Computers & Education 61 (2013) 168–175

Contents lists available at SciVerse ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Enhancing nursing students' medication knowledge: The effect of learning materials delivered by short message service

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ARTICLE INFO

Article history:
Received 12 June 2012
Received in revised form
17 September 2012
Accepted 24 September 2012

Keywords:
Adult learning
Applications in subject areas
Interactive learning environments
Post-secondary education
Teaching/learning strategies

ABSTRACT

The aim of this study was to evaluate the effectiveness of using mobile phone short message service (SMS) to enhance knowledge of medications among nursing students. A quasi-experimental design was used. A convenience sample of 111 nursing students who were taking a pharmacology course at a university in southern Taiwan received an invitation to participate. The intervention group received learning materials by SMS twice per day for 10 days. Data were collected from 52 students in the intervention group and 54 students in the comparison group at baseline and at one week, two weeks and four weeks after the intervention. A generalized estimating equation (GEE) was used to determine the effectiveness of the intervention. The findings show a statistically significant difference between the two groups over time in the medication knowledge score. The students in the intervention group reported an above-average satisfaction level with this learning method; students reporting higher levels of satisfaction with the intervention had higher scores on medication knowledge. These results indicate that providing learning materials by SMS can significantly enhance nursing students' medication knowledge.

1. Introduction and background

Preventing medication errors among nurses and nursing students has become a critical issue in patient safety. One American study found 1305 medication errors made by nursing students over a five-year period (Wolf, Hicks, & Seremebus, 2006). The main contributing factors to medication errors made by nursing students have been identified as performance deficit, not following procedures, and knowledge deficit (Wolf, Hicks, Altmiller, & Bicknell, 2009). Clearly, sound educational preparation regarding medications is necessary for nursing students before undertaking their practicum.

Nursing students generally acquire medication knowledge and medication administration skills through lectures in pharmacology or nursing. In order to administer medications safely, students require skills in preparing medications, knowledge about the action and side effects of different medicines, and the ability to observe and interpret patients' responses (Sung, Kwon, & Ryu, 2008). Assisting students to obtain and retain this information is a challenging task for faculty members.

Several studies have shown that electronic learning (e-learning) among nurses and nursing students can reduce learning time, increase academic achievement, improve knowledge or skills, and increase satisfaction with the learning program (Atack, Rankin, & Then, 2005; Beeckman, Schoonhoven, Boucque, Van Maele, & Defloor, 2008; Jang, Hwang, Park, Kim, & Kim, 2005; Salyers, 2007; Sung et al., 2008). With the development of new mobile devices, mobile learning has emerged as a promising trend in nursing education and one that enhances the availability and accessibility of existing e-learning environments.

Of these devices, the mobile phone is the most widely used and has an international reach. In 2010, Taiwan had 27.9 million subscribers and 19.5 million internet mobile subscribers; in that same year, 6497 million text messages were sent (National Communications Commission, 2011). These statistics indicate that the mobile phone penetration rate exceeds 100%. Adolescents and young adults are the primary users and carry their phones with them most of the time. Thus the mobile phone has the potential to provide learning materials to today's students.

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http://dx.doi.org/10.1016/j.compedu.2012.09.013

Against this background, the present study aimed to investigate the extent to which medication learning materials delivered via SMS could reinforce nursing students' medication knowledge and to gauge their satisfaction with this learning method. Two hypotheses were: (1) students who received medication leaning materials by mobile phone SMS would score higher on the multiple-choice questionnaire when compared to students who did not, and (2) students who had greater satisfaction with the SMS leaning intervention would have higher score on the questionnaire.

2. Literature review

2.1. Theoretical framework

Banning's (2003) theoretical framework of applied pharmacology and therapeutics, adapted from O'Neill and Dulhy (1997) and Fraser and Greenhalgh (2001), underpinned this study. Banning's theoretical framework has three interrelated components: the acquisition of knowledge; storage and utilization of knowledge; and style of reasoning. Nursing students need to acquire knowledge of medication and skill in its administration, to store the knowledge and to apply it. By using the medium of SMS, students can acquire and store relevant knowledge, which can subsequently be applied in practice.

Additionally, the framework of this study was also grounded in the information processing theory (Guitt, 2003; Wickens & Carswell, 2006). This theory describes human performance and deals with the analysis of how persons receive new information and then transfer it to store and then to recall in memory. Between a stimulus and a response, there are three major components in the model: sensory register, short-term memory, and long-term memory. After receiving new information from external stimulus, sensory register holds the new information for very brief period of time. Then, the information will be transferred into short-term memory or even long-term memory by organization, repetition, elaboration, and distributed practice. Learning through supplemental SMS materials was one method of elaboration when students process medication information. In this study, the same text message containing well-organized contents regarding medications had been delivered to the students twice a day, so that the contents taught in the class could be repeated. This method could enhance students' memory about the contents. In addition, the message could be saved in the mobile phone and be retrieved and reviewed later. Through organization and repeating, transferring medication information into short-term memory, even retaining the information in long-term memory would be possible.

2.2. Knowledge of medications

One of the purposes of nursing education is to ensure that graduates have the knowledge and skills required to deliver the best nursing care for clients (Manias, Aitken, & Dunning, 2004). With respect to knowledge about medication, however, there remains considerable room for improvement and more education is needed for nurses, graduate nurses, and nursing students. In one study of medication knowledge, for instance, pediatric nurses scored an average of 72.9 ($\pm$13.9) out of a possible 100. More than three quarters (77.1%) of the nurses said that they needed further education to improve their knowledge (Lan, 2008). According to Bullock and Manias (2002), clinical nurses found graduate nurses lack a deep understanding of pharmacology. Similarly, Lo (2006) reported insufficient knowledge of high-alert medications among nursing students. These studies concluded nursing students and new graduate nurses needed more knowledge of medication.

There is limited information regarding medication errors made by nursing students; this may be due to the fear of exposure to legal liability, or to underreporting (Wolf et al., 2006). One study retrieved data from the MEDMARX database, which is operated by United States Pharmacopeia and used by more than 700 hospitals and health systems in the United States. It is the largest known database that is able to provide information on medication errors made by nursing students. The study found 1305 such errors between 1999 and 2003, of which 301 (26.25%) were attributed to knowledge deficit. While medication errors have multiple causes, lack of medication knowledge among nurses or nursing students is one of the most frequently cited factors (Meuier, Parmar, & Vincent, 1997; Tang, Sheu, Yu, Wei, & Chen, 2007; Wolf et al., 2006).

It has been suggested that nursing students should have adequate medication knowledge before beginning their nursing career. Honey and Lim (2008) reported that nursing students felt overwhelmed by the amount of pharmacological information they were exposed to in their course of study. They also believed, however, they needed more content to be covered in the classroom. In addition, new graduate nurses with insufficient medication knowledge felt less confident or less competent regarding their future practice (Gerrish, 2000; King, 2004). Whitehead (2001) also found that insufficient knowledge about medication was a source of anxiety and pressure for new graduate nurses in the clinical environment.

2.3. Applications of mobile phones in education

New technologies are changing rapidly and have the potential to play an important role in teaching and learning. Mobile and wireless technology brings new opportunities to traditional classroom-based learning as well as to lifelong learning outside the classroom (Cavus & Ibrahim, 2008). Educators can access these widely available, affordable and instantaneous tools to deliver relevant information or learning materials to students. Apart from learning, text messaging can be a tool to support students at school or during their clinical practicum by sending messages from their tutors. It is more cost-effective than voice communication (by mobile phone or telephone) and print-based interventions (Sherry, Colloridi, & Warnke, 2002).

SMS interventions have been found effective in English vocabulary learning (Cavus & Ibrahim, 2009; Lu, 2008). In Lu's study (2008), fourteen English words were sent over two weeks via SMS to an intervention group of 15 students; the comparison group received the words in paper format on the first day of the week. Students in the intervention group had significantly higher test scores on the immediate post-test results than did the students in the comparison group, although there were no significant differences on test scores between the two groups at three weeks after the intervention. This might suggest the immediate vocabulary gains were not sustained. Nonetheless, students reported positive attitudes toward using SMS to enhance their English vocabulary. On the other hand, Cavus and Ibrahim (2009)