Chapter X
What Factors Make a Multimedia Learning Environment Engaging:
A Case Study

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ABSTRACT

The purpose of this study is to investigate students' engagement with a multimedia enhanced problem-based learning (PBL) environment, Alien Rescue, and to find out in what ways students consider Alien Rescue motivating. Alien Rescue is a PBL environment for students to learn science. Fifty-seven sixth-grade students were interviewed. Analysis of the interviews using the constant comparative method showed that students were intrinsically motivated and that there were 11 key elements of the PBL environment that helped evoke students' motivation: authenticity, challenge, cognitive engagement, competence, choice, fantasy, identity, interactivity, novelty, sensory engagement, and social relations. These elements can be grouped into 5 perspectives of the sources of intrinsic motivation for students using Alien Rescue: problem solving, playing, socializing, information processing, and voluntary acting, with problem solving and playing contributing the highest level of intrinsic motivation. The findings are discussed with respect to designing multimedia learning environments.

INTRODUCTION

In order for technology to positively impact classroom learning, students must be motivated to use the technology in addition to learning the content presented with that technology. Literature on motivation and classroom learning has shown that motivation plays an important role in influencing learning and achievement (Ames, 1990). If motivated, students tend to approach challenging tasks more eagerly, persist in difficult situations, and take pleasure in their achievement (Stipek, 1993). Studies have indicated strong positive correlations between intrinsic motivation and academic achievement (Cordova & Lepper, 1996; Gottfried, 1985; Hidi & Harackiewicz, 2000; Lepper, Iyengar, & Corpus, 2005). This suggests that motivational problems or lack of effort is often a primary explanation for unsatisfactory academic performance (Hidi & Harackiewicz, 2000).

Students' lack of interest in mathematics and science has been cited as one of the primary reasons contributing to U.S. students lagging far behind other high-performing countries in math and science, especially at the middle-school level (National Science Board, 1999). According to Osborne, Simon, and Collins (2003), research has indicated a decline in attitudes toward science from age 11 onward. Other researchers have also found that as children become older, their intrinsic motivation to learn science tends to decline (Eccles & Wigfield, 2002; Gottfried, 1985; Lepper, Iyengar, & Corpus, 2005). Therefore, in order to help students succeed in learning math and science, instructional technologists must create technology enhanced learning environments that can motivate students and facilitate learning.

In an effort to meet this goal, we have designed and developed a multimedia enhanced problem-based learning (PBL) environment for six-grade science, *Alien Rescue* (Liu, Williams, & Pedersen, 2002). This program has been used by thousands of middle school students in multiple states. Our previous research examining the impact of this multimedia PBL environment has primarily focused on its cognitive effects such as its use on acquiring science knowledge and problem-solving skills (Liu, 2004; Liu & Bera, 2005; Li & Liu, 2008), cognitive tools and cognitive processes (Liu, Bera, Corliss, Svinicki, & Beth, 2004), and its effect on reducing cognitive load (Li & Liu, 2007). Studies on *Alien Rescue* have shown it to be an effective learning environment for science knowledge and problem-solving (Liu, 2004, 2005; Liu & Bera, 2005).

As we continued to work with students and teachers in different classrooms, it became apparent that students often considered their experience with *Alien Rescue* "fun" and enjoyed using it. The following quote from a teacher captured the essence of this observation:

Kids are talking about science outside of the classroom. They talk about *Alien Rescue* in the halls and they talk about *Alien Rescue* after school. All of the sixth graders are doing this, and so some of them have friends in different class periods that are working with *Alien Rescue*. They will say, "what did you find out today or have you found where this alien can go?" I think that the most exciting thing is that they are talking science outside of the classroom; I think that is the most impressive thing.

This sentiment led us to ask questions regarding the affective effects of *Alien Rescue*. Why did students like using *Alien Rescue*? What did they find interesting? How did it compare to other school activities they usually do in the classroom? The purpose of this study is to investigate sixth-graders' affective experiences, specifically motivation, as they were using *Alien Rescue* and to find out in what ways *Alien Rescue* was motivating to these students. Our guiding research question was:

*How does a multimedia enhanced problem-based learning (PBL) environment, **Alien Rescue**, motivate students to learn science?*

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