Research Based Strategies for the Classroom

Part # 12 - Simulations and Games

Introduction

Much education research encourages teachers to foster the kinds of environments and tools provided by simulations and games. For example, the more students use multiple systems of representing knowledge, the better they are able to think about and recall what they have learned (Marzano, Pickering, & Pollock, 2001). Providing students the opportunity to visualize and model improves their chances for understanding. Simulations enhance this potential by making modeling dynamic. Games and modeling activities can elicit curiosity, create a demand for knowledge, and enable students to discover knowledge through exploration (Edelson, 1998). Experimentation, manipulation of media, and personal experience are critical allies in deepening learning. We know that student engagement and motivation are critical to sustained understanding. Simulations and games provide powerful new opportunities for learning.

Simulations allow learners the opportunity to model, explore, and try out a variety of strategies. Role-playing is a learning experience where students collaboratively invent, experiment, and practice interpersonal skills in a relatively low-risk environment. Games and simulations differ in important ways, although contexts may overlap. In simulations, no one "wins," and participants role-play experiences that result in their character suffering or benefiting from decisions and actions. Simulations are multi-modal and non-linear, branching into scenarios based on user choice. Finally, simulations are structured by authentic rules that mirror actual results. This definition can be broken down further to describe how students can learn from simulations.

Experimental simulations provide learners the opportunity to engage in situations that would otherwise be too hazardous or cost prohibitive to conduct in the classroom. For example, a simulation of an atom smasher uses gum balls to help students envision what happens in a linear accelerator; a rollercoaster design simulator allows students to experiment with slope, angle, and speed. Symbolic simulations dynamically represent the behavior of a population, system, or set of processes. The student is on the outside looking in, conducting operations and manipulating variables to explore reactions. Symbolic simulations allow students to discover and explain scientific relationships, predict events, and learn procedural skills. For example, biology students can use simulation software to explore the implications of vanishing habitat on various species. The use of technology offers unprecedented experimental environments in which to learn.

Serious games is a new term for games that are applied to "serious" goals instead of entertainment, bringing gaming technology to fields such as education, policy development, and leadership. Major corporations, government institutions, foundations, educators, and nonprofits are turning to games and emerging technologies as a new approach to simulations, training, education, and other practical applications.

Key Research Findings

- Simulation environments and modeling have unique capabilities for enhancing learning (Gordin & Pea, 1995).
- Gaming teaches competition strategies, cooperation and teamwork, and conflict resolution (Neubecker, 2003).
- The effectiveness of gaming relies on the degree to which the games simulate real life (Hood, 1997).
- When students are able to represent and explore new information in science classrooms using modeling tools, they are able to explore and deepen their understanding, as well as share it with others. This helps them understand the phenomena they are investigating (Michalchik, V., Rosenquist, A., Kozma, R., Kreikemeier, P., Schank, P., & Coppola, B., in press).
- Games are dynamic, intrinsically motivating, and involve high levels of involvement. They provide immediate feedback to participants, and mistakes do not result in actually losing assets (Hood, 1997).
- Games have been found to serve a range of functions in education including tutoring, exploring and practicing skills, and attitude change (Dempsey et al., 1994).
- Simulations can provide students engaging experiences towards learning crisis - management, communication and problem solving, data management, and collaboration (Gredler, 1994).
- The effective use of games differs depending on the educational areas where the games are employed. The best results were found to be in the areas of mathematics, physics, and language arts (as opposed to social studies, biology and logic). The beneficial effects of gaming are most likely to be found when specific content is targeted and objectives precisely defined (Randel et al 1992).

Implementation

Simulations and games provide new learning opportunities for students. Teachers who have an interest in increasing learning potential employ strategies such as:

1. Incorporate simulations into curriculum. Explore online simulations that offer skill or concept learning.

2. Simulations support related research recommendations. View the incorporation of simulations into curriculum through the lens of other related research-based strategies. Providing feedback, setting objectives, nonlinguistic representation, and homework and practice are strategies that simulations support.

3. Use dynamic simulations to model complex systems. Help students understand systems and variables by using software that allows students to see the impact of change. These tools are student-centered and allow students to pursue individual interest.

4. Teach cooperative learning skills through role-playing simulations. Role-playing can provide important opportunities to learn and practice skills when forming cooperative learning groups. Individual and small-group skills can improve with teaching and practice, which in turn impacts the success of cooperative learning.

5. Foster meta-cognitive awareness. Games and simulations offer students a chance to "get outside themselves." Introduce to students the concept of "watching yourself act" as a way to raise awareness of important meta-cognitive processes. Students can learn to be more self-reflective when engaged in a simulation or game.