

Optimizing Suture Training: Evaluating Self-Learning vs. Modified Peyton's with Expert Videos

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Abstract: Effective learning methods are crucial for improving wound suturing efficacy using expert videos. This study compared the effectiveness of self-learning and the Modified Peyton's Approach (MPA) in teaching wound suturing with expert video instruction. This experimental study enrolled 20 first-year medical students. Following a pre-test, students were randomized into two groups: a control group (n=10) using the self-learning method, and an intervention group (n=10) utilizing the MPA method. All students then completed a post-test mirroring the pre-test. Individual recordings of pre- and post-test sessions were analyzed for skill scores and total time taken. Data analysis was performed using SPSS 24. Both the self-learning and MPA groups showed significant improvement. The control (self-learning) group demonstrated significant improvements in skill scores (p=0.000) and total time taken (p=0.013). Similarly, the intervention (MPA) group showed significant improvements for both variables (p=0.004). While no statistically significant difference was found between the self-learning and MPA methods for either variable (skill scores p=0.089, total time p=0.179), the MPA group consistently demonstrated better results across both skill scores and time taken. Both self-learning and the Modified Peyton's Approach are effective methods for suture learning using expert videos, with no statistically significant difference in overall effectiveness. However, the Modified Peyton's Approach consistently led to a higher performance level in both skill acquisition and procedural efficiency.

Keywords: *Sutures Techniques, Medical Student, Self-learning, Peer-assisted learning, Modified Peyton's Approach*

INTRODUCTION

The proficiency of wound suture, both as a definitive and temporary measure, should be mastered by physicians. It is important for medical students to start learning wound suturing regardless of their future specialization (Kachare et al., 2019). In order to attain mastery of a clinical skill, it is necessary for students to engage in frequent learning and practice. In many higher education worldwide, the predominant educational strategy used by lecturers and students is traditional lecture-based teaching. Nevertheless, this conventional teaching method is viewed as passive and superficial, demanding minimal engagement from students in their learning process (Zhang & Maconochie, 2022). Furthermore, the majority of preoperative surgical training programs struggle with the task of securing the availability of experienced surgeons to effectively instruct trainees. Research indicates that trainees could potentially experience benefits when given the opportunity to actively influence their learning environments, or in other words, to do self-learning (Safir et al., 2013). The use of experts' instructional videos helps students to do self-learning (Kumins et al., 2021; Wu et al., 2021; Grady et al., 2022). With the aid of videos, students can engage in self-learning at their convenience, anytime and anywhere. They have the flexibility to adjust the playback speed, repeat certain sections, or pause the video as per their individual needs (Routt et al., 2015).

However, there are studies that refute the conclusion about self-learning solely from videos is sufficient and emphasize the need for expert or peer involvement (Tejos et al., 2021). In the absence of expert or peer involvement, students do not receive feedback regarding their work. Without feedback from different perspectives, the likelihood of individuals being able to identify areas for improvement and enhance their abilities becomes minimal (Tejos et al., 2021). The limited availability of experienced surgeons to effectively instruct trainees encourages an increase in research that explores the application of peer-assisted learning (PAL) methods. Researches have stated that PAL offers numerous benefits, including overcoming limited teaching resources, providing a familiar environment for practice, enhancing teaching skills, and minimize gaps of understanding between students (Zhang & Maconochie, 2022).

Peer-assisted learning (PAL) encompasses educational strategies where students gain knowledge and skills from their peers rather than exclusively from expert instructors (Olaussen et al., 2016). The Modified Peyton's Approach (MPA) is a commonly used instructional strategy within PAL, based on the original four-step approach established by the European Society of Cardiology in 2000 (Bekele et al., 2019). Peyton's original approach is structured for procedural skills training, comprising a sequence of demonstration, deconstruction, comprehension, and assessment. The primary strength is found in the robust cognitive scaffolding established during the comprehension phase, wherein

learners articulate each procedural step as the instructor executes the task, thus improving understanding, retention, and psychomotor integration (Jawhari et al., 2012). Nonetheless, a significant limitation of the original method is its dependence on a 1:1 instructor-to-student ratio, which constrains scalability and practicality in medical schools with large student populations and restricted faculty resources (Yap et al., 2016).

Yap et al. (2016) introduced the Modified Peyton's Approach (MPA) to address this limitation, adapting the method for small-group and peer-assisted settings typically found in undergraduate medical education. MPA maintains the fundamental pedagogical framework of the original method while reallocating instructional responsibilities among students, thus diminishing reliance on expert instructors. The initial demonstration and deconstruction stages in MPA are instructor-led, which ensures procedural accuracy and standardization. The comprehension stage, recognized as a crucial element of the learning process (Jawhari et al., 2012), is preserved yet altered through the pairing of students, with one articulating the procedure while the other executes it. This is succeeded by a role reversal, enabling both learners to alternate between cognitive explanation and psychomotor execution prior to assessment.

The primary benefit of MPA lies in its efficiency and scalability, facilitating active learning in larger cohorts while ensuring learner engagement and the repetition of essential procedural steps. Peer interaction fosters collaborative learning and may mitigate performance anxiety. However, the method presents potential weaknesses, such as variability in the quality of peer feedback and diminished direct expert supervision, which could impact skill accuracy if not properly monitored. Despite these limitations, MPA provides a practical equilibrium between educational efficacy and resource availability, rendering it especially appropriate for procedural skills training within modern medical curricula.

With the availability of wound suture instructional videos created by experts, the instructions from the experts can still be effectively conveyed to students (Kumins et al., 2021). Therefore, in this study, the role of the instructor can be fulfilled through faculty expert videos. A study conducted by Kumins' concluded that self-learning in wound suturing using videos is effective (Kumins et al., 2021). On the other hand, Yap's research suggested that wound suturing education requires the application of Fitts and Posner's learning phase principles, specifically the modified Peyton's Approach (MPA) (Yap et al., 2016).

This study is innovative in three ways. First, it explicitly compares video-based self-learning with the Modified Peyton's Approach (MPA) for wound suturing abilities, unlike earlier studies. Second, this study uses expert instructional videos to replace direct instructor interaction in the MPA framework, addressing faculty availability while maintaining structured

procedural learning. Third, it provides empirical results from Indonesian first-year medical students, a demographic and educational context underrepresented in procedural skills training literature.

METHODS

1. Participants and randomization

The sample size was 20 students, based on Roscoe, who mentioned that a simple experiment needs intervention and control groups, with each group size being 10-20 students (Yani, n.d.). The participants were students from the second semester of the School of Medicine at UPN Veteran Jakarta.

The authors utilized a simple random sampling method. They initiated the process by sending email invitations to second-semester medical students at Universitas Pembangunan Nasional "Veteran" Jakarta (the number of students in the second semester was 150). 60 respondents wrote their consent, and the numbers 3, 6, 9, etc. were chosen, and we got 20 respondents. Ethical approval for this study was granted by the Research Ethics Committee for Health Studies of Universitas Pembangunan Nasional "Veteran" Jakarta (Approval No. 212/V/2023/KEPK). All participants have agreed to remain anonymous in surveys and assessments conducted for research purposes.

2. Workflow

All students initially completed a pre-test, which involved performing four simple interrupted sutures using the provided kit. The study analyzed skill scores and total time taken as the variables. Subsequently, the students were divided into two groups: the self-learning method (control group) consisting of 10 students, and the MPA method (intervention group) consisting of the other 10 students. All students then completed a post-test, which mirrored the tasks of the pre-test. Both pre-test and post-test sessions were recorded for subsequent review, with skill scores and total time is taken being assessed. The session duration was 45 minutes. Figure. 1 outlines the workflow.

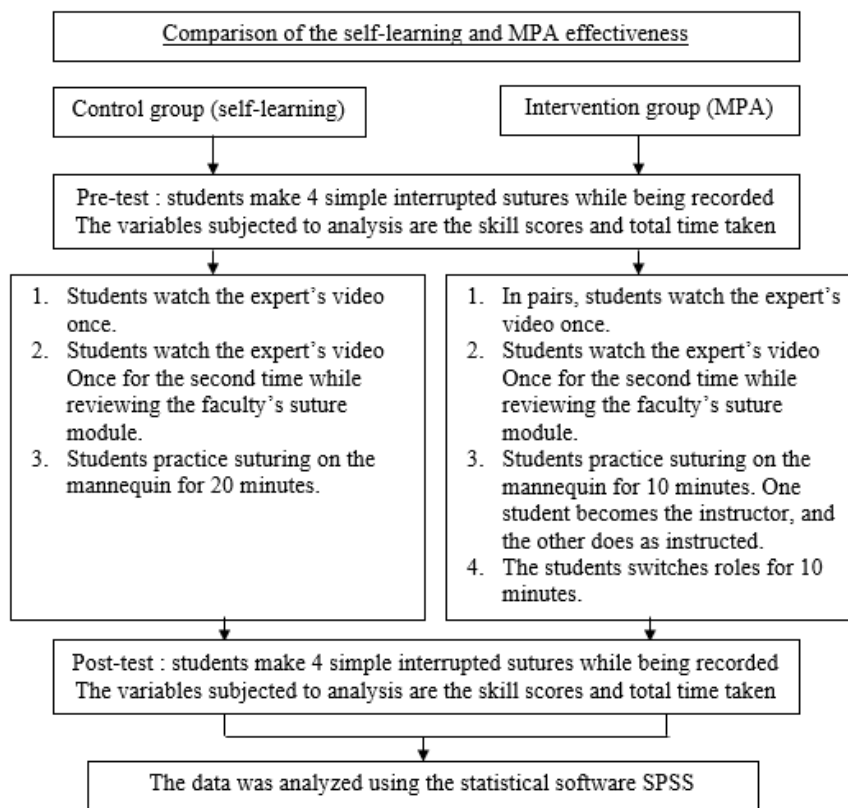


Figure. 1. The workflow diagram

3. Teaching methodologies

Self-learning as the control group: The students watched a video presented by an expert once. Then, the students rewatched the video once again while reviewing the faculty's module. Afterwards, the students independently practiced wound suturing on a mannequin for a duration of 10 minutes.

MPA as the intervention group: The students break off in pairs. They watched a video presented by an expert once. Then, the students rewatched the video once again while reviewing the faculty's module. Afterwards, one student practiced wound suturing on a mannequin for a duration of 10 minutes, while the other explained the procedure. Finally, they switched roles.

4. Material

Each participant was provided with a suture kit, which included a soft leather-covered foam as the synthetic skin mannequin, a needle-holder, a grasper, and 2-0 size silk sutures. The video is made by one of the faculty's surgical experts, uploaded on the faculty's YouTube channel (<https://youtu.be/keaXDyMi070>).

5. Evaluation

Prior to randomization, the video recordings of the pre-test were conducted. Similarly, the post-test video recordings took place immediately after the final training session. The author analyzed the video recordings of the participants. Performances were assessed and times were recorded, resulting in individual scores.

6. Data analysis

The skill scores were based on ten tasks, each worth one point, as outlined in the university's module and University of Bergen suturing skills assessment tool (UBAT) (Almeland et al., 2020), as seen on Table 1.

Table 1. Skill score indicators' table

Indicator	Yes	No
Correctly handling instruments	1	0
Placing the needle holder at the appropriate position (1/3) from the thread loop's end)	1	0
Holding forceps correctly	1	0
Penetrating the tissue at the correct angle (90°)	1	0
Maintaining proper suture placement	1	0
Leaving enough thread for knotting (3-4 cm)	1	0
Executing a surgeon's knot correctly	1	0
Tying a correct square knot	1	0
Creating parallel sutures	1	0
Handling the tissue gently	1	0
Total skill score	10	
Total time taken	... seconds	

Source: *Almeland et al. (2020)*

The tasks included correctly handling instruments, placing the needle holder at the appropriate position, penetrating the tissue at the correct angle, maintaining proper suture placement, leaving enough thread for knotting, executing a surgeon's knot correctly, managing the suture without tangling the ends, tying a correct square knot, creating parallel sutures, and handling the tissue gently. The total time taken for suturing was recorded in seconds. Total time taken is also recorded in seconds. Higher scores and less total time taken indicate better performance, thus improvement of those aspects means effectiveness of a method.

The independent variables in this study were the skill scores and total time taken, while the dependent variable was the effectiveness of the methods based on the participants' performances. Paired-sample T-tests and Wilcoxon tests were used to assess the significance of the improvement in skill scores and

total time taken within each group. To compare the two groups, the Mann-Whitney test was used. All data analyses were performed using SPSS 24.

RESULT

A total of 20 students participated in the experiment. Table 2 presents the basic demographic information of the participants.

Table 2. Basic demographic information of the participants

	Frequency (n)	Percentage (%)
Gender		
Male	3	15
Female	17	85
Age (years old)		
18	7	35
19	11	55
20	2	10
Total	20	100

Figure. 2-3 shows the pre-test and post-test sutures of the participants. Figure 4 illustrates a participant's grasp of forceps, depicting both the incorrect and correct techniques.

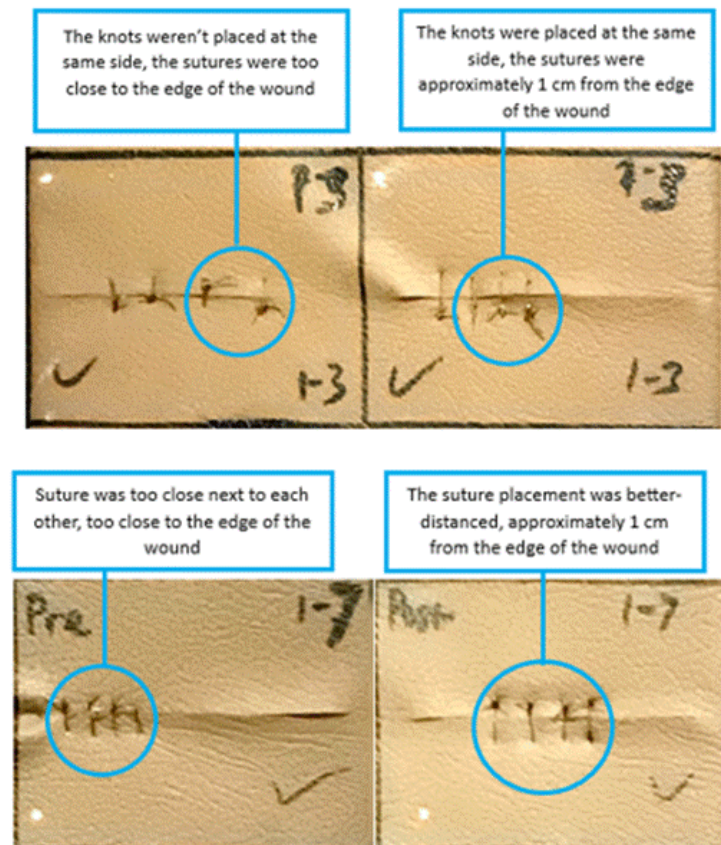


Figure. 2. Pre-test and post-test results of the participants of the control group

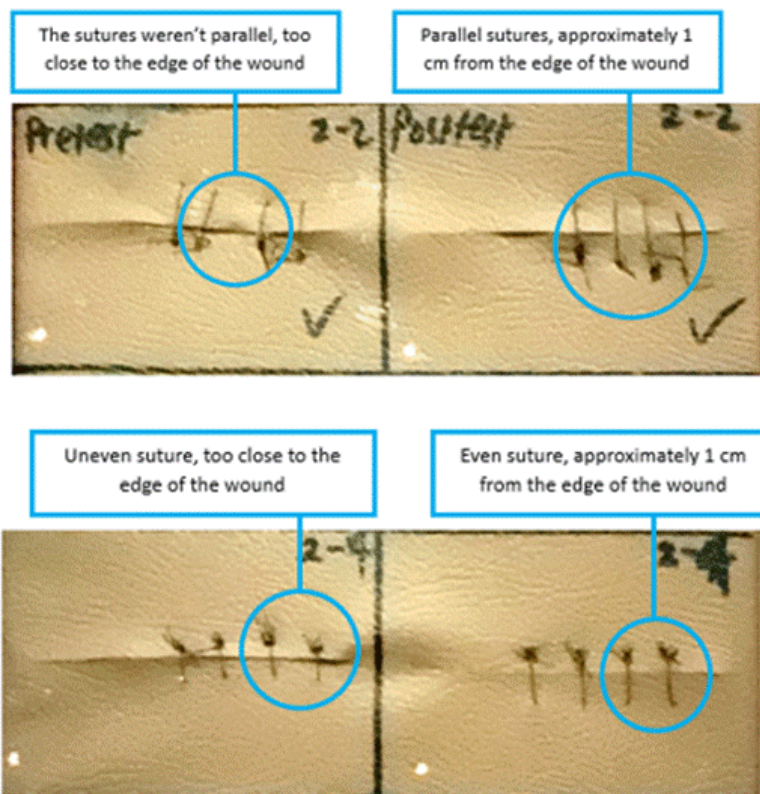


Figure. 3. Pre-test and post-test results of the participants of the intervention group

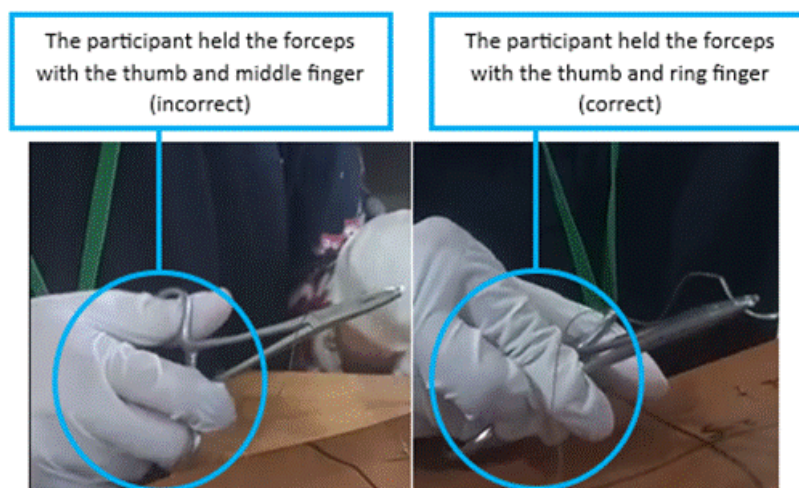


Figure. 4. The incorrect (pre-test) and correct (post-test) hold on forceps

Table 3. Descriptive statistics results and significance analysis of the groups

	Minimum	Maximum	Mean	Standard deviation	p value
Control group					
Skill score					
Pretest	4	6	4.8	0.789	0.000 ^{a)}
Posttest	7	9	8	0.667	
Total time taken (seconds)					
Pretest	482	1054	753.5	230.885	0.013 ^{a)}
Posttest	429	1023	572.3	171.166	
Intervention Group					
Skill score					
Pretest	4	6	5.2	0.632	0.004 ^{a)}
Posttest	8	9	8.5	0.527	
Total time taken (seconds)					
Pretest	487	909	673.8	148.791	0.004 ^{b)}
Posttest	345	698	489.3	127.393	
Control and intervention group significance comparison					
Posttest skill score					
Control group	7	9	8	0.667	0.089 ^{c)}
Intervention group	8	9	8.5	0.527	
Posttest total time taken (seconds)					
Control group	429	1023	572.3	171.166	0.174 ^{c)}
Intervention group	345	698	489.3	127.393	

a) Wilcoxon's test

b) Paired t test

c) Mann-Whitney test

Table 3 displays the results of the experiment. It shows that in both methods, there were improvement on the mean skill scores and mean total time taken. A significant portion of the participants consisted of women, representing 17 individuals (85%). The age distribution of the respondents was predominantly 19 years, with 11 students (55%) falling within this age group. The data were assessed whether they were distributed normally and homogenous. Only one pair of data were found to be normally distributed and homogeneous, allowing for parametric significance tests. The remaining data were not normally distributed, so the data were subjected to nonparametric significance tests.

Table 3 shows the significance analysis performed on the control group, the intervention group and the comparison between the two groups. In the control group, there was a significant increase in the skill score and the total time taken, as evidenced by the statistical significance ($p = 0.0$ and 0.013). These results indicate the effectiveness of the self-study method. While in the

intervention group there was also a significant increase in skill scores and total time taken ($p = 0.004$ and 0.004). This shows the effectiveness of MPA. Finally, a comparison was made between the post-test skill scores and the total time taken in each group. Between-group comparisons of post test outcomes revealed no statistically significant differences in skill scores ($p = 0.089$) or total time taken ($p = 0.174$). However, the intervention group consistently demonstrated higher mean posttest skill scores and shorter total time taken compared to the control group.

DISCUSSION

Although both methods were effective, no statistically significant differences were observed between groups in posttest skill scores and total time taken. Videos enable students to learn at their own pace, allowing for replay, pausing, and adjusting of the playback speed (Kumins et al., 2021).

The stages of the modified Peyton's Approach (MPA) are evident in this study: demonstration, where students watch instructional videos without referring to the faculty module; deconstruction, where students watch instructional videos while cross-referencing them with the faculty module; comprehension, where students work in pairs to practice wound suturing, with one student acting as the instructor explaining the procedure while the other student performs it; re-comprehension, where students switch roles; and finally, individual competency assessment for each student, where they make four wound sutures on a mannequin.

Although no statistically significant differences were observed between groups, several factors may explain this finding, including the relatively small sample size, the short duration of the intervention, and baseline similarities between participants. Although previous studies have reported superior outcomes for peer-assisted learning compared to self-learning, the present findings suggest that the use of high-quality expert instructional videos may reduce the performance gap between self-learning and MPA, particularly among early-stage learning. The benefits of peer-assisted learning were observed in this study, including overcoming limited teaching resources, providing a familiar environment for practice, and enhancing teaching skills (Grady et al., 2022).

Despite the lack of statistical significance, the consistently higher mean performance observed in the MPA group suggests a potential educational advantage. Mechanistically, MPA facilitates immediate peer feedback, explicit verbalization of procedural steps during comprehension and re-comprehension phases, and social learning through peer interaction, all of which are known to enhance procedural skill acquisition.

Both self-learning and MPA can be applied to students regardless of nationality or learning style (e.g., visual, aural, reading, kinesthetic, or mixed). In

self-learning methods students can adjust their learning style individually, while in the MPA method, learning styles were found to have no impact on the perception of MPA in a previous study (Skrzypek et al., 2020).

Retention of wound suture skills is crucial for maintaining the proficiency, requiring effective scheduling. A study reported proficiency test ratios ranging from 0% to 91.7% for students practicing once a month and four times a month, respectively (Bekele et al., 2019). Previous studies suggest that suture learning sessions should be distributed across small, scheduled sessions rather than one main instructional session (Yap et al., 2016). In another study on MPA method, it was concluded that MPA had no effect on students' skill retention (Ahmed et al., 2018). This implies that both self-learning and MPA methods should be implemented in an effective schedule to ensure students' retention of proficiency.

In conclusion, this study indicates that video-based-self-learning and MPA provide comparable short-term effectiveness in wound suturing education, with MPA demonstrating a favorable performance trend. Both methods may be optimally implemented within structured and repeated training schedules. Medical schools can also implement the MPA methods in formal suture practice sessions. Medical students also should utilize peer-assisted learning methods such as MPA while referencing reliable learning sources (Makkiyah, 2023).

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Conflict of interest

Authors confirm that writers have no conflict of interest in relation to this work.

Authors Contributions

CAPS conceived and designed the study, wrote initial and final draft of article, conducted research, provided research materials, collected and organized data, and analyzed and interpreted data.

FAM conceived and designed the study and revised the study critically for

important intellectual content. PMS conceived and designed the study and revised the study critically for important intellectual content. KK revised the study critically for important intellectual content. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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