Objective comparison of first-person-view live streaming method vs. Face-to-face Teaching Method in improving Wound Suturing Skills For Skin Closure in Surgical Clerkship students: A Randomized Control Trial

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Abstract

Background: Surgical training using digital online teaching media for medical student especially for surgical training is indispensable, yet it is still not widely explored objectively.

Objective: To objectively assess teaching method effectiveness using Go-Pro media vs face-to-face teaching in training simple wounds suture to surgical clerkship students.

Methods: Seventy-four clinical clerkship students at the Surgery Department of Pelita Harapan University between January-April 2023 were recruited as samples in this study, and randomly assigned into two groups: trained simple wound suturing skills by using Live-streaming (LS), or trained using Face-to-face (FTF) method. All of the samples were assessed objectively before and 1 week after training, using Objective Structured Clinical Examination (OSCE). The data will be obtained from the OSCE examination form and questionnaires.

Results: In the paired-analysis of numerical differences of each participants pre-test and post-test we found LS still could enhance participants' ability to do the procedural skills (FTF vs LS : 27.52±20.63 vs 24.41±16.68, p-value 0.4787) but the FTF still showed superior result in their mean post-test score compared with LS group (FTF vs LS : 86.44±10.97 vs 78.92±15.54 , p-value 0.0188).

Conclusions: LS method could enhance students' ability in mastering simple procedural skill such as simple wound suturing, but it is still not as good as FTF method.

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Objective comparison of first-person-view live streaming method vs. Face-to-face Teaching Method in improving Wound Suturing Skills For Skin Closure in Surgical Clerkship students: A Randomized Control Trial

Abstract

Background: The use of digital online teaching media in improving surgical skills of medical students is indispensable, yet it is still not widely explored objectively. The first-person-view online teaching method may be more effective as it provides more realism to surgical clerkship students in achieving basic surgical skills.

Objective: This study aims to objectively assess the effectiveness of first-person-view live streaming method (LS) using a Go-Pro camera compared to standard Face-to-Face (FTF) teaching method in improving simple wound suturing skills in surgical clerkship students.

Methods: A randomised, prospective, parallel, non-blinded, one-centre trial was performed. Randomly selected clerkship students of the Department of Surgery, Pelita Harapan University between January to April 2023 were randomly recruited into either live-streaming or Face-to-Face teaching method for simple interrupted suturing skills. All the participants were assessed objectively before and one week after training, using Direct Observational Procedural Skills (DOPS) method. DOPS results and post-study questionnaires were analyzed.

Results: Seventy-four students were included in this study, with 37 participants in each group. Paired-analysis of each participants' pre- and post- experiment DOPS score revealed that LS method outcome is comparable to FTF method outcome (LS vs FTF: 27.5±20.6 vs 24.4±16.7, *P*=.48) in improving the students' surgical skills.

Conclusions: First-person-view live-streaming training sessions could enhance students' ability to master simple procedural skills such as simple wound suturing, and has comparable results to the current face-to-face teaching method. Teaching a practical skill using the LS also gives more confidence for the participants to perform the procedure independently. Other advantages of the LS method such as the ability to study from outside the sterile environment, are also promising. We recommend improvements in the audio-visual quality of the camera and a stable internet connection before performing the LS teaching method.

Clinical trial registration number: NCT06221917

Keywords: Teaching method; Live streaming; first person view; Face-to-face; Simple wound suturing

Introduction

Utilizing a combination of traditional and online teaching methods in the training of medical students is unavoidable and indispensable in the 21st century, especially in the education 4.0 framework.[1] Although blended learning methods have been applied in many disciplines, its use in surgical clerkship training has not been thoroughly explored.[2, 3] This gap was made obvious during the COVID-19 pandemic, as the training of medical students in various countries was disrupted since digital online tools were not ready to be used in the medical education field.[4-6]

Compounding this problem is the discrepancy between the rate of growth of new medical students compared to the rate of training of certified medical school lecturers.[7, 8] The Indonesian Ministry of Education stated that the ideal ratio number of lecturer to medical students for effective teaching is 1:5, which is not always achievable.[9] Online teaching methods are also especially useful in the operating room environment, as the number of personnel in the operating theatre must remain as few as possible to decrease the risk of surgical infections. [10, 11]

A proposed solution for these problems is by teaching procedural skills using live-streamed media with strict quality assurance to ensure the quality of the graduates.[12, 13] In this manner, a certified lecturer could educate a number of students simultaneously, while reducing the number of people in the operating room. While the surgeon is doing the procedure in the OT, the students or participants can see and learn the procedural skill in other places simultaneously via the internet.[14, 15] Although a previous study by Shikino et al. suggested that video training of students are generally better accepted, this may not be applicable in learning a manual dexterity skill such as suturing.[16]

The viewpoint shown in the livestream could also affect the learners' understanding. Typically, livestreamed videos are presented in either first-person or third-person view, where a first-person view could simulate as if the viewer is the person doing the procedure, and the third-person view which shows as if the viewer is looking at the surgeon doing the procedure from the side. In the context of surgical skills training, a first-person-view could improve the students' skills acquisition, as it provides a more realistic simulation of the procedure performed, especially concerning the hand movements, instrument handling, tissue handling, knot tying and so on.[17-19] A first-person-view could also bring the students' viewpoint closer to the procedure compared to being there in person, as onlookers in the operating room must maintain their distance due to hygiene and sterility issues.[20]

An operator-mounted vlogging camera is also superior compared to fixed operating theatre cameras, installed in the light fixtures or dedicated mounts, that requires complicated instalment and is not readily available in many theatres, and less cumbersome compared to digital cameras with tripod settings. [21-23] Previous researchers have studied and published procedural learning methods using a minimalist and portable vlogging camera such as a GoPro, which could be easily brought to the operating theatre, outpatient clinic or classrooms.[23-25] This device is easily mountable and wearable, which also means surgeons can easily wear it on their heads while operating, and a teaching assistant can help to operate with a simple click.[26] Head-mounted cameras are also easier to use and less intrusive to the operator compared to body mounts. [23, 27]

Previous studies have researched and published procedural learning methods using digital online platforms.[6, 13, 28-32] But to our knowledge, there are still no studies that objectively evaluate the effectiveness of first-person-view live-streaming methods in surgical training such as simple wound suturing, which is unique to this study. The aim of this study is to objectively assess whether performing simple wound sutures via Live-Streaming (LS) using a FPV Go-pro® camera has the same effectiveness as traditional Face-to-face (FTF) teaching.

Mastery in suturing skills for simple and clean wounds is a requirement for medical doctors. Simple wound suturing has internationally established techniques and assessment methods.[33, 34] The most basic of wound closure techniques is the simple interrupted suture, which is a required skill for Indonesian medical doctors. [35-37] Objective assessment of this procedural skill is performed

using the Objective Structured Clinical Examination (OSCE), which is routinely carried out at the Faculty of Medicine, Pelita Harapan University.[32] In order to improve participants' skills, the DOPS method has been incorporated into the curriculum.[38]

Methods

Recruitment, Randomization and Allocation

This study is a randomised, prospective, parallel, non-blinded, one-centre trial, conducted between January and April 2023. This study was reviewed and approved by the Pelita Harapan University Faculty of Medicine Ethical Board (Ethical approval number: 011/K-LKJ/ETIK/I/2023). This study also has been registered at http://www.clinicaltrials.gov/ with registration number NCT06221917. This study was not funded by any sponsor or institution. This study was conducted and reported in accordance with the CONSORT Guidelines.[39]

Seventy-four surgical clerkships of Pelita Harapan University were recruited as study participants based on a Lemeshow study sample calculation based on a previous study by Sakurai et al.[40, 41] They were selected from a pool of 254 fifth- and sixth-year active clerkship students using simple computer randomization. They are in the final years of study in the Faculty of Medicine and have just begun their surgical rotation. These students had learnt suturing in a clinical skills module during their second year of medical school, but have not had previous clinical experience of wound suturing in their clinical rotations, such as from a previous OBGYN or surgical rotation. Details about the study were explained, and informed consent were obtained from all the participants. Participants who dropped out between the 1-week period of pre- and post-intervention were excluded. It was made clear to the students that their participation in this study will not affect their academic results in any way.

The students were then randomized into two groups: the first 37 subjects selected by simple computer randomization were allocated to the FTF group, and the next 37 into the LS group. Each recruited participant underwent a pre-experiment simple suturing Direct Observation of Procedural Skills (DOPS) assessment with a randomly assigned clinical preceptor from the Department of Surgery. These eight clinical preceptors are active surgical specialists and sub-specialists, with previous experience in DOPS and tutoring medical students. The assessment rubrics used in this study have been reviewed by the Medical Education Unit of Pelita Harapan University and were routinely used in OSCE examinations. (Supplementary Material 1).

The FTF group was taught how to perform simple sutures on a mannequin, and then watched from the side as a surgeon (FH) performed the simple suturing procedure on a real patient. FH is an assistant professor at the Faculty of Medicine, and an active surgeon with more than 10 years of practice. The students are allowed to interact with the operator and ask questions.

The operator simultaneously wore a head-mounted GoPro Hero 8 device, which is performing a live streaming function. The two assistants, HSK and VSC, helped in ensuring the audiovisual quality of the demonstration was adequate. When the visual exposure was not adequate, HSK would help by adjusting the camera. [42]

The LS group was taken into a different room, and watched the live-stream from the GoPro on their own devices, while being monitored by HSK or VSC. All participants were instructed to use a university wi-fi network to ensure connectivity. LS participants were encouraged to be actively involved in the teaching process, asking questions or giving feedback directly through a speakerphone when they were not clear regarding the demonstration or explanation.

Participants in both groups were allowed to ask the instructor to stop or to redo the process. If the audiovisual quality of the live stream was poor, the camera set-up is immediately modified, and the instructor will repeat the unclear teaching process to make sure every participant got the same explanation before proceeding to other steps. The live-streamed session was not recorded, and students were not allowed to record it on their device under supervision from HSK/VSC.

One week after the initial training, the participants performed post-experiment DOPS

assessment with the same examiner as the pre-experiment DOPS, using the same rubric to avoid inter-examiner bias. Data on the GPA index and frequency of self-training within 1 week period of both groups were collected.

At the end of the teaching process, we asked both groups using a Likert scale questionnaire for their opinion regarding the quality of surgical teaching, whether the training enhanced their skill, and the confidence of the participants to do the procedure by themselves. We also asked about the audio-visual quality of the online video as well as the internet connection for the LS group, directly after the training was finished. The participant flow is shown in (Figure 1).

Statistical Analysis

Data was analyzed using Statistical Package for the Social Sciences (SPSS) 23.0. Paired samples T-test was used to determine the difference between pre- and post- intervention DOPS scores. Fisher Exact analysis was used to analyze the subjective evaluation of FTF vs LS effectiveness to enhance participants' skills. Descriptive statistics were used to describe audio-visual quality and internet connection quality.

The difference between DOPS scores (Δ / delta) is defined as the numerical difference between scores before and after being given teaching exposure. This numerical difference is calculated from each participant's pre- and post-intervention scores (paired analysis). By calculating this delta, we could objectively review the ability of the LS method compared with the traditional FTF method in enhancing suturing skills in this study.

Results

A total of 74 study participants were included in this study, with 37 participants in the FTF and LS group. The characteristics of the study participants are described in Table 1. The mean GPA index of FTF and LS group did not show significant differences (3.26±0.21 vs 3.20±0.21, *P* .20).

Table 1. Study Characteristics

Characteristics		**Mean ± SD**	***P***
Sex	Male	26 (35.13%)	
	Female	48 (64.87%)	
Age		22.4 (21-26)	
GPA Index	FTF	3.26±0.21	.20
	LS	3.20±0.21	
	Overall	3.23±0.21	

FTF: Face-to-Face, LS: Live Streaming.

Table 2 shows the objective evaluation of FTF vs. LS effectiveness to enhance participants' skill. There is a significant increase between pre- and post-intervention DOPS evaluation scores, and this difference is more apparent in the FTF group. The LS group performed significantly more time performing self-training than the FTF group.

Table 2. Objective Evaluation of FTF vs LS Effectiveness to Enhance Participants' Skill

Variable	**Mean ± SD**	**Min/max**	***P***
Overall DOPS Score			
Pre	56.7±19.5		**<.001**

	Post	82.7±13.9		
Pre-intervention Score				
	FTF	58.9±21.8	15/91.7	.33
	LS	54.5±17.1	20/91.7	
Post-intervention Score				
	FTF	86.4±11	58.3/100	**.02**
	LS	78.9±15.5	41.7/100	
FTF Group Score				
	Pre-intervention Score	58.9±21.8	15/91.7	**<.001**
	Post-intervention Score	86.44±11	58.33/100	
LS Group Score				
	Pre-intervention Score	54.5±17	20/91.7	**<.001**
	Post-intervention Score	78.9±15.5	41.67/100	
Score Difference Between Pre-intervention and Post-intervention (Delta)				
	FTF	27.5±20.6	0/76.6	.48
	LS	24.4±16.7	16.6/63.3	
Total Self-Training Frequency In 1 Week				
	LS	6.3± 3.4	2/20	**.04**
	FTF	4.9± 2.3	0/12	

FTF: Face-to-Face, LS: Live Streaming using Go-Pro. [a]Mean difference by T-test

Table 3 shows the subjective evaluation of teaching method effectiveness. Most students rate both FTF and LS methods as good or very good. Most students in the FTF group think that the training improves their skill, while most students in the LS group did not find the training very useful.

Table 3. Subjective Evaluation of FTF vs LS Effectiveness to Enhance Participants' Skill

Variable	**FTF Method**		**LS Method**		***P***
	n	**%**	**n**	**%**	
Teaching quality from instructor					
Very good	29	78.4	18	48.65	.02
Good	7	18.9	17	45.95	
Passable	1	2.7	0	0	
Poor	0	0	2	5.4	
Does the training improve your skill?					
Yes, it improves my skill a lot	26	70.3	7	18.9	<.001
Yes, it does	2	5.4	6	16.2	
Not too much	9	24.3	21	56.8	
No, it doesn't improve my skill at all	0	0	3	8.1	
Confidence in doing the procedure by themselves					
Very confident	0	0	2	5.4	<.001
Confident	24	64.9	34	91.9	
Not confident	13	35.1	1	2.7	

Table 4 shows the student assessment of Live-Streaming method quality. Most students find the first-person-view quality to be good or passable. Most students have good or acceptable internet connection, while one student had frequent disconnections.

Table 4. Subjective Evaluation of Audio-visual Quality and Internet Connection Quality for Live-

Streaming Group

Variable	n	%
Audio-visual quality of Live Streaming		
Very good	5	13.9
Good	17	47.2
Passable	13	36.1
Poor	1	2.8
Internet connection quality		
Good	25	67.6
Passable (Some Signal Disconnections)	11	29.3
Poor (Frequent Signal Disconnections)	1	2.7

Discussion

Principal Results

This study aims to prove that teaching using first-person-view live-streaming (LS) has the same effectiveness compared to traditional face-to-face (FTF) teaching in enhancing medical students' practical skills in performing simple wound suturing. As of this writing, no other study has compared these methods before.

We considered these two groups to have equal basic abilities prior to their training, as their GPA index and their pre-intervention score were similar. It is good to see that the overall DOPS scores increased significantly between the pre- and post-intervention period (*P*=<.001), suggesting that the training process generally had good results in enhancing participants' skills regardless of their training method.

However, the post-test scores of the FTF participants were significantly better than the LS participants (FTF vs. LS: 86.4±1 vs. 78.9±15.5, *P*=.02). Seen on the box-plot graph, the data variation in the LS group is wider than in the FTF group (Figure 2, pink box-plot). This wide range of data suggests significant variability in the results in the LS group, ranging from high to poor value (score).

We compared the ability of LS to enhance the participants' skills with FT by performing a paired analysis of the numerical differences between each participant's pre- and post-intervention scores (Δ / delta). Based on this analysis, we found that the score increase between the FTF and LS group is not significantly different (FTF vs. LS: 27.5±20.6 vs. 24.4±16.7, *P*=.48). Nevertheless, when we observed the data variation as depicted in box-plot graph (Figure 3) we noted that the data spread of LS group was narrower in its numerical differences compared to FTF group, which suggested more limited ability of LS to enhance participants' procedural skills compared to the FTF method. The mean score of the two group and the standard deviation are 27.5±20.6 for FTF group and 24.4±16.7 for LS group, which shows that the FTF group has higher score differences than the LS group. Therefore, we deduced that the LS method is still inferior to FTF in enhancing participants' ability to do simple procedural skills.

Procedural skills differ from cognitive matters as they need to be mastered and self-trained within some period. We encouraged the participants to train themselves as often as possible in 1 week period. In an effort to reduce bias, we asked the participants at the end of 1 week period about their self-training frequency during that period. This analysis showed the LS group has more self-training frequency in average (6.3± 3.40 vs 4.9± 2.3, *P*=.048). It is debatable whether the participants in LS group performed more self-training because they felt compelled to by the LS demonstration as mentioned by Offiah et al., or because of something else.[23] It is interesting to see that even though LS method participants perform more self-training than FTF participants, they did not acquire the

same increase in post-test DOPS score.

The quality of the instructions given during FTF and LS was also evaluated. Participants were instructed to give feedback regarding the teaching quality, asking if the instructor gave a good, clear demonstration and explanation on the technique. We found that the majority of the FTF group thought that the teaching quality was very good (29 participants, 78%), but the LS group was dispersed in “very good” and “good” (18 participants, 49% and 17 participants, 46 %, respectively). This result may be caused by the FTF group being physically present at the room with the instructor, and therefore felt more at ease to ask questions in a natural manner. Although we encouraged the participants in the LS group to actively participate in training sessions, the LS group may have questions or comments as well but did not express them simply because they felt less engaged in the LS system. Lack of social interaction, collaborative learning and teacher-student engagement issues are known to be barriers to online learning.[43] More specifically, the poor engagement between students and instructor in live-streaming settings is also reported in the study of Millet et al.[15] Connectivity problems may also be an issue, as one participant in the LS group rated their connectivity as poor.

Students were also subjectively asked if their method of training improves their mastery of the skill. In the LS group, most participants (21 participants, 56.8%) said the method did not improve their skills much, while some (3 participants, 8.1%) said it did not improve their skills at all. This contrasted sharply with the perception of the FTF group, where most participants (26 participants, 70.3%) said the method improves their skills a lot. These results are different from the meta-analysis performed by Mao et al, which found that skills proficiency improvement was not significantly different between video and conventional methods.[44] Unfortunately, the authors did not specifically ask which part of the teaching method that the participants were unsatisfied with.

For the LS group, we also inquired about the audio-visual quality of the live streaming method. Most participants answered in “good” and “passable”, reflecting that the quality of the teaching material needs to be enhanced. In the LS method, the participants cannot move their viewpoint, head or body position to get a better picture of what is going on compared to being present in the FTF group. The Go-pro itself needed to be adjusted several times during the training due to limited visual ability, causing the participants in the LS group to not see the demo clearly. The authors also thought that the visual exposure in the LS method was still lacking, even when we used the Go-Pro Hero 8 which came with a 4000-pixel resolution.[42, 45] This experience was also noted in live-streaming of neurosurgery cases by Jack, et al which using GoPro Hero 5.[46] The LS group also mentioned of an audio delay during the live demo, which could be why participants’ opinions of the quality of teaching and the training ability to improve procedural skills are varied. This audio delay is a common problem with the LS method and should be minimized in the future to enhance the effectiveness of LS in teaching procedural skills.[47] Future studies may also considered virtual reality for teaching technical skills, as it is a more immersive experience for the students.[48] Perhaps it is the quality of the teaching materials that needs to be improved to enhance the first-person-view live-streaming method results.

Finally, we asked the participants about their confidence in performing simple wound suturing by themselves after the training. Interestingly, although the majority of both groups are confident, participants of the FTF group were less confident in performing the procedure compared with the LS group (13 participants, 35.1% vs 1 participant, 2.7%). We previously thought that participants of the gold standard face-to-face teaching method will be more confident in performing the procedure, as this method gives the participant direct visualization of the procedure and better proximity to the instructor to ask questions, and therefore would impart more confidence to perform the procedure independently. This finding may be an effect of the first-person-view live-streaming method, since this method puts the viewers directly in the instructor’s field of view, as if they are doing the procedure themselves. This way, the participants felt as if they have done the procedure before, and are more confident in performing it independently.[19, 49] Another reason may be that

the LS group could learn in a more relaxed setting, as they do not have the stress and tension of trying to learn a skill from inside the high-stress environment of an operating room, and therefore could enhance their confidence and willingness to practice.[50, 51]

Limitations

Some methods in this study could be improved. Several confounding factors could not be controlled, such as the exposure of individual students to the practice of suturing when asked to assist their preceptors in surgery during their rotation, or the enthusiasm of some students to perform self-training. As such, we limited the duration between pre-and post- intervention testing to one week, to reduce the effects of these factors. The retention of skills over a longer period is not explored here. We were also unable to limit contact and communication between participants from both groups during the 1-week period.

We also noted that 33% of the LS participants had a passable/poor connection when using their own mobile devices, even though the participants were encouraged to use the university internet connection. Connectivity problems needs to be more stringent in the future, with all students required to connect to university wi-fi.

We recommend future studies to use higher quality recording devices to improve the quality of the teaching materials. Each participant has a different learning curve, and therefore providing a standardized recording of the procedural skill for students would be helpful in giving them a chance to review and giving them confidence before they do it independently. Using a pre-recorded video to standardize the teaching material could be used, as suggested by Tackett et al., although using recorded media will remove the interactive quality of live-streamed first-person view method.[52] The effects of teaching method on confidence could also be explored, to see if first-person-view method could independently increase the participants' confidence.

Conclusions

Using live- streamed first-person view teaching of simple procedural skills such as simple wound suturing could provide many benefits for the educator, the students, and the teaching hospital. This method is comparable to standard face-to-face teaching for improving the students' skill in performing manual tasks. Teaching a practical skill using the LS also gives more confidence for the participants to perform the procedure independently. Further improvement to the quality of the recording device, better internet connection, and better teaching materials could improve this method in the future.

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Conflicts of Interest

None declared

Abbreviations

FTF: Face-to-face
LS: Live streaming
DOPS: Direct Observational Procedural Skills

References

1. Chituc C-M, editor. A framework for Education 4.0 in digital education ecosystems. Smart and Sustainable Collaborative Networks 40: 22nd IFIP WG 55 Working Conference on Virtual Enterprises, PRO-VE 2021, Saint-Étienne, France, November 22–24, 2021, Proceedings 22; 2021: Springer.
2. Tuma F, Malgor RD, Nassar AK. Actions to enhance interactive learning in surgery. Annals of Medicine and Surgery. 2021;64:102256.
3. Foo C-c, Cheung B, Chu K-m. A comparative study regarding distance learning and the conventional face-to-face approach conducted problem-based learning tutorial during the COVID-19 pandemic. BMC medical education. 2021;21:1-6.
4. Doulias T, Gallo G, Rubio-Perez I, Breukink SO, Hahnloser D. Doing more with less: surgical training in the COVID-19 era. Journal of Investigative Surgery. 2022;35(1):171-9.
5. McKechnie T, Levin M, Zhou K, Freedman B, Palter VN, Grantcharov TP. Virtual surgical training during COVID-19: operating room simulation platforms accessible from home. Annals of surgery. 2020;272(2):e153-e4.
6. Navia A, Parada L, Urbina G, Vidal C, Morovic CG. Optimizing intraoral surgery video recording for residents' training during the COVID-19 pandemic: comparison of 3 point of views using a GoPro. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2021;74(5):1101-60.
7. Mustika R, Nishigori H, Ronokusumo S, Scherpbier A. The odyssey of medical education in Indonesia. The Asia Pacific Scholar. 2019;4(1):4.
8. Song JSA, McGuire C, Vaculik M, Morzycki A, Plourde M. Cross sectional analysis of student-led surgical societies in fostering medical student interest in Canada. BMC Medical Education. 2019;19:1-8.
9. Makarim N, Sadikin BG. Surat Keputusan Bersama (SKB) nomor 02/KB/2022 tentang Peningkatan Kuota Penerimaan Mahasiswa Program Sarjana Kedokteran, Program Dokter Spesialis dan Penambahan Program Studi Dokter Spesialis melalui Sistem Kesehatan Akademik. In: Kesehatan K, Kementerian Pendidikan K, Riset, dan Teknologi, editors. Jakarta2022.
10. Hagopian TM, Vitiello GA, Hart AM, Perez SD, Pettitt BJ, Sweeney JF. Do medical students in the operating room affect patient care? an analysis of one institution's experience over the past five years. Journal of Surgical Education. 2014;71(6):817-24.
11. Wathen C, Kshettry VR, Krishnaney A, Gordon SM, Fraser T, Benzel EC, et al. The association between operating room personnel and turnover with surgical site infection in more than 12 000 neurosurgical cases. Neurosurgery. 2016;79(6):889-94.
12. Awad M, Chowdhary M, Hermena S, Falaha SE, Slim N, Francis NK. Safety and effectiveness of live broadcast of surgical procedures: systematic review. Surgical Endoscopy. 2022;36(8):5571-94.
13. van Bonn SM, Grajek JS, Schneider A, Oberhoffner T, Mlynski R, Weiss NM. Interactive live-stream surgery contributes to surgical education in the context of contact restrictions. European Archives of Oto-Rhino-Laryngology. 2022;279(6):2865-71.
14. Grafton-Clarke C, Uraiby H, Abraham S, Kirtley J, Xu G, McCarthy M. Live streaming to sustain clinical learning. The Clinical Teacher. 2022;19(4):282-8.
15. Mill T, Parikh S, Allen A, Dart G, Lee D, Richardson C, et al. Live streaming

ward rounds using wearable technology to teach medical students: a pilot study. BMJ Simulation & Technology Enhanced Learning. 2021;7(6):494.
16. Shikino K, Nishizaki Y, Fukui S, Yokokawa D, Yamamoto Y, Kobayashi H, et al. Development of a Clinical Simulation Video to Evaluate Multiple Domains of Clinical Competence: Cross-Sectional Study. JMIR Medical Education. 2024;10(1):e54401.
17. Schmidt MW, Friedrich M, Kowalewski K-F, De La Garza J, Bruckner T, Müller-Stich B-P, et al. Learning from the surgeon's real perspective–First-person view versus laparoscopic view in e-learning for training of surgical skills? Study protocol for a randomized controlled trial. International Journal of Surgery Protocols. 2017;3:7-13.
18. Lin C, Andersen D, Popescu V, Rojas-Munoz E, Cabrera ME, Mullis B, et al., editors. A first-person mentee second-person mentor AR interface for surgical telementoring. 2018 IEEE international symposium on mixed and augmented reality adjunct (ISMAR-Adjunct); 2018: IEEE.
19. Jaeger D. The impact of the use of video recording eyewear on skill acquisition: A comparison of first-person and third-person perspective video modeling: Florida Gulf Coast University; 2016.
20. Croghan SM, Phillips C, Howson W. The operating theatre as a classroom: a literature review of medical student learning in the theatre environment. International journal of medical education. 2019;10:75.
21. Madani A, Hirpara D, Chadi SA, Dhar P, Okrainec A. Leveraging videoconferencing technology to augment surgical training during a pandemic. Annals of Surgery Open. 2021;2(2):e035.
22. Smith CD, Skandalakis JE. Remote presence proctoring by using a wireless remote-control videoconferencing system. Surgical Innovation. 2005;12(2):139-43.
23. Offiah G, Ekpotu LP, Murphy S, Kane D, Gordon A, O'Sullivan M, et al. Evaluation of medical student retention of clinical skills following simulation training. BMC Medical Education. 2019 2019/07/16;19(1):263. doi: 10.1186/s12909-019-1663-2.
24. Alameddine MB, Englesbe MJ, Waits SA. A video-based coaching intervention to improve surgical skill in fourth-year medical students. Journal of surgical education. 2018;75(6):1475-9.
25. Hummel Jr RL, editor. Teaching with a GoPro Camera! Simultaneously incorporate technology and learning while creating flipped classroom content. Society for Information Technology & Teacher Education International Conference; 2015: Association for the Advancement of Computing in Education (AACE).
26. Baatjes KJ, Keiller AV, Louw AJ, Van Rooyen M. Point-of-view technology to teach surgery. The Clinical Teacher. 2021;18(2):147-51.
27. Kapi E. Surgeon-Manipulated Live Surgery Video Recording Apparatuses: Personal Experience and Review of Literature. Aesthetic Plastic Surgery. 2017 2017/06/01;41(3):738-46. doi: 10.1007/s00266-017-0826-y.
28. Faiz T, Marar O, Kamel MK, Vance S. Teaching operative surgery to medical students using live streaming during COVID-19 pandemic. Surgical Innovation. 2021;28(2):253-4.
29. Ganry L, Sigaux N, Ettinger KS, Salman SO, Fernandes RP. Modified GoPro Hero 6 and 7 for intraoperative surgical recording—transformation into a surgeon-perspective professional quality recording system. Journal of Oral and Maxillofacial Surgery. 2019;77(8):1703. e1-. e6.

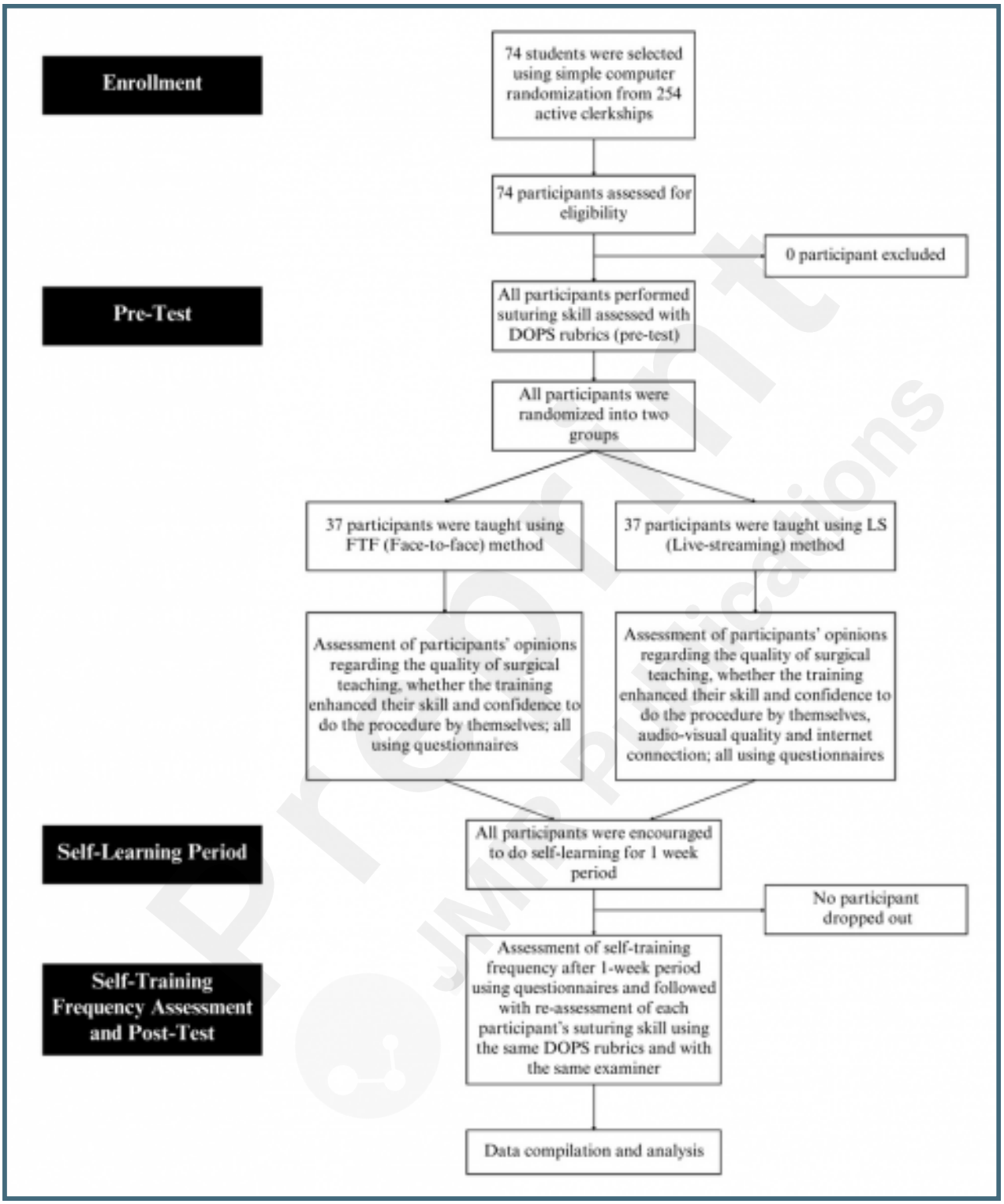
30. Koh W, Khoo D, Pan LTT, Lean LL, Loh M-H, Chua TYV, et al. Use of GoPro point-of-view camera in intubation simulation—A randomized controlled trial. Plos one. 2020;15(12):e0243217.
31. Moore MD, Abelson JS, O'Mahoney P, Bagautdinov I, Yeo H, Watkins AC. Using GoPro to give video-assisted operative feedback for surgery residents: a feasibility and utility assessment. Journal of surgical education. 2018;75(2):497-502.
32. Zulharman Z. Perancangan Objective Structured Clinical Examination (OSCE) untuk Menilai Kompetensi Klinik. Jurnal Ilmu Kedokteran (Journal of Medical Science). 2017;5(1):7-12.
33. Temple CLF, Ross DC. A new, validated instrument to evaluate competency in microsurgery: the University of Western Ontario Microsurgical Skills Acquisition/Assessment instrument [outcomes article]. Plast Reconstr Surg. 2011 Jan;127(1):215-22. PMID: 21200214. doi: 10.1097/PRS.0b013e3181f95adb.
34. Martin JA, Regehr G, Reznick R, MacRae H, Murnaghan J, Hutchison C, et al. Objective structured assessment of technical skill (OSATS) for surgical residents. Br J Surg. 1997 Feb;84(2):273-8. PMID: 9052454. doi: 10.1046/j.1365-2168.1997.02502.x.
35. Indonesia KK. Standar kompetensi dokter. Jakarta: Konsil Kedokteran Indonesia. 2006.
36. MOY RL, WALDMAN B, HEIN DW. A Review of Sutures and Suturing Techniques. Dermatologic Surgery. 1992;18(9):785-95. PMID: 01787395-199209000-00004. doi: 10.1111/j.1524-4725.1992.tb03036.x.
37. Kudur MH, Pai SB, Sripathi H, Prabhu S. Sutures and suturing techniques in skin closure. Indian journal of dermatology, venereology and leprology. 2009;75:425.
38. Loerwald AC, Lahner F-M, Nouns ZM, Berendonk C, Norcini J, Greif R, et al. The educational impact of Mini-Clinical Evaluation Exercise (Mini-CEX) and Direct Observation of Procedural Skills (DOPS) and its association with implementation: A systematic review and meta-analysis. PloS one. 2018;13(6):e0198009.
39. Schulz KF, Moher D, Altman DG. Consort. Guidelines for Reporting Health Research: A User's Manual. 2014:80-92.
40. Lemeshow S, Jr. DWH, Klar J, Lwanga SK, Organization WH. Adequacy of sample size in health studies. England: Chichester; 1990. 239 p. ISBN: 0471925179.
41. Sakurai H, Kanada Y, Sugiura Y, Motoya I, Yamada M, Tomita M, et al. Standardization of Clinical Skill Evaluation in Physical/Occupational Therapist Education–Effects of Introduction of an Education System Using OSCE–. Journal of Physical Therapy Science. 2013;25(9):1071-7.
42. GoPro I. GoPro Hero 8 Black User Manual 130-28314-000 REVB. GoPro I, editor. California: GoPro, Inc.; 2019. 138 p.
43. Zaki MS. ADVANTAGES AND DISADVANTAGES OF ONLINE LEARNING. Journal of International Social Research. 2022;15(92).
44. Mao BP, Teichroeb ML, Lee T, Wong G, Pang T, Pleass H. Is online video-based education an effective method to teach basic surgical skills to students and surgical trainees? A systematic review and meta-analysis. Journal of surgical education. 2022;79(6):1536-45.
45. Hyndman B, Papatraianou LH. Engaging external pre-service teachers in simulated Health and Physical Education learning. Learning Communities: International Journal of Learning in Social contexts. 2017;42(1):84-102.

46. Jack MM, Gattozzi DA, Camarata PJ, Shah KJ. Live-streaming surgery for medical student education-educational solutions in neurosurgery during the COVID-19 pandemic. Journal of surgical education. 2021;78(1):99-103.
47. Celebi KC, Bailey SK, Burns MW, Bansal K, editors. Is virtual reality streaming ready for remote medical education? measuring latency of stereoscopic VR for telementoring. Proceedings of the Human Factors and Ergonomics Society Annual Meeting; 2021: SAGE Publications Sage CA: Los Angeles, CA.
48. Queisner M, Pogorzhelskiy M, Remde C, Pratschke J, Sauer IM. VolumetricOR: A New Approach to Simulate Surgical Interventions in Virtual Reality for Training and Education. Surgical Innovation. 2022;29(3):406-15. PMID: 35137646. doi: 10.1177/15533506211054240.
49. Hatt D, Zimmerman E, Chang E, Vane J, Hollenbach KA, Shah A. First-Person Point-of-View Instructional Video on Lumbar Puncture Procedure. Pediatric Emergency Care. 2023;39(12):953-6.
50. Miandoab NY, Behmaneshpour F, Arbabisarjou A. Stressors of clinical education in operating room students. Drug Invention Today. 2019;12(11).
51. Norouzi N, Imani B. Clinical Education Stressors in Operating Room Students: A Qualitative Study. Investigación y Educación en Enfermería. 2021;39(1).
52. Tackett S, Green D, Dyal M, O'Keefe E, Thomas TE, Nguyen T, et al. Use of commercially produced medical education videos in a cardiovascular curriculum: multiple cohort study. JMIR medical education. 2021;7(4):e27441.

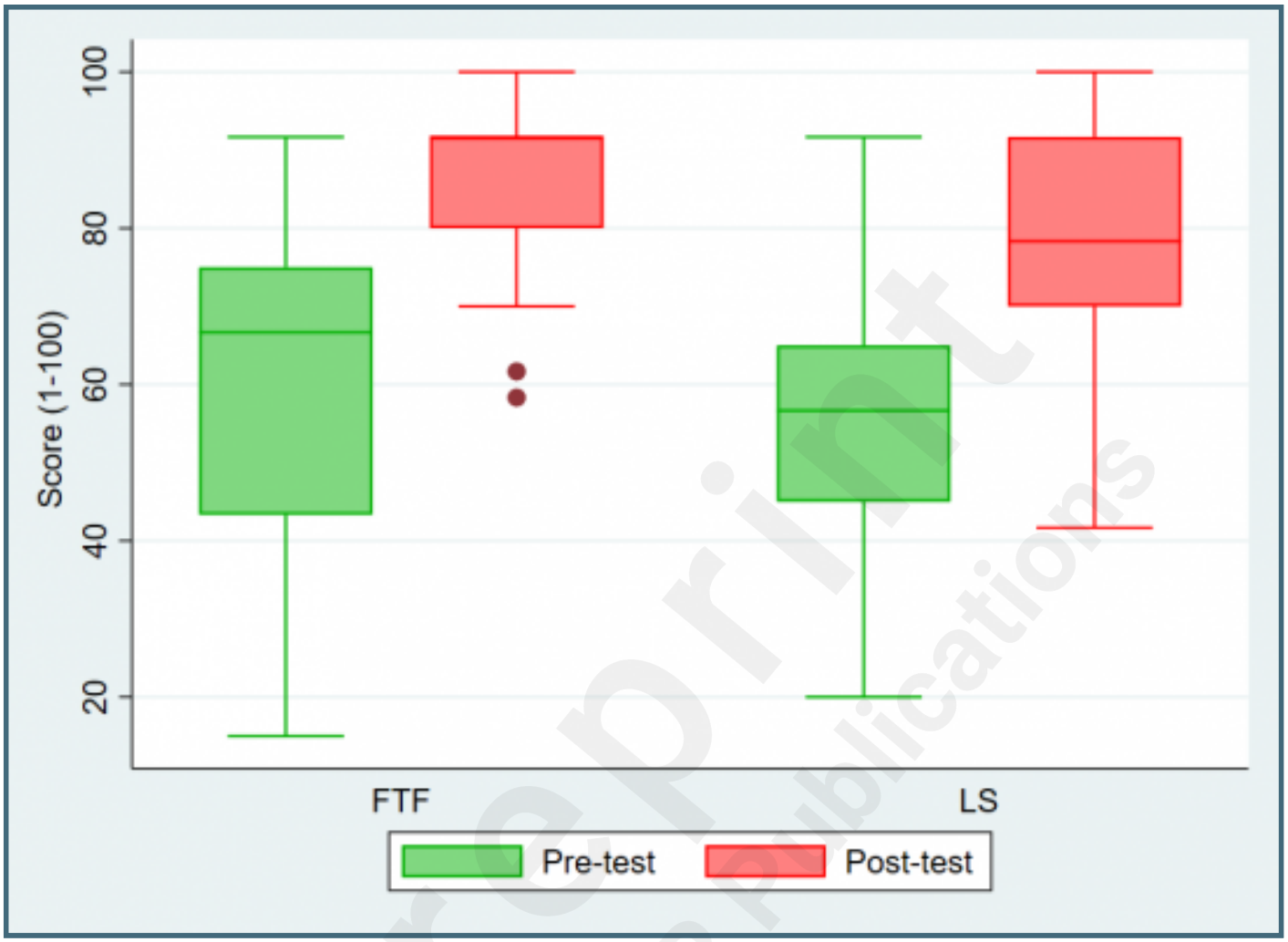
Supplementary Files

Figures

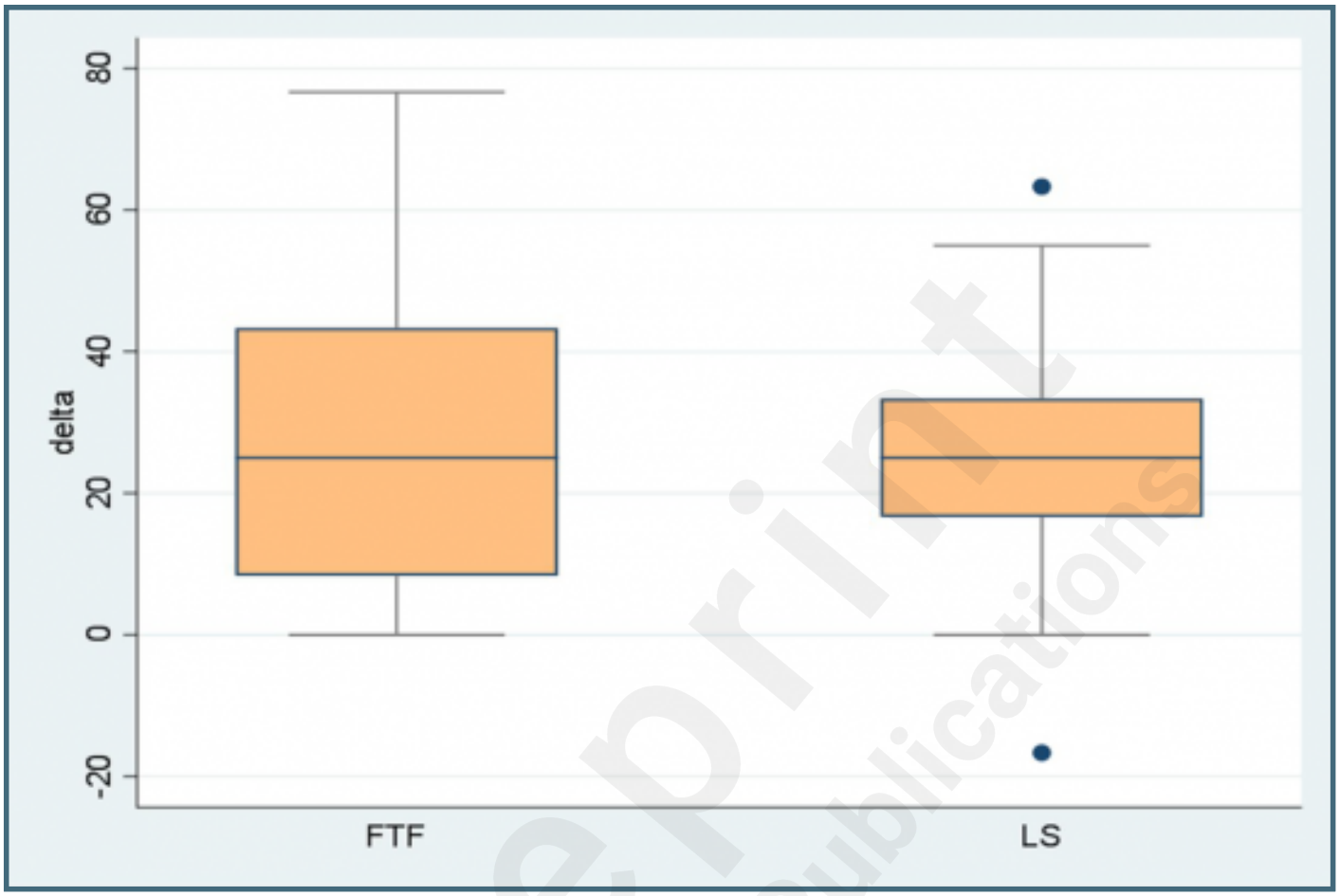
CONSORT Diagram of Participant Flow.



Box-plot Graph of Pre-test and Post-test Scores of FTF vs LS Group.



Box-plot graph of numerical differences of both groups scores.



CONSORT (or other) checklists

CONSORT 2010 Checklist.
URL: http://asset.jmir.pub/assets/2d0cb900141cff3c2977176ed784ce77.pdf

Related publication(s) - for reviewers eyes onlies

revised article with comments of the revisions.
URL: http://asset.jmir.pub/assets/d5548cff25fcd035ac742f49c6d5087b.pdf