Chapter 19
Games, Models, and Simulations in the Classroom:
Designing for Epistemic Activities

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EXECUTIVE SUMMARY

Games, models, and simulations have been suggested as an effective classroom activity for the middle school. This chapter describes the use of a teacher created simulation targeted to one unit of the science curriculum. The authors found the key feature in playing games in the classroom is for each student to commit to the effort of playing the game. Given the cultural importance of video games, students understand the underlying requirements of playing games. Once the students commit wholeheartedly to playing the game they are able to engage their imagination and creativity while understanding that "failure" is simply a part of the game. The key to the authors' success was the use of a whole class scaffolding technique that allowed the teacher and her students an opportunity to play.

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INTRODUCTION

Scientific knowledge is a crucial skill for the 21st Century. Consider that 100 years ago swamps were viewed as a major health threat and were systematically drained. Now we know that swamps are an intrinsic part of the larger eco-system. By understanding the role that these wet lands play in the eco-system, we are able to choose a more appropriate response. Instead of gaining science knowledge, the United States is losing its edge and is falling farther behind in the highly competitive disciplines of Science, Technology, Engineering and Mathematics (STEM). The Nation's Report Card documents this decline in science knowledge among our nation's high school graduates. According to the National Assessment of Educational Progress, the nation's 12th graders are performing significantly lower than 12th graders were only a decade earlier in 1996 (NAEP, 2009). This trend is all the more troubling because the modern world demands a minimum of science literacy of all its citizens

Improving our children's grasp of scientific knowledge is difficult (See Hibert and Sigler 2004) because the predominant teaching paradigm within most classrooms today in the United States according to Schwartz, Chase, Oppezzo and Chin (2011) is *tell and practice* (T&P). T & P as an instructional delivery strategy is similar to the classic recitation model. First the teacher tells or demonstrates content and then has the students either answer questions or perform some task (Hibert and Sigler 2004, p. 13). This form of instructional delivery however, according to some researchers, hinders a deeper understanding of the problem. Catrambone writes that

"Students tend to memorize the details of how the equations are filled out rather than learning the deeper, conceptual knowledge that is implicit in the details. Thus, if they are given a new problem that seems similar to an old one—at a surface level—they will try to apply a set of steps from the old problem (1998, p335).

In contrast deVries, Lund and Baker argue that "An important goal of teaching is for students not only to be able to solve specific problems, but also for them [students] to understand the concepts and principles that underlie problem solving" (2002, p. 64). They want students to become flexible in "new situations, predicting future states of affairs, and solving types of problems that have not already been practiced" (deVries, Lund & Baker, 2002, p. 64).

Quality instruction creates opportunities for students to engage, to practice with the new knowledge or skill. Therefore, "Effective practice is deliberate. It involves attention, rehearsal and repetition and leads to new knowledge or skills that can later be developed into more complex knowledge and skills" (Brabeck & Jeffery, N.D. para. 1).

The goal, therefore, is to design learning activities that encourage students to engage in effective practice (deVires, Lund & Baker, 2002). Well designed practice is essential in providing students with the opportunity to apply not only "what" or