Learning With Games and Digital Stories in Visual Programming

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INTRODUCTION

This paper traces the recent development and the use of games and digital stories for engaging students in learning in visual programming environments (Lau & Yuen, 2015).

Games have long been used to arouse and sustain students' learning interest. Wu and Wang (2012) contended that as students modify or develop a game by using a game development framework (GDF), they can learn different skills and concepts in computer science (CS) and software engineering (SE). They labeled this learning experience as game development-based learning (GDBL), and showed that it consisted of "four elements (course aim, pedagogical theory support, GDF resource pool, and impact factor), two methods (learning by creating and learning by modifying games), and six steps in the teaching process and two subjects (students and teachers)" (p. 16). More recently, Wang and Wu (2015) reviewed 66 articles related to game development and CS/SE education published between 2004 and 2012 and found that the number of articles published on this topic had increased steadily from 2004 to 2009. On average, 12 articles were published each year from 2009 to 2012. Game development was mainly used in colleges and universities (81%) but also in high schools (9%) and middle schools (9%). In CS, game development was adopted primarily to teach introductory courses and programming (77%).

Psomos and Kordaki (2012a, 2012b) advocated the practice of educational digital storytelling (EDS), which denotes the intersection of education, storytelling, and digital technology, to help students achieve the six cognitive objectives of the revised Bloom's taxonomy (Bloom, Mesia, & Krathwohl, 1964) and acquire various literacy skills (Robin, 2006). McWilliam (2009) surveyed 300 online digital storytelling programs and found that 123 were provided by educational institutions. Of these 123 programs, 55 were hosted in K–12 schools; 42 in universities; and 26 in colleges or institutes. In schools, digital storytelling was mainly used to engage students in learning and to enhance student print and media literacy, whereas in universities and colleges, it was either embedded in student-teacher training programs or formed part of multimedia and design courses. A recent review by Gregori-Signes (2014) showed that EDS has been used extensively in different subjects and contexts at the primary, secondary, and tertiary levels as well as for teacher prepration programs.

In the following sections, I first discuss the theoretical basis and educational benefits of GDBL and EDS in general. I then present empirical evidence to support the positive effects of these two pedagogical approaches on student learning outcomes. Subsequently, I provide insights into future research directions regarding learning with games and digital stories in visual programming and then conclude the paper.

BACKGROUND

According to Dempsey, Lucassen, Haynes, and Casey (1996), computer games are rule-guided, artificial, and technologically rendered scenarios that involve one or more players and have specific

goals, constraints, payoffs, and consequences. Many people are enthusiastic about playing games and express high hopes for its positive impacts on learning. Connolly, Boyle, MacArthur, Hainey, and Boyle (2012) concluded that playing computer games, in general, was associated with numerous perceptual, cognitive, behavioral, affective, and motivational impacts and outcomes. In particular, the most prominent effects were found in knowledge acquisition/content understanding and affective and motivational outcomes. McClarty et al. (2012) identified five potential benefits of using digital games in education: 1. Games are built on sound learning principles. 2. Games provide personalized learning opportunities. 3. Games provide more engagement for learners. 4. Games teach 21st century skills. 5. Games provide an environment for authentic and relevant assessment (pp. 6–7).

Furthermore, Werner, Denner, and Campe (2014) argued that designing and programming a game can be regarded as an ill-structured design problem (Jonassen, 2000) that requires students to define the goal, decide how to reach that goal, and evaluate the solution. Because most games involve problem-solving tasks that are dynamic, time dependent, and complex, game development is often understood as a complex problem-solving process that draws on an individual's abilities to formulate complex problems, design systems, and understand human behavior (Denner, Werner, Campe, & Ortiz, 2014). Thus, it is anticipated that such a practice can help improve student problem-solving skills and higher-order thinking abilities.

Digital storytelling refers to "the art of combining narrative with digital media such as images, sound, and video to create a short story" (Dreon, Kerper, & Landis, 2011). The Center for Digital Storytelling in Berkeley, California, identified seven crucial elements of digital storytelling: point of view, a dramatic question, emotional content, the gift of your voice, the

power of the soundtrack, economy, and pacing (http://digitalstorytelling.coe.uh.edu/page.cfm?id=27&cid=27&sublinkid=31). Robin (2008) asserted that digital storytelling enables users to combine the traditional processes of creative story writing with various types of multimedia, which results in an electronic artifact that is accessible through both local computers and the Internet. Constructionism and the narrative paradigm are the two basic theories that support the use of digital storytelling in education (Wang & Zhan, 2010). In constructionism, students create external and sharable objects (learning by making) through active interaction and engagement in the learning process. The narrative paradigm posits that meaningful learning occurs as students attempt to interpret actions, words, and deeds from a story into something relevant to their experiences.

Digital storytelling benefits student learning in numerous ways. Using digital storytelling in the classroom helps both general education students and those with learning difficulties become more motivated to practice traditional writing. Digital storytelling can be an effective method for engaging students, from kindergarten through college, in student-centered activities mediated by technology. Digital storytelling empowers students to express themselves through multimodal communication techniques and to develop multiliteracies such as digital, global, technology, visual, and information literacy (Robin, 2008). It helps students to understand more clearly the subject matter and to improve their literacy skills.

Porter (2005) found several advantages of practicing digital storytelling: helping students to improve their multiple literacy skills, increasing their content learning, engaging students in learning across the curriculum in schools, fostering their mastery of many 21st century skills, and meeting technology standards. Digital storytelling can be integrated across a range of subject areas to enhance student learning outcomes. Curriculum

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