Design for Quality of ICT-Aided Engineering Course Units

Stelian Brad, Technical University of Cluj-Napoca, Cluj-Napoca, Romania

ABSTRACT

Developing high quality engineering course units is a challenging task. Capacity to explain complex technical solutions and behavioral phenomena of engineering technologies in a limited timeframe is not an easy job. Moreover, ensuring information reproducibility for individual study is also important. Sometimes, courses should be delivered remotely. In this context, the latest developments in information and communication technologies (ICT), including multimedia and Internet-based education platforms, facilitate the creation of reliable solutions to these challenges. Even if information technologies are helpful, careful planning is required to design quality course units because many conflicts occur in meeting quality targets. In this respect, a generic approach for improving the quality of engineering course units when a large set of requirements and constrains intervenes on the design map is introduced in this paper as a mean to identify the best places where and how ICT can aid the education process. Quality planning and innovation tools are considered to master this situation. The research shows that smart application of multimedia technologies and web-based education platforms can deliver great results towards better quality of engineering courses.

Keywords: Course Unit Design, Course Unit Quality Planning, Engineering Education, ICT-Aided Education, Information and Communication Technologies (ICT), Quality Improvement

1. INTRODUCTION

Nowadays dynamics in science and technology generates a quite rapid depreciation of knowledge in engineering. There are some areas, like software technologies, where obsolescence is about one year. Producing companies operate in environments influenced by globalization and rapid change in customer requirements and behaviours. In this demanding economic environment, such companies expect from engineers to excel from graduation to retirement. This rises up many challenges on how to approach properly the educational process for engineers. Countless opinions show there is no general pattern for success. Depending on the subject area, customized models and tools are required to maximize the impact of the educational process (Barros, Read & Verdejo, 2008; Brad, 2005; Liang, 2009; Lindroos, Malmivuo & Nousianinen, 2007; Ogot & Okudan, 2007; Popescu, Brad & Popescu, 2006; Salihbegovic & Tanovic, 2008; Takago, Matsuishi, Goto & Sakamoto, 2007). Sometimes, specific engineering theory has to be redefined and often interrelated with components from other theories, with practical knowledge and with skills development before it can be applied in

DOI: 10.4018/ijqaete.2014010103
real projects (Brackin, 2002; Kolmos & Du, 2008; Yeo, 2008). Team working, communication, project management, learning to learn, visioning, change management, leadership are additional skills required to engineers besides the basic technical knowledge (Hutchings, Hadfield, Horvath & Lewarne, 2007; Kaminski, Ferreira & Theuer, 2004; Richardson, 2013).

Nowadays, both undergraduate students and postgraduates in engineering look for flexible ways to attend high quality courses and for rapid access to the most appropriate educational facilities. In front of such expectations, ICT-aided education, which exploits the facilities provided by the latest developments in multimedia and web-based technologies, is of real interest. (e.g. Bhatt, Tang, Lee & Knowi, 2009; Callaghan, Harkin, McGinittly & Maguire, 2008; Du, Li & Li, 2008, Ebner & Walder, 2008; Helander & Emami, 2008, Smith, 2005).

Provision of ICT-aided courses is not a simple task (Finger, Gelman, Fay & Szczerban, 2005; Lau, Mak & Ma, 2006; Li & Wang, 2007). Beyond the immanent technological challenges, there are other issues that require meticulous treatment. In this respect, a course in engineering should be seen as an educational product that strives for high quality towards four generic pillars: need-requirement pillar, education provider pillar, study program pillar and teaching-learning process pillar (Popescu, Brad & Popescu, 2006). The needs and related requirements are closely linked to the challenges that students encounter onto the workforce market. The education provider should permanently adapt the course units to the latest technological developments. The teaching-learning process should be student-centred, with facilities for customising the learning process and its outcomes. The four pillars should be tackled in a concurrent way.

Engineering courses come up with supplementary requirements than, let us say, socio-humanistic courses. Moreover, if they have to be delivered remotely, specific requirements have to be added, like: virtual collaborative experimentation, interactive remote approach, collaborative remote learning, off-line active learning, cross-institutional collaboration, remote test and assessment (e.g. Helander & Emami, 2008; Hutchings, Hadfield, Horvath & Lewarne, 2007; Miladin, 2013; Jou, Chuang, Wu & Yang, 2008; Mackey & Ho, 2008; Rizzotti & Burkhart, 2006; Wang, Dannenhoffer, Davidson & Spector, 2005). Therefore, a comprehensive planning is required to design a high-impact engineering course (Bier & Cornesky, 2001; Brad, 2005; Brad, 2009; Koskal & Egitman, 1998; Ogot & Okudan, 2008). Under these circumstances, quality must be “designed” within the course before course delivery (Brad, 2005).

Thus, the first objective of this paper is to introduce a roadmap for quality planning and innovation of engineering course units. The second objective is to see how ICT can aid on increasing the course quality. The article is organized as follow. In section two, basic information about quality planning and innovative problem solving are introduced. Key issues on course quality and challenges on requirements definition are also revealed in this part of the paper. Section three highlights the areas of intervention towards designing for quality ICT-aided engineering course units. Section four is dedicated to the theoretical description of the methodology. Application of the theory on a case study is illustrated in section five. The paper ends with conclusions and ideas for future researches.

2. BACKGROUND

Educational product requires a careful quality planning in the early stages of its design (Brier & Cornesky, 2001; Brad, 2005). Moreover, negative correlations between various technical characteristics that define the performance of an educational product must be solved without compromises (e.g. time allocated to prepare the ICT-aided course versus life-cycle of the course). This necessitates innovative problem
Online Automated Essay Grading System as a Web Based Learning (WBL) Tool in Engineering Education
www.igi-global.com/chapter/online-automated-essay-grading-system/44727?camid=4v1a