ABSTRACT

This article reports on Digital Play, one of three prominent themes identified in a qualitative case study of sixth grade students who used mathematical simulations in their proportional thinking unit of study. The study was designed to investigate learner curiosity but found play as a prominent theme. Five different virtual manipulatives or simulations were used as part of the study. The Digital Play theme is then further examined, identifying aspects of the virtual manipulatives that led to play and ludic activities. Students’ interview responses revealed all three of Salen and Zimmerman (2004) categories of play, which also align with several patterns of play identified by the National Institute for Play (2009), during their use of the simulations. Students also described the nature of their play with the simulations which was traced to Winnicott’s (2007) potential space. Finally, the implication of the possibility for transformative play is discussed.

Keywords: Digital Play, Learner Curiosity, Mathematical Simulations, Mathematics, Proportional Thinking, Virtual Manipulative

INTRODUCTION

As the dominant pursuit of childhood and adolescence, play encompasses social, emotional, and intellectual development (Van Hoorn, Nourt, Scales, & Alward, 2011). The substance of play is derived from the social and emotional worlds of players while providing an opportunity for developing an understanding of self and others (Van Hoorn, et. al., 2011). Recognizing play and its substance as an essential means of development can allow educators to both leverage and promote learning. Because play in the 21st century often includes technology-based games, activities, and discovery experiences (Marsh, 2010), simulations offer opportunities for extended play through technology (Van Hoorn et al., 2011).

Digital simulations can be leveraged to promote extended play that develops logical-mathematical thinking. This type of thinking includes understandings created through
cause and effect relationships explored during physical activities, development of schemes for interpreting surroundings, and symbolic transformations intrinsic to role playing (Van Hoorn et al., 2011). Because simulations allow for ideas and concepts to be “played out” through various scenarios and perspectives, critical thinking and problem solving are developed through this play.

In order to understand the impact of a technology-rich learning environment on learner curiosity in a sixth grade mathematics classroom, researchers conducted a qualitative case study that examined students’ curiosity while deepening their conceptual knowledge building using five different virtual manipulatives or simulations (McLeod, Vasinda, & Dondlinger, 2012; McLeod, 2011). Although the study was part of a more comprehensive project focused on examining whether, how, and why students demonstrated curiosity with technology-integrated learning, analysis of data from student interviews yielded several codes across all four categories that tied directly to play in general and ludic activities specifically. Indeed, one of three prominent themes identified through this analysis was Digital Play (McLeod, 2011). This article further examines the concept of play and presents the results of data analysis that supported the Digital Play theme, first defining simulations and theories of play and then examining aspects of the virtual manipulatives that led to play and ludic activities.

THEORETICAL PERSPECTIVE

Defining Simulations

Various definitions of simulations have evolved over time as technology and its applications to learning have developed. An early definition by Harold Guetzkow (1963) asserted that a simulation is a representation of reality which includes two essential features: it must represent a real situation and be ongoing and dynamic. Horn (1977) later refined this definition as a representation of “the essence of the physical or social system of interaction. Simulations attempt to replicate essential aspects of reality so it may be better understood and/or controlled” (p. 3). This definition includes consideration of a larger system that the simulation attempts to model, but acknowledges that elements of that system may need to be withheld or controlled so that learners can develop understanding and competence with the various elements and concepts before layering on the complexities of the whole system. However, both of these early definitions suggest that in addition to modeling reality, a simulation must allow users to explore the interactions or dynamics of a particular system.

Later definitions clarify these interactions in more detail. According to Aldrich (2007), “simulation elements model some part of reality, and the role of someone in it,” (para. 1) which includes representing what actions are available, how the actions impact relevant systems, and how those systems produce feedback and results (Aldrich, 2007). In describing simulations designed specifically for education, Gibson and Baek (2009) provide the following defining characteristics:

An adequate model of a complex real-world problem or situation with which the student interacts, a defined role with a set of available actions, a data-rich environment that permits a range of strategies from a variety of perspectives, feedback in the form of changes in the problem or situation, embedded instructional goals, and mechanisms for active participation and the promotion of interest, which elicits deeper, more expedient, and better retention of understanding of a concept, mastery of a skill or strategy, or acquisition of knowledge (p. xxi).

Without deviating from the essential elements of previous definitions (modeling reality and an interactive system), these two definitions better describe the nature of the interactions: a range of possible actions and visible feedback from the system following any given action. Virtual manipulatives can be thought of as simulations since they are interactive systems that model reality in some way. Moyer,
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