Chapter 11
Improvement of Engineering Students Education by E-Learning

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ABSTRACT

Traditional education for engineers has shifted towards new methods of teaching and learning through the proliferation of Information and Communication Technologies. The continuous advances in technology enable the realization of a more distributed structure of knowledge transfer. Virtual Learning Environment has become an increasingly ambiguous term in recent years because of essential elements facilitating a consistent environment for learners. It has the potential to position the learner within a meaningful context to a much greater extent than traditional interactive multimedia environments. The 3D environment acquaints students with features of different shapes and objects, and can be particularly useful in teaching younger students different procedures and mechanisms for carrying out specific tasks. This case explains the key issues and success factors regarding the e-Learning for engineering education especially in developing countries.

BACKGROUND: ENGINEERING EDUCATION AND CHANGES

Recent years have seen dramatic changes in engineering education in terms of increased access to lifelong learning, increased choice in areas of study and the personalization of learning. To advance across all domains seems to necessitate incompatible changes to the learning process, as practitioners offer individualized learning to a larger, more diverse engineering student base. To achieve this cost effectively and without overwhelming practitioners requires new approaches to teaching and learning coupled with access to a wide range of resources: practitioners need to be able to source and share engineering materials, adapt and contextualize them to suit individual needs, and use them across a variety of engineering educational models (Littlejohn, et al., 2008). Hence a great deal of effort has focused on the integration of new technologies

DOI: 10.4018/978-1-61520-869-2.ch011

such as multimedia video, audio, animation, and computers, with associated software, to achieve the improvement of traditional engineering education. The internet technologies have also been popularly applied to web-based learning (Hung, et al., 2007). The growth of the information society provides a way for fast data access and information exchange all over the world. Computer technologies have been significantly changing the content and practice of engineering education (Gladun, et al., 2008). Information and communication technologies (ICT) are rightly recognized as tools that are radically transforming the process of learning. Universities, institutions and industries are investing increasing resources to advance researches for providing better and more effective learning solutions (Campanella, et al., 2007).

Nowadays, the use of ICT has improved learning, especially when coupled with more learner-centered instruction, or convenience, where learning and exchange with the instructor can take place asynchronously at the learners own pace or on as-needed basis (Motiwalla, 2007). The consequent applications of all multimedia and simulation technologies, computer-mediated communication and communities, and Internet-based support for individual and distance learning have the potential for revolutionary improvements in education (Gladun, et al., 2008).

Hence, electronic collaboration (e-collaboration) technologies for engineers are technologies that support e-collaboration. An operational definition of e-collaboration is collaboration among different individuals using electronic technologies to accomplish a common task. These e-collaboration technologies include several Internet-based technologies, such as e-mail, forums, chats, and document repositories (Padilla, et al., 2008).

The first computer-supported collaboration system emerged in 1984 from the need of sharing interests among product developers and researchers in diverse fields. This revolutionary approach was called computer-supported collaborative work and it was used to support learning by means of desktop and video conferencing systems. Consequently, a new paradigm arose around educational institutions which were defined as computer-supported collaborative learning (CSCL). This emerging system was based on the contributions of constructivist learning theories about the term collaborative learning, which focus on social interdependence and maintain that engineering students consolidate their learning by teaching one another. CSCL environments were created for using technology as a mediation tool within collaborative learning methods of instruction. Since then, and thanks to the great evolution of network technologies, engineering education is moving out of traditional classrooms. These collaborative e-Learning environments have caused a revolution in the academic community, providing a great amount of advantages for using both the Internet and technologies for 'any-time, any-place' collaborative learning (Jara, et al., 2008). Figure 1 shows a brief history of distance learning (Hamza-Lup, 2007; Harper, 2004).

SETTING THE STAGE: E-LEARNING AND ENGINEERING STUDENTS

The final objective of a learning object is to realize three fundamental learning goals:

- To inform the engineering students to be responsible of their learning, capable to manage processes to reach aims and to understand their learning needs;
- To promote real and meaningful learning environments and contexts, enabling the engineering students to retrieve information and build knowledge by using different learning ways;
- To create stimulating situations and learning dynamics that prelude to wider learning tasks