Chapter VI
Technology Assisted Problem Solving Packages for Engineering

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ABSTRACT

This chapter presents the development of technology-assisted problem solving (TAPS) packages at University Tenaga Nasional (UNITEN). This project is the further work of the development of interactive multimedia-based packages targeted for students having problems in understanding the subject of engineering mechanics dynamics. One facet of the project is the development of engineering mechanics dynamics problems for core undergraduate engineering courses. This chapter discusses the development of an interactive multimedia environment for solving relative motion of a rigid body using rotating axes. More specifically this chapter outlines the framework used to develop the multimedia package, highlighting our multimedia design process and philosophy.

INTRODUCTION

The influence of the computer is best seen in its multimedia configuration which includes an integration of multiple media elements that is, text, graphics, images, audio, video and animation into a coherent learning environment which in turn transform student learning and problem solving approach (Janson, 1992). Previous studies have shown that traditional learning (classroom teaching) could not engage the learners in visualization tasks and perform virtual experiments

(Cairncross, 2000). In contrast, multimedia learning aids have the potential to promote interactivity through its wide range of graphical environments. Additionally, the learner can control the rate of delivery and sequencing of the material being presented, that is the learner can learn at his or her own pace without loosing interest in the subject matter.

The present study discussed pertinent issues of a technology-assisted problem solving (TAPS) engineering environment project at University Tenaga Nasional (UNITEN). Our past research has led to the implementation of structured three-dimensional (3-D) environment that enhanced visualization coupled with real-time motion by integrating 3D animations with multimedia technology. This problem-solving environment has been extended to 3D virtual worlds where the user could freely explore and learn-by-discovery.

Newer emerging technology, such as virtual reality (VR), is also being researched for its effectives in education. VR systems were first introduced in the learning environment in mid 90s (Macpherson, 1998). The term 'virtual reality' is currently used to describe a range of computer-based systems in which a user can explore hardware or software generated 'micro world' (artificial environments) that allow close resemblance to reality. VR extends the interaction-oriented features of multimedia by the concept of cyberspace, that is, modeling objects and their behavior in virtual environments, integrating position-tracked human-computer interaction devices and performing numerically intensive computations for real-time navigation.

The prime feature of VR is 'interactivity.' Special VR hardware and software are thus required to allow human-computer interaction to permit input of the user's actions and movement to the computer and to provide corresponding simulated feedback to the user. An early application of such system was the flight simulator used to train pilots. However, it is in the area of hi-tech computer games that many of the application developments in this field have taken place. Although VR has been used for educational purposes (Bell & Scott, 1995, Dede et al., 1996; Kim et al., 2001), the potential of VR is just beginning to be exploited by a few science and engineering educators (Manseur, 2005).

The long-term objective of this work is to develop realistic 2D and 3D virtual TAPS packages where a user could learn-by-discovery and gain better knowledge by doing meaningful tasks. Our present research aimed to improve and define new patterns of interactions by adding interactivity to realistic 2D and 3D environment. It is believed that interactivity could enhance user learning by giving the virtual environment the capability to coach and provide feedback.

CURRENT STATE OF TEACHING AND LEARNING ENGINEERING COURSES

In general, education, in higher learning institutions in Malaysia still focuses on older educational models of linear progression or surface learning, whereas counterparts from other nations provide predominantly high-impact audio-visual perception.

The western countries, particularly the UK and USA, have used computers and CAL packages to motivate students of higher learning institutions since the 1960s (Ismail, 2001). Although encouraged by the government's policy towards the use of new technology in teaching, several academicians in Malaysia commented that they do not have the experience in developing multimedia-learning materials (Julia et al., 2002).

However, since the emergence of newer hardware and software technologies for multimedia and VR, educational practitioners began to study on the pedagogical effectiveness of these technologies. In a developing country such as Malaysia, multimedia technology was first briefly introduced in the late 1990s and became popular with the launch of Multimedia Super Corridor