Chapter 14
The Effect of List–Liner–Based Interaction Technique in a 3D Interactive Virtual Biological Learning Environment

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ABSTRACT

Various interaction techniques (such as direct, menu-based, etc.) are provided to allow users to interact with virtual learning environments. These interaction techniques improve their performance and learning but in a complex way. In this chapter, we investigated a simple list-liner based interface for gaining access to different modules within a 3D interactive Virtual Learning Environment (VLE). We have implemented a 3D interactive biological VLE for secondary school level students by using virtual mustard plant (VMP), where students interact by using 3D interactive device with the help of list-liner based interface. The aim of this work is to provide an easy interaction interface to use list-liner interaction technique by using 3D interactive device in an information-rich and complex 3D virtual environment. We compared list-liner interface with direct interface and evaluations reveal that the list-liner interface is very suitable and efficient for student learning enhancement and that the students can easily understand and use the system.

1. INTRODUCTION

The use of advance technology for teaching and training purposes is increasing day-by-day and many fields such as surgery, aeronautic assembly, architecture, businesses and education etc, are using digital technology applications to achieve efficiency in their work processes (Fung, 2002; Johansson & Wickman, 2018). These technologies are very helpful for the improvement of skill and independent learning (de Oliveira & Galembeck, 2016; Emvalotis & Koutsianou, 2018). As technological development are rapidly growing in science education, to develop new strategies and to enable teachers to develop pedagogical content knowledge around novel topics (Williams, Eames, Hume, & Lockley, 2012). According to Dalgarno and Lee, "technologies themselves do not directly cause learning to occur but can afford certain tasks that themselves may result in learning" (Dalgarno, Hedberg, & Harper, 2002). One of the advance technologies is the use of Virtual Reality (VR) technology that provides an efficient solution for problems where the physical alternative is not available, the cost of doing the actual work is high or the procedure of the task is very dangerous to perform, particularly in education because of their unique technological characteristics that differentiate them from the other Information and Communication Technologies (ICT) applications (Baggott la Velle, Wishart, McFarlane, Brawn, & John, 2007).

1.1 Virtual Reality (VR)

The recent advances in computer hardware and software have made VR technology capable to be used in many fields such as medical, military and education. According to Howard Rheingold VR is a three-dimensional computer-generated environment where user feels his/her presence. In the virtual environment user is able to navigate freely from one point to another, observe it from different sides, to get in touch with it, to seize it and manipulate it (Rheingold, 1991). VR can be described as a montage of technologies that support the creation of synthetic, highly interactive Three Dimensional (3D) spatial environments that represent real or non-real situations (Mikropoulos & Natsis, 2011). VR allows user to change the flow of occurrences in a virtual environment and hence to interact with virtual things. It uses many hardware components and software techniques for each application area. Virtual environment presents the 3D representation of the real or imaginary facts and provides to users a real time interaction (Hachet, 2010). Virtual reality can be classified into three basic schemes that are interaction, immersion and involvement (Pausch, Proffitt, & Williams, 1997). Interaction can be performed by pointing and gesturing, and by picking objects to manipulate them or examine them. The 3D interaction interfaces provide to users more realism and immersion in a virtual environment where users feel their presence. In virtual reality the 3D interaction is considered as a coercing component which allows the user to navigate, select, control and manipulate objects in a virtual environment (Ullah, 2011). Involvement is the user participation in a virtual world where he/she can navigate in a passive or active way (Pausch et al., 1997). Therefore, we must design the virtual environments in a way that is based on 3D interaction techniques where user feels more realism and immersion in it.

1.2 Virtual Reality in Education

In the teaching-learning process innovative approaches have been developed by using new technologies, in which VR is considered the essential one (Richard, Tijou, Richard, & Ferrier, 2006). VR is one of the most imperative contrivance that support students learning in different fields. Therefore, there are a lot

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