Chapter 5.1
Collaborating to Learn:
Designing and Building 3D Immersive Virtual Learning Environments for Exploring STEM Concepts in Middle School

Nita J. Matzen
Appalachian State University, USA

William Edward Roberts
Appalachian State University, USA

Penny Barker
Ashe County Schools, USA

Julie Marklin
Davie County Schools, USA

ABSTRACT

STEM and ICT Instructional Worlds: The 3D Experience (STEM-ICT 3D) is funded by the National Science Foundation ITEST program. The project proposes to translate the success of earlier projects and reaches toward a model of implementing the use of 3D virtual immersive environments that can be replicated with other middle schools over time. STEM-ICT 3D is intended to inspire middle school students to pursue studies and careers in science, technology, engineering, and mathematics (STEM), as well as prepare students with the skills necessary to succeed in STEM education and careers. This chapter presents an applied case study that describes the design of the project, examines the first phases of implementation, and explores the use of students as technical experts collaborating with teachers, the pedagogical experts, to build 3D virtual worlds for middle school instruction.

INTRODUCTION

How can K-12 teachers successfully implement the use of 3D immersive virtual environments into instruction? What affect will this environment have on student learning as well as change the way that students learn science, technology, engineering, and mathematics (STEM) material? Online environments have become more complex due to higher bandwidth availability and new technology including the evolution of social networking sites such as My Space and Facebook, massive multiplayer online role-playing games (MMOR-PGs) such as the World of Warcraft, and virtual worlds such as Second Life. Despite evidence that today's K-12 students are actively engaged in the use of virtual environments, typically in a non-school leisure environment, there has been little effort to explore the role such settings can play in teaching, learning and collaboration. *STEM and ICT Instructional Worlds: The 3D Experience* (STEM-ICT 3D) is a National Science Foundation Innovative Technology Experiences for Students and Teachers (ITEST) strategies project that seeks to address this need.

STEM-ICT 3D is an initiative of the Carolinas Virtual World Consortium composed of Appalachian State University and Clemson University in partnership with Davie and Catawba County Schools in North Carolina, and Oconee and Pickens County Schools in South Carolina, the Appalachian State University Mathematics and Science Education Center (MSEC), North Carolina Department of Environment and Natural Resources (NCDENR), and Teleplace, Inc. The project is intended to inspire middle school students to pursue studies and careers in science, technology, engineering, and mathematics (STEM) – particularly information and communication technology (ICT) fields - as well as prepare students with the skills necessary to succeed in STEM education and careers. *STEM-ICT 3D* incorporates a series of activities that provide an engaging, safe environment for middle school students and teachers to explore STEM concepts through a unique approach where students, serving as the technical experts, collaborate with their teachers to develop an inquiry-based learning project for use in a 3D immersive virtual environment.

The objective of this chapter is to present an applied case study that describes the design of *STEM-ICT 3D*, examines the implementation, and explores the use of students as technical experts collaborating with teachers, the pedagogical experts, to build 3D virtual worlds for middle school instruction. The background of the project including the literature and research that contributed to the conceptualization of the program will be covered first, followed by a description of the student and student/teacher workshops. An overview of the Presence Pedagogy framework presented to the teachers for consideration in their instructional development will be discussed and a description of the 3D virtual worlds that were created will be provided. Finally, a discussion of student and teacher perceptions of the workshops, and successes, will point to future research and next steps for the project and broadening its impact.

BACKGROUND OF THE *STEM-ICT 3D* PROJECT

Faculty in the Leadership and Educational Studies department at Appalachian State University in Boone, North Carolina (USA) developed the AETZone more than eight years ago. A recipient of the *2006 Campus Technology Innovators: Virtual and Immersive Learning* award, the AETZone provides a protected 3D virtual environment for graduate programs of study including instructional technology, library science, school administration, and higher education. The interdisciplinary design of this virtual world for graduate education allows faculty to create and pilot best practices for online learning environments. For those who are interested, a more detailed description of the AETZone 3D virtual immersive learning envi-

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