

## Chapter 40

# 21st Century Learning: The Role of Serious Games

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### ABSTRACT

*Today's students need more than just content knowledge to be able to work and excel in the 21<sup>st</sup> century workforce. Skills in problem solving, communication, collaboration, creativity, and innovation are essential for students to succeed. An increasing body of evidence suggests video games are powerful ways to give students these skills. This chapter includes a description of 21<sup>st</sup> century skills and provides information on generative gaming based on the generative learning theory, which requires students to generate their own learning based on their experiences in an individualized environment. It concludes with an example of a mathematics-based game development initiative at New Mexico State University that teaches content knowledge and fosters 21<sup>st</sup> century skills by enabling generative gaming.*

### INTRODUCTION

Education has progressed from an agrarian age to an industrial one, and now to the information age. During the agrarian age, food cultivation needs influenced education and progress. As individuals worked together on the farms, they shared knowledge from one generation to the next one. In the industrial age, people moved from farms to cities

for work in factories. Specific jobs were created for mass production and education included the transfer of the necessary skills for work. As society evolved from the industrial age to the information age, education placed more of an emphasis on *knowing* rather than *doing*,

*“Knowledge work has replaced manual labor as the predominant form of work. There is a much greater need now for lifelong, self-directed learning. There is much greater complexity in our*

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## 21st Century Learning

*societal systems and technological tools, creating a much stronger need for such types of learning as higher-order thinking skills, problem-solving skills, systems-thinking skills, collaboration skills, emotional development, and character development” (Reigeluth, 2009, p. 390).*

Videogames have a significant influence in the lives of today’s learners. A survey asked more than 280,000 American students to identify their top requirements for 21<sup>st</sup> century classrooms. Their choices included a laptop for each student and more games or virtual simulations for learning (Project Tomorrow, 2009). The serious game movement has embraced the potential of videogames in teaching content and skills. Particularly when integrating instructional strategies with appealing gameplay, games have tremendous potential in expanding students’ knowledge base, as well as developing their skill in problem solving, communication and creativity.

This chapter discusses 21<sup>st</sup> Century Learning, and the related knowledge and skills necessary for success. It reviews generative learning and gaming practices, in which students create their own knowledge once placed in meaningful environments. It closes with an example of a project which uses generative games, animations, and supplemental learning guides to communicate specific math concepts and develop 21<sup>st</sup> century skills.

### **21ST CENTURY LEARNING: SKILLS AND KNOWLEDGE**

Several organizations have established frameworks to identify the necessary individual skills for success in the 21<sup>st</sup> century. The enGauge 21<sup>st</sup> Century Skills Framework includes digital-age literacy, inventive thinking, high productivity and effective communication as the most relevant skills. Effective communication is further defined by teaming and collaboration, interpersonal

skills, personal responsibility, social and civic responsibility, and interactive communication (NCREL, 2003).

One of the most detailed and adopted frameworks was developed by Partnership for 21<sup>st</sup> Century Skills, which embraces the following skills:

1. Learning and innovation skills: Critical thinking and problem solving, communication and collaboration, and creativity and innovation;
2. Digital literacy skills: Information literacy, media literacy, and information and communication technologies;
3. Career and life skills: Flexibility and adaptability, initiative and self-direction, social and cross-cultural interaction, productivity and accountability, and leadership and responsibility (Trilling & Fadel, 2009).

In addition to these skills, the Partnership for 21<sup>st</sup> Century Skills also defined a group of content areas essential for today’s learners including arts, mathematics, and science. This organization also emphasizes literacy in financial, economic, business, entrepreneurial, civic, health, and environmental subject areas, as well as global awareness.

Several groups recognize the need for 21<sup>st</sup> century skills, including the Organization for Economic Co-operation and Development (OECD, 2005), the National Leadership Council for Liberal Education and America’s Promise (LEAP, 2007), the International Society for Technology in Education (ISTE, 2007), and the Educational Testing Service (ETS, 2007). Although groups emphasize different areas, these 21<sup>st</sup> century skills frameworks are consistent and complimentary with each other (Dede, 2010).

The 21<sup>st</sup> century skill frameworks provide a content map for what types of skills are needed by students. Equally important is a framework for understanding how current students learn. The noted learning theorist Howard Gardner (2006, 2010) identified needs human beings have in this

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