

e-Learning in Surgical Education: A Systematic Review

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OBJECTIVE: e-Learning involves the delivery of educational content through web-based methods. Owing to work-hour restrictions and changing practice patterns in surgery, e-learning can offer an effective alternative to traditional teaching. Our aims were to (1) identify current modalities of e-learning, (2) assess the efficacy of e-learning as an intervention in surgical education through a systematic review of the literature, and (3) discuss the relevance of e-learning as an educational tool in surgical education. This is the first such systematic review in this field.

DESIGN: A systematic search of MEDLINE and EMBASE was conducted for relevant articles published until July 2014, using a predefined search strategy. The database search was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

RESULTS: A total of 38 articles were found which met the inclusion criteria. In these studies, e-learning was used as an intervention in 3 different ways: (1) to teach cases through virtual patients (18/38); (2) to teach theoretical knowledge through online tutorials, or other means (18/38); and (3) to teach surgical skills (2/38).

Nearly all of the studies reviewed report significant knowledge gain from e-learning; however, 2 in 3 studies did not use a control group.

CONCLUSIONS: e-Learning has emerged as an effective mode of teaching with particular relevance for surgical education today. Published studies have demonstrated the efficacy of this method; however, future work must involve well-designed randomized controlled trials comparing e-learning against standard teaching. (J Surg 72:1145-1157. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Internet, graduate medical education, educational technology, computer-assisted instruction, surgery

COMPETENCIES: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

INTRODUCTION

The history of education is replete with instances of new technology being introduced to improve the practice of teaching and learning. Surgical education today is in a state of flux, with external pressures significantly reducing the time available for training. Conventional master-apprentice methods of training need to be reformed to ensure that high-quality training is offered to future surgeons. As such, technology can play an important role in this endeavor, namely e-learning.¹

e-Learning emerged as a significant entity in 1959 at the University of Illinois, with the development of Programmed Logic for Automatic Teaching Operations (PLATO), a computer-assisted instruction system.² In the meantime, the World Wide Web was introduced in 1991,³ which, combined with the rapid growth of the Internet, allowed information to be shared across the world on an easy-to-use platform. The term “e-learning” has since been redefined to refer to the online aspect of teaching and learning. The World Wide Web in its present form (Web 2.0) offers significantly more user interaction than Web 1.0, with tools such as blogs and video sharing, resulting in a dynamic option for education.⁴

The literature shows that e-learning is not a single entity but a combination of teaching methods, such as online tutorials or virtual patient cases.⁵ e-Learning also offers scope for novel educational techniques in web-based teaching, for example, “spaced learning” (repeating the same course material at least once during the course for better retention) and “blended learning” (online teaching combined with

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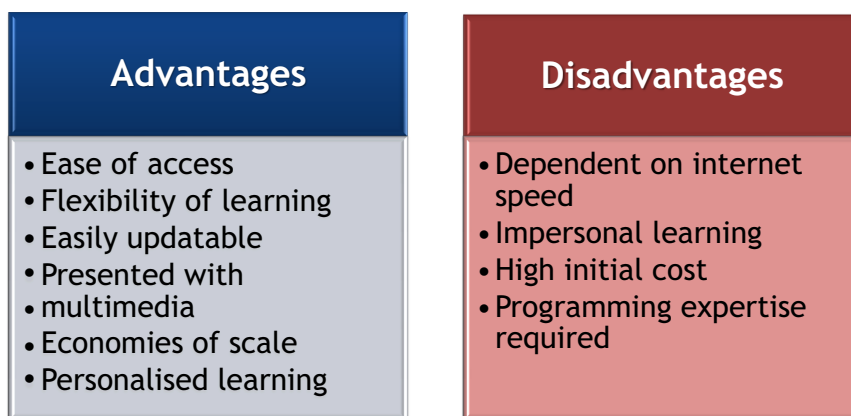


FIGURE 1. Advantages and disadvantages of e-learning. A schematic listing the advantages and disadvantages of e-learning.

noncomputer-based lectures or tutorials).⁵ The variety of e-learning interventions available offer surgical educators the opportunity to choose appropriate teaching method(s) for their training program, without being limited to traditional lectures only. In the United States, for example, the Surgical Council on Resident Education (SCORE)—an amalgamation of 6 national surgical organizations⁶—delivers e-learning to residents in General Surgery. The SCORE web site provides a modular curriculum with teaching delivered through text and videos.⁷ As an established model of e-learning in surgical education incorporating Web 2.0 features, the SCORE web site may well be a model to follow for surgical educators elsewhere.

e-Learning has its advantages and disadvantages, which are worth considering in the context of surgical education (Fig. 1). External forces,⁸ as summarized later, are compelling the discipline to change from traditional master-apprentice mentorship models⁹ to remain relevant in this day and age.

Work-Hour Restrictions

American residents are required to limit their working hours to 80 per week¹⁰ whereas in Europe, the European Working Time Directive has limited the working week to 48 hours since 1998, with the consequence that trainees now operate on fewer occasions than a decade ago.¹¹

Financial Constraints

Training surgeons is expensive. Bridges et al.¹² estimated a cost of \$53 million per year to train American residents nationwide in the operating room; this cost was owing to learning facilities provided to the resident, support for scholarly activities,¹³ and increased length of operations performed by residents.¹⁴ The global recession has restricted healthcare budgets and, in the United Kingdom, the National Health Service is expected to make efficiency savings of £15-20 billion between 2011 and 2014.¹⁵

Increased Public Scrutiny

Surgeons in the United Kingdom now need to publish data on their performance¹⁶ although articles on surgical mistakes and surgeons regularly appear in the popular press. Senior surgeons are under pressure to perform to the best of their ability; allowing trainees to take part in their cases could potentially move them down the “league table” of surgeons.

New Technologies

Minimally invasive surgery is now a mainstay of many surgical specialties, with the technology moving at a rapid pace from the original 2-dimensional laparoscopic surgery to robotic surgery and 3-dimensional laparoscopic surgery. New techniques and unfamiliar technologies need to be mastered by senior surgeons and trainees, providing a great opportunity to offer e-learning to everyone on the training spectrum.

Owing to these pressures, surgical education must reform to ensure that trainees reach competence and perform safely despite the reduced opportunities for learning. e-Learning can offer an alternative to traditional training; however, e-learning needs to be beneficial for trainers to consider adopting this modality into surgical curricula worldwide.

Therefore, our objectives were to

1. identify current modalities of e-learning,
2. assess the efficacy of e-learning as an intervention in surgical education through a systematic review of the literature, and
3. discuss the relevance of e-learning as an educational tool in surgical education.

MATERIALS AND METHODS

This study was conducted following guidelines defined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA).¹⁷

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