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Evaluating an online pharmaceutical education system for pharmacy interns in critical care settings

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ABSTRACT

Incorporating electronic learning (eLearning) system into professional experimental programs such as pharmacy internships is a challenge. However, none of the current systems can fully support the unique needs of clinical pharmacy internship. In this study we enhanced a commercial eLearning system for clinical pharmacy internship (The Clinical Pharmacy Internship eLearning System, CPIES). The KAP questionnaire was used to evaluate the performance of group A with the traditional teaching model and group B with the CPIES teaching model. The CPIES teaching model showed significant improvement in interns' knowledge and practice ($p = 0.002$ and 0.031, respectively). The traditional teaching model only demonstrated significant improvement in practice ($p = 0.011$). Moreover, professionalism, such as attitudes on cooperating with other health professionals, is developed by learning from a good mentor. The on-line teaching and traditional teaching methods should undoubtedly be blended in a complete teaching model in order to improve learners' professional knowledge, facilitate correct attitude, and influence good practice.

1. Introduction

The fundamental aim of pharmacy education is to cultivate pharmacists with sufficient knowledge in pharmacy profession to enable them effectively to support health care and research development. Thus, pharmacy education embraces not only classroom knowledge but also professional skills and attitudes in pharmaceutical care practice. Pharmacy students develop their professional skills and attitudes mainly through a pharmacy internship program in which pharmacy students serve as interns and senior pharmacists serve as site preceptors in a clinical care setting. The internship program is designed to assist interns in integrating their undergraduate learning into real-world practice and transition from student to independent competent pharmacist.

The required pharmacy internship hours may vary by institutions/countries, depending on the level of care and the

degree of specialization. In Taiwan pharmacy students are required to take a 640 h pharmacy internship program [1], including at least 120 h in clinical pharmacy services at a hospital. The clinical pharmacy internship program mainly focuses on the modules of medication assessment and recommendations for patients, evaluation of pharmacokinetics and therapeutic drug monitoring (TDM), adverse drug reactions (ADR), pharmaceutical care in intensive care, infection control and antibiotic management, and evidence based pharmaceutical care [2]. In Taipei Medical University Wan Fang Hospital (TMUWFH), the clinical pharmacy internship program consists of four consecutive weeks (40 h a week). The modules are organized and presented as the formats of case studies, lectures, discussions, site observations and team research reports on the issues of pharmaceutical care in ICU, ADR and TDM. During the period of the intership, interns usually interact closely with their preceptors to complete the designated learning units and document accomplishments and growth in their learning portfolios accordingly. It is very important for preceptors to review their students' portfolios and give them responsive feedbacks along the course of internship.

The nature of pharmacy student internship program in learning and teaching involves intensive interactions among preceptors, students and learning resources. Although the students are closely supervised throughout the internship, they are strongly encouraged to develop independent learning. At present most internship programs are conducted largely by using traditional face-to-face lectures, group discussions and in person contacts. Based on a survey, most hospital clinical pharmacists' workload is already too heavy [3]. They can hardly contribute to the quality of the program. In nowadays, online learning (or eLearning) technology has been widely adopted by most education programs [4–7]. However, most of the tools, such as online learning modules, search engines, social networks, and so on, are distributed and separated in different systems. It is not an easy task for pharmacy students to put the tools working together for specific learning objectives, particularly for pharmacy internship programs. Thus, we need a unified, integrated eLearning system to support the internship programs that can offer high quality of the internship, and reduce the preceptors' teaching workload without compromising patient care.

2.   Background

Traditional healthcare applications are restricted for use at specific geographical locations [8]. However, the Internet promises many advantages: Access from all over the world with a low-cost technical infrastructure; independence from proprietary solutions in hardware and software by means of a common browser as front-end; independence from time restrictions because the material is available 24 h a day, 7 days a week without any technical necessity for downtime [9]. Incorporating electronic learning (eLearning) systems into professional experimental programs such as pharmacy internships is a challenge. A well-designed eLearning system can engage learners in a learning process by allowing them to participate in activities to facilitate active learning [10]. Many researches have noted the merits of eLearning, such as

flexibility and the ability to be individualized. A legitimate aspiration of e-learning is to make existing approaches to teaching and learning more effective and efficient [11]. The eLearning allows students to adjust their learning paces and efficiently achieve better results [12–16]. Zapantis et al. combined class teaching and eLearning to develop a web-based course management system for adult acute care medicine [17]. The results showed that the web-based courses could promote students' experience in adult acute care medication management and acute care advanced pharmacy practice experiences (APPEs) [18,19]. Kofranek et al. developed a new interactive web-based application that primarily designed for biomedical education. The results showed that interactive simulations met with visibly high student approval and and the teachers' experience is positive [20]. Furthermore, Lopez et al. developed a web-based e-portfolio system to document students' curricular outcomes and performance in pharmacy practice experiences. The result showed e-portfolio was able to facilitate students' reflection on their own learning, leading to more awareness of learning strategies and needs [21].

The successful development of human resources depends on training and continuing skill development. Educational technology is allowing educators to restructure classroom time for something other than simple transmission of factual information and to adopt an evidence-based approach to instructional innovation and reform. Many educators advocate training for all faculty members to develop their skills as teachers in distance education environments. The most continually survey finding to those new to online is that a majority of Chief Academic Officers rated learning outcomes for online instruction as the same or superior to those for face-to-face instruction. As more schools utilize information technology and the computer becomes an integral part of all pharmacy students' education, many schools will begin to require that students either own or have ready access to a computer [4–7]. However, most of the tools, such as online learning modules, search engines, social networks, and so on, are distributed and separated in different systems. To our knowledge, there is no such a system that can effectively support the needs of clinical pharmacy internship programs, such as online tools for therapeutic drug monitoring, pharmacokinetic calculation and dose adjustment which requires flexible integration of diverse computational tools. The optimal system designs will have to be found numerically and algorithms will have to be implemented for practitioners [22,23].

In this study we enhanced a commercial eLearning system for clinical pharmacy internship and to evaluate the interns' knowledge, attitudes and practice comparing with the traditional teaching model.

3.   An enhanced system supporting internship programs

3.1.   System functionality enhanced Clinical Pharmacy Internship eLearning System (CPIES)

The learning procedure of enhanced Clinical Pharmacy Internship eLearning System (CPIES) is based on client–server architecture. The server that stores the data and control the