

## Chapter 73

# Fifth Graders' Flow Experience in a Digital Game-Based Science Learning Environment

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### ABSTRACT

*This mixed methods study examined 73 5<sup>th</sup> graders' flow experience in a game-based science learning environment using two gameplay approaches (solo and collaborative gameplay). Both survey and focus group interview findings revealed that students had high flow experience; however, there were no flow experience differences that were contingent upon gameplay approaches. Results identified four game design features and student personal factors (reading proficiency) that significantly impacted student game flow experience. Students made significant science content learning gains as a result of gameplay, but game flow experience did not predict learning gains. The study demonstrated that the game was effective in supporting students' flow experience and science content learning. The findings indicated that the adapted game flow experience survey provided a satisfactory measure of students' game flow experience. The results also have implications for educational game design, as game design features that significantly contributed to students' flow experience were identified.*

### INTRODUCTION

In recent years the popularity of game-based learning has prompted increased attention to students' subjective gameplay experience. Research in this area is important because students' experience of

playfulness/enjoyment during gameplay has been found to motivate them to engage in learning. Recently, researchers have begun to examine students' gameplay experience using Csikszentmihalyi's (1975) flow theory. Flow describes an optimal experience of deep engagement that a person has

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when she/he is completely absorbed in an activity. Game flow experience studies focus on the context of gameplay and examine how game design features impact student flow experience. This type of research is especially valuable considering that educational game design and evaluation is still in its infancy. A full body of empirical literature has yet to be developed in terms of how to devise games that are both engaging and effective for student learning (Zheng, Spires, & Meluso, 2011).

The phenomenon of game flow experience has not yet been fully understood. Therefore, the primary purpose of this study was to investigate 5th graders' flow experience in a 3D game-based science learning environment, which is called CRYSTAL ISLAND and funded by NSF. A second purpose of this study was to examine the impact of two different gameplay approaches (solo and face-to-face collaborative gameplay) on students' flow experience. Employing a mixed methods research design (Creswell & Plano Clark, 2006), the study was guided by three research questions:

1. To what extent did 5<sup>th</sup> graders in a suburban elementary school in the southern US experience game flow while playing the CRYSTAL ISLAND game?
  - a. What were the differences in students' game flow experience based on two different gameplay approaches (solo and face-to-face collaborative gameplay)?
  - b. What were the differences in students' game flow experience based on individual differences (i.e., reading proficiency)?
2. How did game design features impact students' game flow experience?
3. What was the relationship between students' game flow experience and their science content learning gains?

## **LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

### **Research on Game Flow Experience**

#### **Overview of Flow Theory**

Flow is an emotion of complete consciousness and engagement that is experienced by individuals who are deeply involved in doing an enjoyable activity. People who experience flow are often considered to be "in the zone" (Csikszentmihalyi, 1975, 1991). Csikszentmihalyi (1991) defined flow experience as having eight dimensions: (1) clear goals, (2) immediate and unambiguous feedback, (3) balance between the challenges of an activity and the skills required to meet challenges; (4) merging of action and awareness, (5) concentration, (6) sense of control, (7) loss of self-consciousness, and (8) a distorted sense of time. Jackson and Marsh (1996) proposed that autotelic experience (a state of the mind when the individual performs an activity out of the great enjoyment derived from performing the task itself instead of doing it for external rewards) be added as the 9th dimension.

In the studies of flow experience during human-computer interaction, these dimensions are often categorized into three stages, including flow antecedents, flow experience, and flow consequences (Ghani & Deshpande, 1994; Shin, 2006; Skadberg & Kimmel, 2004; Webster, Trevino, & Ryan, 1993). Kiili (2005) proposed a game flow experience scale to examine the three stages of flow experience with college students who played a computer science game (see Table 1). This survey was validated in a later study with a different group of college students (Kiili & Lainema, 2008). This present study was based on Kiili and Lainema's (2008) game flow model.

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