E-LEARNING

Practice makes perfect.

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It's an age-old fact: Learning is most effective when people learn by doing. No amount of reading or lectures offers the expertise one can gain from actually performing a task. Call it trial-and-error, apprenticeship, or learning on the job, theoretical knowledge almost never replaces the value of a hands-on experience. However, hands-on learning can be costly, impractical, time-consuming, and in some cases downright dangerous. Would you want someone learning to operate a nuclear reactor to use the trial-and-error method? Simulation provides learners with a model that closely resembles their real-world environment but without the dire consequences that can occur when error follows trial.

Simulation isn't a new concept: Educators have been using simulations for ages. Thought experiments, which are a form of mental simulation of physical phenomena, are as old as science. Situational simulations are widely used by philosophers and teachers of such disciplines as politics, ethics, and commerce. Current technological advancements have made simulations more real and more useful. Computer-based simulations have become the tools of choice for training in any field that involves interactions with a complex environment.

Simulation defined

Simulations are interactive models that re-create a specific environment to enable learners to experience and understand that environment through their interactions and explorations with the model. The operative words in that definition are *model* and *interactive*.

Model implies a consistent representation of a particular environment, phenomena, or theory.

Interactive implies that the model is sensitive to the learner's input, and it reacts to that input in a way that's consistent with the expected behavior of the real environment.

Notice the deliberate use of the word *consistent* instead of *accurate*. In simulations, it's not always possible to re-create a real-world environment with 100 percent accuracy. But, the accuracy of the representation is an important metric that reflects the sophistication of the simulation.

It's hard to mimic the real world on a computer. One technique is to include a certain level of randomness in the simulation's reactions to the user input. That randomness is designed to mirror the unpredictability of the real world. Yet, we've all probably experienced a certain pattern to randomness whether it's in a computer game or a training program.

Simulations are becoming better at realism, incorporating sophisticated algorithms that produce virtually unlimited randomness. Computer-based animation has never been more real, which has helped make simulations more popular, more accepted.

Animation versus simulation

In our years of working with e-learning, we've found that people often confuse animation and simulation. Even people in the simulation industry sometimes use those terms incorrectly or interchangeably.

The true definition of animation is a multimedia presentation (usually graphics and sound) that's made up of data. But an animation is almost never interactive. A good example is the typical cartoon film. It's rich in multimedia and graphics, but a viewer (user) can't interact with it to change how the film behaves. In contrast, user interactions and the ability for a model to react to those interactions are important characteristics of a simulation. So, the next time you face whether something's an animation or a simulation, ask if the model supports and reacts to user interactions.

Types of simulations

Simulations can be classified in various ways. For example, there's a distinction between single-user simulation—in which only one user interacts with the model— versus a multi-user simulation, in which multiple people in a team environment interact with the model. In the case of a multi-user simulation, a user's experience and learning would depend not only on his or her interaction with the model, but also on the interaction of the other participants with the model.

Simulations can also be classified according to level of sophistication, by taking into account such qualities as

- degree of interactivity and randomness
- amount of realism in the representation of the real-world environment
- how well the model reacts to the user's input.

All sophistication-based classifications are somewhat arbitrary because no standards exist for how simulations should be classified based on their level of sophistication.

Another way to classify simulations is by the environment or activity that's being simulated. Some common classifications:

- software
- business
- machine
- game
- process.

There's more agreement on that type of classification, though it's not ubiquitous.

Software simulation. This most common type of simulation is designed to help a user become more proficient with a software application. Software simulations may or may not require the actual software application to be installed on the user's computer. The basic functionality of a software simulation is to allow users to exercise various options available in the software (click the buttons, pull down the menus, and so forth). Some simulations allow users to do that free form, but most follow a scripted path offering guidance at every step.

Off-the-shelf sims are available for most of the commonly used software programs, such as Microsoft Office, but simulating proprietary systems is also popular. That's particularly effective in training employees on business systems, in which it's not practical or possible for learners to experiment with a mission-critical live system such as customer accounts in a bank.

Business simulation. Business simulations are probably the least understood by the average e-learner. Traditional business simulations have been used for years in corporations and higher-ed (mainly MBA programs), and they share many common traits with the e-learning variety: role plays, case studies, and the notion of "what if?" The basic concept is to simulate one or more business scenarios, in which participants can make choices, thus learning the effects of their decisions. Business simulations are often performed in a group setting, where participants play various business roles and the PC is used mostly for computing business results based on mathematical and economic models. Still, it's not uncommon for business simulations to incorporate the behavior of different business roles so that individual users can practice their business skills on their own.

Machine simulation. These have been around for many years, most notably in airline pilot training. Machine sims are good at mimicking complex machinery, without incurring the dire consequences of a mistake. Accuracy of representation and realistic physical reaction of the system are important aspects. For example, in flight simulation (in which the system mimics a cockpit), the simulation must replicate every control and instrument. For the simulation to be effective, physical feedback and cues from the system are just as important as the visual part. When the "plane" simulates turbulence, it's important for pilot trainees to feel the turbulence and learn to perform calmly.

Machinery simulations usually require the most computing resources and very sophisticated graphics. More advanced simulations require special hardware to make the experience as real as possible.

Game simulation. With many Gen Xers in the workforce, game simulations are more popular in adult learning. But like machine sims, game simulations demand many computing resources. The high level of sophistication in most simulation graphics these days owes its evolution in large part to the hugely successful and lucrative gaming market. The learning market has only just begun to adopt the rich, competitive experience many of the newer entrants into the workforce grew up with. Expect to see much more of this type of simulation.

Process simulation. This type of simulation is usually a hybrid between software simulation and business simulation. The goal of process simulation is to train learners on business processes, combined with business interactions with other people. Unlike a single software simulation, which helps learners achieve proficiency in using all of the features of a particular program, a process simulation often incorporates multiple applications and the business logic for using each.

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Simulation and e-learning

Because the best e-learning is often a window into the environment of the user, simulations are playing an important role in achieving maximum effectiveness for e-learning. More off-the-shelf simulations are coming into the market every day, as are do-it-yourself simulation tools. When choosing products for creating simulation-based e-learning content, first ask does the created simulation play on the Web through a standard browser without a proprietary software player? That allows broader, easier distribution. In addition, is the simulation content compliant with e-learning specs, specifically SCORM? That enables interoperability with learning management and other e-learning systems.

Simulation technologies are constantly breaking new ground and redefining our perceptions of reality. Virtual reality is being used to re-create an environment and remotely control a live environment. For example, virtual reality technologies are enabling remote surgery, in which a doctor in her New York office can perform surgery on a patient in Paris. Although that borders on doing versus learning, that blending of simulation technologies with live environments will continue.

Whether performing remote surgery or getting contextual guidance on using your company's CRM system, it's a safe bet that we can expect to see more simulations used for learning.

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