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# Developing an e-learning education programme for staff nurses: Processes and outcomes

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## KEYWORDS

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## Summary

**Objective:** To describe the Instructional System Design Processes (analysis, design, development, implementation, and evaluation) used to develop an e-learning education programme for staff nurses at a 700-bed teaching medical center in Taiwan.

**Background:** Evidence has shown that education via e-learning improves knowledge and skills; however, with cost constraints and limited resources, finding effective alternatives is critical for health professionals.

**Methods:** Five courses required for N2 to N3 level nurses were designed for both e-learning and traditional in-classroom programmes. Multiple-choice written test questions and a satisfaction questionnaire were used to compare outcomes between programmes. Nursing care skills were rated as pass or fail. Both programmes were begun at the same time and completed within a 3-month period.

**Results:** Forty-two staff nurses participated in this study. All nurses' knowledge scores were >70 points (out of 100) and all passed nursing care skills. In five courses, only teaching and learning and communication were statistically significantly different ( $p = 0.001$ ). Nearly all nurses (97.6%) felt satisfied or very satisfied with the programmes.

**Conclusions:** Instructional System Design Processes provide an alternative delivery system for in-service nursing education which allows for individualized learning.

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## Introduction

Advanced Internet technology in health care learning – including e-learning, web-based learning, online computer-based educational training, Internet-based learning, and distance learning – has been widely adopted in many developed countries (Anderson and Mercer, 2004; Belcher and Vonderhaar, 2005; Ruiz et al., 2006). Acquiring new knowledge and skills within the flexible schedule required in the healthcare organization has resulted in a shift from traditional in-class teaching to Internet/web-based lectures whose benefits include achieving life learning, fulfilling personal interests, saving time, allowing training based on job needs, providing flexibility, allowing self-regulatory learning, impacting family duties and life less, and improving the quality and speed of information exchange (Atack, 2003; Atack and Rankin, 2002; Chang et al., 2002; Meyen et al., 2002; Nelson, 2003; Yu et al., 2007; Zvarova et al., 2002). Nevertheless, integration of e-learning into nursing education has promoted a shift toward adult learning in which educators no longer distribute educational content. Dornan et al. (2003) strongly suggested that e-learning be implemented in any organization to enhance learning outcomes and keep staff nurses updated.

In Taiwan, web-based e-learning has been used to inform college students of breast cancer self-examination, disease prevention and promotion, smoking cessation among adolescents, and nutritional improvement (Yang et al., 2005; Yeh et al., 2002). However, most e-learning programmes for nursing education have been implemented in nursing schools, not in acute care hospitals. Where they exist, most classes provide information, not in-service nursing education such as fulfills licensing requirements (in the US, Continuing Nursing Education, or CNE). Therefore, expanding e-learning applications to nursing education in acute care hospitals is needed to enhance learning and support ongoing nurse education.

The clinical ladder system for staff nurses has been implemented in many countries, including Taiwan. The system consists of four levels (N1, N2, N3, and N4) which indicate levels of competency. Each level requires specific courses and nursing care skills to assist staff nurses to excel in patient care. Nurses at N1 Level should have basic nursing care competency; N2 level is for intensive care competency; N3 level for teaching new nurses, nursing students, and holistic competency; and N4 level for nursing projects, research, and specialty care competency (Taiwan Nurse Association, 2005). The benefits of implementing a nursing clin-

ical ladder system in acute care settings include assuring nurse competence, enhancing responsibility and commitment to the organization, promoting self-value and positive ethics, providing recognition and financial reward for bedside nursing practice, providing direction for staff development and educational programming, improving the quality of nursing care, and creating a clinical learning climate while promoting professional growth (Hsu et al., 2005; Pettno, 1998). Although the system has been in all acute care hospitals in Taiwan since 1992 (Taiwan Nurse Association, 2005), few staff nurses have completed all four levels of requirements because of limited time and shift rotations. Additionally, most in-service nursing education classes in Taiwan hospitals are offered during the day and in-classroom settings; sometimes staff nurses cannot be away from work to attend 1 or 2 h of lecture. Thus, web-based or Internet e-learning methods is recommended and should be developed to compensate for the limitations of traditional nursing education methods (Cragg et al., 2003).

One common way to develop and evaluate an Internet education programme is to use Instructional System Design Process, focusing on ADDIE (analysis, design, development, implementation, and evaluation) (Chan and Robbins, 2006; Hayes et al., 2002; Wang et al., 2006). ADDIE was used to develop an e-learning programme (ELP) for staff nurses at a 700-bed medical center in Taipei to answer the research question: Is there a difference in objective learning measures, such as knowledge gained and satisfaction level, between staff nurses in the ELP and those in the traditional in-classroom programme (TICP). The findings of this study can provide a framework for nursing educators and hospital administrators to develop ELP for practicing nurses.

## Methods

### Analysis

ELP objectives were developed by the research team as follows: (1) provide time flexibility for staff nurses to complete the requirements of five courses from N2 to N3 level; (2) increase the knowledge gained by staff nurses; and (3) provide an alternative method for staff nurses to meet their learning needs. Only staff nurses who had passed the N2 level and wanted to go to N3 level were invited to participate. They were told that participation was voluntary and would not affect their job status or promotion opportunity. After signing agreement

letters, participants were randomly assigned to the ELP or TICP. In order to compare the outcomes of these two education programmes, nurses who did not complete either ELP or TICP during the study were excluded and not used in the data analysis.

Since only five courses are required for N2 staff nurses to advance to the N3 level, five instructors from outside the study hospital with appropriate expertise were invited to participate. The five courses covered the following topics: case study (1.5 h), career development (1 h), teaching and learning (1 h), nursing and law (1 h), and communication (1 h). Resources were obtained from the study hospital and a government-funding agent to complete the study.

## Design

The second procedure was to design the ELP and webpages. The ELP were designed based on the requirements for N2 to N3 level staff nurses and availability of resources at the study hospital. Hospital webpages, access to computers, outcome evaluation measures, and an accredited system were planned. A hospital webpage was designed for staff nurses by the computer supervisor at the study hospital and based on three rules: user-friendliness, system stability, and accessibility. Because of limited hospital space and equipment, three locations were selected and the webpages were restricted to access within the institution (Intranet). Knowledge scores and satisfaction with the programme were designed as outcome evaluation measures of this study. User-IDs were assigned only to authorized nurses in the ELP to prevent cheating by nurses during study periods.

## Development

The third procedure was to develop the ELP, test questions for each course and a satisfaction questionnaire. Since the ELP was designed for audio, video, and Power Point presentation formats, the five instructors put their presentations into Power Point. These had to pass an interface review by an expert in computer media communication. After that, each course was divided into subsections. Sections could be no longer than 30 min to improve nurses' attention and to meet the e-learning interface design. After all five courses were recorded completely, they were converted to delivery on the hospital webpage. Then, all staff nurses in the ELP cohort received 4–6 h training in e-learning techniques. At the same time, all operational steps were written as a reference book and CD

and a technical support instruction manual was made to assist nurses with problems. In order for these two programmes to be comparable, the same five instructors invited in the ELP were also invited to give presentation in the TICP. The educational content and materials in both programmes were the same. For the TICP, in-class lectures were arranged during daytime and based on the availability of each instructor. Finally, a 3-month time frame was set for nurses to complete the programmes.

Because each course required 10 multiple-choice test questions, and to make sure there were enough questions to be randomly selected by the computer, each instructor made six sets of questions for each course. To prevent cheating, nurses were required to remember a series number designed to appear randomly during the learning period in order to enter the test stage. Questions appeared randomly at the end of each course, and scores were automatically calculated after the courses were completed. For the TICP, 10 test questions were administered after each class and scored by the instructors immediately.

The satisfaction questionnaire measured with a four-point Likert-type scale where 1 = strongly disagree and 4 = strongly agree. The questionnaire consisted of three domains: (1) course content (e.g., I think the content matched the course title, I think the content was easy to understand, I think the course can be applied in the clinical setting); (2) instructor (e.g. I think the instructor expresses himself/herself clearly, I think the instructor talks appropriately and understandably, I think the instructor can attract my attention); and (3) overall satisfaction with the programme. Finally, a blank space was left for other suggestions and comments. The questionnaire could be completed in under 10 min.

## Implementation

ELP and TICP were implemented at the study hospital at the same time. The only difference was form of delivery. Ten test questions were administered for each course in both ELP and TICP, with a maximum score of 100%. Three additional implementing procedures were conducted as follows.

First, at the beginning of both the ELP and TICP courses, nurses were asked to provide their age, level of education, years of nursing experience, weekly hours of Internet or www access, and typing speed per minute. Second, after the programmes began, nurses in the TICP were notified 1 week before the class. In contrast, nurses in the ELP were told they could take courses any time, but before they went into the computer room, they needed

to obtain a key and sign their names outside of the door. For technical support, an instruction manual and a 24 h assistance telephone number were provided. Third, one research assistant helped keep track of records.

Once all courses were finished, three head nurses in the nursing department of the study hospital were selected to evaluate the nurses' performance on one of the required nursing care skills. For the ELP, a room was selected as recording room. After drawing, a nurse would perform a nursing care skill in front of a camera. After completion, the nurses handed in the tape to one of the head nurses. For the TICP, the nurse performed the nursing care skill in front of the head nurse and was directly evaluate by her. The nursing care skill was rated as pass or fail.

## Evaluation

After all staff nurses completed N2 to N3 course requirements and nursing care skills within 3 months, the differences in outcomes between programmes were evaluated, including knowledge, satisfaction, and nursing care skill scores.

## Data analysis

Descriptive analyses such as number, mean, and standard deviation were used to analyze nurses' demographics. A Chi-square test, fisher exact test, and independent *t*-test were used to compare the differences in nurses' demographics and knowledge scores. The Wilcoxon signed rank test was used to analyze the differences in satisfaction between programmes. The *p*-value for all statistical analyses was set at 0.05. All data were analyzed using the Statistical Package for the Social Sciences (SPSS for Windows 13.0, Chicago, IL).

## Results

### Demographics of staff nurses

Some 54 staff nurses agreed to participate in this study; however, only 42 nurses, 22 in the ELP and 20 in the TICP, completed all requirements and nursing care skills. The reasons for not completing the programmes included conflicting work schedules (10), changing position (1), and quitting the job during the study period (1).

Demographics for the sample of staff nurses are presented in [Table 1](#). All participants were female. The mean age of the staff nurses was 30.5 years for

the ELP and 30.6 years for the TICP with a range of 26–47 years. Most staff nurses (14 in each programme) had graduated from junior college. Mean length of nursing experience was 7.6 years for the ELP and 8.1 years for the TICP. Prior to participating in this study, most nurses spent 1–5 h weekly on the Internet or World Wide Web (ELP, 10 and TICP, 8, respectively). Mean hours of weekly Internet access were 3.5 h in the ELP and 3.1 h in the TICP. For the above demographic data, no statistically significant differences were found between programmes ( $p > 0.05$ ). For typing on word processors, eight nurses (36.4%) in the ELP and 16 nurses (80%) in the TICP typed less than 20 words per minute, with a statistical significant difference between programmes ( $p = 0.008$ ).

### Knowledge scores and nursing care skill scores

In knowledge obtained, the mean scores were: case study course, 75.8 points (ELP = 77.71 points; TICP = 73.67 points); career development course, 84.1 points (ELP = 81.36 points; TICP = 87 points); teaching and learning course, 92.1 points (ELP = 87.73 points; TICP = 97 points); nursing and law course, 87.7 points (ELP = 86.82 points; TICP = 88.82 points); and communication course, 82.1 points (ELP = 75.91 points; TICP = 89 points). A statistically significant difference between programmes was found in the teaching and learning and communication courses ( $p = 0.001$ ) (see [Table 2](#)).

### Satisfaction with the programme

In overall satisfaction, 41 nurses (21 in the ELP and 20 in the TICP) felt satisfied or very satisfied with the contents, instructors, and programmes. Interestingly, 36 nurses (20 in the ELP and 16 in the TICP) expressed a preference for the same programme for their future in-service nursing education, but no statistically significant difference was found between programmes ( $p = 0.73$ ).

## Discussion

Before the study, only nine staff nurses (21.4%) spent less than 1 h on the Internet per week. The finding was much lower than in [Lee et al. \(2005\)](#), who found that about 70% of nurses spend less than 1 h daily using the computerized nursing care planning. The findings may be due to differences in measures, questions asked, and hospital applications between studies. In the study hospital where

**Table 1** Characteristics of the nurses between programs ( $N = 42$ )

Variables	ELP ( $n = 22$ )		TICP ( $n = 20$ )		$\chi^2/t$	$p$
	$n$ (%)	$M$ (SD)	$n$ (%)	$M$ (SD)		
<i>Gender</i>						
Male	0 (0)		0 (0)			
Female	22 (100)		20 (100)			
Age (in years)		30.5 (4.2)		30.6 (5.0)	-.10	.92
<i>Level of education</i>						
≤ Junior college	14 (64)		14 (70)		.05	1.0
≥ University	8 (36)		6 (30)			
Years of nursing experience		7.6 (3.9)		8.1 (3.4)	-.49	.63
<i>Weekly Internet or www access (h)</i>						
<1	3 (14)	3.5 (1.37)	6 (30)	3.1 (1.39)	.66	.42 <sup>a</sup>
1–5	10 (45)		8 (40)			
6–10	5 (23)		3 (15)			
>10	4 (18)		3 (15)			
<i>Typing speed (words/per min)</i>						
<20	8 (36.4)		16 (80)		6.97	.008 <sup>a,*</sup>
21–50	10 (45.4)		3 (15)			
51–75	2 (9.1)		1 (5)			
76–100	2 (9.1)		0 (0)			

Notes: ELP denotes e-learning programme.

TICP denotes traditional in-classroom programme.

<sup>a</sup> Data were analyzed by Fisher exact test.

\*  $p < 0.05$ .

**Table 2** Comparison of the nurses' knowledge scores between programmes ( $N = 42$ )

Courses	ELP ( $n = 22$ ) $M$ (SD)	TICP ( $n = 20$ ) $M$ (SD)	95%CI	$p$
Case study	77.71 (6.96)	73.67 (13.96)	-2.78 to 10.87	.238
Career development	81.36 (10.37)	87.00 (2.21)	-14.29 to 3.02	.195
Teaching and learning	87.73 (9.22)	97.00 (8.01)	-14.69 to -3.86	.001 <sup>*</sup>
Nursing and law	86.82 (7.16)	88.82 (6.97)	-6.64 to 2.63	.386
Communication	75.91 (7.34)	89.00 (7.88)	-17.84 to -8.34	.001 <sup>*</sup>

Notes: ELP denotes e-learning programme.

TICP denotes traditional in-classroom programme.

Each course consists 100 points.

\*  $p < 0.05$ .

nursing care planning had not been computerized, further research was needed to explore whether the computerized system implemented in the hospital would affect nurses' access to the Internet.

In these five courses, statistically significant differences between programmes in nurses' knowledge scores were found only in teaching and learning and communication. These findings might have been due to the fact that these two courses require more nurse-instructor interactions and extra time for questions to be answered immediately. Since nurses in the TICP could discuss issues with

the instructor in the classroom or after class, their scores were higher than those of the ELP. A study by Ruiz et al. (2006) pointed out that e-learning was not designed to replace traditional instructor-led training or classroom lectures but that it could be used as a complement. Nevertheless, with changes in health care delivery system and advances in health sciences, Jeffries (2005) strongly suggested that online courses be implemented for both teachers and learners to promote quality, effective learning outcomes even without learner-teacher interaction. Offering online discussion

in future e-learning programmes may minimize these limitations.

However, learning takes time and energy, especially in travel and preparation. Nurses in the ELP did not need to leave their units to participate in a live presentation; therefore, most of them thought their time could be saved to focus on patient care to maintain continuity of patient care. The findings resembled those of numerous other studies (Belcher and Vonderhaar, 2005; Billings and Rowles, 2001; Jeffries, 2005; Scollin, 2001; Wang et al., 2006) which all noted that e-learning education can improve participants' knowledge and clinical outcomes when time is constrained or shift rotation is demanded. A study by Berk and Wiseman (2003) found that e-learning education training could save people's time by as much as 25–60% when compared to traditional classroom training. If nurses could self-initiate and self-direct to improve their knowledge and skills at any time or location, the cost to hospitals and nurses for in-service continuing education could be reduced.

Nurses in both programmes felt satisfied or very satisfied about their learning experience. The findings were supported by Belcher and Vonderhaar (2005) who found that any continuing education could help nurses maintain professional competency and deal with patient care problems regardless of format. The result was similar to a study by Beta-Jones and Avery (2004), who found that students who participated in a web-based course were pleased with the course overall. Therefore, ELP is worth implementing at acute care hospitals for future staff nurses to obtain knowledge from web-sites.

Nevertheless, only one nurse in the ELP, compared to eight nurses in the TICP, felt dissatisfied with the time arrangement. These findings indicated that 30 min for one subsection in the ELP was adequate for learning time and was better received than TICP courses which required 1- or 2-h blocks of time. Additionally, nurses in the ELP can self-select to take courses when they are available. However, five nurses in the ELP were not satisfied with the location arrangements. These results may have been due to the fact that only three locations were available in the study hospital and two nurses interrupted learning periods because of computer problems. A study by Ruiz et al. (2006) indicated that location might have some effect on learners' satisfaction. Additionally, Chan and Robbins (2006) also pointed out that the availability of e-learning software's does not guarantee that the education programme will be used efficient or satisfactory. Therefore, for future e-learning education programmes, careful selec-

tions of location and strong computer technical support might enhance nurses' satisfaction. Since the ELP permitted nurses to self-select the course time and sequence, the programme could be implemented repeatedly for future continuing in-service nursing education without troubling instructors.

### Limitations

The study had some limitations. First, because of limited resources, only N2 and N3 level nurses were selected for this study. Therefore, results could not be generalized to other levels of requirement in the nursing clinical ladder system. Second, since the e-learning courses were provided only through the Intranet, the outcomes might be affected, especially for participants satisfaction with location. Hence, improving accessibility for staff nurses will help clarify future study outcomes.

### Conclusion

Although nurses in the TICP received higher scores in four courses – career development, teaching and learning, nursing and law, and communication – than those in the ELP, only teaching and learning and communication scores were statistically significantly different between programmes. However, all nurses' knowledge scores were  $\geq 70$  points (out of 100) for both programmes. Also, 41 nurses (97.6%) felt satisfied or very satisfied with ELP and TICP, and would choose the same programme for future in-service continuing education. Therefore, ELP is worth making available to staff nurses in acute care hospitals and should be implemented in future in-service nursing education to meet the training needs of practicing nurses within the strictures of their busy professional lives.

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