Available online at www.sciencedirect.com
SCIENCE DIRECT®
Computers & Industrial Engineering 47 (2004) 289–312
computers & industrial engineering
www.elsevier.com/locate/dsw

The virtual company: a re-configurable open shell for problem-based learning in industrial engineering☆

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Received 19 May 2003; accepted 5 August 2004
Available online 1 October 2004

Abstract

The interactive multimedia e-learning system (IMELS) is an e-learning courseware for industrial engineering developed at the University of Hong Kong. The system adopts a problem-based learning approach to the teaching and learning through the delivery of realistic case problems using interactive multimedia technology over the World-Wide-Web. The main features of the system include a multimedia portfolio of industrial engineering, an electronic knowledge base and the virtual company suit that presents the case problem that exists in two virtual enterprises. As the system is designed to enhance the effectiveness of teaching industrial engineers who will become more capable individuals to fit into their future careers through the exposition of vivid case problems in their learning process, one of the main features of the system is its ability to create computer-based material for case problems in a flexible and efficient manner. In this respect, the open-shell architecture of the virtual company, which consists of a client-based interface that runs on user PCs and a server-based repository, enables web-based materials to be loaded and organized in real time so that the content of individual virtual companies can be dynamically configured to cater for each case problem. Apart from the introduction of the IMELS, this paper focuses on the design and the functionality of the virtual company. The unique feature of the configurable animated entities will be explained and is illustrated with a case problem that exists in the GX Port Holdings Corporation virtual company.

Keywords: Industrial engineering education; E-learning; Problem-based learning

☆This manuscript was processed by Area Editor D.L. Kimbler.

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doi:10.1016/j.cie.2004.08.002

1. Introduction

In recent years, there has been a rapid growth in the Interest of applying information technology (IT) for teaching and learning in a wide range of subject areas at all levels. This development has been accelerated by the significant reduction in cost of the Internet infrastructure and the easy accessibility of the World-Wide-Web. In tertiary education, popularity of introducing computer-based learning tools that provide interactive multimedia effects, computer graphics and animations, and online features is ever increasing.

In addition to the audio-visual richness of IT-courseware, these computer-based teaching and learning tools provide a learning environment that overcomes the limits of space and time in knowledge delivery and capturing, as well as allow students to determine their own learning path and pace. This is clearly a big advantage in knowledge acquisition over traditional teaching methods that mainly rely on classroom lecture and demonstrations. The use of the Internet and IT infrastructure for teaching and learning, commonly known as e-learning, has vastly enhanced flexibility and effectiveness of knowledge delivery.

In a typical e-learning system, interactive and multimedia features including computer animations, sound and video, 3D graphics, on-line databases, and other Internet-based features such as email, ICQ and chat room facilities can be integrated to create a cyber-platform for learning. This stimulating learning environment engages students into a deeper learning process that can often elicit a high rate of information retention, and result in a shorter learning time (Ng & Komiya, 2000). In addition, this multimedia education platform can be interactive, which enables the students to control the content and flow of information capturing (Vaughan, 1998). The result is that students become active participants in learning and they take control of their learning processes. Furthermore, with the easy accessibility of the World-Wide-Web and development of peer-to-peer, distributed computing framework (Balakrishnan, Kaashoek, Karger, Morris, & Stoica, 2003), a flexible e-learning system can be created where students can learn at their own pace, wherever and whenever they want.

In commerce, the use of multimedia for information dissemination and employee training have become widely used, especially in management consultancy, banking, insurances, airlines, government agencies, etc. Companies such as IBM, Compaq, Telstra, Morgan Stanley, P&G, Unisys, PeopleSoft, and Dell are heavily involved in deploying e-learning in their training programs. In the academic community, a number of web-based, e-learning platforms have been developed for teaching (Anido, Llamas & Fernandez, 2001; Bonk, Malikowski, Angeli, & East, 1998). Some of these systems are designed for general educational purposes that provide online forum and libraries, virtual classroom and peer networks (Bonk et al., 1998; Hiltz, 1994); internet-based virtual experimental systems and virtual laboratories for complex process studies in chemical engineering (Shin, Yoon, Park, & Lee, 2000); control engineering (Schmid & Ali, 2000); computer science and engineering (Barua, 2001); and electrical engineering and electronics (Coleman, Kinniment, Burns, Butler, & Koelmans, 1998). In many cases where e-learning are adopted, very encouraging feedbacks from both teachers and students are obtained (Chassie, 2002; Jarvela & Hakkinen, 2002; Khalifa & Sena, 2002).

The Department of Industrial and Manufacturing Systems Engineering of the University of Hong Kong has designed and developed a interactive multimedia e-learning system, known as the IMELS that provides a learner-oriented and problem-based learning environment for teaching industrial engineering. This e-learning system is designed to complement the traditional methods of teaching industrial engineering with the incorporation of a number of key components in problem-based learning (Jarvela & Hakkinen, 2002), including (a) active learning through posing questions and seeking answers;