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Context: Telehealth in athletic training education has limited research to support use and integration into practice. To determine if telehealth is an effective educational technique for athletic training students, it is necessary to compare the use of telehealth encounters with current educational techniques, such as standardized patient (SP) encounters. **Objective:** To determine if telehealth encounters using a SP are as effective at improving athletic training student knowledge and confidence as in-person encounters. **Design:** Pretest/Posttest, Non-randomized controlled trial. **Setting:** One undergraduate and one graduate athletic training program. **Participants:** Nine athletic training students volunteered to participate in the research study (n=4 in treatment group, n=5 in control group). **Interventions:** All participants completed a SP encounter of a lower extremity evaluation. The participants in the control group completed the encounter in-person, with the treatment group completed a telehealth encounter virtually using Zoom technology. Prior to the encounters all participants completed a survey including a knowledge assessment of the specific case scenario and confidence rating scale about assessing a patient. The same survey was then completed after the formal debrief following both the treatment and control encounters. **Main Outcome Measures:** Knowledge assessment quiz and confidence rating scale. **Results**: Two separate repeated measures ANOVAs revealed a statistically significant difference between pretest and posttest composite scores for both knowledge and confidence respectively ($F = 14.01$, $p = 0.007$, $\eta_p^2 = 0.667$; $F = 61.86$, $p < 0.001$, $\eta_p^2 = 0.898$). When controlling for the pretest scores, there was no significant difference found between treatment and control groups for either knowledge or confidence ($F = 0.10$, $p =$

0.765, η_p^2 = 0.014; F = 0.09, p = 0.771, η_p^2 = 0.013). **Conclusions:** Telehealth encounters demonstrated similar increases in confidence and knowledge to in-person encounters. Athletic training educators should consider implementing telehealth standardized patient encounters into their educational curriculums. **Key Words:** Simulation, Knowledge, Confidence, Telemedicine

Key points of the manuscript

Athletic training students may experience similar improvements in student learning outcomes with telehealth encounters as they would from in-person encounters using a standardized patient. Participants experienced an increase in confidence as well as an increase in knowledge as a result of either the telehealth or in-person encounter using a standardized patient.

Integrating telehealth encounters into athletic training education may provide a way to improve student learning outcomes and prepare students to provide care via telehealth as practitioners.

The ongoing 2019 novel Coronavirus (COVID-19) pandemic has placed an importance on the use of telehealth services for health care professionals to provide patient care in a way that utilizes social distancing measures to minimize the spread of the virus.[1,2] Telemedicine has been defined as practicing medicine through the use of technology to deliver health care at a distance; with telehealth a more broad term referring to the technologies that may be used to provide these health services at a distance, or non-clinical health related purposes to enhance or support clinical services and provide individual or public health education.[3,4] In addition to being utilized for providing health care, telehealth has also been integrated into various health professions education programs[5-10] with optimistic outcomes including: positive perceptions about telehealth education,[5-7] increased learning opportunities,[8] increases in self-assessment of competency,[11] positive outcomes on clinical skill acquisition,[9] and increased knowledge as well as confidence of telemedicine technology.[7] Telehealth has been minimally discussed in athletic training literature in terms of implementation into practice,[12-14] and only recently has been introduced into athletic training education with the evaluation of lower extremity injuries.[15] Guided by the assumption that telehealth will become a permanent fixture for healthcare professionals, it is important to evaluate the viability of implementing telehealth encounters into athletic training education by comparing telehealth encounters to other currently used educational techniques in terms of the effects on student learning outcomes.

Athletic trainers provide care to a variety of athletic populations, in a variety of settings, and are optimally positioned to integrate telemedicine to evaluate, clinically diagnose, treat, and rehabilitate patients.[14] The COVID-19 pandemic provided an increased opportunity for athletic trainers to engage in telehealth with a recent study citing that more than 40% of the participants surveyed, engaged in some form of telemedicine during the onset of the COVID-19 pandemic.[16]

Despite the amount of participants who engaged in telemedicine, only 3% reported having learned about telemedicine in their professional athletic training programs.[16] In addition to an increase in use of telemedicine in healthcare, implementing educational opportunities in athletic training education in which telehealth is utilized may help prepare athletic training students for professional practice. Prior to implementing telehealth encounters in athletic training education it is necessary to understand how these encounters affect student learning outcomes. One way to understand the effect on students learning outcomes can be to compare telehealth encounters with current active learning techniques that have demonstrated success for athletic training students.

One active learning technique which has proved to be useful in athletic training education and assessment is the use of standardized patient (SP) encounters.[17-22] SP encounters in athletic training education have been associated with positive outcomes in athletic training student confidence,[19,21] skill acquisition,[17,18,20] reflection,[21] and increased learning opportunities.[22] As athletic training programs strive to continue to prepare athletic training students to provide patient care consistent with other healthcare practitioners, it is essential to evaluate the impact on student learning of new and emerging educational techniques such as telehealth encounters.

Knowledge acquisition of clinical skills, and confidence are two outcomes that may be critical to prepare athletic training students for professional practice. Knowledge of clinical skills is a necessary component of all athletic training educational techniques to ensure that students are competent in applying appropriate clinical skills upon graduation to prepare for professional practice.[4] Furthermore, the confidence to apply these skills has been deemed as a critical component for students to become competent practitioners.[15] Recent studies have evaluated skill acquisition and confidence in athletic training students assessing a lower

extremity through SP encounters.[15,19,20] It was found that in-person SP encounters were perceived to increase confidence in clinical evaluation by athletic training students[19] and standardized patients provided a reliable assessment of athletic training student's clinical performance.[20] Winkelmann and Eberman[15] expanded on this research to show that telehealth SP encounters using a lower extremity injury also demonstrated improvements in skill acquisition and self-perceived confidence in athletic training students. Currently there is a gap in athletic training literature with no studies comparing telehealth SP encounters to in-person SP encounters. Comparing the effect of telehealth and in-person SP encounters on the student learning outcomes of knowledge acquisition and confidence would allow educators to determine if telehealth encounters are a viable educational technique to integrate into curriculums. Therefore, the purpose of this study is to fill the current literature gap and determine if telehealth SP encounters are as effective at improving student knowledge acquisition and confidence in a lower extremity evaluation as in-person SP encounters. There are two research questions for this study:

1. How do telehealth encounters using a SP compare to in-person SP encounters at improving athletic training student knowledge acquisition for a lower extremity evaluation?

2. How do telehealth encounters using a SP compare to in-person SP encounters at improving athletic training student confidence in completing a lower extremity evaluation?

METHODS

Participants

Nine (9) participants from one master's and one bachelor's level Commission on Accreditation of Athletic Training Education (CAATE) athletic training programs volunteered for this study. We recruited participants from professional athletic training programs, either

bachelor's or master's level, as long as they met the inclusion criteria of having completed a lower extremity evaluation course that discussed diagnosis and treatment of deep vein thrombosis (DVT). This study was approved by the university's Institutional Review Board, and we obtained informed consent from all participants, in person, prior to beginning the study.

Design

A pretest/posttest, non-randomized control study design was utilized to determine the difference between telehealth SP encounters and in-person SP encounters on the athletic training student learning outcomes of knowledge and confidence. The SP scenario was a lower extremity evaluation of a patient two weeks post anterior cruciate ligament (ACL) reconstruction with symptoms of a Deep Vein Thrombosis (DVT). Due to a lack of validated SP scenarios specific to athletic training, we developed a SP scenario for this study. After development, the scenario was assessed for face validity by a panel of local content experts including; two collegiate athletic trainers and one professional athletic trainer with background and expertise in injury evaluation; two athletic training faculty members with expertise in athletic training education, one nursing faculty member with expertise in simulation development and evaluation, and one exercise science faculty member with expertise in student evaluation and assessment.

Instrumentation

The pretest and posttest surveys assessed athletic training student knowledge and confidence surrounding a lower extremity evaluation. There were no validated instruments available to asses knowledge acquisition for this SP scenario; thus, we developed a knowledge assessment quiz based on the content of the scenario. The quiz consisted of eight questions that were either multiple choice or multiple answer. The quiz questions assessed the content of the learning objectives of the SP scenario as well as the differential diagnoses included in the

scenario. After development, the quiz was assessed for face validity by the same panel of content experts that assessed the scenario.

Confidence was assessed using the confidence rating scale developed by Armstrong and Jarriel[19]. The confidence rating scale consists of 17 items, scored on a five point Likert scale, to assess athletic training student confidence completing a clinical evaluation.[19] The scale was initially tested for face and content validity from a panel of five content experts and internal consistency with a Cronbach $\alpha = 0.971$.[19] This tool was then modified by adding one additional item regarding telehealth to assess athletic training student confidence in a telehealth encounter, and with the additional item demonstrated intrarater reliability was established with a Cronbach $\alpha = 0.941$.[15] Both surveys were administered through Qualtrics® (Qualtrics, Inc., Provo, UT) for the pretest and posttest, basic demographic data was also collected.

Procedures

Once recruited for the study, individual participants were allowed to self-select between two different dates at the simulation center for the study. The dates were predetermined as either a treatment (telehealth) or control (in-person) group, but participants were not aware of which group they self-selected into until the date of the study. The format of the SP encounters were the same for each group with the only difference being that the control group completed the evaluation of the SP in person, whereas the treatment group completed the evaluation of the SP via Zoom© technology (Zoom Video Communications, Inc., San Jose, CA).

On the date of the scheduled patient encounters, all participants from each group began together in a debriefing room. Participants were welcomed to the simulation center, given a brief overview of the structure of the study, signed informed consent forms and then completed the pretest survey battery through Qualtrics® (Qualtrics, Inc., Provo, UT). After participants

completed the pretest survey battery, the simulation educator and primary investigator led the students through a structured pre-brief including the learning objectives of the encounter, pertinent history of the patient encounter including the surgical history of the patient, and three complications that could arise which serve as the differential diagnosis for the patient scenario; deep vein thrombosis (DVT), compartment syndrome, and cellulitis. Participants were encouraged to ask questions prior to the patient encounters to ensure they were adequately prepared for the SP encounters.

At the conclusion of the pre-brief, two participants were randomly chosen from each group to be the active participants during the SP encounter, with the remaining participants to be observers. For the in-person SP encounter the two active participants went into the patient exam room to complete the SP evaluation, whilst the observers live-streamed the encounter in the debriefing room. For the telehealth SP encounter the two active participants were located in the front of the room, nearest to the computer, to be the only two participants to interact with the SP while the observers remained silent and watched on a large screen. Observers were encouraged to take notes during the encounter to facilitate the debrief.

At the conclusion of each SP encounter, all participants were debriefed together by the simulation educator using the Debriefing for Meaningful Learning© model.[23,24] The structure of the debrief was the same for both groups; however, the conversation between the students differed slightly in the treatment and control groups based on the events that occurred during the SP evaluation. Immediately following the debriefing, participants completed the posttest survey battery through Qualtrics® (Qualtrics, Inc., Provo, UT) and were then finished with the study.

Data Analysis

Upon completion of the study, data were extracted from Qualtrics® (Qualtrics, Inc., Provo, UT) and coded to remove participant information. Composite scores of the eight question knowledge assessments were calculated as well as composite scores of the 17 question Likert style confidence rating scale. The coded data with composite scores were uploaded to IBM SPSS (IBM SPSS version 26.0, IBM Corporation, Armonk, New York) for analysis. Descriptive statistics were calculated for means, standard deviation, and confidence intervals. Two separate repeated measures ANOVAs were then calculated, first for the knowledge assessment and then for the confidence rating scale scores to determine variability in means between pretest and posttest scores, as well as between the treatment and control groups. Alpha was set at $p = 0.05$ to determine statistical significance.

Results

Nine participants completed the study, four (44.4%) were categorized as the treatment group and five (55.6%) served as the control. Of the total participants there were three (33.3%) males, and six (66.7%) females. All participants were in professional athletic training programs, two (22.2%) were in a graduate level program, with the remaining seven (77.8%) in an undergraduate level program. All participants (100%) had previous experience with simulation but no previous experience with a SP encounter of any form. In addition, two (22.2%) had previous experience with telemedicine as a patient, with no participants having previous experience with telemedicine as a practitioner.

Descriptive statistics of survey scores between groups can be found in Table 1. A repeated measures ANOVA for group differences on total knowledge scores revealed a significant difference between pre and posttest scores ($F = 14.01$, $p = 0.007$, $\eta_p^2 = 0.667$); however, when controlling for pretest scores, there was not a significant difference between the

treatment or control groups (F = 0.10, p = 0.765, η_p^2 = 0.014). Full model results are demonstrated in Table 2. A repeated measures ANOVA for group differences on the total confidence survey score between the pretest and posttest also revealed a significant difference between pre and posttest groups (F = 61.86, p < 0.001, η_p^2 = 0.898), but no significance when controlling for pretest between the treatment and control groups (F = 0.09, p = 0.771, η_p^2 = 0.013). Model results are demonstrated in Table 3. The overall differences between means of the treatment and control groups for both the total knowledge and confidence pretest and posttest scores is shown in Figure 1.

Discussion

The purpose of this study was to determine if the use of telehealth SP encounters are equivalent to in-person SP encounters. We found that while both confidence and knowledge significantly improved following the encounters, there was not a significant difference between the treatment and control groups. These findings validate that both telehealth and in person SP encounters can be effective teaching strategies for athletic training education and that one is not more beneficial than the other. These findings are supported by previous research through Winkelmann and Eberman[15] which demonstrated increases in student confidence after exposure to a telemedicine SP encounter involving a lower extremity evaluation; as well as, Armstrong and Jarriel[19] who noted increases in student confidence after in person SP encounters of a variety of evaluations. Our findings support this previous research and reveal the gains in confidence of both groups may be equivalent, indicating telehealth SP encounters could be substituted for in person SP encounters if necessary.

Although there is minimal research on telehealth in athletic training education and no other identified published research comparing telehealth and in person SP encounters in the field

of athletic training, there is published research on these areas from other healthcare professions. Posey et al[25] evaluated a group of 41 nurse practitioner students and found that diagnostic reasoning outcomes were equivalent in telehealth SP encounters when compared with face-to-face SP encounters. While this article assessed diagnostic reasoning and not confidence or knowledge, this is still an assessment of student learning outcomes, and diagnostic reasoning is an important student learning outcome for athletic training students. Furthermore, Lempicki and Holland[10] assessed interprofessional teams of third year pharmacy students, second year medical, and occupational therapy students, as well as first year physical therapy students which were randomized to either web-based or face-to-face SP encounters. The students in these interprofessional teams were assessed on interprofessional communication which was determined to be similar for both teams.[10] Our results support the outcomes of both of these studies, demonstrating that athletic training students also experienced similar student learning outcomes when comparing telehealth and in-person SP encounters.

The use of telehealth technology to deliver patient care from a distance has been implemented in many healthcare professions[12,13,26] as well as health professions education programs.[6,7,9-11,27-29] Telehealth has provided opportunities for healthcare professionals to continue to provide health care to patients during the COVID-19 pandemic, while allowing patients and providers the ability to keep social distance and prevent the spread of the virus.[1] In athletic training there has been a growing need for telehealth to provide concussion care in rural areas[12] in addition to providing patient care during the COVID-19 pandemic.[16] As a result of the pandemic, Greicar et al[30] developed a virtual learning environment (VLE) to allow students to demonstrate clinical education outcomes, and found that the VLE provided an alternative to accomplish clinical education when students cannot be physically present. Students from this

study noted many positive learning outcomes including improved self-motivation, communication skills, confidence, and adaptability, among others.[30] This research supports the need to integrate telehealth into athletic training education programs to allow them opportunities to complete clinical skills that they may not be able to complete in person.

Various health professions education programs that have implemented telehealth in their professional programs and found positive student learning outcomes.[6-11,27-29] Nursing has implemented telehealth encounters into their education programs with outcomes including increased knowledge and learning opportunities for students,[8] increased self-assessment of competency,[11] ability to learn advanced health assessment clinical skills,[9] and increased diagnostic reasoning.[25] In medical education, the use of telemedicine has also demonstrated positive student learning outcomes and opportunities for medical students to gain valuable experience while serving actual patients in partner communities.[28] It has also been proposed that introduction to telemedicine as a student could better equip practitioners with knowledge and skills to integrate it into future practice for medical students,[28] as well as for athletic training students.[14] The implementation of telehealth encounters in these health professions education programs provides further support that integration of telehealth encounters into athletic training education can have a positive effect on student learning outcomes and opportunities.

Limitations/Future Research

There are several limitations with this study. The first limitation is the small sample size. Due to the transition to the master's level program in the area, as well as the ongoing COVID-19 pandemic, there were difficulties recruiting participants for the study. Although the sample size was small, a post hoc power analysis revealed the differences found between pre and posttest to be adequately powered, with both groups demonstrating values above a critical F= 5.59. The

second limitation is that neither the SP scenario nor the knowledge assessment quiz developed for this study are valid and reliable tools that have been previously assessed. Due to a lack of valid and reliable SP scenarios or knowledge assessment quizzes based upon these scenarios available for athletic training students, it was necessary to develop a scenario that was appropriately matched for the level and content knowledge of the students. Another limitation of the study is the debrief following the SP encounters. The same debriefing method was utilized for both the control and treatment groups; however, the difference between the SP encounters and the conversation during the debrief may have affected the student learning outcomes of confidence and knowledge and is a confounding variable. A final limitation was that this study was not able to be randomized. Due to scheduling conflicts with participants, it was necessary to schedule students based on their availability which limited the ability to have a truly randomized study.

Future research should include a large-scale randomized study with more participants from multiple athletic training programs to determine if there is a statistically significant change in confidence or knowledge that may not have been found due to the small sample size. In addition future studies should develop and assess the validity and reliability of athletic training SP scenarios and knowledge assessments that can be utilized to evaluate student learning outcomes as a result of telehealth or in-person SP encounters.

Conclusion

The use of SP encounters continues to be a positive educational technique for athletic training students, and integrating telehealth SP encounters may be a viable option for students to improve confidence and knowledge in a virtual setting. As the COVID-19 pandemic continues to affect in person activities, it is imperative that athletic training educators look for ways to

allow athletic training students to demonstrate competency in knowledge and skills, regardless of their ability to be on campus. Integrating telehealth encounters into athletic training education can have similar effects on student learning outcomes as in-person encounters and should be integrated into educational curriculums to help meet student learning objectives in preparing students for autonomous practice.

References

1. Vidal-Alaball J, Acosta-Roja R, Pastor Hernandez N, et al. Telemedicine in the face of the COVID-19 pandemic. *Aten Primaria*. Jun - Jul 2020;52(6):418-422. doi:10.1016/j.aprim.2020.04.003

2. Hollander JE, Carr BG. Virtually Perfect? Telemedicine for COVID-19. *The New England Journal of Medicine*. 2020;382(18):1679-1681.

3. What's the difference between telemedicine and telehealth? American Academy of Family Physicians. Accessed June 9, 2021. https://www.aafp.org/news/media-center/kits/telemedicine-and-telehealth.html

4. Pursuing and maintaining accreditation of professional programs in athletic trainings. Commission on Accreditation of Athletic Training Education. Accessed June 11, 2021. https://caate.net/wp-content/uploads/2021/01/Pursuing-Maintaining-and-Guide-to-2020-Standards-FInal_approved-Dec-2020.pdf

5. Allaire JL. Assessing Critical Thinking Outcomes of Dental Hygiene Students Utilizing Virtual Patient Simulation: A Mixed Methods Study. *Journal of Dental Education*. 2015;79(9):1082-1092.

6. King KR, Purcell RA, Quinn SJ, Schoo AM, Walters LK. Supports for medical students during rural clinical placements: Factors associated with intention to practise in rural locations.

The International Electric Journal of Rural and Remote Health Reseach, Education Practice and Policy. 2016;16

7. Walker C, Echternacht H, Brophy PD. Model for Medical Student Introductory Telemedicine Education. *Telemed J E Health*. Aug 2019;25(8):717-723. doi:10.1089/tmj.2018.0140

8. Erickson CE, Fauchald S, Ideker M. Integrating Telehealth Into the Graduate Nursing Curriculum. *The Journal for Nurse Practitioners*. 2015;11(1):e1-e5. doi:10.1016/j.nurpra.2014.06.019

9. Seibert DC, Guthrie JT, Adamo G. Improving learning outcomes: Integration of standardized patients and telemedicine technology. *Nursing Education Perspectives*. 2004;25(5):232-237.

10. Lempicki KA, Holland CS. Web-based versus face-to-face interprofessional team encounters with standardized patients. *Curr Pharm Teach Learn*. Mar 2018;10(3):344-351. doi:10.1016/j.cptl.2017.11.014

11. Gallagher-Lepak S, Scheibel P, Gibson CC. Integrating Telehealth in Nursing Curricula: Can you hear me now? *Online Journal of Nursing Informatics*. 2009;13(2):1-16.

12. Vargas BB. The Emerging Role of Telemedicine in the Evaluation of Sports-Related Concussion. *Teleneurology in Practice*. 2015:159-165:chap Chapter 15.

13. Winkelmann ZK, Eberman LE, Games KE. Telemedicine Experiences of Athletic Trainers and Orthopaedic Physicians for Patients With Musculoskeletal Conditions. *J Athl Train*. Aug 1 2020;55(8):768-779. doi:10.4085/1062-6050-388-19

14. Connell SA, Winkelmann ZK, Games KE. Athletic Trainers' Exposure to Telemedicine Influences Perspectives and Intention to Use. *Athletic Training & Sports Health Care*. 2021;doi:10.3928/19425864-20200915-03

15. Winkelmann Z, Eberman LE. The Confidence and Abilities to Assess a Simulated Patient Using Telemedicine. *Athletic Training Education Journal*. 2020;15(2):132-147. doi:10.4085/1947-380x-62-19

16. Winkelmann ZK, Games KE. Athletic Trainers' Job Tasks and Status During the Coronavirus Disease 2019 Pandemic: A Preliminary Analysis. *J Athl Train*. Nov 11 2020;doi:10.4085/1062-6050-0275.20

17. Sims-Koenig KN, Walker SE, Winkelmann ZK, Bush JM, Eberman LE. Translation of Standardized Patient Encounter Performance and Reflection to Clinical Practice. *Athletic Training Education Journal*. 2019;14(2):117-127. doi:10.4085/1402117

18. Walker SE, Weidner T. Standardized Patients Provide Realistic and Worthwhile Experiences for Athletic Training Students. *Athletic Training Education Journal*. 2010;5(2):77-86.

19. Armstrong KJ, Jarriel AJ. Standardized Patient Encounters Improved Athletic Training Students' Confidence in Clinical Evaluations. *Athletic Training Education Journal*. 2015;10(2):113-121. doi:10.4085/1002113

20. Armstrong KJ, Jarriel AJ. Standardized Patients Provide a Reliable Assessment of Athletic Training Students' Clinical Skills. *Athletic Training Education Journal*. 2016;11(2):88-94. doi:10.4085/110288

21. Walker S, Weidner T, Armstrong KJ. Standardized Patient Encounters and Individual Case-Based Simulations Improve Students' Confidence and Promote Reflection: A Preliminary Study. *Athletic Training Education Journal*. 2015;10(2):130-137. doi:10.4085/1002130

22. Cuchna JW, Walker SE, Van Lunen BL. Simulations and Standardized Patients in Athletic Training: Part 1 Athletic Training Educators' Use and Perceptions. *Athletic Training Education Journal*. 2019;14(1):35-47. doi:10.4085/140135

23. Dreifuerst KT. The essentials of debreifing in simulation learning: A concept analysis. *Nursing Education Perspectives*. 2009;30(2):109-114.

24. Dreifuerst KT. Getting Started With Debriefing for Meaningful Learning. *Clinical Simulation in Nursing*. 2015;11:268-275.

25. Posey L, Pintz C, Zhou QP, Lewis K, Slaven-Lee P, Chen C. Comparing Nurse Practitioner Student Diagnostic Reasoning Outcomes in Teleheath and Face-to-Face Standardized Patient Encounters. *Journal of Nursing Regulation*. 2018;9(3):27-35.

26. Lewis ER, Thomas CA, Wilson ML, Mbarika VW. Telemedicine in acute-phase injury management: a review of practice and advancements. *Telemed J E Health*. Jul-Aug 2012;18(6):434-45. doi:10.1089/tmj.2011.0199

27. Deaton DH, Balch D, Kesler C, Bogey WM, Powell CS. Telemedicine and Endovascular Aortic Grafting. *The American Journal of Surgery*. 1999;177:75-77.

28. O'Shea J, Berger R, Samra C, Van Durme D. Telemedicine in education: bridging the gap. *Educ Health (Abingdon)*. Jan-Apr 2015;28(1):64-7. doi:10.4103/1357-6283.161897

29. Shaw RJ, Molloy M, Vaughn J, et al. Telepresence Robots for Pediatric Clinical Simulations: Feasibility and Acceptability. *Pediatric Nursing*. 2018;44(1):39-43.

30. Greicar M, Post E, Coliflores J, et al. Developing a Virtual Learning Environment for Clinical Education Amidst a Pandemic. *Athletic Training Education Journal*. 2021;16(2):132-141.

Table 1 Descriptive Statistics of Survey Scores

Descriptive Statistics of Survey Scores

		Knowledge Assessment			Confidence Rating Scale Total		
Group	**Assessment**	**Mean**	**SD**	**95% CI**	**Mean**	**SD**	**95%CI**
Treatment	Pre-Intervention	13.75	1.94	(11.20, 16.30)	28.50	5.80	(22.42,34.58)
	Post-Intervention	16.38	1.65	(13.99, 18.76)	23.50	6.46	(16.75, 30.25)
Control	Pre-Intervention	13.70	2.31	(11.42, 15.98)	36.00	4.58	(30.56, 41.44)
	Post-Intervention	16.80	2.25	(14.67, 18.93)	30.60	5.08	(24.56, 36.64)

Table 2 Repeated Measures ANOVA for Composite Knowledge Assessment

Within-subjects effects

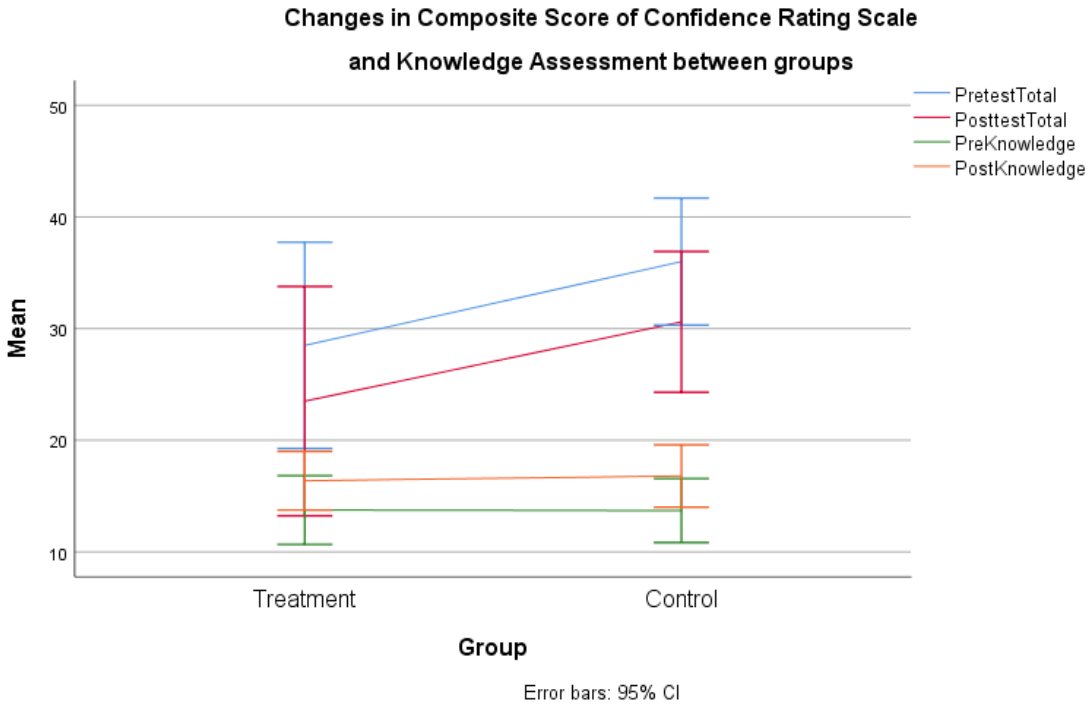
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	36.42	1	36.42	14.01	0.007	0.667
Time*Group	0.25	1	0.25	0.10	0.765	0.014
Error	18.20	7	2.60			

Table 3 Repeated Measures ANOVA for Composite Confidence Scores

Within-subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	120.18	1	120.18	61.86	0.000	0.898
Time*Group	0.18	1	0.18	0.09	0.771	0.013
Error	13.60	7	1.94			

Figure 1



Composite scores change between treatment and control groups for pretest and posttest

*Results with 95% CI error bars