Design Considerations for Delivering E-Learning to Surgical Trainees

Jane Coughlan, Brunel University, UK
Willem-Paul Brinkman, Delft University of Technology, The Netherlands

ABSTRACT

Challenges remain in leveraging e-health technologies for continuous medical education/professional development. This study examines the interface design and learning process features related to the use of multimedia in providing effective support for the knowledge and practice of surgical skills. Twenty-one surgical trainees evaluated surgical content on a CD-ROM format based on 14 interface design and 11 learning process features using a questionnaire adapted from an established tool created to assess educational multimedia. Significant Spearman’s correlations were found for seven of the 14 interface design features – ‘Navigation’, ‘Learning demands’, ‘Videos’, ‘Media integration’, ‘Level of material’, ‘Information presentation’ and ‘Overall functionality’, explaining ratings of the learning process. The interplay of interface design and learning process features of educational multimedia highlight key design considerations in e-learning. An understanding of these features is relevant to the delivery of surgical training, reflecting the current state of the art in transferring static CD-ROM content to the dynamic web or creating CD/web hybrid models of education.

Keywords: E-Health, Internet, Multimedia, Surgery, Training, Web-Based Learning

1. INTRODUCTION

Multimedia applications have proven popular options in delivering education where the integration of different forms of media offer a structured approach to understanding the procedural tasks and decision points in practicing surgery (Luker, Sullivan, Peyre, Sherman, & Grunwald, 2008). Whilst evidence suggests that e-learning, for example in the form of interactive CD-ROMs can benefit surgical education (Baskin et al., 2008), the challenges in delivering this specialised learning material in an electronic format at both the undergraduate level and for continuous medical education/professional development remain (Cosman, Hemli, Ellis, & Hugh, 2007; Gold, Verrier, Olinger, & Orringer, 2002). E-learning comprises of two dimensions - interface design and learning that present specific challenges for delivering training. In terms of interface design, a key challenge in creating educational software is in presenting the appropriate scope and level of material that will engage learners without...
distracting their attention from the relevant items of training information (Ardito et al., 2006; Spires & Prece, 1999). With respect to learning, a key challenge is in the provision of high fidelity demonstrations of surgical procedures and equipment use to allow purposeful practice of surgical skills and attain some degree of feedback on performance for the different types of surgical learning tasks (Khan, Widdowson, & Tiernan, 2004).

Effective educational software seeks to integrate different multimedia formats such as video clips, graphics, animations and audio to provide an interactive and engaging learning experience. However, it has been long been established that poor usability of educational software can be detrimental to learning performance (Megali, Tonet, Dario, Vascellari, & Marcacci, 2005; Parlangeli, Marchigiani, & Bagnara, 1999). Difficulties in learning surgical techniques through multimedia training can arise not because of the learning material itself, but because of inappropriate multimedia formats. For example, a simple animation of the way a surgical tool is used might be more effective than an actual video clip. But a video clip could provide more contextual and realistic detail about a surgical tool compared to graphics, animation or photographs. Design issues have therefore been related to the appropriate selection and organisation of multimedia so that they do not cognitively overload learners (Grunwald & Corsbie-Massay, 2006). However, evaluations of these multimedia training applications are limited, particularly within the surgical training domain, where existing design guidelines do not necessarily accommodate even basic surgical learning demands (Haluck, 2005).

Evaluations of multimedia training are important in understanding the design considerations particularly within the context of surgical education where the growth of the Internet promises increasingly multimedia rich programs (Larvin, 2009; Rissucci et al., 2008). CD-ROMs are being converted to a web-based format or delivered using CD/Web hybrid products (Gold, Begg, Fullerton, & Mathiesen, 2004) and Web 2.0 technologies have facilitated the sharing of educational content (Boulos & Wheeler, 2007), particularly in the use of wikis such as WikiSurgery (www.wikisurgery.com) (Agha, 2006). Given that research has shown that multimedia based surgical training can be flexible enough to adapt to the individual needs of the user with different levels of experience and associated demands for learning (Friedl et al., 2006), it is important to understand the features that support this mode of learning in order to optimise the use of surgical teaching software and inform the development of new computer-assisted curricula. This study uses a multimedia interactive training CD-ROM as a case to examine the interface design and learning process features and their interrelationships and in so doing overcomes many of the problems associated with web-based delivery of education such as bandwidth limitations, loading delays and video streaming in restricted sites.

2. METHODS

This study sought to understand the interface design and learning process features of multimedia surgical training with the use of a CD-ROM titled: “PrimeSkills in Surgery” (Edwards, 1999). The CD-ROM is a relevant exemplar to study as it represents the following: (1) supporting material for trainees on a basic surgery skills training course in the UK; and (2) contribution to the current state of the art in converting CD-ROM content to a web-based format on the site: WikiSurgery (www.wikisurgery.com). The training provided by the CD-ROM enables the learner to: reflect on aptitudes and characteristics that may shape learning profiles; visualise demonstrations of surgical equipment and techniques of their usage; and process learning material by completing recall sections, surgical tests, exercises and quizzes to self-evaluate progress.

An evaluation tool was developed for use in this study, which was adapted from user interface features proposed by Reeves and Harmon (1994) and pedagogical features by Reeves (1998) for evaluating instructional
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