Chapter 4
Assistive Technologies and Environmental Design Concepts for Blended Learning and Teaching for Disabilities within 3D Virtual Worlds and Learning Environments

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ABSTRACT

3D Virtual Learning Environments (3D VLEs) are increasingly becoming prominent supporters of blended learning for all kinds of students including adult learners with or without disabilities. Due to the evidenced effect of architectural design of physical learning spaces on students' learning and current lack of design codes for creating 3D virtual buildings, this case study aims at evaluating the suitability of the architectural design elements of existing educational facilities and learning spaces within 3D VLEs specifically for delivering blended e-learning for adult students with disabilities. This comprises capturing student contentment and satisfaction levels from different design elements of the 3D virtual spaces in an attempt to issue recommendations for the development of 3D educational facilities and hence initiate a framework for architectural design of 3D virtual spaces to augment accessibility, appeal and engagement for enhancing the e-learning experience of under-graduate, post-graduate and independent-study adult learners with disabilities within these virtual worlds.

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INTRODUCTION

This study ultimately endeavors into providing recommendations and hence an initial architectural design framework for creation and deployment of 3D virtual learning spaces within 3D virtual worlds, used for students' blended learning experiences comprising of online courses supplementing face-to-face instruction. Since blended learning advocates mixing different learning environments to deliver education, e.g., combining face-to-face instruction with computer mediated instruction, 3D VLEs have been abundantly used as a technological medium for education, supporting traditional learning. For example, students can be immersed in a 3D VLE, performing learning activities while synchronously being inside a physical classroom; or whilst being in different physical locations; or even asynchronously at different times. The significance of this research hence arises from the increased focus on students' technological involvement which has become one of the motives significantly adjusting learning space design in the physical world (Whitmer, 2009), and thus analogously expected to have an impact on learning space design in 3D virtual worlds. Our aim through this research is therefore to define architectural design elements of 3D virtual learning spaces that can encourage adult students' satisfaction (specifically learners with disabilities) from these learning spaces and thus enhance students' e-learning experiences in 3DVLES. This would hence automatically reflect on improving the students' overall blended learning experience comprising of both the physical and the virtual.

The utilization of 3D VLEs has proven especially beneficial for students with disabilities who might have different forms of physical challenges hindering their participation in "real-life", face-to-face education. Learners suffering from various types of disability constitute about 8% of all the people who use the worldwide web technology. Their disabilities range from visual, hearing and movement impairments to cognitive, language impairments and seizure disorders (Gnome, 2008). Virtual World systems in general are currently being utilized profusely for rehabilitation purposes as they induce encouragement to overcome disability by providing students with a sense of accomplishment for tasks they might not be able to achieve in "real-life" (RL). This is because they can create customized avatars, within 3D virtual worlds, which do not have to be disabled, and thus fly and move in 1st and 3rd person views freely (Flynn et al., 2008). Hence a person's disability in the physical world could be different from that in the virtual world e.g., a person who cannot walk in "real-life" would be able to function normally online as his impairment would not hamper keyboard and mouse control inside 3D VLEs, whilst a person with sensory-motor problems might be able to move normally in RL but have problems in manipulation online due to lack of manual dexterity. Assistive Technologies (AT) and Universal Design for Learning (UDL) are two approaches currently being used to achieve this purpose of improving education for students with disabilities, where UDL focuses on enhancing the physical learning environment as a whole and AT centers on assisting students individually (Edyburn, 2005). Within this research the authors adopt the AT approach where design of 3D virtual Learning environments can be specifically customized to accommodate specific needs of disabled users, particularly according to gender, the individual type of disability, and the age group of the user, as will be elaborated in consequent sections.

Furthermore, there is ample literature in the physical world depicting i) the effect of architectural design elements of "real-life" educational spaces on students, ii) presence of design guidelines for physical educational facilities, and iii) special design characteristics needed to accommodate students with disabilities. These were imperative to generate architectural guidelines and specifications for designing physical educa-