Multi–User Virtual Environments for Teaching and Learning

Edward Dieterle
Harvard University, USA

Jody Clarke
Harvard University, USA

INTRODUCTION

In the late 1970s, Richard Bartle and Roy Trubshaw of the University of Essex developed the first MUD (multi-user dungeon/domain/dimension, depending on the source) to facilitate multiplayer role-playing games run over computer networks (Bartle, 1999; Dourish, 1998), allowing groups of individuals to build virtual realities collaboratively. Despite limited visual and social cues, immersion in text-based virtual environments have the capacity to support thriving virtual communities that demonstrate characteristics of traditional communities, such as love, hate, friendship, and betrayal (Rheingold, 1993).

Advances in computational power and network connectivity have driven the evolution of MUDs, resulting in diverse human computer interfaces such as MOOs (object-oriented MUDs), multi-user virtual environments (MUVEs), and massively-multiplayer online role-playing games (MMORPGs), among others. The present article focuses primarily on MUVEs.

Although MUVEs are commonplace to gamers (i.e., players of *EverQuest, Doom,* and *Madden NFL*), the affordances of this interface are rarely utilized for substantive teaching and learning. This article will discuss how MUVEs can be used to support the situated and distributed nature of cognition within an immersive, psychosocial context. After summarizing significant educational MUVEs, we present Harvard University's River City MUVE (http://muve.gse.harvard.edu/river-cityproject) in depth as an illustrative case study.

BACKGROUND

MUVEs have been used in education for:

- Creating online communities for preservice teacher training and in-service professional development (Bull, Bull, & Kajder, 2004; Riedl, Bronack, & Tashner, 2005; Schlager, Fusco, & Schank, 2002).
- Engaging science-based activities while promoting socially responsive behavior (Kafai, 2006),
- Helping students understand and experience history by immersing them emotionally and politically in a historical context (Squire & Jenkins, 2003).
- Promoting social and moral development via cultures of enrichment (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005).
- Providing an environment for programming and collaboration (Bruckman, 1997).
- Creatively exploring new mathematical concepts (Elliott, 2005).
- Engaging in scientific inquiry (Clarke, Dede, Ketelhut, & Nelson, 2006; Ketelhut, Dede, Clarke, Nelson, & Bowman, in press).

Regardless of content and intended user group, all MUVEs enable multiple simultaneous participants to (a) access virtual contexts, (b) interact with digital artifacts, (c) represent themselves through "avatars" (in some cases graphical and in others, text-based), (d) communicate with other participants (in some cases also

Table 1. Summary of educational MUVEs, learning goals, functionality, and corresponding URLs

MUVE	Developer	Learning Goals and Objectives	Functionality	Web site
AppEdTech	Appalachian State University	Distance education courses and services for graduate students	AppEdTech is a graphical MUVE designed to support graduate students working over distance. Student control avatars that interact with other students, instructors, and artifacts, such as course resources.	http://www.lesn.appstate.edu/aet/aet.htm
AquaMOOSE 3D	Georgia Institute of Technology	Visualization of and experimentation on parametric equations	AquaMOOSE 3D is a graphical MUVE designed for the construction and investigation of parametric equations.	http://www.cc.gatech.edu/elc/aquamoose
MOOSE Crossing	Georgia Institute of Technology	Computer programming and collaboration	MOOSE Crossing is a text-based MUVE designed for kids aged 9-13. Through the interface, users create virtual objects, spaces, and characters, while interacting with one another through text.	http://www.cc.gatech.edu/elc/moose-crossing
Quest Atlantis (QA)	Indiana University	Promotion of social and moral development	QA is a graphical MUVE designed for children ages 9-12 to complete activities with social and academic merit in both formal and informal learning settings.	http://atlantis.crlt.indiana.edu
Revolution	Massachusetts Institute of Technology	History	Revolution is a multiplayer role playing game where students experience history and the American Revolution by participating in a virtual community set in Williamsburg, VA on the eve of the American Revolution.	http://educationarcade.org/revolution
River City	Harvard University	Scientific inquiry and 21st century skills	River City is designed for use in middle school science classrooms. As visitors to River City, students travel back in time, bringing their 21st century skills and technology to address 19th century problems.	http://muve.gse.harvard.edu/rivercityproject
Tapped IN	SRI	Online teacher professional development	TI bundles synchronous and asynchronous discussion tools, a notes section, an interactive whiteboard, and file sharing space. After logging into the virtual space, users are teleported to the TI Reception Area and greeted by Helpdesk staff.	http://tappedin.org
Whyville	Numedeon, Inc	Scientific literacy and socially responsible behavior	Whyville is a graphical MUVE designed for children between middle childhood and adolescence. Whyville users, called citizens, from all over the world access Whyville through a Web-based interface to (a) communicate with old friends and familiar faces through synchronous chat and the *Whyville-Times* (Whyville's official newspaper with article written by citizens), (b) learn math, science, and history through interactive activities, and (c) build online identities. As citizens participate in a variety of activities, they earn clams (the official monetary unit of Whyville), which they can use to enhance their avatars and throw parties.	http://www.whyville.net

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