



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

Teaching and Learning in Nursing

journal homepage: www.journals.elsevier.com/teaching-and-learning-in-nursing

Research

Innovative use of a flipped-classroom approach to teach fundamental nursing skills

Kimberly E. Wilson, DNP, APRN, NP-C*, Jill R. Hobbs, EdD, MSN, RN, FNP-BC, ACNP-BC, CNE

Capstone College of Nursing, University of Alabama, Tuscaloosa, AL, USA

ARTICLE INFO

Article History:
Accepted 15 August 2022

Keywords:
COVID-19 pandemic
Flipped-classroom
Fundamental nursing skills
Low-fidelity simulation model
Prelicensure nursing
Satisfaction
Self-confidence

ABSTRACT

Prelicensure nursing students are required to master fundamental nursing skills. The COVID-19 pandemic created challenges in maintaining excellence while teaching skill acquisition. The purpose of this study was to evaluate skill validation scores and student satisfaction and self-confidence using a flipped classroom approach and a low-fidelity simulation model to innovatively teach skill acquisition. Researchers used a quasi-experimental method to compare skill validation scores of a control group and intervention group using independent samples t-test. Researchers also evaluated whether prelicensure nursing students had satisfaction and self-confidence with this teaching strategy. Findings suggested that skills validation scores were no different using a flipped-classroom approach than in-person instruction. Prelicensure nursing students were satisfied and self-confident following the implementation of this teaching strategy. This teaching strategy has the potential to decrease in-person clinical practice time, provide alternative opportunities for clinical make-up and remediation, and decrease cost.

© 2022 Organization for Associate Degree Nursing. Published by Elsevier Inc. All rights reserved.

Mastery of fundamental nursing skills is an integral component of nursing education. Students must demonstrate competence to progress through the program and provide safe nursing care. The COVID-19 pandemic created numerous challenges for nurse educators. Adhering to mitigation strategies resulted in decreased clinical practice time. Despite these obstacles, standards of excellence in nursing education did not waiver and nursing students still needed to be taught foundational skills such as intravenous insertion, urinary catheter insertion, and medication administration. Nursing faculty addressed these challenges by using a flipped-classroom approach to innovatively teach skill acquisition.

Background

A disconnect between classroom education and clinical practice exists, even before the COVID-19 pandemic. Students struggle with skill retention and transfer of knowledge from the classroom to the clinical setting (Ross, 2012). A lack of consistent teaching strategies and evaluation methods occurs among nursing schools. Prelicensure nursing programs teach clinical skills in a variety of ways including in-person demonstrations, expert supervised practice, online video demonstration, and case studies using a variety of simulation models, ranging from simple task trainers to high-fidelity simulators (Kemery & Morrell, 2020; McGowan et al., 2014; O'Flaherty & Phillips, 2015).

A flipped classroom is a blended teaching strategy used to introduce students to content before attending face-to-face instruction. The literature supports a flipped classroom as an instructional method; however, there is limited research on the use of this strategy to teach skill acquisition in nursing. Dinndorf-Hogenson et al. (2019) evaluated 42 nursing students' skill acquisition via a flipped-classroom approach by comparing a media group that received video examples of insulin administration and a reading group that received an instruction sheet with pictures. After each intervention, students demonstrated the skill during the simulation and were evaluated using a skills checklist. Students also completed a survey on their perception of the teaching strategy. The survey revealed the reading group was more likely to use additional learning resources compared to the media group. The media group was more likely to recommend their learning method over the reading group. Both groups performed well on the skills validation with at least 86 percent of students successfully demonstrating the skill.

In another nursing study, McKenny (2011) utilized a flipped-classroom approach by comparing two groups of students performing a sterile wet-to-dry dressing change. One group received an online video demonstration, and the other group received a traditional in-person demonstration. Both groups were allowed to practice the skill with faculty feedback. A pretest/posttest evaluated the participant's knowledge, and findings revealed both groups were successful in their return demonstration, resulting in no significant differences between the groups. In summary, a flipped-classroom approach is a

*Corresponding author.

E-mail address: kewilson14@ua.edu (K.E. Wilson).

recognized teaching strategy; however, there is limited research specific to teaching foundational skills in nursing education.

The impact of COVID-19 led to immediate disruption of in-person classes, forcing nurse educators to use new technology and implement social distancing while maintaining the same teaching standard (Konrad et al., 2021). The additional challenges created by the pandemic led to an increase in anxiety, stress, and depression in nursing students (Kim et al., 2021). Despite these obstacles, nurse educators were challenged to graduate competent, safe nurses ready to fulfil the role of nursing. Failure to adapt to the challenges presented by the pandemic would have detrimental outcomes such as course failures, increased attrition rates, and a decrease in the number of nursing graduates, contributing to the national nursing shortage (American Nurses Association, 2021). Rising to the challenge by using a flipped classroom to teach skill acquisition creates potential benefits including an alternate source for remediation, decreased faculty and facility cost, opportunities for clinical makeup, and an increase in available clinical practice lab (CPL) space.

Theoretical Framework

Prelicensure nursing students must master foundational clinical skills while developing confidence in preparation for their nursing careers. Mastery learning is the theoretical framework that guided this study. Mastery learning asserts that with time and practice a student can become proficient at a skill when demonstrating a required set of predetermined competencies (Bloom, 1974). As a student meets the standard, progression occurs. Mastery is dependent upon time and quality of instruction. Mastery learning requires frequent formative assessments, deliberate practice, and feedback from an expert. Instruction is scaffolded, building upon simple to more complex concepts (Bloom, 1974; Lipsky et al., 2019). Gonzalez and Kardong-Edgren (2017) state that mastery learning requires deliberate practice and teaching strategies that are designed to promote effortful learning, focusing on the critical components of the skill rather than the steps. With continued practice, the student should become more fluent and efficient, leading to mastery. The final evidence of mastery is successful performance on a standardized patient using a task trainer to provide the closest context to the clinical environment.

To meet students' learning needs within the confines of the pandemic, researchers used a well-documented teaching strategy in a novel way. The researchers evaluated whether mastery of clinical skills was attained when implementing a flipped-classroom approach using demonstration skill videos and a low-fidelity simulation model kit to teach clinical skills to nursing students. This study also evaluated the students' satisfaction and self-confidence during the implementation of this teaching strategy.

Methods

Context

Following Institutional Review Board (IRB) approval, students enrolled in the fundamentals of nursing course during the fall of 2020 and spring of 2021 were invited to participate in the study. A convenience sample of 133 nursing students enrolled in the study. Fourteen students failed to complete all components of the study, leaving a total of 119 participants. Students enrolled in the fundamentals of nursing course met inclusion criteria. Exclusion criteria applied to any student not enrolled in the fundamentals course. A power analysis of independent sample t-tests using an alpha of 0.05, an effect size of 0.50, and a power of 0.80 revealed a needed total sample size of 102 (Faul et al., 2009).

Intervention and Measures

The research design was a quasi-experimental method. Researchers obtained waived consent from the IRB to review skills validation scores from a pre-pandemic cohort (Fall 2019) of students who served as the control group. The control group attended two 8-hour days of in-person, instructor-led teaching each week in the CPL. Students were divided into clinical groups, each group consisting of 6–8 students and one clinical instructor. Students were provided with the skills validation rubric and encouraged to use the rubric while learning the skills in CPL. A typical day in the CPL involved a skill being taught in front of the entire group, then breaking into clinical groups where the clinical instructor demonstrated the skill once again. After repeated instruction, students practiced performing the skill on CPL models. Students from the control group did not have access to medical supply kits or simulation models outside of the CPL. The control group did not receive expert-led video demonstrations before coming to CPL. All learning and practice occurred within the CPL setting during their designated CPL days.

The intervention group received a low-fidelity simulation model and medical supply kit needed to perform skills for use outside of the CPL setting. The simulation model included a mouth/nose piece, male and female genitalia, wound, and skin for use of injection and peripheral intravenous catheter insertion. The medical supply kit included additional supplies such as needles and syringes, needed to perform each skill included on the validation rubric. The intervention group received a decrease of 4–8 hours of in-person CPL instruction each week. Participants were given the skills validation rubric and informed that the rubric would be used during skills validation. The intervention group participants were encouraged to bring the rubric to the CPL, as they practiced each nursing skill. Expert-led skill videos utilizing the low-fidelity simulation model and medical supply kit were posted in the learning management system for the students to view before clinical practice time in CPL. The skill videos were recorded by two experienced faculty members, who are also the researchers of this study. The expert-led videos included demonstrations of intravenous catheter insertion, intramuscular and subcutaneous medication administration, urinary catheter insertion, and wound care.

After approximately 5 weeks of instruction, learning outcomes were assessed. An expert-reviewed skills validation rubric was utilized to score the students during in-person skills validation. The validation rubric provided a step-by-step list for performing skills. The following skills were included in the rubric: (a) mixing of insulin, (b) subcutaneous injection, (c) mixing of powdered medication, (d) intramuscular injection, (e) insertion of peripheral intravenous catheter, (f) insertion of a urinary catheter, (g) sterile field preparation, and (h) wound care. The participants in the intervention group were evaluated on three randomized skills, and a numerical score was assigned based on their performance. Researchers compared the control group's validation scores to the intervention group's validation scores.

Finally, the intervention group completed the *National League of Nursing's (NLN) (2005) Student Satisfaction and Self-Confidence in Learning* as a posttest to evaluate participants' satisfaction and self-confidence using the flipped classroom teaching strategy and simulation model kit. The questionnaire is a 13-item, Likert scale instrument utilized to measure student satisfaction with simulation activity and self-confidence in learning. The questionnaire is divided into a 5-item section on satisfaction with learning and an 8-item section on self-confidence in learning. The questionnaire's response options ranged from one (strongly disagree) to seven (strongly agree). This is a valid and reliable tool tested using Cronbach's alpha with satisfaction of 0.94 and self-confidence of 0.87. Permission for non-commercial use of the NLN instrument is allowed per the NLN website. One question was omitted from the self-confidence section of the questionnaire due to reverse coding. This question has been

removed in other studies due to lowering the overall reliability of the tool (Riley et al., 2021). Another question was omitted due to lack of applicability to this study's overall aim, reducing the total number of self-confidence questions to six.

Analysis

Analyses were conducted using inferential and descriptive statistics. Researchers compared the learning outcomes of the control group to the intervention group using an independent samples t-test. Using descriptive statistics, researchers evaluated whether prelicensure nursing students had satisfaction and self-confidence using the flipped-classroom approach and simulation model.

Ethical Considerations

Expedited approval according to 45 CFR 46 was granted by the Institutional Review Board (IRB # 20-08-3802). Informed consent was obtained from the intervention group. All research has some potential risks, but no more than minimal risks were associated with this study. There was a potential risk for embarrassment and peer pressure to participate or not participate, as well as psychological effects such as anxiety and mental stress due to survey completion. While every effort was made to maintain the confidentiality of participants, there was a potential risk of loss of confidentiality. There were no conflicts of interest for the researchers.

Results

The demographic data revealed that 5% of the participants were male and 93% were female. Regarding ethnicity, 82% identified as white, 10% as black, 3% as Asian, and 3% as other. When asked about previous experience with a flipped classroom, 44% of participants affirmatively responded while 53% did not.

Researchers compared the learning outcomes of the control group to the intervention group using an independent samples t-test. In-person validation scores from students in a pre-pandemic cohort were compared to the intervention group. Researchers did not find any evidence that a flipped-classroom approach was different than in-person instruction of skill acquisition. The control groups' in-person skills validation scores ($n = 99, M = 90.67, SD = 10.14$), were not significantly different from the intervention groups' in-person skills validation scores ($n = 119, M = 91.64, SD = 8.88$), $t(196.5) = 0.75, p = .457$.

Researchers also evaluated whether prelicensure nursing students had satisfaction and self-confidence using the flipped-classroom approach. Results revealed that students were satisfied and self-confident with the teaching strategy and simulation model. Both cohorts generally "agreed" to questions assessing confidence and being satisfied with the learning method (Table 1).

Discussion and Implications

In summary, the pandemic caused immediate disruption of in-person classes and clinicals, forcing nurse educators to reconsider the

method of teaching clinical skills. The participants in this study received a decrease of in-person instruction compared to previous cohorts who learned in nonpandemic times; yet were just as successful at mastering skills. There were many obstacles to overcome including the use of new technology, missed instruction due to quarantine or infection with COVID-19, and other personal stressors that emerged because of the pandemic. Despite these challenges, the results of this study revealed no difference between solely in-person instruction versus a flipped-classroom approach in teaching fundamental skill acquisition. These findings suggest that a flipped classroom strategy is an acceptable alternative to traditional in-person skill acquisition. Therefore, these findings have the potential to impact how nursing schools teach foundational clinical skills, even in a non-pandemic time.

Study results also revealed students felt satisfied and self-confident with the instructional strategy and use of the low-fidelity simulation model. Question two in the *Student Satisfaction and Self-Confidence in Learning* asked whether the learning materials and activities promoted learning. Participants reported 82% satisfaction that the learning materials and activities promoted learning. Three questions in the self-confidence subscale of the questionnaire inquired about knowledge and proficiency of the content. Results confirmed that participants showed confidence in mastering the content, covering critical content, and developing skills and required knowledge from the study's instructional strategy (question #6: 86%, question #7: 87%, and question 8: 90%). These findings align with the participants' skills validation scores which demonstrated mastery of skill acquisition in both the control and study group.

Much of the literature only addresses students' perception of learning using a flipped-classroom approach (O'Flaherty & Phillips, 2015). To strengthen the implications of this study, researchers not only evaluated the participants' satisfaction and self-confidence with the flipped classroom approach but also analyzed the learning outcome of the participant's skills validation score. The results of this study are consistent with other research findings. McKenny (2011) compared two groups of students learning how to perform a sterile wet-to-dry dressing change. The intervention group received an online video demonstration, while the control group received an in-person demonstration. A pretest/posttest evaluating participant knowledge revealed that both groups showed evidence of learned and retained information with no differences in the groups. Some limitations of this study included a small sample size of 39 participants. Our study results align with McKenny (2011), because we both used online video demonstration and all participants were successful in their return demonstration of the skill, despite the teaching strategy. Dinndorf-Hogenson et al. (2019) used a flipped-classroom approach to teach insulin administration before a simulation experience. The control group received a video instruction demonstrating the skill, while the intervention group received a written instruction guide. There were no differences found between each group's performance on their skills during simulation, however, the written instruction guide group was more likely to use additional resources to supplement their learning. While Dinndorf-Hogenson et al. (2019) used a flipped-classroom approach as we did, our study differed because our control group received in-person instruction and our intervention group received video demonstration.

Limitations

This study had limitations that affect the generalizability of the findings. First, the study was not a randomized, controlled study. Second, the intervention group resided in one geographic area and lacked gender and race diversity. Next, the intervention groups' answers to the surveys were self-reported, so personal and cultural bias could have

Table 1
Descriptive Statistics of Student Satisfaction and Self-Confidence in Learning

Cohort	Questionnaire	N	M	SD	Median
Fall 2020	Satisfaction	47	29.4	4.65	31
	Confidence	45	36.38	3.85	36
Spring 2021	Satisfaction	57	30.22	5.25	31
	Confidence	57	37.72	4	38

affected the study results. Although an expert-reviewed rubric was utilized to evaluate skills demonstration, potential discrepancies between faculty grading could be a limitation.

Conclusions

In conclusion, nurse educators faced many challenges due to the COVID-19 pandemic, including how best to teach clinical skill acquisition while following virus mitigation strategies. Teaching fundamental nursing skills using a flipped-classroom approach is an alternative teaching strategy that is as effective as traditional in-person instruction. These findings have the potential to change how clinical skills are taught, even in nonpandemic times. This alternate method of teaching has the potential to improve the way nurse educators teach skill acquisition by decreasing clinical practice time in the CPL setting and providing an alternative opportunity to make up clinicals and/or remediate. This approach could also lead to decreased supply cost and need for clinical faculty in the CPL, as well as freed up CPL space. Further research is needed to evaluate the transfer of these skills into the clinical setting. As a result of the study findings, faculty have continued to incorporate this teaching strategy into the curriculum of the course. As a result of this study, students continue to be allowed to take medical supplies and the low-fidelity simulation model kit out of the CPL, increasing the opportunity for additional practice time. In previous semesters, students were not allowed to do this due to potential safety concerns with demonstration medications and needles. No adverse effects on nursing students or other students were found when students were allowed to do so. This could be implemented at other institutions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- American Nurses Association. (2021, September 25). *Nurses in the workforce*. <https://www.nursingworld.org/practice-policy/workforce/>
- Bloom, B. (1974). Time and learning. *American Psychologist*, 29(9), 682–688. doi:10.1037/h0037632.
- Dinndorf-Hogenson, G. A., Hoover, C., Berndt, J. L., Tollefson, B., Peterson, J., & Laudenbach, N. (2019). Applying the flipped classroom model to psychomotor skill acquisition in nursing. *Nursing Education Perspectives*, 40(2), 99–101. doi:10.1097/01.NEP.0000000000000411.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. doi:10.3758/BRM.41.4.1149.
- Gonzalez, L., & Kardong-Edgren, S. (2017). Deliberate practice for mastery learning in nursing. *Clinical Simulation in Nursing*, 13(1), 10–14. <http://dx.doi.org/10.1016/j.ecns.2016.10.005>.
- Kemery, S. R., & Morrell, B. L. (2020). Differences in psychomotor skills teaching and evaluation practices in undergraduate nursing programs. *Nursing Education Perspectives*, 41(2), 83–87. doi:10.1097/01.NEP.0000000000000515.
- Kim, S. C., Sloan, C., Montejano, A., & Quiban, C. (2021). Impacts of coping mechanisms on nursing students' mental health during COVID-19 lockdown: A cross-sectional survey. *Nursing Reports*, 11(1), 36–44. doi:10.3390/nurserep11010004.
- Konrad, S., Fitzgerald, A., & Deckers, C. (2021). Nursing fundamentals - supporting clinical competency online during the COVID-19 pandemic. *Teaching and Learning in Nursing*, 16(1), 53–56. doi:10.1016/j.teln.2020.07.005.
- Lipsky, M. S., Cone, C. J., Watson, S., Lawrence, P. T., & Lutfiyya, M. N. (2019). Mastery learning in a bachelor's of nursing program: The Roseman University of Health Sciences experience. *BMC Nursing*, 18(52), 1–9. doi:10.1186/s121912-019-0371-x.
- McGowan, B. S., Balmer, J. T., & Chappell, K. (2014). Flipping the classroom: A data driven model for nursing education. *The Journal of Continuing Education in Nursing*, 45(11), 477–478. doi:10.3928/00220124-20141027-11.
- McKenny, K. (2011). Using an online video to teach nursing skills. *Teaching and Learning in Nursing*, 6, 172–175. doi:10.1016/j.teln.2011.04.003.
- National League for Nursing. (2005). Student satisfaction and self-confidence in learning. https://www.nln.org/docs/default-source/uploadedfiles/default-document-library/instrument-2-satisfaction-and-self-confidence-in-learning.pdf?sfvrsn=6ef5d60d_0
- O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *Internet and Higher Education*, 25, 85–95. <http://dx.doi.org/10.1016/j.iheduc.2015.02.002>.
- Riley, E., Ward, N., Capps, N., McCormack, L., & deGravelles, P. (2021). Piloting high-fidelity postpartum hemorrhage simulation with prelicensure nursing students: Evaluating knowledge, confidence, and satisfaction. *Teaching and Learning in Nursing*, 16(4), 296–300. doi:10.1016/j.teln.2021.04.001.
- Ross, J. G. (2012). Simulation and psychomotor skills acquisition: A review of literature. *Clinical Simulation in Nursing*, 8(9), e429–e435. doi:10.1016/j.ecns.2011.04.004.