Suturing Workshop for Third-Year Medical Students: A Modern Educational Approach

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Abstract

Background: This study sought to determine if developing suturing workshops based on modern educational theory would lead to a significant increase in third-year medical students' confidence and preparedness as compared to before the workshop.

Methods: A group of pre-clinical, third-year medical students (n = 20) were voluntarily recruited. The workshop consisted of an interactive didactic session, a hands-on suturing session, and a question-answer session with surgeons. The nine-point Likert scale surveys were given pre-and post-workshop to 17 participants. Total scores of "confidence" and "preparedness" were analyzed using the Student t-test. Results of Q-Q plot and normality tests were used to validate the normality assumption. All analysis was conducted using SAS Software 9.4 (Cary, North Carolina).

Results: A statistically significant increase in both confidence and preparedness was found between results of pre- and post-workshop surveys. Average total scores in confidence increased by 19.7 points, from 19.3 to 39 (95% CI: 15.0-24.4; *P* value < 0.001). For scores in preparedness, the total score increased by an average of 18.4 points, from 22.8 to 41.2 (95% CI: 14.1-22.8; *P* value < 0.001).

Conclusions: These findings suggest that a structured course based on modern educational theory can increase both the confidence and preparedness of third-year medical students who are matriculating into their hospital-based clerkships.

Introduction

Suturing is an important practical skill that allows physicians to close skin incisions and lacerations to facilitate optimal wound healing. Skilled suturing approximates the skin edges, minimizes the dead space, and allows the wound to heal by primary intention with minimal scarring.[1]

There is no national standardized curriculum for suturing, thus it is taught variably between medical schools. The most common method utilizes the "see one, do one, teach one" format, also known as the "master-apprentice" system. This method generally includes student observation of a more highly trained individual, then personal attempt performing the skill, and finally peer education. This commonly used method, though helpful in certain settings, has some limitations. There are financial, time, and ethical constraints for students to learn new skills on patients especially without standardization.[2] Studies have shown that simulation improves student suturing skills.[3] Furthermore, it has been shown that a variety of simulation materials can successfully approximate the look and feel of human skin; pig skin has been deemed the optimal tissue substitute.[3,4] While appropriate simulation is an important part of medical training, it alone may not sufficiently address the integration of knowledge, dexterity, and adeptness.

Successful student suturing requires knowledge of choosing the correct instrument and knowing how to hold it, choosing the optimal suture, and proper handling of skin flaps.[5] Furthermore, understanding the choice of closure (ie, interrupted simple stitch versus running subcuticular stitch) requires a solid baseline knowledge of wound healing.[5] Additional baseline knowledge should include: wound classification, types of suture materials, and modes of wound healing.[6] Given the time constraints of the "master-apprentice system", there often is not time for this baseline knowledge to be imparted in a way that promotes retention by the medical student. With that said, it is rarely expected medical students have mastered these skills. This study focuses on the potential benefit of an educational, theory-based suturing workshop to create more confidence and preparedness among participants.

Medical student suturing sessions at The University of New Mexico School of Medicine currently consist of incoming third-year medical students receiving a brief

demonstration from a senior medical student followed by a block of time where the student can practice on synthetic skin. This process is sometimes overseen by a resident or attending who can answer individual questions. There is otherwise no formal suturing for students to learn or practice leaving a gap in baseline knowledge among students entering third year rotations. Studies have shown that this model is likely not the most effective way to teach suturing skills in a way that fosters confidence and retention for medical students.[7]

A pilot study by Thomas[6] found that integration of Robert Gagne's Nine Events of Instruction into suturing workshops led to an improved quality of education. We sought to expand upon this study by further assessing the effects of this approach in two unique domains: confidence and preparedness.

Methods

Approval from our Human Research Review Committee was obtained for this study (HRRC #16-093). A power analysis for a two-sided comparison of means between matched pairs was conducted, and a target sample size of 16 participants was established. Study participants were recruited based on enrollment status: The University of New Mexico School of Medicine third-year medical students entering their first hospital-based clerkships. The first 20 individuals to respond to the recruitment email, which included HRRC-approved consent information, were subsequently enrolled in the workshop. Five of the 20 enrolled students did not attend, and two members of the "wait list" were subsequently contacted and invited to attend. Our HRRC approved verbal consenting given by students for study participation with the return of surveys.

The framework for the workshop was based on Gagne's Nine Events of Instruction. To start, students were given a pre-workshop nine-point Likert scale survey assessing their current levels of confidence and preparedness with suturing, ranging from "absolutely disagree" to "absolutely agree." Students were then given a brief, formal presentation on various aspects of suturing: types of wounds, reasoning for suturing, types of instruments/suture, and various techniques often employed in suturing. This presentation opened with attention-grabbing pictures demonstrating the adverse effects of poor suture technique, provided students with the objectives for the day, engaged students in a question-answer (Q&A) session that would stimulate their preexisting knowledge, and ultimately taught the material in an engaging manner that elicited student participation and provided pictures and videos related to suturing. After this formal presentation, students were led to a separate room where workstations were set up (four students per station, each with their own instruments, suture, and pig skin). Students worked independently on the previously taught suturing techniques while an instructional video played on repeat at each station. During this time, three fourth-year medical students, two surgical residents, and one surgical attending physician walked amongst the students to offer feedback and instruction. Finally, the workshop ended with a Q&A panel and the post-workshop survey, which was identical to the pre-workshop survey.

Analysis was conducted on 17 participants who served as their own controls in this paired-study design; this included 15 of the initial 20 recruits, plus two recruits from the study's wait list. The power analysis performed at the 5% significance level suggested a total sample size of 16 participants, producing a power of 80% for a medium-large effect size of 0.65. For pre- and post-workshop surveys, total scores were constructed for each student based on responses to the survey questions for each of two domains regarding suturing: preparedness and confidence. The nine-point Likert scale survey responses ranged between "absolutely disagree" and "absolutely agree," contributing between one and nine points per question to the total score. Total scores for each domain therefore had a possible range between five and 54 points per domain. To determine if the mean differences between the pre- and post-workshop surveys were statistically significant, paired Student t-tests were performed for each domain ($\alpha = 0.05$). A Q-Q plot of difference was used to validate the normality assumption of the data. Statistical analysis was completed using SAS Software 9.4 (Cary, North Carolina).

Results

For the confidence domain, pre-workshop surveys' mean total score was 19.3, compared to a post-workshop mean total score of 39. For the preparedness domain, pre-workshop surveys' mean total score was 22.8, compared to a post-workshop mean total score of 41.2, as shown in Table 1. Students reported feeling significantly more "confident" with successful suturing after the workshop compared to before. On average, students' total scores increased by 19.7 points (95% CI: 15.0–24.4; *P* value <0.001) between pre- and post-workshop surveys (Figures 1 and 2). Students reported feeling significantly more "preparedness" with successful suturing after the workshop compared to before. On average, students' total scores increased by 18.4 points (95% CI: 14.1–22.8; *P* value <0.001) between pre- and post-workshop surveys (Figures 3 and 4).

Table 1. Score results from Likert-scale surveys given to 17 participants before and after the workshop

Domain	Pre-workshop score (n = 54 points)	Post-workshop score (n = 54 points)	*P* value
Confidence			<0.001
Mean (SD)	19.3 (9.9)	39.0 (6.0)	
95% CI	14.2-24.4	35.9-42.1	
Preparedness			<0.001
Mean (SD)	22.8 (8.7)	41.2 (6.5)	
95% CI	18.3-27.3	37.8-44.5	

CI, confidence interval.

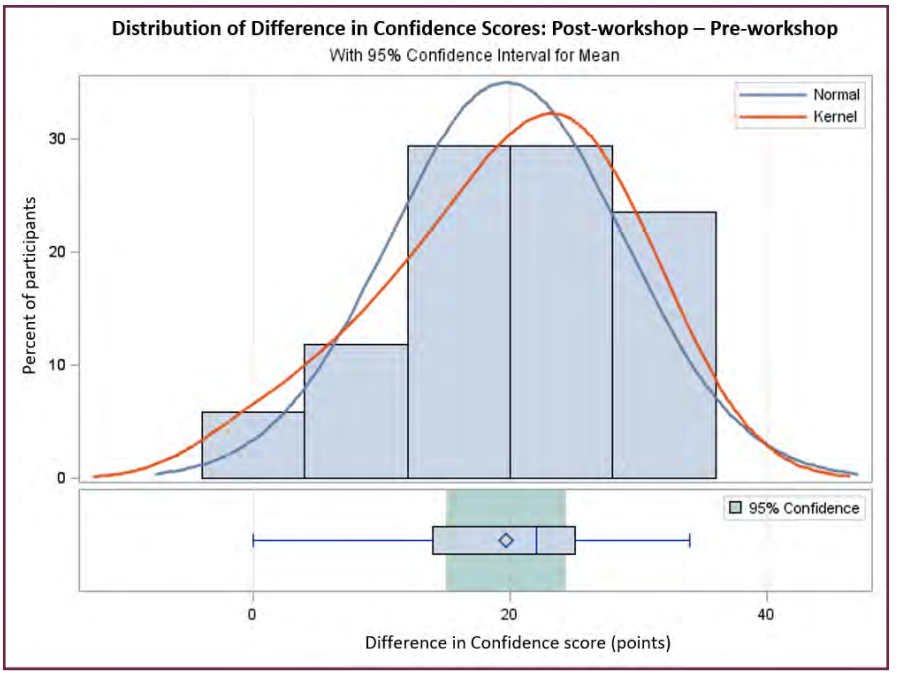

Figure 1. Normally distributed differences between pre-workshop and post-workshop confidence scores for participants (n = 17). Notably, the mean confidence score (denoted by diamond symbol in boxplot) increased by 19.7 points between pre- and post-workshop surveys (*P* value < 0.001) and almost all individual scores increased.

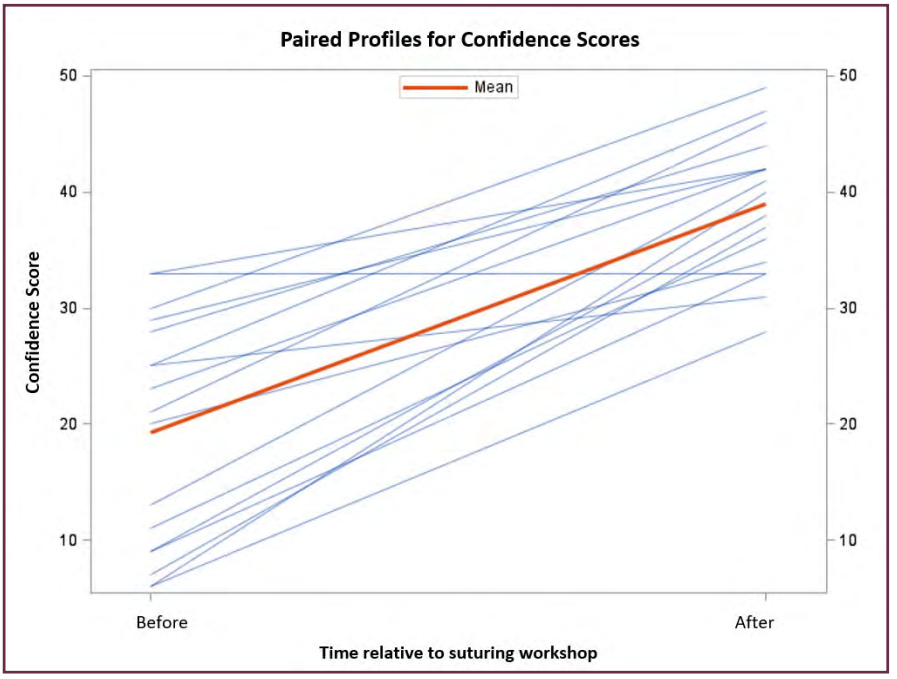

Figure 2. Paired profiles for confidence scores before and after suturing workshop for each participant (n = 17). Bold red line represents the sample mean confidence score before and after the suturing workshop. Notably, confidence scores increased after the workshop for all but one participant.

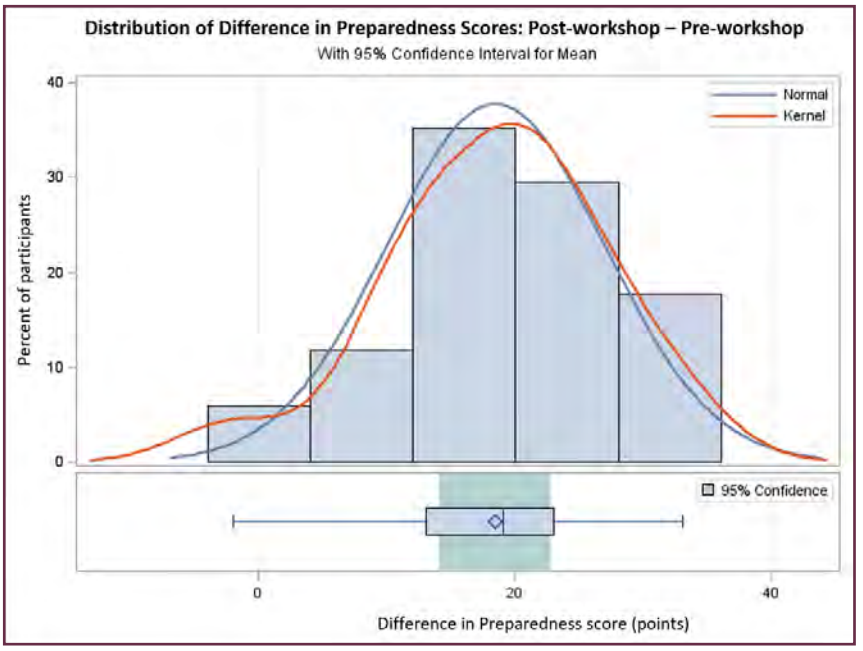

Figure 3. Normally distributed differences between pre-workshop and post-workshop preparedness scores for participants (n = 17). Notably, mean preparedness score (denoted by diamond symbol in boxplot) increased by 18.4 points after the suturing workshop ($P < 0.001$) and almost all individual preparedness scores increased.

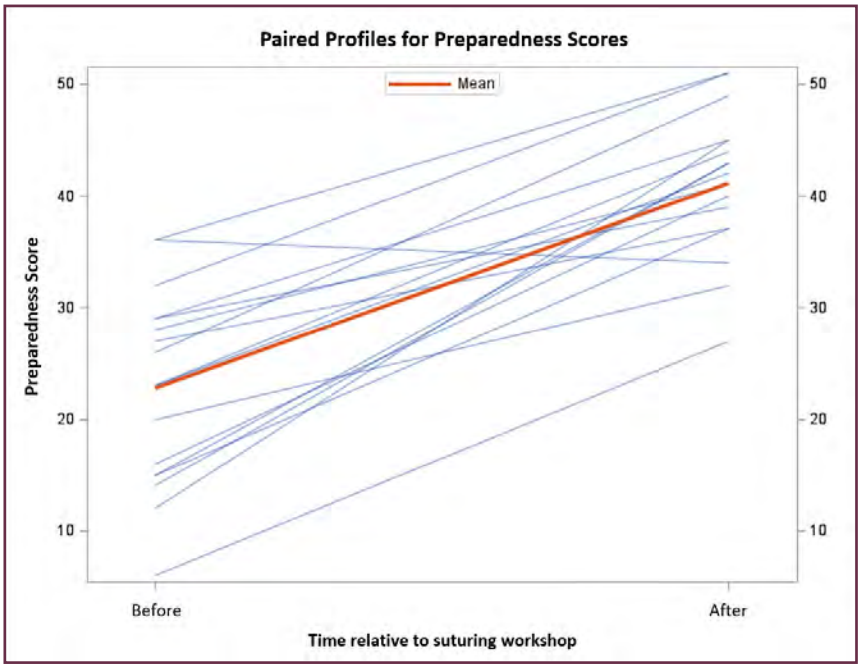

Figure 4. Paired profiles for preparedness scores before and after suturing workshop for each participant (n = 17). The bold red line represents the sample mean confidence score before and after the suturing workshop. Notably, confidence scores increased after the suturing workshop for all but one student.

Discussion

On the basis of our results, this study suggests that second-year students transitioning into third year may benefit from a suturing workshop incorporating modern educational theory. In both domains, confidence and preparedness, the cohort showed a significant increase in their abilities between the pre-workshop survey and the post-workshop survey. Our study cohort additionally demonstrated a slightly greater increase in confidence than preparedness, which may be attributable to our question categories defining confidence largely as a willingness to attempt the skill in the hospital versus preparedness being defined as a current assessment of baseline knowledge and ability.

Of note, 16 of the 17 study participants showed individual increases in pre- to post-workshop confidence and preparedness. As we did not collect subjective, qualitative data, it is hard to interpret the results of the one student whose confidence score remained the same and preparedness score dropped from pre- to post-surveys and thus qualify this result as an outlier.

Finally, although our study is limited to 17 participants, they account for greater than 15% of the total class body, which provides a relatively generalizable number to work

with (particularly concerning the third-year medical student population at The University of New Mexico). However, we recognize that some selection bias may have resulted from sampling students using a recruitment email. It is possible that students with an anticipated specialty involving suturing (eg, surgery, emergency medicine, and obstetrics or gynecology) were more likely to participate in the workshop than students interested in different specialties that do not involve suturing, including allergy- and asthma-related specialties. We acknowledge that our study is limited to The University of New Mexico, and given the moderate variation of curriculums across institutions, these results may only carry weight at institutions with similar suturing curriculum deficits.

Overall, we believe the integration of modern educational theory into practical skill workshops, such as suturing, for transitioning medical students is an effective method for facilitating an effective and efficient learning environment for the retention of skills and knowledge related to suturing.

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Conflict of Interest

The authors report no conflicts of interest.

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