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Research Article

Effect of Mobile-Based Video Teaching Method on Students Learning Outcome on Female Catheterization among Nursing Students at Two Schools in Enugu, Nigeria

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ABSTRACT

This study compared mobile video instruction to face-to-face demonstrations in nursing practicum outcomes. Using quasi-experimental design, two nursing student groups were studied: UNTH-SON received mobile video instruction, while BS-SON had face-to-face demonstrations. Each group consisted of a randomly selected sample of 56 students (n=112). Prior to the intervention, a pre-test evaluated baseline skills, with the intervention group receiving a 30-minute video tutorial accessible on handheld electronic devices for three weeks, and the control group receiving twice-weekly 30-minute face-to-face sessions for the same duration. A post-test, conducted 21 days post-intervention, utilized a 39-item OSCE checklist with content validity of 0.902 and test-retest reliability of 0.817. Data were subjected to descriptive and inferential analysis (Student t-test and Fisher's exact test) at a 5% significance level. Baseline skill assessment revealed the mobile video group's mean score at 16.54 (5.46), with 82.1% performing poorly, compared to the face-to-face group's mean score of 21.82 (6.72), with 64.3% performing poorly ($p < 0.001$). Post-intervention, the mobile video group scored 32.73 (5.49), with only 3.6% performing poorly, while the face-to-face group scored 33.23 (6.89), with 5.4% performing poorly ($p = 0.627$). Mobile video-based instruction exhibited a 42% higher effectiveness than face-to-face instruction, with a mean difference of 16.19 versus 11.41 (Effect Ratio 1.41). However, post-test scores showed no significant difference ($p = 0.672$). In conclusion, video-based teaching is effective for instructing basic nursing students in female urinary catheterization during educational practicum, especially when face-to-face demonstrations are impractical.

Keywords: *Nursing practicum, mobile-based videos, face-to-face demonstrations, learning outcomes, comparative analysis, educational practicum instruction.*

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INTRODUCTION

At no time in history has there been a sudden transition from face-to-face teaching to electronic mediated teaching than in the past few years (Jowsey *et al*., 2020). In the wake of the Covid-19 pandemic and social lockdown of 2020 and 2021, online teaching became more emphasised than ever (Haslam, 2021). Consequently, the use of mobile phone technology for day-to-day interactions developed rapidly. Internet use for entertainment, commerce, and conferences increased by over 70% (Jahnke *et al*., 2020). For many students, mobile devices like smartphones became an imperative part of social life (Koohestani *et al*., 2018). With the social lockdown in place, conventional face-to-face teaching became impossible. Video clips delivered by mobile devices were the format most favoured by educators for online teaching (Lee *et al*., 2018). The mobile-based videos enabled educators to teach and demonstrate remotely, intending to achieve high-impact teaching and effective online learning (Bao, 2020). This transition to online teaching from conventional (face-to-face) classroom teaching may have influenced the teaching-learning process that basic nursing students had known.

Basic nursing students are persons who have enrolled to study the art and science of nursing at a non-university-based institution, usually a school or college of nursing. In the pre-

COVID-19 era, they ran a three-year programme to be awarded a Registered Nurse (RN) certificate. The educational programme involved both a theoretical classroom component and a clinical practicum component. Nevertheless, due to COVID-19 pandemic, stakeholders in nursing education have begun reconsidering how best to continue the much-needed teaching of nursing students. In line with this, several methods such as blended and online teaching have become very topical issues. Blended teaching is a formal education programme in which a student learns and obtains teaching services in part via online delivery of content and at a supervised classroom outside the home. In contrast, COVID-19 realities have also at certain times stimulated a switch to complete online delivery of instructional content without the blended feature amounting to full online teaching. Particularly in the context of COVID 19, nurse educators are challenged to keep up with the sudden need for change in educational methods and technology as applied to nursing education.

Nursing education is designed by nurse educators to facilitate the transfer of theoretical concepts to clinical nursing skills that are useful in clinical settings (Gambo *et al*., 2017). Competence in clinical nursing skills is a basic required achievement for nursing students before college graduation. The learning of nursing skills is also crucial for enhancing critical thinking and ensuring a progressive nursing career (Lee *et al*., 2018). Its traditional or conventional strategy is the provision of prompt feedback on student competency in clinical skills. As one of the methods recognized as essential in the development of nursing knowledge, clinical competence, and maintaining patient safety by nursing students, nurse educators often consider face-to-face teaching with clinical supervision as very valuable (McCutcheon *et al*., 2018). Additionally, the ability of the nursing student to continue in the maintenance of patient safety would depend on clinical nursing skills learnt by observation, imitation, and modifications based on prompt feedback from nurse educators. In this regard, nurse educators often teach clinical nursing skills (practicum) using apprenticeship style practical demonstration sessions and evaluated using the Objective Structured Clinical Examination (OSCE).

The OSCE was invented by nurse educators to assess practicum outcomes such as clinical skill performance and competency of students in preparation for the real world. It often forms part of a multi-method evaluation strategy. Experts argue that the OSCE assesses nursing competencies that one cannot assess using other instruments (Sola *et al*., 2017). It is designed to observe clinically related skills and actions to the tiniest detail to check off on a weighted checklist (Massey *et al*., 2017). Concerning the need for observational assessment of practical nursing skills, Gambo *et al* (2017) argued that face-to-face teaching of nursing practicum may be even more valuable than other innovated methods.

The conventional gold standard for teaching nursing practicum is face-to-face clinical skill demonstration (Kaihlanen *et al*., 2020). It forms a large bulk of nursing education courses. Unlike classroom teaching, face-to-face clinical skill demonstration offers nursing students a chance for experimental learning (Jamshidi *et al*., 2016). It involves face-to-face interaction between a clinical instructor and nursing students. It utilises simulated patient scenarios with models and manikins for practical skill exercises. Face-to-face nursing practicum is usually organised with ten to twelve nursing students in one group, and each group working under the supervision of one instructor. Due to the resource-intensive nature of face-to-face nursing practicum, one student often experiences one supervised exercise per procedure. Few face-to-face practicum sessions per student may not be sufficient to achieve the skill proficiency required to pass OSCE (Solvik *et al*., 2018). Consequently, nursing students are encouraged to familiarise themselves frequently with clinical procedures using alternatives aside from face-to-face practicum. Instructional practicum Videos delivered by mobile devices have been suggested for such unsupervised familiarisation (Massey *et al*., 2017). More so, it is not very clear if the aims of face-to-face nursing practicum sessions could be reasonably achieved if face-to-face practicum sessions were completely replaced with mobile-based video demonstrations in extreme COVID 19 lockdown situations (Ortega-Moran, *et al*., 2020).

Mobile devices and smartphones are popular among nursing students at present. About 90% of students in their twenties and 99% of students in their thirties have access to smartphones. Mobile devices and smartphones are devices that are highly portable and accessible and can be used anywhere at any time. Using smartphones and mobile devices students can search for and provide information, learning tools and communicate more easily across very distant and remote places in real-time and offline. Smartphones and mobile devices have been applied in the past in various areas of education. Information can be replayed and self-directed learning can be achieved where students can practice certain skills repetitively without spatial constraints (Kim *et al*., 2019). Mobile devices and smartphones are fast becoming a preferred educational tool in nursing education due to their many advantages. It has been suggested that utilising these devices in clinical nursing education might enhance self-supervised learning by reinforcing a student-centred approach to learning (Forehand *et al*., 2017). Especially in situations where complex nursing skills are required, nursing students may experience difficulties in translating theoretical knowledge into skill or the students have been offered limited time to try out skills due to the COVID 19 context. It is asserted that using a mobile device, students can easily meet their diverse information needs for clinical practice. In addition, remotely participating in clinical nursing education with mobile devices and smartphones offers learning solutions outside the classroom. Consequently, nursing faculty now actively upload mobile-based learning activities to make available academic resources needed to facilitate the academic success of nursing students (Jahnke *et al*., 2020). Mobile-based nursing skill videos uploaded by clinical instructors have in recent times grown in use as nursing students spend more time in self-supervised study while using the instructional multi-media electronic solutions.

Multimedia mobile-based nursing skill instructional videos offer nursing students an opportunity to remotely update nursing skills outside the classroom (Forbes *et al*., 2016). It utilises moving images in teaching specialised nursing skill techniques. Mobile-based practicum videos enable nursing students to repeatedly playback a procedure

without fear of criticism. They are however laden with some limitations. The major limitation is that they involve more cognitive than psychomotor interaction. The student is often compelled to memorize the procedural steps but lacks the experience of feel and touch. On this premise, it has thus been speculated that watching mobile-based practicum videos alone is not adequate for students to learn clinical skills (Jang *et al*., 2014). As a result, exploring the impact of this limitation on the learning outcome of clinical skill among student nurses is hence justified.

Previous studies on comparison of practicum learning outcomes between mobile-based videos and face-to-face practicum methods have notable conflicting results. On one hand, a significant improvement in clinical skills was noted among students who utilised mobile-based videos compared to students who had only face-to-face practicum (Chuang *et al*., 2018; Jang *et al*., 2014). On the other hand, no significant difference was found between groups taught with mobile-based video and conventional face-to-face practicum (Strandell-laine *et al*., 2018; Lee *et al*. 2016). Nonetheless, there is one identified anomaly with the design of previous studies on this topic. The reviewed studies compared an experimental group that had both mobile-based video and face-to-face practicum against a control group that had only face-to-face practicum. This anomaly in design would not permit an exclusive outcome comparison between mobile-based video and face-to-face practicum methods. This identified gap in knowledge needs to be further explored. In addition, there is a paucity of published studies on this topic that is set in Africa. The African nursing education system might benefit from a study of this nature with reference to the current emphasis on remote learning and physical distancing.

MATERIALS AND METHODS

This is a non-randomized quasi-experimental study that involves the collection of data before and after an intervention to permit an analysis of change between baseline and outcome values in comparison to reference/comparison group. The term reference or comparison group is used in this context as opposed to the term control because the term control is reserved for study designs with randomization (Polit *et al*., 2020). Since the purpose of a non-randomized design is to observe a change resulting from an intervention or treatment, it was considered appropriate for this study on the effect of mobile-based video and face-to-face demonstrations on practicum learning outcomes among basic nursing students in Enugu Metropolis in Nigeria. Chuang *et al* (2018) utilized a similar design in a study on the effects of a skill demonstration video delivered by smart-phone on facilitating nursing students' skill competencies.

Study Area and Sampling: The study areas are two schools of Nursing which are UNTH and Bishop Shanahan Nsukka in Enugu state. Enugu State is a state in the south-eastern part of Nigeria. Its administrative capital is Enugu metropolis. The key towns in the state include Enugu, Nsukka, Ezeagu, Agbani, Ngwo, Aninri, and Awgu. It is located on the north from Abia, on the east from Anambra, on the south from Benue, and on the west from Ebonyi States. It has an estimated population of 9,741,748 with a fertility rate of 4.1%, and a death rate of 2.4% (source: Enugu South Population Office, 2021). The state has only two public and one mission nursing schools that train basic nursing students. They include the University of Nigeria School of Nursing Enugu metropolis, Enugu State University School of Nursing Parklane Enugu metropolis, and Bishop Shanahan School of Nursing Nsukka. A final sample size of 112 (n = 56 in UNTH-SON and n = 56 in BS-SON) was determined for the study using the Cohen's Power Analysis (Cited in Bolarinwa, 2020) mathematically stated as $n = [(Z_{1-\alpha/2}+Z_{1-\beta})^2 (S_1^2+S_2^2) \div d^2]$, where n = minimum sample size, $Z_{1-\alpha} = 1.96$ (normal distribution constant) , $Z_{1-\beta} = 0.84$ (power), S_1^2 = Variance of Treatment group 7.48^2 based on pivotal data from Yang *et al* (2019), S_2^2 = Variance of comparison group 3.22^2, d^2 = baseline variance 3.22^2. Thus substituting the values into the formula a minimum sample size of 50 was computed, $n = [(1.96+0.84)^2 \times (7.48^2+3.22^2) \div 3.22^2] = 50$. To guard against the threat of attrition or fallout on the statistical conclusion validity of the study, the minimum sample n = 50 was increased by 10% using Bolarinwa's (2020) non-response adjustment fourmula mathmatically stated as: n* = n ÷ (1-attrition); where n * = final sample size; n = minimum sample size of 50; attrition of 10% = 0.1. Substituting the values into the formula, a final sample size of 56 for each arm of the study was computed (n = 56 in UNTH-SON and n = 56 in BS-SON). The determined sample size amounts to 91.8% of the 3rd year students in UNTH-SON and 80% of the 3rd year students in BS-SON.

Study Population: The population for this study includes all 131 200 level basic nursing students in the two selected schools (UNTH-SON = 61 and BS-SON = 70). The 131 is also considered to be the accessible target population for this study.

Inclusion Criteria: The inclusion criteria include: (1) Second year basic nursing students, (2) Willingness to participate in the study and (3) Students present at the time of study

Sampling Procedure: Simple random sampling technique was applied using the lottery ballot technique was conducted on Years 3 nursing students. A total of 131 plastic tallies labeled YES (n = 112) and NO (n = 19) was sourced from a local artist. Each of the tallies would have a unique number. Potential participants were allowed to blind-pick a tally without replacement from the lottery bag. Those who picked a Yes tally were enrolled into the study, and use the unique number therein as an identification number throughout the study. Those who picked a No tally were excluded. In UNTH-SON, the lottery bag for the balloting contained 61 tallies (YES = 56, NO = 5). In BS-SON, the lottery bag for the balloting contained 70 tallies (YES = 56, NO = 14

Instrument for Data collection: The instrument for data collection for this study is composed of two parts. Part one of the instrument was a simplified OSCE (Objective Structured Clinical Examination) checklist of 39 items that assessed the basic 39 steps required during female catheterization. The second part of the instrument was a written component of the OSCE which comprises two sections namely A and B. Section A measured socio-demographic characteristics of the participants using 5 items. All the items were measured

categorically except for age which was measured at discrete-interval levels. Section B involved 6 multiple choice items which assessed the students' knowledge about female catheterization.

Ethical Considerations: An application for ethical clearance was sent alongside a proposed protocol for this study to the Health Research Ethics Committee at the University of Nigeria Teaching Hospital. An approval was obtained. Administrative permission was sought from the heads of institutions. The purpose of the study was explained to the participants. The voluntary nature of the study was explained. The participants who took part in this study were de-identified and kept anonymous by using code numbers. All data collected were used only for the approved academic purpose.

Intervention: The study's intervention involved a mobile video demonstrating the procedure for female catheterization. The video was filmed with a specific camera, and the researcher served as the instructor. It was filmed in a university's practicum/simulation laboratory and shared with the students through the WhatsApp platform. The video emphasized the importance of the procedure, its risks, and the proper technique to reduce the risk of urinary tract infections caused by Foley catheters.

The video demonstration covered four key steps: explanation and consent, preparation, procedure, and after-care. During explanation and consent, the patient's identification was confirmed, and the procedure's rationale, importance, and risks were explained. In the preparation phase, the correct equipment was selected, and a sterile environment was set up. The procedure itself involved proper hygiene, catheter insertion, inflation of the balloon, and securing the catheter. Aftercare instructions were provided to the patient, including proper washing, discomfort monitoring, and notifying nursing staff if any issues arose. Documentation of the catheterization was also emphasized.

The video aimed to educate the students on the entire process, from preparation to after-care, ensuring a comprehensive understanding of the procedure for female catheterization. The video format allowed for visual learning and step-by-step guidance, potentially improving students' knowledge and skills in performing the procedure correctly while minimizing the associated risks.

Procedure for Data Collection: The data collection process involved two groups of basic nursing students from UNTH-SON and BS-SON. In the UNTH-SON group, a 10-minute pretest OSCE was conducted to establish baseline scores on female urethral catheterization. These students then received a mobile video-based demonstration of the procedure, delivered via WhatsApp, and were encouraged to study the material for three weeks. After this period, a post-intervention OSCE test was administered and evaluated. The BS-SON group also underwent a pretest OSCE, followed by face-to-face demonstrations of the procedure twice a week for three weeks, with note-taking and practice encouraged. After 21 days, both groups were re-evaluated by expert nurse educators, with no control for potential confounding factors during this interval. The study aimed to compare the impact of the different teaching methods on student performance by analyzing the OSCE scores from both skills and written stations.

Method of Data Analysis: The study employed a structured approach to analyze the data collected. The OSCE checklist, consisting of 39 items in Part 1, was scored by summing the checked boxes, each multiplied by 1. For Part 2, Section B (the written section), correct answers were tallied and multiplied by 1. Sociodemographic responses were analyzed using frequency, percentage tables, mean, and standard deviation. Test scores were categorized as poor (0-22), moderate (23-26), good (27-31), and excellent (32-45). Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize the collected data. The study compared the OSCE pretest and posttest scores for both UNTH-SON and BS-SON, employing independent t-tests for between-group comparisons, paired t-tests for within-group differences, and Chi-square inferential statistics for category graded scores. A significance level of 5% was used for statistical analysis, conducted using SPSS version 25 (Statistical Products and Service Solutions, IBM Armonk, New York).

RESULTS

Table 1 compared the socio-demographic characteristics of the study participants in the mobile video (Intervention) and face-to-face teaching (Comparison) groups, and no significant difference was observed between the groups ($p = > 0.05$). The majority of respondents were aged 18-28 years in the face-to-face (96.4%, mean 21.77(3.45)) and mobile-video (98.2%, mean 21.04(1.96)) groups ($p = 0.171$). Most of the participants were single in the both the face-to-face (92.9%) and mobile-video (96.4%) groups ($p = 0.679$). The participants were mostly nulliparous in the face-to-face (92.9%) and mobile-video (87.5%) groups ($p = 0.631$). About 92.9% in the face-to-face and 91.6% in the mobile-video groups were resident on campus ($p = 1.000$).

Table 2 summarized the nursing skill for female catheterization in the treatment (mobile video) group and showed that the group had a poor practicum score (Mean(SD): 16.54(5.46)). Majority (82.1%) of the participants scored between 0-22 on a 0-45 scale. About 1.8% of the participants made an excellent grade (score ≥ 32)

Table 3 summarized the baseline nursing skill for female catheterization in the control (face-to-face) group and revealed that the group had a poor practicum skill score (mean(SD): 21.82(6.72)). Majority (64.3%) of the participants scored between 0-22 on a 0-45 scale. About 10.7% of the participants made an excellent grade (score ≥ 32).

Table 4 compared the baseline and post-intervention scores of the participants in the treatment group and revealed a significant improvement in total practicum scores (16.54(5.46) vs. 32.73(5.49), $p = 0.001$). The participants who had poor scores (0-22) in the pretest (82.1%) decreased in the posttest (3.6%), while those who had excellent scores (≥32) in the pretest (1.8%) increased in the posttest (69.6%).

Table 5 compared the baseline and post-intervention scores of the participants in the control group and revealed a significant improvement in total practicum scores (21.82(6.72) vs. 33.23(6.89), p = 0.001). The participants who had poor scores (0-22) in the pretest (64.3%) decreased in the posttest (5.4%), while those who had excellent scores (≥32) in the pretest (10.7%) increased in the posttest (55.4%).

Table 6 compared the effect of mobile-based video and face-to-face demonstration conditions on the outcomes of the study participants showed that mobile video demonstration was more effective compared to face-to-face demonstration (Mean difference 16.19 vs. 11.41; Effect Ratio: 1.42). Nevertheless, both mobile video and face-to-face teaching resulted in significant improvements in the mean test scores in the treatment and comparison groups (p = <0.001) and no significant difference in post-test mean scores (p = 0.672).

Table 1:
Socio-demographic characteristics of the study participants, **N = 112**

Categories	BS-SON	UNTH-SON	Fisher	P value
Teaching method	Face-to-Face	Mobile video		
n	56	56		
Age, Mean (SD)	21.77(3.45)	21.04(1.96)	1.379†	0.171
Age, n (%)			0.343	1.000
18-28 years	54 (96.4)	55 (98.2)		
29-39 years	2 (3.6)	1 (1.8)		
Marital status, n (%)			0.704	0.679
Single	52 (92.9)	54 (96.4)		
Married	4 (7.1)	2 (3.6)		
Parity status, n (%)			0.922*	0.631
Nullipara	52 (92.9)	49 (87.5)		
Primipara	3 (5.4)	5 (8.9)		
Multipara	1 (1.8)	2 (1.8)		
Residence, n (%)			0.152	1.000
On-campus	52 (92.9)	53 (94.6)		
Off-campus	4 (7.1)	3 (5.4)		

*n = frequency SD = Standard deviation, † = independent t-test statistic, * = chi square statistic, p < 0.05 = significant*

Table 2:
Baseline skill for female catheterization in the treatment (mobile video) group, **n = 56**

	Practicum Domains	Mean (SD)	n (%)
Affective	Gaining patient's consent	1.89(1.33)	
Psychomotor	Preparation for procedure	3.55(1.81)	
	Performing the procedure	6.84(3.50)	
Cognitive	Written question station	4.25(1.03)	
Test Grade	Poor (score 0-22)		46 (82.1)
	Moderate (score 23-26)		9 (16.1)
	Good (score 27-31)		-
	Excellent (score 32-45)		1 (1.8)
	Total pretest score	16.54(5.46)	

n = frequency SD = Standard deviation, , Total score <22 = poor (0-49%), 23-26 = Moderate (50-59%), 27-31 = Good (60-69%), 32-45 = Excellent (70-100%)

Table 3:
Baseline skill for female catheterization in control (face-to-face) group, **n = 56**

	Practicum Domains	Mean (SD)	n (%)
Affective	Gaining patient's consent	2.14(1.53)	
Psychomotor	Preparation for procedure	4.27(2.48)	
	Performing the procedure	10.96(4.91)	
Cognitive	Written question station	4.45(1.03)	
Test Grade	Poor (score 0-22)		36 (64.3)
	Moderate (score 23-26)		9 (16.1)
	Good (score 27-31)		5 (8.9)
	Excellent (score 32-45)		6 (10.7)
	Total pretest score	21.82(6.72)	

n = frequency SD = Standard deviation, Total score <22 = poor (0-49%), 23-26 = Moderate (50-59%), 27-31 = Good (60-69%), 32-45 = Excellent (70-100%)

Table 4:
Baseline vs. post-intervention skill for female catheterization in treatment (video) group, **n = 56**

Practicum Domains	Pre-test		Post-test		Δ	Paired t-test / χ^2	P value
	Mean (SD)	**n (%)**	**Mean (SD)**	**n (%)**			
Total score	16.54(5.46)		32.73(5.49)		16.19	-16.23†	<0.001
Affective							
Gaining patient's consent	1.89(1.33)		4.89(0.41)				
Psychomotor							
Preparation for procedure	3.55(1.81)		8.64(1.54)				
Performing the procedure	6.84(3.50)		14.27(4.55)				
Cognitive							
Written question station	4.25(1.03)		4.91(0.99)				
Test Grade						89.36	<0.001
Poor (score 0-22)		46 (82.1)		2 (3.6)			
Moderate (score 23-26)		9 (16.1)		4 (7.1)			
Good (score 27-31)		-		11 (19.6)			
Excellent (score 32-45)		1 (1.8)		39 (69.6)			

*n = frequency SD = Standard deviation, Δ=mean difference, † = t-test statistic, * = chi square statistic, p < 0.05 = significant, Total score <22 = poor (0-49%), 23-26 = Moderate (50-59%), 27-31 = Good (60-69%), 32-45 = Excellent (70-100%)*

Table 5:
Baseline vs. post-intervention skill for female catheterization in control (face-to-face) group, **n = 56**

Practicum Domains	Pre-test		Post-test		Δ	Paired t-test / χ^2	P value
	Mean (SD)	**n (%)**	**Mean (SD)**	**n (%)**			
Total score	21.82(6.72)		33.23(6.89)		11.41	-8.41†	<0.001
Affective							
Gaining patient's consent	2.14(1.53)		4.50(0.89)				
Psychomotor							
Preparation for procedure	4.27(2.48)		7.95(2.13)				
Performing the procedure	10.96(4.91)		15.30(5.33)				
Cognitive							
Written question station	4.45(1.03)		5.27(0.73)				
Test Grade						51.17	<0.001
Poor (score 0-22)		36 (64.3)		3 (5.4)			
Moderate (score 23-26)		9 (16.1)		6 (10.7)			
Good (score 27-31)		5 (8.9)		16 (28.6)			
Excellent (score 32-45)		6 (10.7)		31 (55.4)			

*n = frequency SD = Standard deviation, Δ=mean difference, † = t-test statistic, * = chi square statistic, p < 0.05 = significant, Total score <22 = poor (0-49%), 23-26 = Moderate (50-59%), 27-31 = Good (60-69%), 32-45 = Excellent (70-100%)*

DISCUSSION

The study found that the initial skill levels of the treatment group (receiving mobile video) in female catheterization were poor, with 82.1% of participants scoring between 0 and 22 on a 0-45 scale (mean (SD): 16.54 (5.46)). Only 1.8% achieved an excellent grade (score ≥ 32), indicating that final-year basic nursing students may still require support to master this procedure. This result contrasts with a study by Lee *et al*. (2016), where a higher baseline performance score (26.57±2.20) was reported for Korean nursing students, possibly due to differences in scoring scales. Furthermore, the baseline scores from Yang *et al*. (2019) were higher (89.69±3.22 on a 0-100 scale) for second-year Chinese nursing students, but the disparity was expected given the different year levels and potential curriculum and syllabus

variations between countries. The discussion highlights the debate on rote learning and its potential impact on procedural step performance in nursing education, suggesting the need for further empirical investigation.

This study found poor practicum skill scores, as 64.3% of the participants in the comparison (face-to-face) group scored between 0 and 22 in female catheterization (mean (SD): 21.82 (6.72)). About 10.7% of the participants made an excellent grade (score ≥ 32). This finding indicates that final-year basic nursing students lack proficiency in female catheterization, suggesting a need for reinforcement of learning. This result contrasts with the baseline score of 78.23 ± 10.35 reported by Wenjing *et al*. (2021) in a quasi-experimental study on the effect of online video teaching versus face-to-face classroom teaching methods on nursing students' OSCE achievements at Xiang Nan University, Hunan Province, China. The discrepancy in findings could be explained by the larger sample size in Wenjing *et al*.'s study (181 participants) compared to this study's sample of 56 participants from each basic nursing school, as larger samples better estimate population variance. This study's lack of random assignment of participants into groups introduces some potential systematic error.

This finding contradicts Berga *et al*. (2021), who reported an 83.58 baseline score in a quasi-experiment comparing mobile videos in blended learning with traditional face-to-face learning among nursing students in Canada, possibly due to differences in sampling techniques; this study utilized simple random sampling, while Berga *et al*. (2021) used convenience sampling. Furthermore, this finding differs from the 65.5 ± 11.5 reported by Terry *et al*. (2018) in a quasi-experiment on the effect of face-to-face and mobile online video on clinical skills retention among nursing students in Australia, likely stemming from variations in the clinical skills evaluated. Terry *et al*. (2018) assessed multiple clinical skills, potentially leading to different outcomes compared to this study, which focused specifically on female catheterization practical skills.

This study found a significant improvement in mean practicum scores (16.54 (5.46) vs. 32.73 (5.49), p = 0.001). The participants with poor pretest scores (0–22) decreased from 82.1% to 3.6% in the posttest, while those with excellent pretest scores (32) increased from 1.8% to 69.6% in the posttest. This suggests that the mobile video-based intervention has the potential to enhance practicum learning outcomes, which aligns with the findings of Hansen *et al*. (2011), who reported similar improvements with instructional videos in New Zealand, with differences likely attributed to the follow-up period. The results also supported Fernández-Alemán *et al*. (2011) and their significant benefits of mobile video-based teaching, possibly due to the shared use of the Objective Structured Clinical Examination (OSCE) checklist as a data collection method. Similar positive outcomes were expected based on the t-test inferential statistical tool's application in both this study and Kim *et al*., (2018) study in South Korea, despite possible variations in the level of significance. Additionally, the findings supported Chen *et al*. (2021), as both studies focused on video-based interventions.

This study found a significant improvement in practicum scores (21.82 (6.72) vs. 33.23 (6.89), p = 0.001). The participants with poor pretest scores (0–22) decreased from 64.3% to 5.4% in the posttest, while those with excellent pretest scores (32) increased from 10.7% to 55.4% in the posttest. This indicates that the conventional face-to-face teaching method is effective in enhancing practicum skills among student nurses, aligning with the results reported by Kim *et al*. (2018) in a randomized controlled trial on Korean students. The similarity in findings could be attributed to the study design used by both Kim *et al*. (2018) and this study, involving a single group of students in one school for face-to-face teaching. Similarly, the findings supported Terry *et al*. (2018), who reported significant skill improvement among Australian nursing students with face-to-face teaching only, despite potential limitations in the convenience sample size used in their study. Furthermore, this finding aligned with the results of the study by Yang *et al*. (2019), where face-to-face teaching in four classes to a quota sample of nursing students led to a significant improvement in skill performance, given the shared focus on female urethral catheterization content in both studies.

This study found that mobile video teaching was more effective compared to face-to-face teaching (mean difference 16.19 vs. 11.41) in terms of the mean difference. However, both methods resulted in significant improvements in mean test scores in the treatment and comparison groups (p = < 0.001), with no significant difference in post-test mean scores (p = 0.672). The effectiveness of video-based teaching may be attributed to its replayability and higher reliability in demonstrating procedural steps. This suggests that both video-based and face-to-face teaching can yield similar results when applied to nursing students, highlighting the effectiveness of learner-paced video-based teaching for acquiring and retaining practical nursing skills.

This finding aligns with the results reported by Lee *et al*. (2016), where no significant difference was observed in urinary catheterization skill performance OSCE post-test scores between the video and face-to-face groups among Korean nursing students. The similarity in findings is attributed to the statistical tool (student t-test) utilized for hypothesis testing. This similarity may not hold if alternative statistical tools were used. Similarly, this finding supports Kim *et al*. (2018) conclusion in a study on the impact of a smartphone video application on nursing students' skill performance among Korean nursing students. Although video-based teaching had a greater impact on nursing skills retention, the difference in post-intervention scores between nursing students who received video-based and face-to-face teaching was not statistically significant (p > 0.050), aligning with the highly reliable Objective Structured Clinical Examination (OSCE) tool for skill assessment.

Furthermore, this finding concurs with Terry *et al*. (2018), who reported a greater mean difference in impact in the video-taught group compared to the face-to-face group but no significant difference in the mean post-test score in Australia. The similarity in findings was expected due to the difference in follow-up periods between the studies. The proximity of the follow-up period in this study (21 days) and the one conducted by Terry *et al*. (2018) (26 weeks) may have contributed to the similar results, considering the potential decay of memory over time.

Additionally, this finding aligns with Yang *et al*. (2019), where no significant difference in OSCE scores on urethral catheterization was observed between the video and face-to-face taught groups among nursing students in China. The similarity in results was not expected due to the unequal sample sizes and non-probability sampling procedure used in Yang *et al*. (2019) study, making the comparison somewhat dissimilar. Finally, this finding is in agreement with Berga *et al*. (2021), where no significant difference in final OSCE nursing knowledge scores was found between the intervention and control groups (83.08 vs. 83.58, p = 0.100) in a study comparing mobile videos and face-to-face teaching of nursing students in Canada. The similarity in results is attributed to the quasi-experimental design employed in both studies.

In conclusion, this study concludes that video-based teaching is an effective way of providing educational practicum instructions in female urinary catheterization to basic nursing students.

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