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Development and Effectiveness of a Smartphone Application for Clinical Practice Orientation

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Abstract

This paper presents a smartphone application for the clinical practice education conducted in hospitals, with an aim to evaluate its effectiveness. A nonequivalent control group posttest design was used, which included a total of 100 nursing of school students who conducted their clinical practice. They were divided into one control and one experimental group (50 students each). The control group was directly trained in the clinical practice orientation, and the experimental group was a group who self-learned the clinical practice orientation using a smartphone application. Research data were collected between March 5 and April 27, 2019. They were analyzed with descriptive statistics and independent t-test, using the SPSS Statistics Version 24. The smartphone application customized for the clinical practice education was implemented through the following four phases: analysis, design, development, and evaluation. The developed application was registered in Google Play (for Android apps) and Apple Store, and related information was provided, making it available for download. The study showed that the satisfaction with and self-confidence in learning differed significantly between the groups. However, technology acceptance and knowledge acquired through practice showed no statistically significant difference. The research results serve as basic data for applying smartphone applications as an educational method that can replace traditional modes of education, serving as a significant indicator of the education delivery method diversification.

Keywords: Application, Clinical practice, Educational method, Intention, Evaluation

1. Introduction

After acquiring knowledge in nursing practice according to a systematic regular curriculum, nursing students cultivate their competencies at health care institutions for clinical practice by verifying and applying the theoretical knowledge in their work. As clinical practice performance is indispensable for nurses [1], the

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Korean Accreditation Board of Nursing Education advises universities to efficiently operate their clinical practice curriculums and ensures that a typical nursing school student completes a total of 1,000 hours in clinical practice [2].

However, several nursing students experience the stress of clinical practice [3,4], which refers to tense situations that make nursing students feel anxious by influencing their feelings, perceptions, and physical condition in connection with their clinical practice [5]. As nursing students can readily adjust to practice when they have information and knowledge on the health facilities where they engage in their clinical practice [6], the hospitals conduct clinical practice orientation for nursing students before the clinical practice starts there with the aim of reducing the aforementioned stress.

The traditional clinical practice orientation that health facilities provide to nursing students is in most cases implemented as face-to-face training. This type of training is divided into the pre-knowledge about hospitals and precautions for practice, such as basic hospital facilities and nursing organization, ward management, fire prevention & safety, protection of private data, infection control, wastes control, pre-practice precautions, and clinical practice etiquettes that nursing students must know about the health facilities where they practice. Such practice orientation is provided to nursing students, not only to protect them during the practice, but also to improve the quality of patient safety management and nursing at the hospitals that receive the students. The clinical practice orientation for nursing students typically lasts from 2 to 4 hours in a certain location inside the health facility in a format that suits the facility, and most nursing students join the off-the-job training by visiting the facility. Moreover, the one-time face-to-face off-the-job training, unfamiliar environment, and the significant amount of information and education from the hospital staff may get students nervous and stressed out as in clinical practice, as they might take time familiar with details of the program [3,4]. While nursing students are urged to participate in such training at hospitals, the learning satisfaction, self-confidence, knowledge in the practice etc. with regard to the training implemented at hospitals are rarely evaluated after their training comes to an end.

Lately, education with latest information technology (IT) and smart devices is increasing as people look to the Fourth Industrial Revolution. In response to change, an app tailored for clinical practice orientation has been developed [7], presenting a new teaching method. The educational method that taps into smartphones as a new method for teaching and learning is suggested as a way to provide tailored information, serving as a medium that imposes no temporal or spatial restrictions on learners and registers excellent accessibility [7]. In fact, the mobile postpartum care app developed for primiparas has proven quite effective in boosting their knowledge and self-confidence in their postpartum care through reiterative learning instead of a one-time lesson [8].

The smartphone applications that have so far been developed for nursing students have focused on theory class and practice session. In theory class, drug dosage calculations training [9], nursing training in high-risk drugs [10], and nursing training for women's health [11] have been developed and applied to students, and in practice session, the research for the clinical practice orientation application [7] has been carried out. To the best of our knowledge, thus far, there are no studies that have developed a customized clinical practice orientation program for hospitals that conduct clinical practice for nursing students and evaluated its educational effectiveness by applying it to nursing students during a practice session.

Meanwhile, acceptance intention refers to the commitment to performing specific acts [12] and exerts direct influence on its actual use [13]. In their study on the future of professions with the highest job security, Susskind and Susskind [14] suggested that due to the technological advancement, existing tasks may be replaced by new methods. Most people who work at hospitals are specialists who may be susceptible to such new changes. Therefore, verification of the nursing students' intention to use the mobile application technology

can serve as basic data that enable an early understanding of the future health care professionals' intention to receive new technology considering changes coming in the future.

With a view to remedying the existing problems with the conventional clinical practice orientation implemented as face-to-face off-the-job training at health care institutions, this study has been conducted to develop a mobile application for facility-customized clinical practice orientation that taps into the smartphones owned by nursing students and tests its effectiveness.

The study, which aims to develop a smartphone-based clinical practice orientation application and evaluate its effectiveness, has the following two objectives: First, it aims to develop a smartphone-based facility-customized clinical practice orientation application. Second, it makes a comparative evaluation of the control group that is provided with the conventional educational method and the experimental group that applies the smartphone application for clinical practice orientation.

2. Methods

1. Study design

This study has been conducted using a nonequivalent control group posttest design that develops a smartphone-based customized clinical practice orientation application for nursing students and evaluates its effectiveness.

2. Participants

The organization of the subjects employed the G-Power 3.1.3 program. The number of the subjects calculated with 0.625 in effectiveness (d), .05 in the significance level (two-tailed test), and .80 in statistical power, obtained by comparing the average and standard deviation in the smartphone application's educational effectiveness for nursing students between the two groups based on the research results [9], was 42 in each group. At the short-term nursing intervention dropout rate of 10%, a total of 92 persons were recruited, with 46 persons in each group. The subjects were provided with a guide to the research objectives and method, guaranteed anonymity. In addition, voluntary research participation and agreement were signed before the research. A total of 100 college students participated in the research, with 50 in the control group and another 50 in the experimental group and without any dropouts.

3. Measurements

3.1 Satisfaction and Self-Confidence in Learning

The tool for satisfaction and self-confidence in learning is called the Student Satisfaction and Self-Confidence in Learning Scale, developed by the National League for Nursing in the United States. Its validity has been tested by Yu [15]. It is composed of 13 questions, with five questions in learning satisfaction and eight in self-confidence. Questions are measured on a 5-point Likert scale, and higher scores suggest greater satisfaction and self-confidence. In the study by Yu [15], Cronbach's α was .89 in learning satisfaction and .72 in self-confidence, whereas in this study, it was .91 in learning satisfaction and .83 in self-confidence.

3.2 Knowledge in Practice Education

To measure the knowledge in the clinical practice orientation, the researcher developed a practice training knowledge measuring tool with a total of 15 questions that were applied after they were reviewed by three

nursing professors and three head nurses as hospital training committee members. Each of the 15 questions scored 1 when correct or 0 when false. Higher scores suggested higher levels of knowledge in the practice training.

3.3. Technology Acceptance

The tool measuring the intention to use technology was the one constructed by Gang Han-seom [16], noting the research by Taylor and Todd [17] and Choe and Shin [18]. The term technology in the tool was changed to mobile application before it was applied in this study. A total of four questions were measured on a 10-point Likert scale, and higher scores suggested a greater acceptance intention. In this study, Cronbach's α was .96.

3.4. Data collection

The subjects were selected considering the following requirements: (1) nursing students participating in clinical practice at "S" hospital; (2) nursing students who have a smartphone (either an Android phone or an iPhone); (3) a person who can download and use applications. The data collection that took place between March 5 and April 27, 2019, involved the nursing students engaged in clinical practice at "S" hospital for the sake of convenience.

3.5. Data analysis

The collected data were analyzed using the SPSS Statistics Version 24. For the general characteristics of the research subjects, descriptive statistics were employed, whereas the variables in the research were analyzed using descriptive statistics and an independent t-test.

3.6. Ethical consideration

Before the research was conducted, an approval from the institutional review board of "D" University was obtained(IRB No 1041493-A-2018-009). Participation was completely voluntary, and there was no disadvantage for non-participation. After students were informed, they were asked to sign a consent form and were free to withdraw from the study at anytime without penalty or limitation.

4. Results

4.1 The Analytical Phase

In the analytical phase, the user, teaching content, technology, and environment were analyzed. The analysis of users consisted of the teaching content prepared as necessary for the nursing students by the faculty in charge of the clinical practice, faculty in charge of the hospital, and the head nurse in charge of training at the hospital. The types of smartphones owned by the students were identified. The teaching content that had to be provided to the students was available in the 11 categories of hospital introduction, nursing department introduction, guide to hospital facilities, preparations for clinical practice, practice etiquettes, safety, ward management duties, fire prevention & safety, private date protection, infection control, and medical wastes & laundry management. The analysis of the technology and the environment showed that the students had Android smartphones or iPhones and that they were able to download applications and put them to educational use.

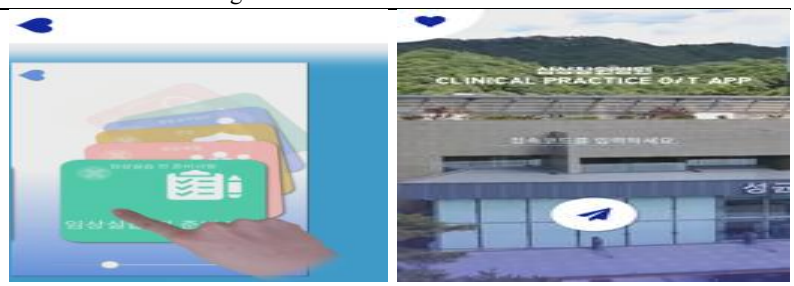
4.2 The Design Phase

The design phase, which was based on the study[7], proceeded with teaching content, interface, and system design. The teaching content was composed of application introduction, how to use the application, and the content of clinical practice (Table 1). In the application introduction, a guide to the developed application was presented, and later, a video on how to use the application was included. The specifics of the clinical practice training were knowledge and quizzes on hospital practice based on the survey in the analytical phase. In the quizzes, questions and answer choices were randomly provided, and an answer choice had to be selected to move on to the next question. It was designed so that once all the questions were answered, the text-taker could instantly view their own knowledge scores.

The interface design employed PowerPoint documents with one and the same template so that consistency and unity were felt. As for the on-screen mobility for learning, pagination and scroll mode varied with the content of clinical practice training and were presented so that the learner could visually check the amount of the content.

The system was designed so that the main screen was presented after the password was entered first, when the clinical practice training app was first run. Its design ensured the user's free connection and use anytime and anywhere.

Table 1. Illustration of the Screen of the Mobile Application for Clinical Practice Training

Category	Images Presented
How to Use the Application	
Clinical Practice Teaching Content Quizzes	

4.3 The Developmental Phase

In the developmental phase, the overall design was figured out with a story board, and the development project was entrusted to a professional developer with the condition that it would be used both on iPhones and Android smartphones. The project employed the same environment and tools that were used in the study by Lee and others [7]. In addition, the students were instructed to download and use the type of the app that suited their smartphones, from either Google Store for Android phones or App Store for iPhones. The name of the app uploaded to the stores was the "SMC Nursing Student Orientation App."

4.4 The Evaluation Phase

4.4.1 The General Characteristics of the Subjects

As for the general characteristics of the subjects, there were 90% of females (45 persons) and 10% of males (5 persons) in the experimental group, and 82% (41 persons) of females and 18% of males (9 persons) in the control group. There were 20% of junior students (10 persons) and 80% of senior students (40 persons) in the experimental group, and 100% of juniors (50 persons) in the control group. Considering age, 80% (40 persons) of the experimental group and 96% (48 persons) of the control group were aged between 21 and 25. Considering the satisfaction with their major in nursing, 28 persons (56%) from the experimental group were satisfied, whereas 28 persons (56%) from the control group were satisfied. Twenty-eight students (56%) from the experimental group and 15 students (30%) from the control group found it to be "moderate" . As for their experience in hospital orientation, 34 students (68%) from the experimental group and 48 students (96%) from the control group said they had experience. As for the types of smartphones owned by the students, in the experimental group, 21 students (42%) had Android phones, 28 students (56%) had iPhones, and one student (2%) had some other phone. In the control group, 14 students (28%) had Android phones, 35 students (70%) had iPhones, and one student (2%) had some other phone.

4.4.2 The Subjects' Learning Satisfaction and Self-Confidence

The subjects showed their learning satisfaction and self-confidence as presented in Table 2. The learning satisfaction for the control group for which off-the-job training was conducted scored 3.30±0.56 pts, whereas that for the experimental group for which the mobile application was applied scored 4.18±0.60 pts, with the average scores of the two groups registering a statistically significant difference (t=-7.53, p<.001).

The self-confidence for the control group for which off-the-job training was conducted scored 3.41±0.44pts, whereas that for the control group for which the mobile application was applied scored 3.95±0.51pts, with the average scores of the two groups registering a statistically significant difference (t=-5.66, p<.001).

Table 2. The Research Subjects' Satisfaction and Self-Confidence in Learning (N=100)

Variables	Control Group (n=50)	Experimental Group (n=50)	t	p
	M±SD	M±SD		
Learning Satisfaction	3.30±0.56	4.18±0.60	-7.53	<.001
Self-Confidence	3.41±0.44	3.95±0.51	-5.66	<.001

M=mean; SD=standard deviation.

4.4.3 The Subjects' Knowledge in Practice Training

The subjects' knowledge in practice training was as shown in Table 3. The knowledge in practice training for the control group for which off-the-job training was conducted scored 12.14±1.78 pts, whereas that for the experimental group for which the mobile application was applied scored 12.16±1.41 pts, with the average scores of the two groups registering no statistically significant difference (t=-.062, p<.951).

Table 3. Group Comparisons of The Subjects' Knowledge in Practice Training (N=100)

Variables	Control Group (n=50)	Experimental Group (n=50)	t	*p*
	M±SD	M±SD		
Knowledge in Practice Training	12.14±1.78	12.16±1.41	-.062	<.951

M=mean; SD=standard deviation.

4.4.4 The Subjects' Intention to Use Technology

The subjects' intention to use technology is presented in Table 4. The intention to use technology for the control group for which off-the-job training was conducted scored 7.98±2.03 pts, whereas that for the experimental group for which the mobile application was applied scored 8.41±1.66 pts, with the average scores of the two groups registering no statistically significant difference (t=-1.15, p<.251).

Table 4. The Subjects' Intention to Use Technology (N=100)

Variables	Control Group (n=50)	Experimental Group (n=50)	t	*p*
	M±SD	M±SD		
Acceptance Intention	7.98±2.03	8.41±1.66	-1.15	<.251

M=mean; SD=standard deviation.

5. Discussion

This study developed an application for clinical practice training for nursing students and evaluated its educational effectiveness, while comparing it with the conventional off-the-job training, because its aim was to provide basic data to promote the excellence and efficiency of the clinical practice orientation, as provided by health care institutions.

This study has been implemented in four phases—analysis, design, development, and evaluation—as in the research on the application [7,9,10] developed for nursing students. The study shows that the satisfaction and self-confidence in learning were significantly greater in the control group to which the mobile application was applied than in the experimental group for which off-the-job training was conducted. As conventional off-the-job training faces limitations in space and time and is offered as a one-time event, educational effectiveness can hardly be expected without active participation. Satisfaction and self-confidence must have increased because a mobile application allows learners to have self-directed and reiterative learning free from temporal and spatial restrictions, and verify their increased knowledge through quizzes. As the effectiveness of training

with mobile applications draws spotlight, learning that employs applications in nursing education is increasing. A study with graduates of US nursing schools found that students experienced difficulty putting their theoretical knowledge into action [19]. Such circumstances require an education delivery method that can help apply theoretical knowledge to actual work. In this light, the smartphone application for customized clinical practice training, which heightens the learner's satisfaction and self-confidence in learning, needs to be considered as a way to boost nursing students' clinical practice performance.

The knowledge in practice training registered no significant difference between the control group for which off-the-job training was conducted and the experimental group to which the mobile application was applied. However, such knowledge registered a significant increase in the control group to which the women's health nursing application was applied for 6 weeks [11]. In addition, the group in which nursing students used a drug dosage calculations application for 4 weeks registered a difference in their drug dosage calculation [9]. The study that applied an application as a learning assistant to ordinary college students also demonstrated its effectiveness regarding academic achievement [20].

As this study was applied to the practice training, and as the two studies were applied to theory class, the research results showed differences. Therefore, further studies with in-depth research stating what to apply and the application period, as well as involving a larger number of subjects, are recommended.

Finally, the technology acceptance, which showed no significant difference between the control group for which off-the-job training was conducted and the experimental group to which the mobile application was applied, registered a significant increase in the acceptance intention with the single-group study to which the women's health nursing application was employed for six weeks [11]. Since 2011, the Ministry of Education has presented the education revolution through the smart education as its vision [21]. Therefore, the intention to use technology [22], which measures not only the commitment to implement technology, but also the plan and intention to use IT, as well as its continuous usage, needs to be figured out in the future application of new IT.

6. Conclusion

To summarize the research results, the control group for which off-the-job training was conducted and the experimental group to which the smartphone-based clinical practice orientation application was applied showed a significant difference in satisfaction and self-confidence in learning, but no significant difference in technology acceptance and knowledge in practice training. A conclusion based on the results is that the clinical practice training application will serve as significant basic data in the application of hospital orientation and that it can be used as useful indicators in the future evaluation of the education delivery method for clinical practice in hospitals.

This study has limitations, in that the selection bias related to the subjects warrants caution in interpreting the results, as a nonequivalent control group posttest design was implemented because a pretest was feared to register the testing effect.

Building on these research results, the study suggests the following. First, the clinical practice training application will have to be applied to a larger number of subjects, and a long-term analytical study on its educational effectiveness should be conducted. Second, the standard for clinical practice performance has to be established with the aim of setting the standard for systematic provision of a teaching method.

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