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Creative thinking in digital game design and development: A case study



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ABSTRACT

In a case study on middle-school student educational game creation course in south central US state, the students' creative thinking process is investigated in order to understand perceptions of the digital design and programming involved in the game creation learning approach. Interviewing 12 students at with three different levels of game design experience, students in grade 6, 7 and 8, with 1, 2, and 3 years of game design experience respectively, findings suggest that students enjoyed the learning approach as satisfying and engaging, yet technologically challenging. The students experienced positive opportunities for engaging the creative thinking process in synthesizing social issue information for constructing their understanding through the creation of interactive, educational digital games. Findings suggest that the creative thinking process in student-centered game creation learning approach may provide learners a rich and enjoyable learning experience with the authentic technology use as well as provide for deep, insightful learning.

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1. Introduction

Digital games have received interest from educators for their capacity to improve learning. Motivating students with engaging interactions, they have the capacity to promote learning procedural knowledge that goes beyond the traditional standards-based, declarative knowledge taught in schools that is offered as being a privileged curricula (Shaffer, 2006). Game play is proposed to provide students with deeper conceptual understanding through digital interactions. Thus, digital games have been identified as an effective way to engage students in learning (Gee, 2007). Moreover, while game play may offer significant learning opportunities, educational game construction has been identified as a student-centered constructivist-approach educational improvement (Baytak & Land, 2011; Caperton, 2010; Kafai, 2006). Specifically, educators call for the inclusion of creative thinking in modern education: "Success is based not only on what you know or how much we know, but on your ability to think and act creatively. In short, we are now living in the Creative Society" (Resnick, 2007, p. 18). Argued as incongruous with standards-based educational trends, the inclusion of creative thinking with technology tools is suggested to be critical for 21st century learners (Sternberg, 2012). Game design and development, in which the students program original educational games suggests empowered learning for "cultural resonance" allowing the learning process to "make sense in terms of a larger social context" (Papert, 1980, p. 54). Designing and programming games offers students authentic participation in the digital game creation and empower them in their learning as a Web 2.0 participant.

Essentially, creative technology use may hold vast potential for transformative learning (Daud, Mustafa, Hussain, & Osman, 2009) and may have significant impact on student creative processes (Gangadharbatla, 2010). Game design and development curriculum that addresses the 21st century learning skills required from students offers a project-based, constructivist approach to learning (Caperton, 2010). Game design and development involves the learning of programming language in order to build interactive and educational games. Creating games engages students in an inventive process that may be suggested to develop digital literacy similar to the way that writing promotes traditional text-based literacy (Vos, van der Meijden, & Denessen, 2011).

Due to the paucity of empirical research of middle-school student design and development of educational games on social issues, this research offers insight on the student's creative experiences in technology-integrated, ill-structured, constructivist learning settings as they engage in programming digital games (Reynolds & Caperton, 2011).

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2. Framing creative thinking in digital game design

2.1. Creative thinking

In defining individual creativity, the concept is suggested as a distinct human trait that evokes positive emotions in the form of personal satisfaction (Csikszentmihalyi, 1996; Root-Bernstein & Root-Bernstein, 1999). While the creative process is posited to be interdependent with creative domain and the field (Csikszentmihalyi, 1996), for the purpose of this study, individual creativity potential, as the individual's creative actions that may be performed in everyday life (Kaufman & Beghetto, 2009). Specifically, the creative process may be found in all individuals as a "capacity to construct original interpretation" (Runco, 2008, p. 98) and is identified as the individual's creative thinking process, as a non-expert, and not dependent on domain and field transforming creativity (Csikszentmihalyi, 1996). Nonetheless, the creative thinking process is posited as a central skill needed in education for preparing all students (Kaufman & Beghetto, 2009; Runco, 2008). In framing this perspective, creative thinking as the extension of thinking and problem solving with student learning (Runco, 2004, 2008; Wallas, 1926), is proposed as the epistemological lens in the study digital game creation environment. Creative and innovative thinking has been identified as a fundamental component of educational technology to support student learning (Gangadharbatla, 2010; Lewis, 2009). However, while creativity has been identified as important to the inventive human potential in all academic disciplines, the lack of meaningful inclusion in educational curricula has been identified as a serious limitations in modern schooling (Robinson, 2001; Root-Bernstein & Root-Bernstein, 1999; Sternberg, 2012).

2.2. Technology

Educational technology use offers a distinct opportunity for development of the creative process (Gangadharbatla, 2010; Lewis, 2009; Rutland & Barlex, 2008; Spendlove, 2008). In the investigation of technology-integrated creativity learning, Gangadharbatla (2010) calls for "a new system for understanding the creative process" (p. 226) and suggests that the technology tool affordances may hold significant opportunities for the creative thinking process in educational settings. How students may be fostered in thinking creatively in technology environments remains ambiguous and requires empirical grounding. The complexity of curricular objectives with technology-integrated learning and existing standards-based education identifies critical tension between creative thinking education and existing educational practice (Klausen, 2010; Sternberg, 2012). For example, researcher have found that educational, transformative use of technology in traditional schools may be typically eschewed (Cuban, Kirkpatrick, & Peck, 2001)

2.3. Games and play

Games and play have been found to be fundamentally important and contribute to the development of society and learners (Caillois, 1961) and are found to hold potential for cognitive development (Vygotskiĭ, 1978). Specifically, games and playing are fundamental elements for the youth in learning to become participants in their culture. With the innovative inclusion of robust technology applications, digital games as learning tools have been argued to hold a vast dynamic potential to engage students in 21st century learning opportunities (Gee, 2007; Squire, 2011). Shaffer (2006) argues that teaching procedural knowledge to students through digital games offers a great improvement in learning beyond the declarative knowledge learning that holds a position of privilege in our current educational curriculum. That is, despite the vast potential for improved learning, digital games may not valued in traditional educational curriculum aligned with high-stakes standards-based models (Jenkins, 2006; Shaffer, 2006).

2.4. Game creation

Game creation is suggested to provide greater student engagement and learning than game play (Vos et al., 2011), in supporting a constructivist approach in which the students learn how to synthesize information and express it, in the authoring of an original game. For example, in a pilot Adventure Author project, researchers explore student perceptions in the game-authoring environment (Robertson & Nicholson, 2007). These researchers reveal that students found it difficult to articulate where their creative design ideas came from and the software limitations constrained the development of their ideas and argue that creative designing is a difficult concept for young children learn.

In an eight-week game-authoring exploratory study, an Adventure Author project using Neverwinter Nights toolset software, with students ages 9–10, researchers found that game-authoring opportunities may offer students motivating, technology-supported learning activities that promote enthusiasm with the young learners and "can empower learners by enabling them to express their creativity and share it with a genuine audience" (Robertson & Howells, 2008, p. 562). Importantly, these researchers found that digital authoring offered opportunity for creativity in authentic learning within a "powerful learning environment" (pp. 576–577).

In a similar case study with grade 5 students using Scratch software, researchers found that the students could design games within a constructionist framework and that programming skill increase with increased design experience (Baytak & Land, 2011). In this study, learners were found to learn programming skills along with science content through the use of graphical programming software. Additionally, they found that the learning in this study was difficult to determine.

In a study using drag-and-drop game design software, creating vocabulary memory games, conditions for learner motivation and deep strategy use were compared between students creating games and playing games (Vos et al., 2011). These researchers found that constructing games may be more motivating and provide opportunities for the use of "deep learning strategies" in the more active condition of constructing when compared to the more passive condition of game playing (p. 135). Although these studies identified the creativity in games with game-authoring software (Robertson & Howells, 2008; Robertson & Nicholson, 2007; Vos et al., 2011), programming skills, using authentic programming software in the game creations were not explored in these studies.

In a game design pilot program, Reynolds and Caperton (2011) found that the game design program, using Flash software, "may provide a particularly interesting and useful context in which to continue exploring pertinent theoretical questions and debates occurring presently in the learning sciences" (p. 287). This research builds on the concept of engaging students in creative thinking as they design and build games

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