

# Mobile-Based Video Learning Outcomes in Clinical Nursing Skill Education

## A Randomized Controlled Trial

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Mobile devices are a regular part of daily life among the younger generations. Thus, now is the time to apply mobile device use to nursing education. The purpose of this study was to identify the effects of a mobile-based video clip on learning motivation, competence, and class satisfaction in nursing students using a randomized controlled trial with a pretest and posttest design. A total of 71 nursing students participated in this study: 36 in the intervention group and 35 in the control group. A video clip of how to perform a urinary catheterization was developed, and the intervention group was able to download it to their own mobile devices for unlimited viewing throughout 1 week. All of the students participated in a practice laboratory to learn urinary catheterization and were blindly tested for their performance skills after participation in the laboratory. The intervention group showed significantly higher levels of learning motivation and class satisfaction than did the control. Of the fundamental nursing competencies, the intervention group was more confident in practicing catheterization than their counterparts. Our findings suggest that video clips using mobile devices are useful tools that educate student nurses on relevant clinical skills and improve learning outcomes.

**KEY WORDS:** Clinical competence, Learning, Mobile device, Motivation, Nursing education

Maintaining the quality and safety of care is essential when meeting patient care needs.<sup>1</sup> In order to provide high-quality and safe nursing care to patients, nurses need to be competent in clinical nursing skills. Complete mastery of clinical skills is one of the tasks nursing students should achieve during their study at a nursing college. Learning clinical nursing skills is a prerequisite not only for a successful and confident nursing career but also for the facilitation

of critical thinking, cultivation of deep interest in the profession, and most important for the overall improvement of patient care.<sup>2</sup>

Regardless of the importance of clinical skill acquisition, if opportunities to experience myriad clinical procedures are not available, then clinical skill acquisition can be challenging. Currently, there are a limited number of these opportunities in nursing education curriculum. This shortage exists for numerous reasons including faculty or clinical liaison shortages, liability issues, and a limited availability of clinical experiences when patients express discomfort or refuse to receive care from students in academic hospital settings. A growing body of research suggests that technology-based learning can supplement conventional teaching to overcome this shortage.<sup>3</sup>

Technology-enhanced learning, especially using mobile devices, has the potential to aid in educating the younger generations. It has been estimated that by 2015 80% of Internet users will access the Web via mobile phone, and the number of mobile devices will outnumber computer devices.<sup>4</sup> Mobile devices and smartphones are undoubtedly a culturally essential device for the latest generation entering the world of higher education. Generation Y (generally referred to as those born between the years 1982 and 2000) is a unique demographic group, possessing “the most technically literate, educated, and ethnically diverse” qualities in history.<sup>5</sup> They are described as being “confident, independent, and individualistic,” yet “socially active, collaborative, and team oriented.”<sup>6</sup> Therefore, education interventions directed at this techno-savvy generation must consider the effects of these unique qualities along with the ubiquitous availability of mobile technology.

The use of new technologies such as e-learning, computer-assisted learning, and Web-based applications for clinical skill education has increased learner satisfaction compared with the conventional education methods.<sup>7,8</sup> However, systematic reviews on technology-enhanced learning for clinical nursing skills demonstrated inconsistent findings for its effects on knowledge and skill as learning outcomes across these studies and methodology limitations.<sup>7,9</sup> Hence, further studies are needed to explore how technology-enhanced learning affects knowledge and clinical skill acquisition among nursing students, in relation to other learning outcomes.

Among various technology resources, video clips are the most effective for knowledge acquisition.<sup>1,7</sup> A recent study

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on the effects of video clips found that videos of clinical skills viewed through mobile devices were more convenient for medical students than those viewed through the computer were.<sup>10</sup> Thus, use of mobile-based video clips in nursing skill education may also enhance accessibility to these videos and ultimately improve learning outcomes.

Use of mobile devices in education highlights the transition from educator-centered teaching to learner-centered education.<sup>11</sup> For effective mobile learning, the role of the learner is important.<sup>12</sup> Nursing educators should understand the learning characteristics of the young generation and encourage academic achievement by facilitating their interests and capabilities. Learning motivation is one of the key properties learners must possess to satisfactorily participate in learning activities. The young generation who has grown up with mobile devices may become more motivated to learn when mobile devices are incorporated in education. A study of undergraduate nursing students demonstrated that learning motivation was positively associated with class satisfaction.<sup>13</sup> Hence, mobile-based learning may enhance the learning motivation and class satisfaction of nursing students. However, few studies have investigated how learning motivation can be improved among students and whether motivation is associated with other learning outcomes. Furthermore, the use of mobile-based video clips in nursing skill education has not been thoroughly investigated. Therefore, the purpose of this study was to identify the effects of mobile-based video clips on learning motivation, competency, and class satisfaction in undergraduate nursing students as well as explore the relationships among these variables.

## METHODS

The specific aims of the study were (1) to identify the effects of a mobile-based video clip on learning motivation, fundamental nursing competency, and class satisfaction, (2) to examine the correlations among learning motivation, fundamental nursing competency, and class satisfaction, and (3) to explore the experiences of the nursing students who used the mobile-based video clip for clinical skill acquisition.

### Study Design and Sample

We performed a randomized controlled trial with a pretest and posttest design. The sample was composed of 74 second-year nursing students who were attending the College of Nursing at a university located in Seoul, South Korea. The student participants were randomly assigned to one of the two groups using a random-number-generation program. In order to minimize any skewing of the data due to gender differences, extra steps were taken to distribute the small number of male students equally between the two groups. The participants were recruited from a cohort of second-year nursing school

students enrolled in the Fundamentals of Nursing II course at this university.

This study was designed to have power greater than 80% in order to detect a relative improvement of 0.5 points or greater in the students' learning motivation, fundamental nursing competency, and class satisfaction scores for the intervention group in comparison to the control group using a two-sided type I error of 0.05. The power calculation was performed using the G\*POWER software version 3.1 (Heinrich Heine University, Dusseldorf, Germany). A minimum sample size of 68 was calculated for this study. Three participants failed to complete the study, resulting in the final sample size of 71. The framework for subject allocation is shown in Figure 1.

### Instruments

General characteristics included age, gender, religion, high school type and location, nursing credential history, economic status, deciding to join nursing by his/her own will, level of interest in the course, self-perceived class participation, final grade in the Fundamentals of Nursing I course, weekly hours spent on self-study, and postgraduation plans. An 11-point scale (0 = lowest, 10 = highest) was used for student self-rating of economic status, level of interest in the course, and class participation (Table 1).

### Learning Motivation

The level of learning motivation was measured by the Instructional Materials Motivation Survey (IMMS) developed by Keller.<sup>14</sup> The research team obtained permission from the author to adapt the survey solely for the purposes of the present study. One of the members of our research team translated the IMMS into Korean, and two other members of the research team reviewed the Korean version of the IMMS. Afterward, the Korean version was back-translated into English by two doctoral-level nurses who are fluent in English. The original, Korean, and back-translated versions of the IMMS were reviewed by our research team and revised to accommodate our research aims. The IMMS consists of four domains: attention, relevance, confidence, and satisfaction, with a total of 36 questions on a 5-point Likert scale (1 = do not agree, 2 = agree, 3 = moderately agree, 4 = agree, and 5 = strongly agree). Possible scores range from 36 to 180, with a higher score indicative of a higher level of learning motivation. Cronbach's  $\alpha$  was calculated as .72 to .79 for the present study.

### Fundamental Nursing Competency

Axley<sup>10</sup> defines the concept of *nursing competency* with a broad perspective. It is not simply "the mere attainment of skills," but essential qualities such as "attitudes, motives, personal insightfulness, interpretive ability (critical thinking), receptivity, maturity and self-assessment" also apply. Therefore, in this study, we measured the levels of fundamental nursing competency

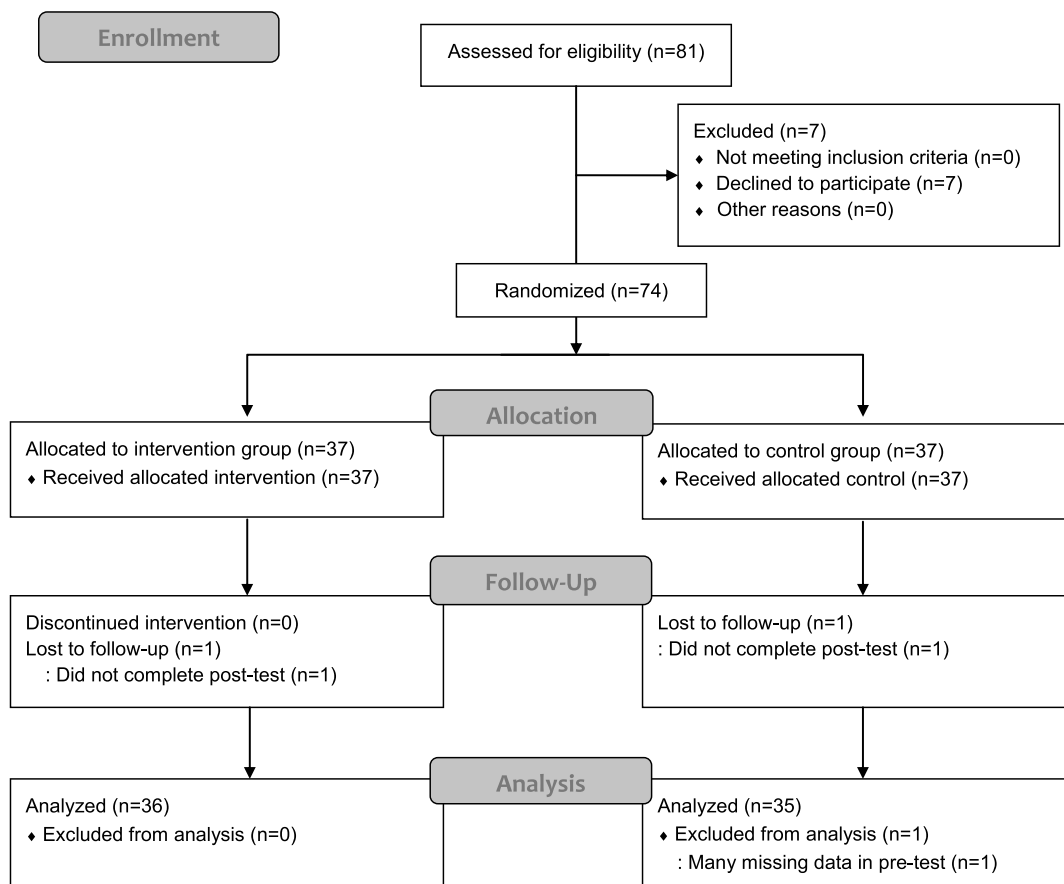


FIGURE 1. CONSORT flow diagram.

by assessing not only the level of students' knowledge and skills performance, but also their incorporated confidence in performing a urinary catheterization.

Urinary catheterization knowledge was measured using 10 multiple-choice and five short-answer questions were developed by the research team. These questions were tested for knowledge of the principles, indications, equipment, procedure steps, and management of a urinary catheterization. For example, we presented mixed steps of urinary catheterization and asked the students to arrange the steps in a good order. The skills performance was evaluated against the procedure checklist, which was developed specifically for this study. This checklist was developed according to the standards of the Korean Accreditation Board of Nursing Education's core basic nursing skills protocol, which is consistent with principles and guidelines from fundamental nursing textbooks.<sup>15</sup> The procedure checklist included correct hand-washing techniques, the collection of correct materials, verification of the correct patient, correct body mechanics, correct preparation, sterile

glove donning, insertion of the catheter without breaking the aseptic technique, and correct execution of the postinsertion clean-up process. Subsequently, two seasoned clinical nurse specialists (each with more than 5 years of experience) provided feedback comments and verified the final urinary catheterization performance checklist. Training was provided for evaluators in order to minimize any possible variance between these evaluators. The evaluators were blinded to the students' participation in this study. A preliminary test of the checklist was performed on two senior nursing students who were not involved in the research study, and interrater reliability was assessed among the four evaluators in our research team. The evaluation criteria were composed of 15 items rated on a 3-point Likert scale (0 = totally incorrect or omitted, 1 = partially incorrect performance, 2 = accurate performance). The total possible scores ranged from 0 to 30, with higher scores indicating a higher level of skill performance in urinary catheterization. The participants demonstrated urinary catheterization on a transparent female catheter model. Lastly,

**Table 1.** Homogeneity for General Characteristics and Learning Motivation Between the Intervention and Control Groups at the Pretest

Variables	Categories or Possible Range	Intervention (n = 36)	Control (n = 35)	$\chi^2$ or t	P
		Mean $\pm$ SD or n (%)	Mean $\pm$ SD or n (%)		
Age, y		19.92 $\pm$ 1.03	20.37 $\pm$ 1.70	-1.370	.174
Gender	Female	33 (91.7)	31 (88.6)	0.191	.662
	Male	3 (8.3)	4 (11.4)		
Religion	Yes	21 (58.3)	16 (45.7)	4.524	.340
Mobile device use	Yes	35 (97.2)	34 (97.1)	0.000	.984
Type of high school	Public, general	34 (94.4)	29 (82.9)	4.801	.187
Location of high school	Urban area	9 (25.0)	15 (42.9)	4.524	.340
	Suburban/rural area	23 (63.9)	16 (45.7)		
Decision to join the nursing major	By myself	17 (47.2)	23 (65.7)	5.877	.118
	Advice from others	19 (52.8)	12 (34.3)		
Postgraduation plans (multiple answers allowed)	Clinical nurse	25 (69.4)	23 (65.7)	0.113	.737
	Graduate school	20 (48.8)	21 (51.2)	0.144	.705
	Change careers	8 (22.2)	5 (14.3)	0.747	.387
	Other <sup>a</sup>	9 (42.9)	12 (57.1)	0.735	.391
Economic status	0–10 <sup>b</sup>	5.17 $\pm$ 1.80	5.34 $\pm$ 1.75	-0.419	.677
Interest in nursing	0–10 <sup>b</sup>	6.50 $\pm$ 1.65	6.26 $\pm$ 1.89	0.579	.565
Interest in fundamental nursing	0–10 <sup>b</sup>	6.67 $\pm$ 1.55	6.46 $\pm$ 1.58	0.565	.574
Participation in class	0–10 <sup>b</sup>	7.28 $\pm$ 1.37	7.29 $\pm$ 1.74	-0.021	.983
Fundamentals in Nursing I grade point	0–4.3 <sup>c</sup>	3.86 $\pm$ 0.52	3.76 $\pm$ 0.58	0.802	.425
Study time of fundamental nursing, h/wk		1.76 $\pm$ 1.10	1.84 $\pm$ 1.06	-0.307	.760
Learning motivation	36–180	121.47 $\pm$ 11.95	121.66 $\pm$ 9.91	-0.071	.944
Attention	12–60	39.92 $\pm$ 5.23	39.66 $\pm$ 3.99	0.235	.815
Relevance	9–45	32.06 $\pm$ 3.46	31.89 $\pm$ 3.11	0.217	.829
Confidence	9–45	28.83 $\pm$ 3.50	29.54 $\pm$ 3.74	-0.826	.412
Satisfaction	6–30	20.67 $\pm$ 2.66	20.57 $\pm$ 2.39	0.158	.875

<sup>a</sup>Other: school nurse, government officer, and so on.

<sup>b</sup>An 11-point scale (0 = lowest, 10 = highest) was used for student self-rating.

<sup>c</sup>0 = F, 4.3 = A<sup>+</sup>.

the level of confidence in practice was measured by using a self-reported scale of 0 to 10. The higher score on this self-reported scale indicated a higher level of confidence in performing urinary catheterization.

#### Class Satisfaction

A self-reported scale of 0 to 10 was used to measure the level of class satisfaction. A higher number on this scale indicated a more positive level of satisfaction with the Fundamentals of Nursing II course.

The intervention group responded to additional questions related to their mobile learning experience at the end of the study, including the type of device used to download and

watch the video clip, number of viewings, satisfaction with quality of the video clip, perceived usefulness of the video clip as a learning material, and perceived usefulness for knowledge acquisition and clinical skill improvement. Lastly, open-ended questions were used to ask about the positive and negative aspects of the mobile-based video clip on urinary catheterization.

#### Intervention

Urinary catheterization is an essential, fundamental nursing skill that all nurses must master. It requires an adequate amount of practice to ensure aseptic techniques that decrease the risks of infection and minimize the risks of injury. The female urinary catheterization video clip was created using a

female catheterization simulator M180 made by Sakamoto Model Corporation (Osaka, Japan) and following the checklist developed for this study. In addition, a concise voice narration was included with each scene to help clarify the demonstration in the video. The total video duration was 6 minutes 30 seconds. The video clip could be downloaded to all mobile devices in this study.

The validity of the clinical nursing principles and accuracy of the performance skills portrayed in the video as well as the recording quality are all important factors to be mindful of in the production of such video clips. Our video included a detailed portrayal of preparedness and the process of urinary catheterization, which was demonstrated by an experienced clinical instructor using instructional narration. The final version of the urinary catheterization video clip was shared with two professors from the Fundamentals of Nursing course and two clinical instructors in order to verify the accuracy and the quality of the video, before it was released to the participants of this study.

### Procedures

The research team explained the purpose of this study to the students, and informed consents were obtained voluntarily after questions and concerns were adequately addressed (Figure 1). Initially, all students who agreed to participate in the study completed the questionnaire for the pretest, which collected data on general characteristics and learning motivation. Two weeks later, participating students attended a 90-minute lecture on urinary catheterization. During the lecture, all of the students watched the video we created for this study. This was the only time that the control group had the opportunity to watch the video clip. After the lecture, the intervention group was separately instructed on how to access the urinary catheterization video clip. These students were highly encouraged to view the provided video clip using their mobile devices throughout the subsequent 7 days as much as possible. Text messages were sent every 2 days to remind the intervention group to access the video clip. The intervention group was asked not to share the video clip with any of their peers.

One week after the urinary catheterization lecture and the release of the video clip, both the intervention and the control groups attended a 2-hour practice laboratory. In the practice laboratory, the faculty demonstrated urinary catheterization using a female catheterization simulator, and all participants practiced the required skills. A posttest was conducted after the completion of the practice laboratory. All students filled out the questionnaire regarding learning motivation, confidence during the practice laboratory, and their satisfaction with the class on urinary catheterization. In addition, the intervention group completed a posttest questionnaire on their mobile-based learning experience. After the practice laboratory,

four instructors evaluated the urinary catheterization skills of students in both groups according to the developed checklist. On the 11th day after completing the practice laboratory, students in both the control and intervention groups were given a written examination to test their knowledge of urinary catheterization.

### Ethical Considerations

After obtaining approval from the College of Nursing Institutional Review Board, informed consents were signed by each participant. The video clip of the urinary catheterization was also distributed to the control group after the completion of this study.

### Analysis

All data were analyzed using SPSS version 21.0 for Windows (IBM Corp, Armonk, NY). The descriptive properties of the general characteristics were calculated as percentiles and means. In order to determine the homogeneity between the two groups (intervention vs control) at the pretest,  $\chi^2$  tests and independent *t* tests were performed. The independent *t* test was used to identify differences between the intervention and control groups for learning motivation, fundamental nursing competency (knowledge, skill performance, and confidence in practice), and class satisfaction at the posttest. Pearson correlation coefficients were used to examine relationships among learning motivation, fundamental competency, and class satisfaction. Lastly, independent *t* tests and Pearson correlation coefficients were used to test for significant differences in learning motivation, confidence in practice, and class satisfaction according to the intervention groups' general characteristics and mobile-based learning experiences.

## RESULTS

### Tests for Homogeneity

Homogeneity in the general characteristics and for learning motivation was tested between the intervention and control groups (Table 1). There were no differences for any of the general characteristics or for learning motivation.

### Effects of Mobile-Based Learning

The intervention group who received the mobile-based learning video scored significantly higher for learning motivation, confidence in practice, and class satisfaction compared with the control group (Table 2). In addition, scores for knowledge and skill performance, markers of fundamental nursing competency, were higher in the intervention group than in the control group, but there were no statistically significant differences.

There were significant positive correlations for learning motivation with class satisfaction ( $r = 0.725$ ,  $P < .001$ ) and confidence in practice ( $r = 0.717$ ,  $P < .001$ ). Lastly, there



**Table 2.** Differences Between the Intervention and Control Groups at the Posttest

Variables	Possible Range	Intervention (n = 36)	Control (n = 35)	t	P
		Mean ± SD	Mean ± SD		
Learning motivation	36–180	126.28 ± 14.96	116.89 ± 10.45	3.060	.003
Attention	12–60	44.22 ± 5.56	41.23 ± 4.08	2.580	.012
Relevance	9–45	32.56 ± 3.75	30.71 ± 3.03	2.272	.026
Confidence	9–45	28.78 ± 5.00	25.77 ± 3.42	2.947	.004
Satisfaction	6–30	20.72 ± 3.57	19.17 ± 2.13	2.962	.030
<b>Fundamental nursing competency</b>					
Knowledge	0–15	10.44 ± 1.76	10.26 ± 1.86	.436	.664
Skill performance	0–30	27.25 ± 2.57	26.57 ± 2.20	1.194	.236
Confidence in practice	0–10	6.61 ± 1.81	5.34 ± 1.71	3.031	.003
Class satisfaction	0–10	7.25 ± 1.42	6.43 ± 1.36	2.489	.015

was a significant positive correlation between class satisfaction and confidence ( $r = 0.772, P < .001$ ). However, neither knowledge nor skill performance was significantly correlated with the other variables (Table 3).

### Mobile-Based Learning Experience in the Intervention Group

We examined whether the number of viewings, type of mobile device used for viewing, subject's characteristics, and perception about the usefulness of the video clip were related with learning motivation, confidence in practice, or class satisfaction in the intervention group. The average number of viewings among students in the intervention group was 3.89 (SD, 2.04) times in 1 week. More than 75% of students viewed the video clip using a smartphone, and 25% viewed it using a tablet PC, iPad/iPod, or laptop computer. The type of device was not associated with any of the outcome variables, but the number of viewings was significantly and positively correlated with confidence in practice ( $r = 0.352, P = .035$ ) and class satisfaction ( $r = 0.453, P = .005$ ).

Among the students' characteristics, self-study time for the Fundamentals of Nursing course was positively correlated with

learning motivation ( $r = 0.515, P = .001$ ), confidence in practice ( $r = 0.517, P = .001$ ), and class satisfaction ( $r = 0.548, P = .001$ ). Learning motivation had a significantly positive correlation with the students' interest in fundamental nursing ( $r = 0.348, P = .037$ ). The confidence levels in students who were self-motivated to enter the nursing major were higher than those who decided to join nursing based on others' recommendations ( $t = 2.734, P = .010$ ). Postgraduation plans, interest in nursing and fundamental nursing, level of participation in class, and final grade of the previous course, Fundamentals of Nursing I, were not related with learning motivation, confidence in practice, or class satisfaction.

Overall, the students perceived the mobile-based video clip as useful. The mean perceived usefulness of the video clip as a learning material was 7.67 (SD, 1.60) of 10. The mean perceived usefulness of the video clip was 7.39 (SD, 1.70) for knowledge acquisition and 7.00 (SD, 1.74) for skill improvement. Students' perceived usefulness of the video clip as a learning material, for knowledge acquisition, or for skill improvement was positively correlated with learning motivation ( $r = 0.775, P < .001; r = 0.728, P < .001; r = 0.759, P < .001$ , respectively), confidence in practice ( $r = 0.762, P < .001$ ;

**Table 3.** Pearson Correlation Coefficients Among the Measured Variables After Mobile-Based Learning in the Intervention Group

Variables	1	2	3	4
	r (P)	r (P)	r (P)	r (P)
1. Learning motivation				
2. Class satisfaction	0.725 (<.001)			
3. Confidence	0.717 (<.001)	0.772 (<.001)		
4. Knowledge	0.111 (.519)	0.017 (.921)	0.029 (.867)	
5. Skill performance	-0.053 (.758)	-0.010 (.955)	-0.157 (.361)	-0.266 (.117)

$r = 0.759$ ,  $P < .001$ ;  $r = 0.882$ ,  $P < .001$ , respectively), and class satisfaction ( $r = 0.752$ ,  $P < .001$ ;  $r = 0.788$ ,  $P < .001$ ;  $r = 0.885$ ,  $P < .001$ , respectively).

### Student Feedback About Mobile-Based Learning

The students who participated in the intervention group answered open-ended questions about the benefits of and recommendations for using mobile-based learning in clinical nursing skill education. Of the 36 nursing students, 20 students reported benefits of mobile-based learning, and 21 students gave recommendations for future mobile-based learning in clinical nursing skill education. According to these students, the advantages of mobile-based education were its accessibility without constraints of place and time, availability for preparation and review, visualized learning effect, increased learning motivation, improved confidence in urinary catheterization, and reduced anxiety about making mistakes when performing the skill. They also suggested that technical support be developed for future mobile-based learning. They recommended using online streaming instead of downloading to view the video clip to avoid the extra time associated with downloading the video using a smartphone. Lastly, the addition of closed captioning was suggested to allow for viewing the video with the sound off.

### DISCUSSION

We evaluated the effects of using a mobile-based video clip as an adjunct to the clinical teaching of urinary catheterization in undergraduate nursing students through a randomized controlled trial. The findings demonstrated that the mobile-based video clip increased students' learning motivation, confidence in practice, and class satisfaction. The use of video clips for teaching clinical skills is not a new teaching method. Previous literature has shown its benefits, but these studies have methodological weaknesses such as a small sample size, lack of a control group, or questionable reliability and validity in its instruments.<sup>16</sup> However, the present study applied mobile technology using a video clip for nursing skill education, and students were able to view the video clip an unlimited number of times. By using a randomized controlled trial, we were able to create robust evidence that demonstrates the effect of the mobile-based video clip on clinical nursing skill education.

In the current study, students' confidence scores were significantly different between the intervention and control groups. In the intervention group, students reported having a lower amount of anxiety about making mistakes and more confidence because they were able to view and review the video clip. Added confidence may be a more vital factor than knowledge or skill acquisition in preparing nursing students for a smooth transition into clinical practice. Holland et al<sup>16</sup> found

that students who watched online videos on oral medical administration tended to perceive their experiences in clinical training as having well prepared them for clinical practice, whereas students in the control group who received traditional classroom teaching viewed their classroom learning experience to be separate from their clinical practice. In the study of Hansen et al,<sup>3</sup> which explored the effect of using iPods to view videos of urinary catheterization, they found that the levels of clinical skills competence and self-confidence in medical interns changed over time and at different rates depending on the type of procedure. The confidence scores for female catheterizations increased over time in both groups (iPod group vs no-iPod group), whereas those for the male catheterization decreased over time in both groups. The confidence score for the female catheterization increased over time in the intervention group, and the confidence score for female catheterization at the 3-month follow up was the highest. These changes in the students' confidence could be associated with the type of clinical skills and the length of the intervention period. In our study, the intervention period for viewing the urinary catheterization video clip was 1 week, which may be enough time for students' confidence in practice to change. However, the frequency of viewing may also be an important factor. On average, students viewed the video clip four times a week, and the frequency of viewing the video clip was significantly correlated with learning motivation, confidence in practice, and class satisfaction. Therefore, to enhance the effectiveness of these outcomes in research on the effect of mobile-based learning video clips, it is important to measure how many times or how frequently students watch the video and investigate how the frequency and number of times affect outcomes within the intervention period.

While our study showed no significant changes in terms of the student's performance or knowledge of urinary catheterization, several previous studies have reported different results. In the study by Hansen et al,<sup>3</sup> skill competency decreased over time in the control group for both male and female catheterizations, whereas the competency level remained stable in the intervention group for both procedures. In the study by Holland et al,<sup>16</sup> at the end of the 15-week clinical skills module, the failure rate of the Objective Structured Clinical Examination was lower in the intervention group who had access to online videos than that in the control group who received standard teaching. In our study, students could view the video clip during only 1 week, and their skill competency levels were evaluated immediately thereafter. Urinary catheterization is one of the high-level fundamental nursing skills that require a lot of training and practice time to master. Therefore, 1 week may not be enough time to allow differences about their skill and knowledge of urinary catheterization to become evident between the intervention and control groups. Considering the results of the study of Hansen et al,<sup>3</sup> we suggest that video clips be

used for more than 1 week to improve the students' skills and knowledge competencies.

In the intervention group, students' motivation levels were significantly higher in all four domains (attention, relevance, confidence, and satisfaction) after the intervention compared with those of the control group. Our results demonstrated significant correlations among students' motivation level, confidence in practice, and satisfaction with the intervention. These results are not surprising, given that the subjects of this study were mostly younger-generation students. Young students use mobile devices as an integral part of their lives, and familiarity increases their motivation to learn.<sup>17</sup> In the present study, learning motivation was correlated with self-study time and personal interest in the Fundamentals of Nursing course. We expect that the mobile-based video clip improved students' learning motivation and then increased students' interest in studying for Fundamentals of Nursing, which also might have lengthened their total self-study time. A study evaluating the impact of Internet-based learning on nursing students' knowledge, satisfaction, and self-directed learning found an interaction between students' level of motivation and the teaching methods; in the intervention group receiving the Internet-based learning, less motivated students showed better performance in knowledge acquisition than did their counterparts in the control group receiving traditional, face-to-face class teaching.<sup>13</sup> In addition, Gagnon et al<sup>13</sup> demonstrated that motivation was the only variable that had a positive effect on satisfaction. However, Gagnon et al<sup>13</sup> used only one item to measure motivation level; therefore, instruments with rigorous validity and reliability should be used to assess motivation. Further research is needed to identify the relation between motivation and mobile-based learning methods and their effects on learning outcomes and satisfaction. Students' level of motivation should be assessed before selecting teaching methods or designing mobile-based learning methods, and efforts to improve students' motivation should be considered in mobile-based education.

Most students viewed their mobile learning experiences positively in this study. Student's class satisfaction was significantly higher in the intervention group. As other studies have demonstrated,<sup>16,18,19</sup> the greatest benefit of using a mobile device was the accessibility and availability without the constraints of place and time. Students reported that the mobile-based video clip promoted fundamental nursing learning by providing opportunities for preview and review. Free access to video clips using mobile technology could complement students' limited access to expert instruction, which results from the limited number of faculty members and large number of students typical in an undergraduate skills laboratory. The need for flexibility in learning has become increasingly important as generations change. Mobile devices became an integral part of younger generation's lives, like the participants

in this study, and using a mobile device as a learning tool might motivate these students to learn. Mobile learning allows users flexibility in the time and place they chose to study, therefore increasing their independence and sense of responsibility for learning. In addition, mobile learning might make students motivated to learn using new technology and teaching methods.<sup>19</sup>

Technical issues was one of the challenges we experienced in effectively creating a mobile learning video for this nursing education course. Unfamiliarity with mobile technology and financial difficulty in purchasing a mobile device were reported as barriers in utilizing mobile devices in previous nursing education studies.<sup>18</sup> Adequate user training and technical support are requisites to success in incorporating mobile technologies into education.<sup>20,21</sup> In the present study, almost all students had a prior experience of using a mobile device and were able to download the video clip on their own devices. Although we held only one training session after the lecture, students seemed to access the video easily using their devices. Even though previous studies have mentioned the importance of providing financial support toward the use of technology-based learning in education,<sup>18,22</sup> we found that mobile learning can be easily utilized to support and complement traditional nursing education among students who are accustomed to using mobile devices. We believe that the potential advantages of using mobile devices in nursing education will become more evident in the future.

## LIMITATIONS

This study has several limitations. First, these students could not be blinded to the intervention because this study was implemented in a real education setting. In the beginning of the study, students were instructed not to share the video clip with other students. However, these students attended the same institution and practiced in the same laboratory, so contamination may have occurred. Second, four evaluators were involved in evaluating the students' skill performance using the developed checklist, so variance among the evaluators may have affected our results, even though pilot interrater reliability was checked in the preliminary test. Lastly, this study evaluated only one nursing skill, from one nursing college, and at one time after the intervention; therefore, our findings have limited generalizability.

## CONCLUSION

This study demonstrated that a mobile device is a valuable form of technology that can be used with video clips in nursing education to promote nursing students' learning motivation and confidence in learning a clinical nursing skill; motivation and confidence in learning were improved, and students' satisfaction with the class was high. This randomized controlled trial provides evidence that mobile learning using a video clip



was successful in clinical nursing skill education. This study suggests that nursing educators should investigate ways to enhance their learners' motivation by engaging them in the learning experience and reinforcing their self-learning behaviors. One way that motivation might be enhanced is through the design and implementation of a mobile-based learning video clip for use in nursing education. Future research on the effect of mobile-based video clips of other clinical skills and retaining educational outcomes is needed.

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