



Review

Impact of e-learning on nurses' and student nurses knowledge, skills, and satisfaction: A systematic review and meta-analysis

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ARTICLE INFO

Article history:

Received 5 February 2012

Received in revised form 18 November 2012

Accepted 19 December 2012

Keywords:

e-Learning

Nurse

RCT

Traditional learning

ABSTRACT

Objective: To review the impact of e-learning on nurses' and nursing student's knowledge, skills and satisfaction related to e-learning.**Design:** We conducted a systematic review and meta-analysis of randomized controlled trials (RCT) to assess the impact of e-learning on nurses' and nursing student's knowledge, skills and satisfaction. Electronic databases including MEDLINE (1948–2010), CINAHL (1981–2010), Psychinfo (1967–2010) and Eric (1966–2010) were searched in May 2010 and again in December 2010. All RCT studies evaluating the effectiveness of e-learning and differentiating between traditional learning methods among nurses were included.**Data extraction and quality assessment:** Data was extracted related to the purpose of the trial, sample, measurements used, index test results and reference standard. An extraction tool developed for Cochrane reviews was used. Methodological quality of eligible trials was assessed.**Data synthesis:** 11 trials were eligible for inclusion in the analysis.**Results:** We identified 11 randomized controlled trials including a total of 2491 nurses and student nurses. First, the random effect size for four studies showed some improvement associated with e-learning compared to traditional techniques on knowledge. However, the difference was not statistically significant ($p = 0.39$, MD 0.44, 95% CI -0.57 to 1.46). Second, one study reported a slight impact on e-learning on skills, but the difference was not statistically significant, either ($p = 0.13$, MD 0.03, 95% CI -0.09 to 0.69). And third, no results on nurses or student nurses' satisfaction could be reported as the statistical data from three possible studies were not available.**Conclusion:** Overall, there was no statistical difference between groups in e-learning and traditional learning relating to nurses' or student nurses' knowledge, skills and satisfaction. E-learning can, however, offer an alternative method of education. In future, more studies following the CONSORT and QUOROM statements are needed to evaluate the effects of these interventions.

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What is already known about the topic?

- The use of e-learning and computer assisted methods is rapidly increasing in medical and nursing education.
- The use of innovative learning methods has been shown to be promising in medicine to improve knowledge among learners.

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- There is still a lack of evidence about the impact of computer assisted and e-learning methods in nursing education.

What this paper adds

- There is a lack of systematically conducted RCT studies comparing the effects of e-learning and traditional learning methods in nursing education.
- In nursing education, e-learning is not superior to traditional learning method but can be used as an alternative method in nursing education.
- e-Learning should be used with a good understanding of learners' needs.

1. Introduction

Lifelong learning is one of the priorities in the European educational area (European Commission, 2010). Information and communication technology (ICT) opens doors to new innovative methods to deliver education across the lifespan (European Commission, 2011). The use of e-learning is a rapidly growing form of education and a new way of delivering education in general (Digital Agenda Assembly, 2011; Commission of the European Communities, 2000, 2001, 2003). This is also the case in health care, where the Internet and Worldwide Web (WWW) have expanded the opportunities for flexible, convenient, and interactive education (Cook et al., 2010a, 2008; Belcher and Vonderhaar, 2005; Wutoh et al., 2004) for educational provision and health care professionals (Lowry and Johnson, 1999).

e-Learning has been described as a dynamic, innovative and rich way to provide learning opportunities (Belcher and Vonderhaar, 2005). Students can access a class through a website and participate in lectures and group discussion in real time. Materials may also be provided asynchronously; students access the website, follow lectures or complete assignments according to their own schedules (Simpson, 2003.) In the recent literature there are a few systematic reviews of research on e-learning (Cook et al., 2008, 2010a,b; Curran and Fleet, 2005; Cobb, 2004; Wutoh et al., 2004; Schitteck et al., 2001). In general, the benefits reported for e-learning are flexibility, accessibility, satisfaction and cost-effectiveness (Smith, 2005; Wutoh et al., 2004; Ward et al., 2008). A meta-analysis by Cook et al. (2010a) showed that e-learning can increase students' own control over the content, place and time of learning. Furthermore, it can help students gain knowledge and skills faster than traditional instructor-led methods (Cook et al., 2008).

The review by Cook et al. (2008) and Wutoh et al. (2004) focused on the effectiveness of e-learning. Cook et al. (2008) reported positive results in their meta-analysis comparing e-learning intervention to non-intervention. Wutoh et al. (2004) also report in their review that e-learning for delivering continuing medical education is as good as other methods in transferring knowledge. In addition, Cook et al. (2010b) compared e-learning interventions to other types of computer based educational

interventions. They showed that interactivity, practice exercises, repetition, and feedback improved learning outcomes while using e-learning interventions (Cook et al., 2010b).

However, reviews of the effectiveness of e-learning have focused mostly on professionals working in the field of medicine or health care in general (Cook et al., 2008, 2010a; Curran and Fleet, 2005; Cobb, 2004; Wutoh et al., 2004). To the best of our knowledge only one review has been conducted on e-learning in general (Schitteck et al., 2001). No systematic reviews of e-learning and its effectiveness have been done among nurses or student nurses by meta-analytic methods although nurses are one of the largest groups of professionals in health care (Eurostat, 2011). Therefore it is important to focus on the impacts of e-learning on this professional group. In addition, as in the concern expressed by Curran and Fleet (2005), Curran et al. (2010), too often evaluative education studies rely on participants' satisfaction level while more energy should be put into knowledge transfer, skills improvement and the changes in practice after educational interventions. The importance of focusing on a variety of outcomes when evaluating educational training such as e-learning is also noted in Kirkpatrick's model of learning outcome evaluation (Galloway, 2005). Kirkpatrick's model has four levels to evaluate educational training: (1) reaction, i.e. student satisfaction, (2) learning, i.e. knowledge increase, (3) behavior, i.e. change in practice and (4) results, i.e. final outcomes (Kirkpatrick, 1998; Galloway, 2005). Therefore the focus in this review was on the impact of e-learning on knowledge, skills and satisfaction among nurses and nursing students.

2. Objective

This systematic review aims to investigate the impact of e-learning on knowledge, skills and satisfaction among nurses and nursing students compared to traditional education methods.

3. Methods

The research consists of a systematic review (Higgins and Green, 2011).

3.1. Data sources and searches

We electronically searched MEDLINE (1948–2010), CINAHL (1981–2010), PsychInfo (1967–2010), Eric (1966–2010) for publications in English in May 2010. The search was updated in December 2010. No restrictions were placed on date of publications and each database was searched as far back as possible (Savoie et al., 2003). This is recommended method when search terms has varied in past history or showed a huge diversity which is the situation with the concept of the e-learning (Egger et al., 1997).

As each database has its own unique indexing terms, individual search strategies were developed for each database. Consideration was given to the diverse terminology used for e-learning as this would influence the

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