Chapter 11
Learning With Games and Digital Stories in Visual Programming

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ABSTRACT

This chapter traces the recent development and the use of games and digital stories for engaging students in learning in visual programming environments. It reports on the application of game development-based learning and educational digital storytelling to engage students in learning in visual programming environments. The empirical findings support the positive effects of these two learning approaches on a range of student learning outcomes. Because many available visual programming tools are free of charge and provide a low-floor, high-ceiling learning environment, teachers should encourage students to venture into the programming world with these tools. Such practice is beneficial to student learning both within the computer science discipline and across disciplines.

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

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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