

# Chapter 18

## Virtual Worlds for Teaching: A Comparison of Traditional Methods and Virtual Worlds for Science Instruction

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### ABSTRACT

*Immersive virtual worlds structured for education have the potential to engage students who do not respond well to traditional classroom activities. To test the appeal and usability of virtual environments in the classroom, four ninth grade science classes in a rural Upstate New York school were randomly assigned to learn an introductory genetics unit for three class periods in either an online, multi-user, virtual world computer environment or in a traditional classroom setting using lecture, worksheets, and model building. The groups were then reversed for a second three-day trial. Quizzes were given before, at midpoint, and at the end of the study. Both groups demonstrated significant knowledge gain of the genetics curriculum. This study demonstrates that self-directed learning can occur while exploring virtual world computer environments. The students were enthusiastic about using virtual worlds for education and indicated a strong preference for a variety of teaching methods, which suggests that offering mixed modalities may engage students who are otherwise uninterested in school.*

### INTRODUCTION

Motivating students in subjects such as mathematics and science remains challenging. Minorities and girls seem especially vulnerable to this phenomenon. They begin to lose interest in these subjects as early as middle school and ultimately

become underrepresented in these career fields later in life (Clark, 1999). There appear to be very complex relationships among the motivational factors involved in this process. Dicintio & Gee (1999) found that at-risk students' academic motivation was strongly related to amount of control over decisions and choices they felt they had within

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the learning environment. This perceived control related to a decrease in boredom, confusion and desire to be doing something else. Unencumbered

Hidi & Harackiewicz (2000) suggest that engaging children in activities that interest them will naturally lead to goal-oriented behavior. They use the image of a child interested in baseball who practices swinging a bat thousands of times to perfect her swing to elucidate this point. The trick, they argue, is to engage children in a variety of activities, ideas and materials and let them find whatever aspects of a topic interest them personally. This will lead to the development of the students' personal mastery goals, which may be much more powerful motivators than any they receive from adults.

Deci et al (1991) review studies centered on the Self-Determination Theory of Motivation that provide evidence that classroom environments supportive of student autonomy (i.e., compared to those focused on controlling behavior) promote a higher level of intrinsic motivation, perceived competence and self-esteem. "When intrinsically motivated, people engage in activities that interest them, and they do so freely, with a full sense of volition and without the necessity of material rewards or constraints (p. 328). See also Deci & Ryan (1985).

Many adults have noted the intensity with which students play video games and wished these children would apply the same effort to their schoolwork. Educational researchers such as Gee (2005) offer suggestions for incorporating learning principles into video games in addition to content to maximize their educational potential. He states, "Challenge and learning are a large part of what makes good video games motivating and entertaining" (p. 34).

According to these authors, perceived control and interesting activities (such as video games) that also offer challenge are key factors to building self-motivated learning. It seems that numerous researchers have taken this advice to heart in the development of serious games for classroom. Chris

Dede's River City Project at Harvard University uses multi-user virtual environments with middle school students to enhance their motivation to learn science. This program is offered in addition to conventional classroom activities (Dede et al, 2005; Dede et al, 2004; Dede et al, 2003). In addition to being generally well-received by the students, the researchers have found that the program also improves attendance and reduces disruptive behavior (Dede et al, 2005).

Researchers at Indiana University (Barab, Gresalfi & Arici 2009) use virtual worlds to teach science content with the Quest Atlantis program. Cher et al (2006) conducted a study with fourth grade students in Singapore that demonstrated a significant amount of science learning with Quest Atlantis as measured on a pre and post test. And college students in an immersive virtual worlds condition significantly outperformed those using an electronic textbook on standardized test items (Barab, Goldstone & Zuiker, 2009).

Another study examined social knowledge construction and the development of "scientific habits of mind" (p. 530) in the popular online multi-user virtual world game environment World of Warcraft (Steinkuehler & Duncan, 2008). The authors illustrate how the nature of virtual worlds lends itself to scientific inquiry and problem solving within a social context, which provides further support for their potential for academic use.

There are also numerous articles offering guidance in designing and implementing virtual worlds to maximize the educational impact of these environments. Bellotti et al (2010) recommends creating realistic environments with a great deal of embedded information and activities students can discover on their own. De Freitas et al (2010) draw on experiences with adult learners in Second Life to introduce a four dimensional framework (i.e., Learner Specific, Pedagogical, Representative and Contextual) to design and evaluate educational experiences that apply to learners of all ages, across platforms. Warren et al (2009) take an in depth look at Quest Atlantis

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