtual environment. The sessions started by exposing the user to a "spider" that was far away. As treatment progressed, the subject would view spiders closer and closer, and eventually (with use of a cyberhand) was able to touch and pick up the spiders without panicking.

Long-term evaluation for this study included follow-up with the subject. After completing treatment, the individual with extreme arachnophobia had decided to partake in a camping trip in the woods, something she would not have done previously due to the distinct possibility of coming into contact with her greatest fear. This is just one example of how a simulation was successful by changing a behavior and allowing a user to learn (or unlearn) in a safe and accessible environment.

Future Research on Simulations

Because computer simulation is still a relatively new area of study, there is still a lot to learn about best practices and most effective applications. Author Les Lunce suggests that future efforts should focus on specific areas of research, including:

- Conducting more studies on the efficacy of simulations in DE settings, using larger control groups.
- Investigating the functionality of development tools.
- Understanding which tools will shorten development cycles while yielding high-quality simulations, in order to lessen costs.
- Creation and documentation of simulation for use in humanities and social sciences.

- More effort toward development of assessment instruments measuring efficacy of simulations in DE.

Conclusion

Computer simulations are still a relatively new phenomenon, and offer students the ability to practice skills or participate in environments that were previously unavailable to students in remote locations. I think that the promise for these technologies to enrich learning is great, but I also think that we have a lot to learn, and a long way to go to make these tools effective and accessible to everyone. I imagine that the not-too-distant future will bring conclusive results involving best practices for use of simulations, and that while we should never completely depend on simulations, they are an effective way to give students the opportunity to learn from experience, where previously these opportunities did not exist.

Sources

Lunce, L.M. (October 2004). Computer Simulations in Distance Education. International Journal of Instructional Technology & Distance Learning. http://itdl.org/Journal/Oct_04/article02.htm.

Fogg, B.J. (2003). Persuasive Technology: Using Computers to Change What We Think and Do. (pp 67-87). San Francisco. Morgan Kaufman Publishers.