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Using Telehealth Technologies to Build Nurse Practitioner Student Confidence

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Abstract

Telehealth technologies play a vital role in delivering quality healthcare to patients regardless of geographic location and health status. Use of telehealth peripherals allow providers a more accurate method of collecting health assessment data from the patient and delivering a more confident and accurate diagnosis, saving not only time and money but creating positive patient outcomes. Advanced Practice Nursing (APN) students should be confident in their ability to diagnose and treat patients through a virtual environment. This pilot simulation was completed to help examine how APN students interacted in a simulation-based education (SBE) experience with and without peripherals, funded by the National Science Foundation's Future of Work at the Human-Technology Frontier (FW-HTF) program. The SBE experience was created and deployed using the INACSL Healthcare Simulation Standards of Best Practices™ and vetted by a simulation expert. APN students (N = 24), in their first assessment course, were randomly selected to be either a patient (n = 12) or provider (n = 12) in a telehealth simulation. Student dyads (patient/provider) were randomly placed to complete a scenario with (n = 6 dyads) or without (n = 6 dyads) the use of a peripheral. Students (providers and patients) who completed the SBE experience had an increased confidence level both with and without the use of peripherals. Students evaluated the simulation via the Simulation Effectiveness Tool-Modified (SET-M), and scored their perception of the simulation on a 1 to 5 point Likert Scale. The highest scoring areas were perceived support of learning by the faculty (M=4.6), feeling challenged in decision-making skills (M=4.4), and a better understanding of didactic material (M=4.3). The lowest scoring area was feeling more confident in decision making (M=3.9). We also recorded students' facial expressions during the task to determine a probability score (0-

100) for expressed basic emotions, and results revealed that students had the highest scores for joy (M = 8.47) and surprise (M = 4.34), followed by disgust (M = 1.43), fear (M = .76), and contempt (M = .64); and had the lowest scores of anger (M = .44) and sadness (M = .36). Students were also asked to complete a reflection assignment as part of the SBE experience. Students reported feeling nervous at the beginning of the SBE experience, but acknowledged feeling better as the SBE experience unfolded. Based on findings from this pilot study, implications point towards the effectiveness of including simulations for nurse practitioner students to increase their confidence in performing telehealth visits and engaging in decision making. For the students, understanding that patients may be just as nervous during telehealth visits was one of the main takeaways from the experience, as well as remembering to reassure the patient and how to ask the patient to work the telehealth equipment. Therefore, providing students opportunities to practice these skills will help increase their confidence, boost their self- and emotion regulation, and improve their decision-making skills in telehealth scenarios.

Introduction and Background

Patients who may be delayed from healthcare due to their location or health status require an alternative healthcare delivery method. Virtual visits, using telehealth technologies, with a healthcare provider, removes the confinement of geographical barriers and improves patient outcomes [1, 2, 3]. Advanced Practice Registered Nurses (APRNs) have become vital frontline providers for patients with both geographical and health status challenges. As the delivery of healthcare grows and improves with technology, so will the need for APRNs who are competent and confident in the use of telehealth technologies [4].

This substantial role that APRNs play in rural telehealth and virtual visits requires them to graduate with the ability to understand and use telehealth technologies proficiently [1].

Additionally, patients must feel that the telehealth care they receive is timely and appropriate for their healthcare needs. The use of peripherals (telehealth medical equipment) substantially aids the provider in their diagnostic ability when completing a telehealth visit with a patient [1, 2, 3]. Additionally, providers may feel more confident when their diagnostic reasoning is aided with the use of a telehealth peripheral [5].

Telehealth, defined for this study, is, "all uses of technology to communicate with patients and/or practitioners regarding health and healthcare delivery, monitoring, and/or education" [6]. Both resources and location may allow some providers to have the use of peripherals to aid them in the assessment of the patient, while others may not.

This study aimed to answer the following questions:

1) Will student providers feel more confident in their diagnosis when able to have a peripheral available during the assessment of a student patient during a simulated telehealth visit?

2) Will student patients feel more confident in the ability of their provider to accurately diagnose them when able to have a peripheral available during the assessment of a simulated telehealth visit?

Methods

APRN students in the Doctorate of Family Nurse Practitioner track (DFNP), who were enrolled in the Advanced Health Assessment course at a university in Florida completed a simulation based education (SBE) experience as part of the course curriculum. Participating students ($N = 24$) from this course were randomly selected by drawing a stick labeled either "provider" or "patient" to perform the provider or patient role for the SBE experience. Students who were selected to be "providers" were tasked with completing a telehealth visit on a student

"patient". Students not selected as providers were "patients". "Patients" were randomly assigned to an examination room with access to a telehealth peripheral (otoscope) or one without. All students selected to be patients were given a script on the simulation scenario to guide them through the telehealth visit, in order to standardize the SBE experience. The SBE scenario was vetted by a Certified Healthcare Simulation Educator® (CHSE®) and completed in a Certified Simulation Center at the university.

Prior to the start of the SBE experience, students were all read a standard pre-brief, written according to INACSL standards, by their course instructor. Student "providers" were then placed in a room with a laptop computer connected to a teleconference meeting that linked them to their student "patient". Patients were placed in rooms with a laptop computer connected to a teleconference meeting that linked them to their provider, some with and some without a telehealth peripheral. Student providers were given 25 minutes to perform a brief history and physical-type assessment, as well as formulate a diagnosis and plan. The scenario ended when the student provider thanked the student patient for the visit.

During the visit, students were video-taped, with permission, for later viewing by the course instructor and to enable the use of face recognition software. After each SBE session, students were given information about the study by the Principle Investigator (PI) and students who chose to be part of the research study were sent an anonymous Qualtrics^{XM} link to their school email address. The link was also made available in a course announcement. Students answered surveys dependent on their role in the scenario. Questionnaires were: SBE Questionnaire Provider (without peripherals), SBE Questionnaire Patient (without peripherals), SBE Questionnaire Provider (with peripherals) or SBE Questionnaire Patient (with peripherals). Students were also given the opportunity to complete the Simulation Effectiveness Tool-

Modified (SET-M) after their SBE experience and were sent an anonymous Qualtrics^{XM} link for the SET-M to their student email address as well as via course announcement.

Students were debriefed as an entire class at the end of the lab day and were asked to complete a short reflection assignment as part of their standard course assignments. Students who wished to have their reflection included as part of the study were asked to send an email to their course instructor. After grading the reflection, those reflections that were to be included in the study were de-identified by the course instructor and sent to the PI via encrypted email. Additionally, students were asked if their video-tape, during the scenarios, could be used in the study in conjunction with face recognition software to determine their facial expressions of emotions expressed during the SBE experience. Students who wished to have their video-tape used in the study told the course instructor. The course instructor removed any text identifiers on the video and made the PI aware of the videos to be included in the study.

Tools

Confidence Questionnaire

Student participants were given the opportunity to complete a confidence questionnaire based on their role and scenario during the SBE experience. The questionnaire was developed by the PI and used in previous telehealth studies with student participants. Each questionnaire was composed of ten questions related to how confident "patients" or "providers" were regarding the telehealth visit. Some example questions include: "I had difficulty communicating with my provider/patient using telehealth technology.", "I find completing a visit using telehealth technology frustrating.", "I worried that something would happen to the internet connection when I was using telehealth technology with my provider/patient.", "I am certain my provider/I

correctly diagnosed me when they examined me using/not using a telehealth peripheral.". Responses were based on a 5-point Likert Scale from "Strongly Agree" to "Strongly Disagree".

Simulation Effectiveness Tool – Modified (SET-M)

Participant perceptions regarding the effectiveness of the SBE experience were evaluated with the SET-M by Leighton and colleagues [7, 8]. The predecessor version of the tool, the SET, was created by METI, now named CAE Healthcare (Leighton et al., 2018). The tool includes 19, three-point Likert items from "No Agreement" to "Strong Agreement" (with three being strong agreement) with an additional open-ended question for comments [8]. Examples of the questions include: "I feel more confident that I will be able to recognize changes in my real patient's conditions.", "I feel more confident in my decision making skills.", "I learned as much from observing my peers as I did when I was actively involved in caring for the simulated patient.". There is no total scoring evaluation range for the SET-M, however researchers are encouraged to look at low-scoring items as a reason to reevaluate or rewrite the SBE experience [8].

Reflection

Debriefing is an integral part of SBE experiences [9]. Even after debriefing takes place in-person, students may need time to reflect on their SBE experience. As a standard assignment in the Advanced Health Assessment course, students were asked to reflect on the following questions: (1) How did you feel during the simulation? (2) Give a brief description of the scenario. (3) What aspects were managed well and why? (4) What aspects would you like to change and why? (5) What key takeaways did you learn from this simulation? If the student agreed to have their reflection included in the study, their responses were de-identified by the course lead and read by the researcher. Responses to each question were analyzed for recurring themes and exemplar quotes were reported.

Facial Expressions of Emotion

We examined students' facial expressions during the session, and ran each student's video through the Affectiva module in the iMotions software platform [10]. The module scans individual faces for facial landmarks (called action units), based on the Facial Action Coding System [10, 11], such as lowering the eyebrows, wrinkling the nose, and pressing the lips. The expression of a group of action units combines to form an emotion (i.e., each emotion expressed is a combination of expressed action units). The module assigns a probability score at a framerate of 30Hz (range from 0-100) for each of the seven basic emotions: joy, anger, surprise, fear, contempt, sadness, and disgust. This score identifies the likelihood of an emotion being expressed. We examined the average probability score for each emotion per student expressed during their SBE experience. See *Figure 1* for sample student facial expressions during the learning sessions.

Figure 1. Student participants' facial expressions during the learning sessions.

Results

Confidence

Descriptive data pertaining to the confidence questionnaire were analyzed based on the student's role and scenario; questions were scored individually. The lowest confidence areas of those participants who played the role of a patient (n=8) with the ability to use a peripheral to aid the physical assessment were nervous when using telehealth technology (n=4) and felt that the

physical assessment using the peripheral made them uncomfortable (*n*=4). However, 75% (*n*=6) felt confident that their student provider diagnosed them correctly and 100% (*n*=8) were confident that their student provider selected the correct treatment plan for them.

Participants who played the role of a patient without the ability to use a peripheral to aid the physical assessment (*n*=5), reported lower confidence and were nervous when using telehealth technology (*n*=3). Additionally, 80% (*n*=4) felt their provider may have missed something on the physical assessment due to lack of peripheral use. All five of these participants were not confident that their internet connection was sufficient during the visit and 80% (*n*=4) were not confident their provider knew what to do in case of an emergency during the telehealth visit.

When scoring the student provider confidence questions, five examined student patients using a peripheral and five examined student patients without the use of a peripheral. Those whose patients had a telehealth peripheral available to them and used it (*n*=5) had the lowest confidence score regarding being afraid they missed an important part of the visit due to telehealth (*n*=4) and being nervous using telehealth technology (*n*=5). However, all of the student providers (*n*=5) were confident in their diagnosis and treatment plan with the use of the telehealth peripheral. Conversely, student providers had the lowest confidence scores (*n*=5) in being confident in their diagnosis and (*n*=4) treatment plan without the use of a telehealth peripheral. These same student providers (*n*=5) reported being confident when using telehealth technologies and were not worried about connectivity issues.

Simulation Effectiveness Tool – Modified (SET-M)

Item mean scores on the SET-M [7] for all students spanned from 3.9-4.6 (min = 0.1, max = 5.0). Twenty-four students completed the SET-M. The highest scoring areas were "support of learning by the faculty" (*M*=4.6), "feeling challenged in decision-making skills" (*M*=4.4), and "better understanding of didactic material" (*M*=4.3). The lowest scoring areas were "feeling more confident in decision making" (*M*=3.9) and "feeling more confident recognizing changes in a real patient's conditions" (*M*=4.3).

Reflection

Reflection questions were analyzed for recurring themes. "Relaxed", "nervous", "comfortable" and "anxious" were used by the student participants to answer the question, *How did you feel during the simulation?* One student stated, "nervous as it was my first experience with using telehealth and peripherals". Another described how they felt as "initially nervous, then became comfortable once I established a rapport with the patient".

When students were asked to *Give a brief description of the scenario.*, they used the following terms, "Telehealth visit", "peripherals", "ear pain", "otitis media". A student stated, "I

was able to complete a health history and diagnosis/plan. My patient was able to perform the ear exam using the peripheral." Another added, "My scenario was as the provider with a patient who had a telehealth peripheral."

Student participants replied to the reflection question, *What aspects were managed well and why?* with themes such as "easy to use", "able to assess/diagnose", "set up for success", "instructors available", "ZOOM was easy", "flowed well", "timing". "We were able to sign in to Zoom quickly and without issue. The patient was given sufficient information to answer the questions I had as a provider. I thought it went really well!" was a statement given by one student. Another answered the question with, "completed OLDCARTs and health history well. We managed the technical aspect of the telehealth visit well including with the peripherals."

What aspects would you like to change and why?, was the next question answered. Themes for this question included, "have a script", "more prep work", "opportunity to use peripherals", "switch roles". One student noted their change be, "allowing each participant to have a turn to be a patient and a provider". While others added, "I would not change anything." and "having more abnormals in the exam and more practice attempts".

The final question, *What key takeaways did you learn from this simulation?* produced the following themes from students, "practice", "slow down", "use clear communication", "feel more comfortable", "peripherals provide needed information" and "peripherals eased nervousness". Some direct student takeaways included, "Increased compatibility of technology in the healthcare setting."; "This gives us a good understanding of how to be prepared for technical problems and it will help with future communication skills." and "I learned that clear communication is vital in a telehealth scenario, since you are relying on the patient to give you

all of the information you need without performing a hands-on assessment." Lastly, "peripherals can provide much examination information to have a quality assessment."

Facial Expressions of Emotion

Students' facial expression probability scores revealed the highest average probability score for students (52%) was for expressed joy ($M = 8.47$), followed by surprise ($M = 4.34$), disgust ($M = 1.43$), fear ($M = .75$), contempt ($M = .64$), and anger ($M = .44$). The expressed emotion with the lowest average probability score was sadness ($M = .36$). See *Figure 2* for the distribution comparison of all facial expressions of emotions during the SBE experience.

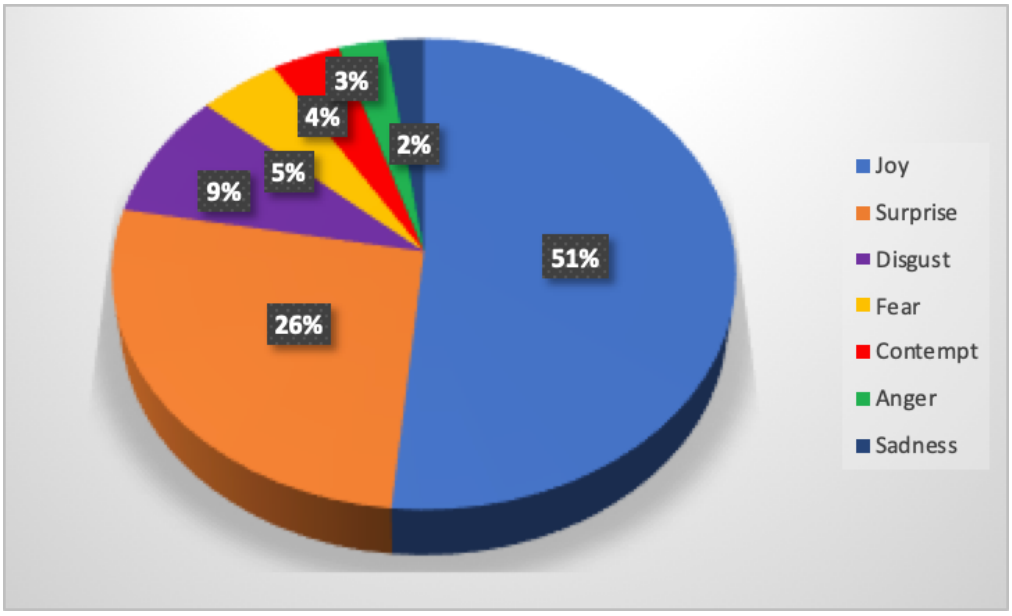

Figure 2. Distribution of emotions expressed by students.

Discussion, Limitations, and Lessons Learned

Overall, our pilot study revealed students benefited from engaging in the telehealth simulation–it increased their effectiveness in using the tool and boosted their confidence in doing so. In addition, the majority of students on average expressed more positive emotions, such as joy and surprise, during the sessions, with low averages of negative emotions, such as disgust, fear, contempt, anger, and sadness. This demonstrates that not only did students become more

adept at using the tool, they had positive feelings and attitudes towards doing so. Therefore, implications from this study point towards the effectiveness of including simulations for nurse practitioner students to increase their confidence in performing telehealth visits and engaging in decision making. In addition, other main takeaways from the experience for the students is understanding that patients may be just as nervous during telehealth visits, as well as remembering to reassure the patient and how to ask the patient to work the telehealth equipment. These are important factors to consider when developing simulations for students because there are several elements that need to be mastered while studying to become an effective nurse practitioner. Providing students practice opportunities allows them to address all of these factors, fostering their domain knowledge, but also their knowledge of social skills and interactions with patients in these scenarios.

Limitations and lessons learned for this study included technical issues, student participation in completing surveys in a timely manner, small sample size (N=24), and only one class of students at one College of Nursing studied. One of the technical issues that occurred was the updating of teleconferencing software just minutes prior to the SBE exercise beginning. Researchers noted that software needs to be checked the day prior to SBE exercises to help with this issue. The STIM Center lost power for 15 minutes during the final rotation of the SBE exercise, but when power returned students were able to continue where they had left-off of the telehealth visit. The last technical issue was the loss of a telehealth otoscope. It was accidentally dropped on the floor and had to be sent out for repair two days prior to the SBE experience. There were back-up telehealth otoscopes and the experience was not compromised.

Due to COVID-19, trained standardized patients were not available for the SBE experience. This situation meant that student participants had to serve as patients. Of those who

were randomly selected to be the patient, many felt unprepared to be the patient and give their colleague a good experience. As untrained patients in simulation, the patient role may have not been standardized across all SBE experiences for this study. This may have caused student patients to be tentative with their answers or give extra clues to the diagnosis and treatment plan to their classmates. Future research and SBE learning opportunities may better serve students if standardized patients are used. Then all students would be able to utilize the provider role. Additionally, adding peripherals to all scenarios would offer the students an opportunity to practice and gain confidence in their use and add to their diagnostic reasoning skills.

Lastly, some students forgot to remove their face coverings at the beginning of the telehealth visit. This made the facial expression recognition of these students difficult (i.e., impossible). In the future, students should be reminded when entering the examination room to remove their face coverings, as they were in the conference room alone.

Conclusion

Based on findings from our pilot study, there is a clear benefit to providing students opportunities to practice the skills they will need during telehealth visits with patients using peripherals. Our results revealed these practice sessions boosted students' confidence and self-/emotion-regulation, as well as improved their decision-making skills in telehealth scenarios, paving the way for successful future careers in the workforce as nurse practitioners.

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