

# Chapter 24

## Personalisation of 3D Virtual Spaces for Enhanced Ubiquitous Learning

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### **ABSTRACT**

*This study explores, using experiments, the effects of different architectural design features of 3D virtual educational buildings on higher-education learners during online e-learning sessions. Architectural features tested include shape, lighting, dimensions, colours and textures. Learners are divided into three groups: under-graduates, post-graduates, and adult learners. Results are demonstrated comprising charts and statistics capturing the extent of learners' enjoyment, information retention, and participation from being inside different 3D virtual spaces with different design characteristics. Consequently, design characteristics causing highest student retention, participation and contentment are established for design of a better 3D virtual learning environment (VLE). These provide guidelines for customised design practices inside 3DVLEs to create 3D virtual educational spaces best suited for ubiquitous "any-time" "any-place" e-learning of each individual student. This will aid in guiding the otherwise current ad-hoc design approach to building educational facilities in 3DVLEs.*

### **INTRODUCTION**

Three-dimensional Virtual Learning Environments (3DVLEs) have been increasingly recognised over the past decade as media that add value to both blended and e-learning experiences, for varieties of students and educators. The novelty of practice afforded by 3DVLEs, such as Second Life, has persuaded

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many universities, such as Harvard, Princeton, Oxford, to construct 3D virtual campuses (Kozhevnikov & Garcia, 2011).

As a result, many opportunities have arisen for 3D designers and architects to create educational buildings inside such 3DVLEs, crossing the limits of reality and probing into the realms of imaginative fictional building due to the essential difference between the physical and a virtual world, where there are no constraints on budgets, natural forces or physics, material strength, or even infrastructure requirements and regulations (Bridges & Charitos, 1997). The absence of gravitational force, for example, allows for 3D virtual buildings to look futuristic, float in mid-air or be situated under the deepest ocean. Such novel design concepts have been used to build virtual university campuses in 3DVLEs to produce a wide diversity of designs ranging from realistic portrayals, or replicas of physically existing campuses, to completely imaginative embodiments (Alarifi, 2008). However there is currently very little research discussing the suitability or effects of these varieties of fictional designs on students' e-learning experiences in 3DVLEs (Lucia et al., 2009; Minocha & Reeves, 2010; Ewais & Troyer, 2014). Furthermore, current design practices for creating 3D virtual buildings are ad-hoc, not following any predefined processes, guidelines or methodologies to ensure best design practices for enhancing the e-learning they support (Seidel et al., 2010; Fonseca et al., 2014).

From experience and general student feedback, Minocha et al. (2010) claim that design and usability of 3D learning spaces are key factors that influence student experience, learning, engagement, motivation (Joua & Liu 2011) and performance (Montoya et al 2011). Ubiquitous learning takes into account the context, characteristics, behaviour and preferences of the students so that the system can provide content and features tailored for them regardless of location and time of access. Therefore this research investigates and discusses the impact of different architectural digital design elements of 3D virtual educational facilities (e.g. space shape, size, colour, texture, dimensions,) on a student's e-learning experience in 3DVLEs. The research focuses on specific measures of this impact on learning objectives including information retention, student participation and the extent to which students report enjoying the experience. Further analysis explores which elements of design cause specific effects, and hence finally what design configuration or recommendations could be best used to guide the design process of creating and customising 3D virtual learning spaces for users' specific purposes and personalisation, thus enhancing the student's overall learning experience in 3DVLEs.

This chapter commences by establishing from literature the significance of 3DVLEs as a medium for delivery of e-learning, and in parallel, crafts a rich description of the importance of architectural design elements on learning. Hence the undertaken research will be explained, the choice of the architectural design elements chosen for testing, the experiments conducted to investigate effects of the chosen design elements on retention, participation and enjoyment of students, and subsequent statistical results and recommendations. The specific effects of different architectural design features of 3D virtual educational buildings on higher-education learners during online e-learning sessions and project work are identified as one of the benefits conducted in 3D virtual worlds (Karsakov et al, 2014; Laffey et al., 2014). Architectural design features tested include shape of class, lighting and open spaces, dimensions and size of space, colours, and textures. Learners are divided into three groups: (i) under-graduate students, (ii) post-graduate students, and (iii) adult learners and researchers. Results are thus demonstrated comprising charts, diagrams and statistical analysis demonstrating the effect of different architectural design elements on learners' enjoyment, information retention, and participation. Hence, design characteristics causing highest student retention, participation, contentment, preferences and suggestions for design

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