

Effect of a Web-enhanced Clinical Practicum on Learning Outcome of Adult Nursing Practicum in Nursing Students

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ABSTRACT

This study was conducted to develop Web-based multimedia content that assists undergraduate students in a clinical practicum on adult nursing. The study examined whether students in the intervention group could obtain clinical knowledge and perform more effectively when encouraged to learn Web content as compared with students in the conventional group. Web-based multimedia content consisting of 13 learning modules was developed based on real patients' scenarios through collaboration among college professors. A total of 120 nursing students (74 for the intervention and 46 for the conventional groups) from two universities in G-city, who engaged in a 3-week long clinical practicum in the digestive and respiratory units of a university hospital, participated in the study. Students' knowledge, self-directed learning, and clinical performance ability were measured using self-administered questionnaires. Data for pre- and posttests were collected over a 2-month period, between May and June of 2009. Clinical knowledge and self-reported clinical performance scores were significantly higher in students using the Web-enhanced clinical practicum than in those in the conventional group. However, there was no significant difference in self-directed learning ability between the 2 groups. These results demonstrate that Web-based multimedia content can be an effective educational tool for enhancing students' clinical knowledge and performance.

Keywords: Computer-Assisted Instruction, Nursing Practice, Nursing students.

1. INTRODUCTION

Clinical practice is regarded as an essential part of nursing education. It provides students with the opportunity to incorporate theoretical knowledge obtained from the classroom into practice in various clinical settings, because it equips them with a wide range of clinical skills applicable in those settings [1]. Through clinical practicums, students are encouraged to apply complex cognitive motor, communication and health assessment skills, and are expected to learn problem-solving skills and cultivate a value system as professionals. In real life, however, the direct application of students' clinical performances to patient care is limited in Korea because of enhanced patients' rights and complicated clinical situations. In addition, student nurses can face increasing pressure during the course of a clinical practicum, and the scope of instructors' clinical practicum guidance can be limited [2]. Thus, there is a need to focus on an instructional learning strategy in which students are provided with the opportunity to experience vivid clinical sites and repeatedly learn theories obtained in the

classroom, thereby reducing their sense of pressure and strengthening their adaptability and performance in various clinical settings.

The most important way to increase Web-Based Instruction (WBI)'s effectiveness and induce students' in-depth learning is to develop a strategy in which mutual interaction between Web page designers and learners can be fostered [3]. As part of such a strategy, utilizing videos and pictures that offer virtual hands-on practice on actual clinical sites could be effective in enhancing students' concentration and transferring knowledge [4]. This Web composition is designed in a 2-way mode in which mutual interaction and feedback between designers and learners is allowed and a kind of responsibility for learning is enhanced.

Previous studies have focused more on the effectiveness of WBI on theoretical curricula, such as health assessment [5], electrocardiogram learning [6], and nutrition [7], in which the WBI has been shown to be more effective in knowledge acquisition than traditional instruction methods. Despite the increasing use of Web-based learning within nursing education, evidence to support its usefulness for assisting clinical skills is limited. The findings of previous research have demonstrated that the application of WBI to relevant clinical curricula, such as nursing management [8], aseptic technique [9],

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intramuscular injection [10], Foley catheterization [11], and hand washing skills [12], could have a positive impact on students' clinical performance and knowledge.

Although such Web-based learning could create an effective instruction-learning environment focused on learners, many researchers are hesitant to participate in the development of WBI because it requires a great deal of time and effort and the participation of many people [2]. If researchers who belong to diverse institutions maintain a close cooperative relationship and are willing to do research jointly, however, the development of Web-based learning programs could be revitalized. Furthermore, if the findings of the research are completely and freely shared among researchers and academic credits among different colleges are acknowledged, the rate of WBI development will accelerate, while maximizing the use of developed learning materials [13].

Students and practicing nurses are able to improve their cognitive and metacognitive clinical reasoning skills in clinical contexts by using self-regulated learning strategies [14]. A previous study found that, having experienced a newly developed e-learning clinical scenario, students experienced a sense of enlargement with regard to their knowledge of situations similar to hands-on activities and showed positive responses to the scenario [15]. In addition, case-based teaching and learning strategies for psychiatric nursing contributed to students' appropriate organization of information to be recalled later for use in clinical reasoning situations, and also enhanced their confidence [16]. As for developing Web-based multimedia contents to assist students in clinical practice, the effects of learning will be maximized if the program is made up of neither basic knowledge nor an array of learning materials, but of self-directed learning focused on real clinical situations. Also students' clinical performance will be enhanced if their clinical practicum is encouraged by the learning of Web-based multimedia contents.

For these reasons, this study aimed at developing, through the collaboration of college professors, multimedia contents on adult nursing focused on real patient cases, in order to assist in students' clinical practicum, and examining the learning effects of the Web-enhanced clinical practicum compared to conventional practicum.

2. METHODS

2.1 Design

This study adopted a quasi-experimental, pretest-posttest design. Web-based multimedia content was developed for assisting a nursing students' clinical practicum on adult patients with digestive, renal, and cardiopulmonary problems. The learning outcome of students in an intervention group who engaged in a Web-enhanced clinical practicum in the digestive and respiratory wards of a university hospital was compared with that of students in a conventional group.

2.2 Research Procedure

The Multimedia content for the clinical practicum on adult

nursing care was developed based on the ADDIE (Assessment, Design, Development, Implementation & Evaluation) model for instructional-learning system design [17] from September 2007 to May 2008. The effectiveness of the program was evaluated over a two month period between May and June of 2009.

2.2.1 Development of multimedia content for an adult nursing clinical practicum

In the first meeting, the researchers decided to develop learning materials for general adult patients regarding the digestive, renal and cardiopulmonary systems as multimedia content. They composed the content to include body assessments, diagnostic tests, treatments and nursing interventions based on real patient cases.

A total of five patient cases were collected from the medical records at C National University Hospital (CNUH). Table 1 shows the patient cases and learning subjects that comprised the learning program. Regarding the digestive and renal systems, the content focused on four patients with stomach and rectal cancers, as well as chronic renal failure, combined with Type 2 diabetes. Regarding the respiratory and cardiovascular systems, the content focused on a patient with acute myocardial infarction combined with chronic obstructive pulmonary disease. Professors with more than five years of clinical and teaching experience delivered lectures based on their individual specialties.

In order to attract students' interest and motivation, we took videos of diagnostic tests, treatment procedures, and nursing interventions in clinical settings at CNUH. The videos taken in the clinical field contained ostomy care, hemo- and peritoneal dialysis care, serum-glucose tests, pre- and post-care of percutaneous coronary intervention, and early care for dyspnea. Videos were also taken of diagnostic procedures such as gastrofiberscopy, echocardiography, electrocardiography, pulmonary function test, bronchoscopy, thoracentesis and chest tube insertion. The nursing intervention scenes were played out by nurses and student actors using scripts suitable for real clinical situations. In addition, photo materials necessary for each learning subject were added. Finally, on the basis of the learning objectives of the content, a total of 13 learning modules were developed for assisting an adult nursing clinical practicum for undergraduate students. Each module included two to three learning subjects, comprising a total of 33 subjects focusing on 5 patient cases. It took 40 to 50 minutes to finish the learning of each module.

The developed multimedia content was installed in the learning management system (LMS) of a local e-learning center located in G city. The main screen consisted of learning objectives, learning activities (including video lectures and multimedia aids), a summary of key points, and questions and answers for knowledge assessment. The LMS was intended for instructors as well as learners. The screen for instructors consisted of subjects, teaching hours, teaching details, forum details, content management, questions and answers, inquiries into the use of the system, and inquiries into educational matters.

2.2.2 Design of the groups for evaluation of the effect of a Web-enhanced clinical practicum on the learning outcome

The intervention group, whose members worked with Web-based multimedia content, consisted of 74 junior nursing students of a national university engaged in their first clinical practicum in the digestive and respiratory units of a university hospital during the first semester of 2009 at CNUH in G city. They had undergone lessons in the theory of the digestive and respiratory systems in the field of adult nursing for ten weeks before the clinical practicum. The students were informed about the objectives and methods of the study, and their written informed consent was obtained. They were encouraged to practice self-directed learning through the multimedia contents on digestive and cardiopulmonary systems (24 subjects) before or during their clinical practicum in the digestive ward for one week and the respiratory ward for two weeks. A total of 74 students initially participated in the study, but 6 were excluded from the final analysis due to incomplete responses.

The conventional group consisted of 46 junior nursing students who were recruited from a private university after written informed consent was obtained. They also engaged in first clinical practicum in the digestive and respiratory units and had the same clinical practicum schedule as the intervention group. They had already learned the theory of the digestive and respiratory systems for ten weeks and would participate for two weeks in the first clinical practicum in the digestive and respiratory wards of their affiliated university hospital on the same level as the hospital where the intervention group practiced. They were well informed and guided by the practice manual as usual for clinical practicum. Both universities employed a clinical preceptor to assist in the students' clinical practicum.

2.3 Ethical Consideration

Ethical approval was obtained from the institutional review board of the affiliated institution (IRB-10-011). All study subjects were given both verbal information and a written summary of the study, where the voluntary participation, guarantee of anonymity, free will of withdrawal from the participation, and no disadvantage upon withdrawal were explained.

2.4 Measures

The measurement instrument for knowledge consisted of 25 items regarding the respiratory and digestive systems, developed by the researchers after testing their internal validity with 3 nursing professors. One point was given for correct answers, while zero points were given for incorrect answers. The scores ranged from 0 to 25; the reliability of the instrument measured by the Kuder-Richardson-20 (KR-20) formula was .87.

Self-directed learning ability was measured by the scale of preparation for self-directed learning developed by Yoo (1998) [18], after obtaining permission for its use. It consisted of 32 items including affection for learning, self-confidence about learning, self-understanding, and acceptance of responsibility

for learning. Each item was rated on a 5-point scale in which 5 referred to "absolutely right" and 1 referred to "absolutely wrong." The reliability of the instrument, measurement with Cronbach's alpha, was .89 in this study.

The self-appraisal instrument for clinical performance was a questionnaire consisting of 19 items that were developed by the researchers based on the goals of students' clinical practice and the learning goals of each module. The internal validity was also tested by the researchers. It was rated on a 5-point scale, including health assessment of the digestive and respiratory systems, diagnostic testing care, the application of nursing procedures, care before and after intervention, precautions against complications, and discharge education. A higher score indicated a higher self-appraisal of clinical performance. The Cronbach's alpha was .89.

2.5 Data Collection

Two professors operated and encouraged the students of the intervention group to use the multimedia contents, for a total of 3 credits, during their clinical practicum, during which students took part in hands-on activities in the digestive and respiratory wards. Students signed up for membership in the e-learning center. In the "learning room" of each module, students learned the web content through "instruction observations" placed in each module; they were regarded as "present in class" only if they watched the relevant instructions for 20 minutes during each learning module.

Data from the intervention group were collected from May 1 through June 15 of 2009. Prior to the clinical practicum, the students' levels of knowledge, self-directed learning ability, and clinical performance skills had been evaluated in a pretest; they were then reevaluated at the clinical practice conference after they had completed a posttest on knowledge, self-directed learning ability, and clinical performance skills. The data from the conventional group were collected from May 8 through June 20 of 2009.

2.6 Data Analysis

The collected data were analyzed using the SPSS/Win 13.0 program, and the level of significance was set at .05 for all tests. The baseline characteristics of the intervention and conventional groups were compared by *t*-tests. After the completion of the Web-enhanced clinical practicum, the study variables of the intervention group were compared with those of the conventional group and the differences were analyzed using *t*-tests and paired *t*-tests.

3. RESULTS

The learning modules and screen shots of the Web-based multimedia content are shown in Table 1 and

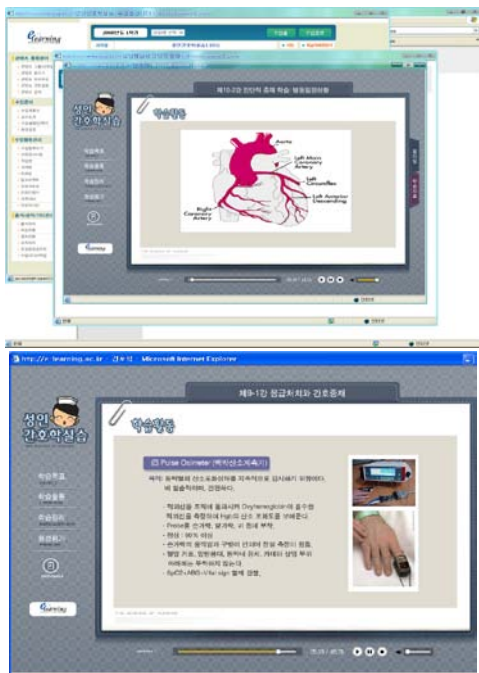


Fig. 1. Screen shots of Web-based multimedia content.

Table 1. Learning Components of the Multimedia Contents

	Digestive systems	Cardio-pulmonary Systems
Patient Cases	-Gastric cancer 56 y, male -Rectal cancer 67 y, female -Hepatoma, 75 y, male c/c:abdominal discomfort, fatigue	-AMI with COPD 68 y, male c/c: dyspnea, chest discomfort
Learning modules & subjects	3 modules 8 subjects	7 modules 16 subjects
Health assessment	-Physical examination -History taking	Physical examination History taking
Diagnostic tests & care	Upper GI series Gastrofiberscopy PET	Angiogram & PCI* EKG* 2D Echocardiogram* Lab tests
Treatment	Chemotherapy drugs TACE Colostomy	Drugs Thoracentesis* Chest tube drainage*

PET=Position emission tomography; TACE=Transcatheter arterial chemoembolization; CAPD=Continuous abdominal peritoneal dialysis; DM=Diabetes mellitus; PCI=Percutaneous coronary intervention; EKG=Electrocardiogram; AMI=Acute myocardial infarction; COPD=Chronic obstructive pulmonary disease

*Videotaped. †The content of renal system was not learned by students in this study.

The study subjects consisted of 120 third-year nursing students, whose average age was 21.6 years. Regarding their motives for choosing nursing as a major, the majority (56.8%) reported “a keen interest in nursing,” followed by “high employment rate” (20.3%); 67% said they wanted to be clinical nurses after graduation and 54.3% reported that they were satisfied with nursing. There were no significant differences in the pretest knowledge, self-directed learning ability, and self-appraisal of clinical performance between the two groups (Table 2).

Table 3 shows the results analyzed using a *t*-test on the differences in the changes of pre- and posttests on the knowledge, self-directed learning, and clinical performance ability between the intervention group, who practiced self-directed study along with a clinical practice, and the conventional group, who engaged in hands-on activities without any Web-based learning. The intervention group showed significantly higher changes in knowledge and clinical performance ability compared to those of the conventional group ($p < .05$). However, there was no significant difference between the 2 groups in self-directed learning ability ($p = .673$).

Table 2. Characteristics of the Subjects (N=120)

Variables		Intervention group n = 74(%)	Conventional group n = 46(%)	t/χ^2 (<i>p</i>)
Age (y)	M±SD Range	21.7±2.5 20-38	21.5±1.4 20-26	0.45 (.651)
Gender	Female Male	68 (91.9) 6 (8.1)	46(100.0) 0 (0.0)	3.93 (.081)
Satisfaction with nursing	Satisfied Neutral Unsatisfied	42 (56.8) 28 (37.8) 4 (5.4)	23 (50.0) 16 (34.8) 7 (15.2)	3.29 (.193)
Expected job after graduation	Clinical nurse Other	53 (71.6) 21 (28.4)	28 (60.9) 18 (39.1)	1.50 (.221)
Knowledge	M±SD	11.2±2.2	9.7±2.43	2.75 (.059)
Self-directed learning ability	M±SD	112.3±10.5	111.1±9.9	0.61 (.543)
Clinical performance ability	M±SD	53.1±7.32	55.2±9.7	-1.40 (.163)

Table 3. Differences in the Changes of Pre- and Posttests on Outcome Variables between Intervention and Conventional Groups (N = 120)

Variables		Pretest M±SD	Posttest M±SD	Difference	t/p
Knowledge	I	11.2±2.2	15.4±3.6	4.2±4.7	3.34
	C	9.7±2.4	12.4±1.9	2.7±2.5	(.001)
Self-directed learning ability	I	112.3±10.5	116.2±9.3	3.9±10.6	3.30
	C	111.1±9.9	114.3±9.7	3.2±1.0	(.673)
Clinical performance ability	I	53.1±7.3	71.5±8.8	18.4±10.2	3.35
	C	55.2±9.7	66.4±7.9	11.2±11.1	(.002)

I=Intervention group, C= Conventional group

4. DISCUSSION

The importance of Web-based learning programs lies in stimulating learners' motivations and inducing self-directed learning. Therefore, good Web design is an essential factor in capturing students' attention and the composition ability of information. In addition, the interaction between the operator and learners is a critical factor in enhancing the efficiency of WBI [19]. In this study, we had close contact with the Web page production company from the first stage of development and created elements such as the discussion room and bulletin board in order to stimulate learners' motivation. In addition, since we placed multimedia contents on the LMS of an e-learning center, there was a high level of satisfaction in terms of students' access to the contents and technology whenever instructors and students interacted with one another. According to the "Comprehensive Revitalization Plan for Information-based Universities" prepared by the Korean Ministry of Education in 2002, colleges are actively moving toward exchanging credits amongst themselves and providing learning services for the community through e-learning by establishing a consortium [20]. Therefore, we encourage nursing professors to actively use local e-learning centers when developing learning materials for virtual learning in the future.

The greatest strength and distinction of this study is the fact that, at the development stage of the multimedia contents for Web-based learning, professors from different colleges collaborated in improving nursing students' knowledge of clinical performance and providing standardized guidelines. In particular, it is meaningful to note that professors of adult nursing from nine colleges in the same area participated in this research; they discussed ways in which to improve learning, jointly developed and shared multimedia teaching materials, and sought to enhance the efficiency of learning. The Web-based content for critically ill patients developed by these researchers prior to the present research turned out to have limitations, in that the content was developed for the sake of

obtaining knowledge related to clinical skills [2]. In order to overcome these shortcomings and enhance students' adaptiveness to clinical situations and integrative thinking power, the clinical situations of real patients were incorporated into learning related to clinical skills in this study.

The intervention group showed significantly higher changes of pre- and posttest scores in knowledge than the conventional group. This result supports many previous studies in that the intervention group members who utilized multimedia contents showed significantly higher scores in levels of knowledge in the courses of fundamental nursing [9] and health assessment [5] than the conventional group members. This is also similar to the results of a study in which the group that practiced Web-based learning about intramuscular injection knowledge and skills showed greater increases in that knowledge and those skills than the traditional lecture-driven group [10]. These findings support the belief that self-directed repetitive learning can have a positive role in the acquisition of complicated and important clinical skills when Web-based multimedia content is used as an educational tool to assist in clinical practice [5].

Clinical performance refers to the measurement of self-assessment regarding the attainment of learning objectives for clinical knowledge and skills in care for patients with respiratory and digestive system problems. The intervention group reported a higher sense of confidence in clinical performance ability than the conventional group. This was the first clinical practice for both the intervention and conventional groups. Accordingly, the intervention group might have had a higher sense of confidence in clinical performance due to their self-learning of multimedia contents than the conventional group, whose members only received the traditional guidance of a preceptor. The students of the intervention group were exposed to situations that were similar to actual clinical situations and thus experienced an enlargement of their knowledge of clinical practice. A review paper also asserted that students are able to improve their cognitive and metacognitive skills in clinical contexts by using self-regulated learning strategies [14]. Therefore, Web-based learning contents designed to enhance students' clinical practicum or knowledge should be developed in clinical contexts. In this study, however, clinical performance ability was measured by students' self-assessment, not their actual performance ability, and our discussion is limited by the fact that there are few existing studies on changes in clinical performance ability after Web-based learning with which to compare our results.

There was no statistical difference in self-directed learning ability between the two groups in this study. This result might be related to the short period of three weeks allotted for the use of multimedia content, which is brief to expect changes in self-directed learning ability.

It is worthwhile to note that instructors from different colleges collaborated in the production and sharing of learning materials by taking advantage of a local e-learning center and attempted to enhance learning efficiency in terms of the development and management of virtual learning. However, the main challenge was that the students in the intervention group had to set aside extra time to learn the multimedia contents while they practiced, which put intense pressure on them.

This study has its limitations. First, the response of the intervention group could have been affected by the researcher, who developed the multimedia contents and was involved in the clinical practicum. Thus, the intervention group students' satisfaction with their practicum could have had a more positive evaluation than was warranted. In addition, the study period was too short to measure changes in the learning outcome.

5. CONCLUSION

Web-based multimedia content consisting of 33 learning modules was developed through integration among colleges in an effort to enhance nursing students' clinical practice of adult nursing. The students in the intervention group, who took a Web-enhanced clinical practicum, reported significantly higher increases in knowledge and self-reported clinical performance ability in care for patients with digestive and respiratory problems than those in the conventional group, who engaged in a traditional clinical practicum. These results demonstrate that Web-based multimedia contents can be an effective educational tool for enhancing students' clinical knowledge and performance, implying the necessity of developing multimedia contents for diverse areas of clinical practice in the future.

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