

RESEARCH

Open Access



Near-peer teaching of laparoscopic skills among medical students: a randomised feasibility study

Martin Patrick Ho^{1*}, Leonie Heskin^{1,2}, Lena Dablouk¹, Yasmina Richa¹, Joshua Nolan¹, Andrew O'Brien¹, Samin Abrar¹ and Derek Hennessey^{1,3}

Abstract

Background Laparoscopic surgery is integral to modern surgical practice. However, many medical students graduate with limited exposure to essential skills. Near-peer teaching is a promising, student-led approach to address this gap, though its objective impact remains under-evaluated. The aims of this study were to develop a novel objective assessment tool, assess changes in students' confidence and objective performance in laparoscopic tasks following near-peer versus self-directed training, and explore factors associated with performance.

Methods This single-blinded, randomised feasibility study enrolled 42 medical students without prior laparoscopic experience. Participants were randomly assigned to near-peer (Group 1) or self-taught group (Group 2) and completed six weekly sessions across four laparoscopic stations: Ball Transfer, Circle Cutting, Peg Transfer, and String. Performance was scored using a novel objective assessment tool developed through a Modified Delphi Method. Two blinded surgical trainees assessed all performances.

Results No significant differences were observed in pre-intervention objective performance between groups, except for the "Peg Transfer" station. Post-intervention, both groups improved significantly across all tasks ($p < 0.001$). Their confidence also improved ($p < 0.001$). The peer-taught group outperformed the self-directed group in "Circle Cutting" ($p = 0.02$), "String" ($p = 0.01$), and "Peg Transfer" station ($p = 0.04$). There was no relationship between age, gender, or video game experience and performance.

Conclusions This is the first study to demonstrate that near-peer teaching of laparoscopic skills improved laparoscopic performance among medical students compared with a control group. These findings support the integration of near-peer laparoscopic teaching into undergraduate surgical education. The novel assessment tool demonstrated sensitivity to change in performance pre- and post-intervention.

Keywords Near-peer teaching, Laparoscopy, Laparoscopic, Surgical skills, Surgical training, Medical students, Medical education, Simulation

*Correspondence:

Martin Patrick Ho
drmartinho1@gmail.com

¹Department of Surgery, University College Cork, Cork, Ireland

²ASSERT Research Centre, Brookfield Health Sciences Complex, University College Cork, Cork, Ireland

³Department of Urology, Mercy University Hospital, Cork, Ireland



© The Author(s) 2026. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Background

Early exposure to surgical skills is essential for those who wish to enter surgical training, as it facilitates baseline competency when entering the operating theatre. Furthermore, it may entice students who previously had not considered surgery as a career.

Despite this benefit, medical students receive little hands-on surgical training. To address this, many universities have adopted the “Near-peer” model to teach surgical skills [1, 2]. That is, senior or experienced medical students teach junior students basic surgical skills. This model addresses personnel limitations associated with limited surgical faculty. It also provides a low-cost, low-pressure, sustainable learning environment for students. Furthermore, this model allows students to develop collaborative leadership and teaching experience at a junior level.

Previous studies have evaluated near-peer teaching of suturing skills, however, only one study has examined laparoscopic skills, and only at a single station [3]. No study has comprehensively evaluated student performance across multiple laparoscopic stations. Laparoscopic surgery represents an increasing proportion of surgical procedures [4]. It possesses unique learning requirements, including spatial awareness, depth of perception, and dynamic force application.

Given these technical demands, reliably assessing performance is essential. Currently, no comprehensive, validated criteria exists to evaluate laparoscopic training performance. Previous metrics used include time to task completion [5]. However, trainees should prioritise correct surgical technique rather than speed. The Objective Structured Assessment of Technical Skills is a validated tool that was developed to evaluate surgical performance [6]. However, many of the questions are not applicable to laparoscopic training [3].

While several studies have evaluated the impact of a single or two-day surgical skills course [1, 2, 5], few have conducted an extended evaluation. Distributed practice over extended periods facilitates sustained skill improvement, which has been described as “a key marker of the efficacy of an intervention” [7].

Furthermore, few studies have assessed laparoscopic performance among medical students, a heterogeneous group with wide variation in psychomotor skills, making them an ideal population to study.

Although near-peer teaching of surgical skills is increasingly used in medical education, no study has rigorously evaluated sustained, objective improvements in student laparoscopic performance. This feasibility study had four aims: [1] to develop a novel objective assessment tool using the Modified Delphi Method; [2] to evaluate and assess change in student self-reported confidence; [3] to evaluate and assess change in student objective performance across multiple laparoscopic stations; and [4] to identify factors associated with objective performance.

Methods

Study design

This was a single blinded, prospective, randomised feasibility study. Ethical approval was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals (ECM 4(u) 19/11/2024 & ECM 3(e) 02/02/2025). Informed consent was obtained from study participants who approved use of their data for research purposes. While a formal power calculation was not possible, a pragmatic sample size of 42 participants was chosen to allow estimation of effect magnitude to inform future studies. This is consistent with recommendations that at least 30 participants be included in a feasibility study [8, 9].

Stations

All participants used the Laparo® Aspire Simulator [10] to complete four laparoscopic stations. These were Ball Transfer, Circle Cutting, Peg Transfer, and String, with time limits of seven, seven, two, and seven minutes respectively (Fig. 1). The “Peg Transfer” station trained foundational dexterity using bimanual coordination, midline transfer, and non-dominant hand use. As it was a simpler station, the time was reduced to two minutes. The “Ball Transfer” station was more difficult as it emphasized depth of perception and dynamic force application. This allowed for discrimination between scores. The “Circle Cutting” simulated tissue tension and replicated surgical dissection. It also allowed for strategies to be employed to complete the station. Finally, the “String” station tested depth of



Fig. 1 The four laparoscopic stations: string (top left), circle cutting (top centre), peg transfer (top right), ball transfer (bottom)

perception, anticipatory instrument positioning, and the ability to plan ahead.

Laparoscopic training

All participants completed a pre-intervention questionnaire (Appendices 1, 2) and received a standardised video presentation, demonstrating the objectives of each station. Following this, participants completed a pre-intervention recorded assessment.

Next, participants completed 30 minutes of training. This was divided into four seven-minute stations plus one minute of rest in between. Altogether, each participant received three hours of training (six 30-minute sessions). Each training session was one week apart to evaluate for skill retention. Two “Catch-Up Sessions” were included, allowing those who had missed a training session to attend. Following the final training session, participants completed a post-intervention questionnaire and recorded assessment.

Intervention

Prior to completing the pre-intervention questionnaire, participants were allocated to peer-taught (Group 1) or self-taught (Group 2) at a 1:1 ratio according to a random sequence generated by an independent administrator. Group 1 received instruction from senior medical students acting as near-peer teachers during training sessions, with a teacher-to-participant ratio of 1:4 to 1:5. Group 2 trained laparoscopy without near-peer teaching and were forbidden from teaching one another or from receiving feedback during the study period. Six near-peer teachers were recruited, each with at least six months of peer-teaching experience and prior completion of the Basic Surgical Skills Course [11]. Additionally, all near-peer teachers received a one-to-one tutorial from a surgical consultant covering the objectives of each station, ensuring correct technique was emphasised. They

also completed the Professional Development Service for Teachers’ Team Teaching Module [12]. This online module was accessible and tailored to novice teachers, covering basic teaching theories, feedback, and roles of teachers within a large group.

Modified Delphi method

A Modified Delphi Method was employed to develop an assessment tool for each station. It began with a draft questionnaire developed by the first author based on a literature review and preliminary framework. This was distributed to three experts in laparoscopic surgery and surgical education who provided feedback until unanimous consensus was achieved. The assessment domains of the assessment tool were unique for each station. Points were allocated for specific task anchors based on the performance quality of each step. The remaining points were allocated for bonuses, deductions, and subjective impression. The assessment tools are seen in Appendices 3–6.

Statistical methods

Pre- and post-intervention recorded assessments were scored by two blinded surgical trainees and analysed. Participant identity and group allocation could not be determined from the recordings. Participant objective performance and subjective confidence were reported as median with interquartile range. Participant improvement was defined as the difference between the median pre-intervention and median post-intervention total scores according to the novel objective assessment tool. Spearman’s rank-order correlation and Mann Whitney U Test determined association between variables and objective performance. Where baseline parity was not achieved, an ANCOVA test was conducted after verifying the assumption of homogeneity of regression slopes. One-way Intraclass Correlation Coefficient was calculated for the two blinded reviewer scores. Analysis was performed with Jamovi version 2.6.26.

Results

Participants

Altogether, 42 participants were included. Mean participant age was 22.9 years. 14 (33.33%) participants were male, while 28 (66.67%) were female. Participant demographics are described in Table 1. Seven participants (16.67%) were lost to follow up.

Pre-intervention objective performance

Using the Mann Whitney U Test, there was no significant performance difference between Group 1 and Group 2 in the “Ball Transfer” (Median difference = 4, $p = 0.37$, Effect Size = -0.17), “Circle Cutting”, (Median difference = 0.5, $p = 0.63$, Effect size = 0.09),

Table 1 Participant demographics. participant age, gender, year of study, and previous video game experience, split by group

	Group 1	Group 2
Age in Years (Mean +/- SD)	22.9 +/- 4.33	22.8 +/- 3.04
Gender		
Male	8	6
Female	13	15
Year of Study		
Year 1	11	9
Year 2	6	7
Year 3	3	4
Year 4	1	0
Year 5	0	1
Previous Video Game Experience		
Yes	14	16
No	7	5

“String” station (Median difference = 3.7, $p = 0.48$, Effect Size = 0.14), or participant confidence. However, Group 1 outperformed Group 2 in the “Peg Transfer” station (Median difference = 12, $p = 0.05$, Effect size = 0.36). One-way Intraclass Correlation was 0.845 for the “Ball Transfer” station, 0.897 for the “Circle Cutting”, 0.951 for the “Peg Transfer”, and 0.846 for the “String” station. Data is shown in Table 2.

Post-Intervention improvement

Post-intervention, participants in both groups improved across all four laparoscopic stations. The results for each station are summarised in Table 3. Using Wilcoxon Signed Rank Test, there was a significant improvement in both groups’ post-intervention objective scores in “Ball Transfer” station ($W = 0$, $p < 0.001$). No significant difference in improvement was seen between the two groups ($p = 0.77$) (Fig. 2). Similarly, both groups improved significantly in the “Circle Cutting” station ($W = 34.5$, $p < 0.001$). Group 1 outperformed Group 2 by five points ($p = 0.02$, Effect size = -0.44) (Fig. 2). Additionally, both groups improved significantly in the “String” station ($W = 27.5$, $p < 0.001$). Group 1 outperformed Group 2 by 25.5 points ($p = 0.01$, Effect size = -0.49) (Fig. 2). Additionally, both groups’ confidence improved significantly following the intervention ($W = 16.5$, $p < 0.001$), with no significant difference in improvement in confidence between the two groups ($p = 0.44$) (Fig. 2).

Both groups improved significantly in the “Peg Transfer” station ($W = 29$, $p < 0.001$). After controlling for baseline performance, the effect of group on improved objective performance was statistically significant, ($F(1, 29) = 4.64$, $p = 0.04$) (Table 4). Group 1 showed higher adjusted post-intervention “Peg Transfer” scores (EMM = 44.39, 95% CI, 33.9–55.9) compared with Group 2 (EMM = 27.7, 95% CI, 16.7–38.7) (Fig. 3).

Factor analysis: objective performance

Pre-intervention confidence was weakly correlated with “Ball Transfer” ($r = -0.24$), “Circle Cutting” ($r = 0.02$), “Peg Transfer” ($r = 0.1$), and “String” performance ($r = -0.22$). Participant age, gender, previous interest in surgery as a career, and video game exposure were not significantly associated with performance in any stations.

Discussion

This study represents the first comprehensive evaluation of near-peer teaching of laparoscopic surgical skills among medical students. The results suggests that near-peer teaching of laparoscopic skills improves objective performance, compared with self-teaching.

Our first aim was to develop a novel objective assessment tool using the Modified Delphi Method. Our objective assessment tool successfully demonstrated

Table 2 Pre-intervention performance and confidence scores by group. Median scores for each station and self-reported confidence are shown for group 1 (peer taught) and group 2 (self-taught). Median differences between groups and corresponding p-values are reported

Station	Median Score Group 1	Median Score Group 2	Median Difference	Significance (p)
Ball Transfer	39	35	4	0.37
Circle Cutting	10	10.5	0.5	0.63
Peg Transfer	16	4	12	0.05
String	22.8	26.5	3.7	0.48
Confidence	10	10	0	0.83

Table 3 Improvement in performance and confidence scores by group. Median scores for each station and self-reported confidence are shown for group 1 (near-peer taught) and group 2 (self-taught). Median differences between groups and corresponding p-values are reported

Station	Median Improvement Group 1	Median Improvement Group 2	Median Difference	Significance (p)
Ball Transfer	42	43.8	1.8	0.77
Circle Cutting	11	6	5	0.02
String	32	6.5	25.5	0.01
Confidence	19.5	20	0.5	0.44

improvement between pre- and post-intervention performance and between groups. Once validated, this tool offers medical students an accessible, objective metric to evaluate their laparoscopic performance.

In addressing our second aim of assessing change in student self-reported confidence, we observed that participants’ confidence in their surgical skills improved following practice, independent of group allocation. This is consistent with previous literature [13, 14]. While a systematic review has characterised subjective confidence as a “poor predictor” of performance [7], it may serve as a motivator to continue practising, and develop interest in surgery, as described in the competence-motivation theory [15, 16]. Therefore, the use of confidence as an outcome measure may be beneficial within undergraduate surgical education.

We also achieved our third aim of evaluating student objective laparoscopic performance. Participant pre-intervention objective performance was measured to establish parity between groups. No significant differences were observed between groups across the stations, except for the “Peg Transfer” task, where Group 1 performed better. This isolated finding was likely due to chance, however it prompted additional statistical analysis to evaluate post-intervention improvement. Although analysis of covariance yielded statistically significant results, this baseline disparity may limit the internal validity of results for this station.

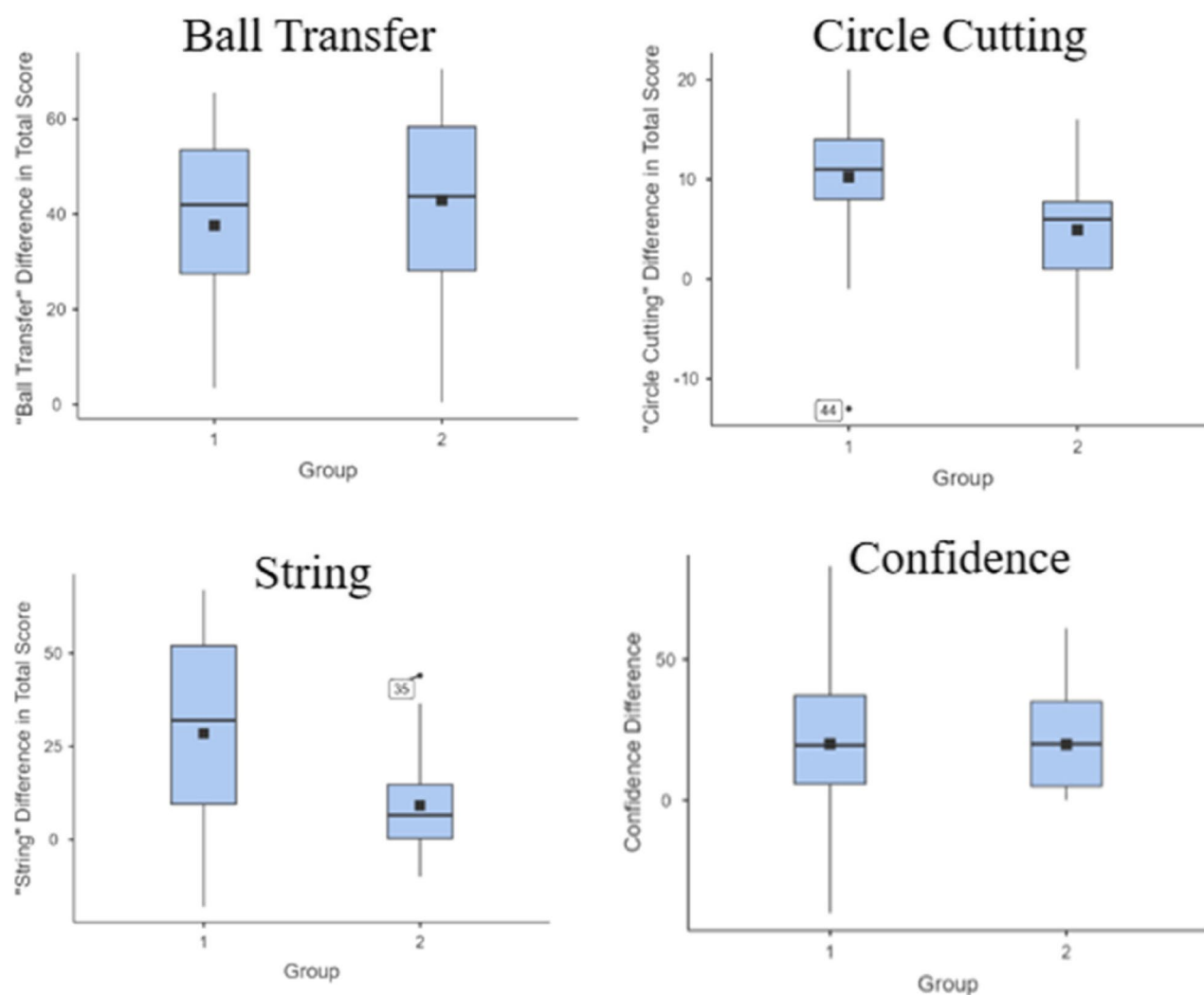


Fig. 2 Box Plots of difference in pre- and post-intervention total scores for the “ball transfer”, “circle cutting”, “string” station, and participant “confidence”. the plots show median improvement in scores (central line), interquartile ranges (boxes), mean (dots), and outliers for participants in group 1 and 2

Table 4 Analysis of covariance for post-intervention “Peg transfer” score. Results of the ANCOVA examining group differences in post-intervention “Peg Transfer” performance scores while controlling for baseline (pre-intervention) “Peg Transfer” performance scores. The model includes group as the fixed factor and pre-intervention objective performance as the covariate

	Sum of Squares	df	Mean Square	F	p
Overall model	1945.3	2	972.6	3.0674	0.062
Group	1930.3	1	1930.3	4.6382	0.040
Pre “Peg Transfer” Total score	14.9	1	14.9	0.0358	0.851
Residuals	12069.3	29	416.2		

Both groups improved significantly in all four stations post-intervention. This is the first study to demonstrate improved objective laparoscopic performance. Currently, many surgical societies lack laparoscopic trainers due to financial constraints [17]. The improvement in objective performance underscores the importance of funding and investment in laparoscopic equipment.

Group 1 significantly outperformed Group 2 in the “Circle Cutting” station, “String” station, and “Peg Transfer” station. These findings suggest that near-peer teaching positively influences objective laparoscopic performance, consistent with previous studies [18, 19]. The concept of cognitive and social congruence underpins near-peer teaching; It suggests that learners better understand material when taught by peers, as they share

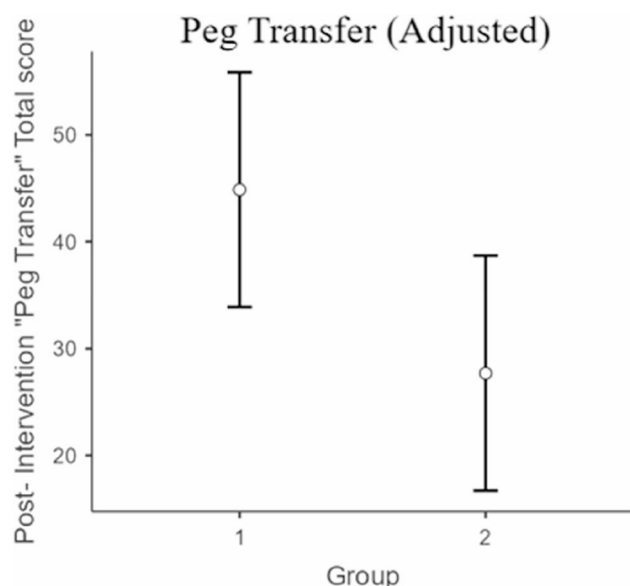


Fig. 3 Adjusted post-intervention “Peg Transfer” Total Scores by Group. Estimated marginal means (± 95% confidence intervals) for post-intervention “Peg Transfer” Total scores derived from the ANCOVA model, controlling for baseline (pre-intervention) performance. Group 1 demonstrated higher adjusted post-test performance compared with group 2

a similar knowledge foundation and feel more comfortable and supported [15].

However, Group 1 did not outperform Group 2 in the “Ball Transfer” station ($p=0.77$). This may be due to station design, as it emphasised dynamic force manipulation which may be difficult to verbally explain and teach. This aligns with theory of cognitive load [20]; a technically complex and unstable station may overwhelm learners’ working memory, negating the advantage of external instruction.

Our final aim was to identify factors associated with objective laparoscopic performance. We noted that patient age, previous interest in surgery as a career, and video game exposure were not associated with improved objective performance in any station. This contrasted with previous studies’ results [21, 22]. While our limited sample size may limit external validity of our results, they question the assumption that younger, technology-experienced individuals are inherently better at laparoscopic surgery. Our results suggest that modifiable factors, such as time spent practising may be more significant determinants of skill acquisition. This highlights the benefit of near-peer teaching and providing early surgical skills training opportunities to medical students.

This feasibility study employed a randomised design with a control group and two blinded evaluators. Despite many medical students attending out-of-city hospital placements, only seven (16.67%) participants were lost to follow up. An attrition rate below 20% is considered to

pose minimal risk to study validity [23]. Furthermore, our attrition rate is comparable to previous studies with only a two-session workshop [18]. This may reflect our inclusion of two additional “Catch-Up Sessions” to maximise participant completion.

Limitations associated with the study include its single centre design and limited sample size with convenience sampling. This ensured feasibility, however limited the external validity of results and ability to draw firm conclusions that inform educational practise.

Regarding the “Peg Transfer” station, although analysis of covariance adjusted for baseline differences, this approach cannot completely eliminate the influence of initial group imbalance. Residual confounding may remain and the adjusted group differences should be interpreted with caution for this station.

Additionally, while the novel assessment tool proved sensitive to change in performance, it was not externally validated. This limited the validity and comparability of results.

Conclusions

We successfully developed a novel objective assessment tool to evaluate student objective laparoscopic performance. Near-peer teaching significantly improved laparoscopic performance among medical students compared with self-directed learning. We also observed increased student confidence in their surgical skills. These findings support the inclusion of near-peer teaching within undergraduate curricula. A multi-centre randomised controlled trial, powered using effect sizes generated from this study is warranted to confirm efficacy and validate the novel assessment tool.

Appendix

Participant questionnaire page 1 of 2

1. What is your participant number?

2. What is your age?

3. What is the gender you identify as?
 a) Male
 b) Female
 c) Non-binary
 d) Prefer Not to say
 e) Other _____
4. Which year in Medicine are you currently in?
 a) DEM Year 1
 b) DEM Year 2
 c) DEM Year 3
 d) DEM Year 4
 e) DEM Year 5
 f) GEM Year 1
 g) GEM Year 2
 h) GEM Year 3
 i) GEM Year 4
5. Have you previously considered surgery as a future career?
 a) Yes
 b) No

Participant questionnaire page 2 of 2

6. How likely are you to pursue surgery as a future career?
- Very unlikely
 - Unlikely
 - Maybe
 - Likely
 - Very likely
7. On a scale of 1-100, how confident are you in your surgical skills at present?
1=Not confident at all, 100 = Extremely confident
8. Have you ever played video games before?
- Yes
 - No
9. Do you currently play video games?
- Yes
 - No
10. How frequently did / do you play video games?
- Every week or less
 - Once per week
 - Several times per week
 - Daily
11. Have you completed any elective rotations or placements related to surgery?
- Yes
 - No
12. Have you ever experienced any difficulties or barriers in learning surgical skills?
- Yes
 - No

Ball transfer evaluator sheet

Ball Transfer

Picks up Ball (Either Hand) (1-2.5 points)	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	Total
First Attempt (2.5pts)											
Multiple Attempts (1pt)											
Mid-Air Transfer (0-2 points)											
Smooth, Efficient (2pts)											
Too Slow (1pt)											
Fails to transfer (0pts)											
Preparation (0-1 point)											
Lines Up Ball Close to Goal (1pt)											
Does Not (0pts)											
Release of Ball (1-3 points)											
Smooth, No Collision or Dropping (3pts)											
Grasper Collides with Goal but Successful Release (2pts)											
Multiple Attempts (1pt)											

Faults (Deductions)

Drops Ball (-1 pt per ball) (-__ pts)
Grasper outside Frame (1 pt/sec. Max -10) (-__ pts)

Bonus/Proficiency Points

No Balls Dropped ☐ (5 pts)
After 1x ball in each goal, 1 point for each additional ball successfully placed (Max 10) (____ pts)

Time Taken (Seconds): ____ sec

Final Score Calculation

Task Score (1+2+3): ____ / 85
Deductions: -____
Bonus Points: +____
FINAL SCORE = ____ / 100

Circle cutting evaluator sheet

Cutting a circle

Grabs Glove with Grasper (0-5 points)	
Grabs Superficial Layer + Applies Traction (5pts)	
Grabs Both Layers / No Traction / Poor Placement for Cutting Hand (3pts)	
Doesn't grab (0pts)	
First Cut (0-5 point)	
Pierces Glove Correctly (Between Lines) (5pts)	
Cuts Outside of Line (0pts)	

Faults (Deductions)

Pierces 2nd layer of glove (-2pts) ☐ (-2 pts)
Graspers Outside Camera View (-1 pt/sec. Max -5) (-__ pts)

Bonus/Proficiency Points

Repositions Grasper as appropriate ☐ 0 ☐ 1 ☐ 2 ☐ 3
Scissors Curve Corresponds to Shape of Circle ☐ 0 ☐ 1 ☐ 2 ☐ 3
Navigates Change in Direction Well (Second Half of Circle) ☐ 0 ☐ 1 ☐ 2 ☐ 3
Cuts with base of scissors as appropriate ☐ 0 ☐ 1

Overall Performance

Smoothness of Circle
(Evaluator's Impression. Score 0 if cuts outside lines) ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Time Taken (Seconds): ____ sec

Final Score Calculation

Task Score (1+2+3): ____ / 10
Deductions: -____
Bonus Points: +____
FINAL SCORE = ____ / 25

Peg transfer evaluator sheet

Peg Transfer Scoring Sheet

Pick Up with Ipsilateral Hand (0-1 point)	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Total
First attempt (1 pt)													
Multiple attempts (0pts)													
Mid-Air Transfer (0-2 points)													
Smooth, 1st Attempt (Correct Grab) (2pts)													
Incorrect grab / Too Much Tension (1pt)													
Multiple grabs / Fail (0pts)													
Setting Down with Opposite Hand (0-2 points)													
Smooth placement (2pts)													
Collision between Peg & Grasper (1pt)													
Failure to place peg (0pts)													

Faults (Deductions)

Dropped peg (-1pt/peg) (-__ pts)
Instrument outside Frame (-1 pt/sec. Max -10) (-__ pts)

Bonus/Proficiency Points

No pegs dropped altogether ☐ (5 pts)
Execution (Evaluator's Impression) ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4
Simultaneous use of Both Hands ☐ 0 ☐ 1 ☐ 2

Time Taken (Seconds): ____ sec

Final Score Calculation

Task Score: ____ / 60
Deductions: -____
Bonus Points: +____
FINAL SCORE = ____ / 75

String evaluator sheet

String Through Hoops

Picks up String (Either Hand) (0-1 point)	H1	H2	H3	H4	H5	H6	H7	H8	H9	Total
Yes (1pt)										
No (0pts)										
Transfers String to Opposite Hand (0.5-1 points)										
No Collision + Grabs at Correct Spot (1-2cm) (3pts)										
Collision / Incorrect Grab / Multiple Attempts / Doesn't transfer (0.5pts)										
Puts Loop through Hoop (1-3 points)										
First Attempt, Doesn't Withdraw (3pts)										
First Attempt but Withdraws (2pts)										
Multiple Attempts (1pt)										
Regrabs + Pulls through (Either Hand) (1-2 points)										
First Attempt (2pts)										
Multiple Attempts (1pt)										

Faults (Deductions)

Moves Board Due to Tension ☐ (-3 pts)
Grasper outside Camera Frame (-1 pt/sec. Max -10) ☐ (-____ pts)

Bonus/Proficiency Points

Overall Smoothness (Evaluator's Impression) ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4

4 ☐ 5

Simultaneous Use of Both Hands ☐ 0 ☐ 1 ☐ 2

Plans ahead for String Consumption ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4

4 ☐ 5

Time Taken (Seconds): ____ sec

Final Score Calculation

Task Score (1+2+3): ____ / 63

Deductions: ____

Bonus Points: ____

FINAL SCORE = ____ / 75

Acknowledgements

The authors would like to thank the ASSERT Centre at University College Cork, the University College Cork Surgical Society, as well as the near-peer teachers and site volunteers for their valuable contributions and support. The authors gratefully acknowledge the Mercy Hospital Foundation for grant support of this research.

Authors' contributions

Author contributions: MH - study conception, study design, data collection, data analysis, manuscript. LH - study design, supervision, manuscript. LD - study conception, data analysis, manuscript. YR - study conception, data collection, manuscript. JN - data collection, data analysis, manuscript. AOB - data collection, data analysis, manuscript. SA - data collection, manuscript. DH - study design, supervision, manuscript.

Funding

No funding was sought or received for the construction of this manuscript.

Data availability

Participants provided informed consent for the use of their data for research purposes, including publication, but did not consent to public data sharing. In accordance with the approval granted by the Clinical Research Ethics Committee of the Cork Teaching Hospitals (ECM 4(u) 19/11/2024 & ECM 3(e) 02/02/2025), data may be made available upon reasonable request to the corresponding author, subject to ethical and institutional approval.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals (ECM 4(u) 19/11/2024 & ECM 3(e) 02/02/2025). All participants provided informed consent for study participation.

Consent for publication

Informed consent was obtained from the study participants who approved the use of their data for publication.

Competing interests

The authors declare no competing interests.

Received: 10 October 2025 / Accepted: 10 December 2025

Published online: 21 February 2026

References

- Down B, Morris S, Kulkarni S, Mohiuddin K. Effectiveness of a multi-session combined near-peer and faculty-led surgical skills course on self-perceived ability to perform basic surgical skills. *Annals Med Surg.* 2020;57:153–6.
- Ong MN, Lew KM, Cheong YJ, Xuan Ting EW, Bohari B, Yita T et al. Can We Use Peer-Assisted Learning to Teach Basic Surgical Skills? *Malays J Med Sci.* 2020;27(5):101. Cited 16 Sep 2024. Available from: <http://pmc/articles/PMC7605839/>.
- Pintér Z, Kardos D, Varga P, Kopjár E, Kovács A, Than P et al. Effectivity of near-peer teaching in training of basic surgical skills – a randomized controlled trial. *BMC Med Educ.* 2021;21(1):1–8. Cited 1 Nov 2024. Available from: <https://bmcmmededuc.biomedcentral.com/articles/10.1186/s12909-021-02590-2>.
- Buia A, Stockhausen F, Hanisch E. Laparoscopic surgery: A qualified systematic review. *World J Methodol.* 2015;5(4):238. Cited 1 Nov 2024. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4686422/>.
- Rosser JC, Rosser LE, Savalgi RS. Objective Evaluation of a Laparoscopic Surgical Skill Program for Residents and Senior Surgeons. *Archives of Surgery.* 1998;133(6):657–61. Cited 1 Nov 2024. Available from: <https://jamanetwork.com/journals/jamasurgery/fullarticle/211624>.
- OSATS | RCOG. Cited 1 Sep 2025. Available from: <https://www.rcog.org.uk/car-eers-and-training/training/assessment-and-progression-through-training/workplace-based-assessments-wpbas/osats/>.
- Glossop SC, Bhachoo H, Murray TM, Cherif RA, Helo JY, Morgan E et al. Undergraduate teaching of surgical skills in the UK: systematic review. *BJS Open.* 2023;7(5). Cited 1 Nov 2024. Available from: <https://doi.org/10.1093/bjsopen/zrad083>.
- Totton N, Lin J, Julious S, Chowdhury M, Brand A. A review of sample sizes for UK pilot and feasibility studies on the ISRCTN registry from 2013 to 2020. *Pilot Feasibility Stud.* 2023;9(1):1–11. Dec 1 Cited 3 Sep 2025. Available from: <https://pilotfeasibilitystudies.biomedcentral.com/articles/10.1186/s40814-023-01416-w>.
- Kieser M, Wassmer G. On the use of the upper confidence limit for the variance from a pilot sample for sample size determination. *Biometrical Journal.* 1996;38(8):941–9. Cited 3 Sep 2025. Available from: <https://doi.org/10.1002/bimj.4710380806>.
- Laparoscopic simulator - Aspire Master. - Laparo Medical Simulators - training / dissection / for general care. Cited 6 Sep 2025. Available from: <https://www.medicaexpo.com/prod/laparo-medical-simulators/product-120403-1069695.html>.
- Course Details | Basic. Surgical Skills | RCSED. Cited 2 Oct 2025. Available from: <https://services.rcsed.ac.uk/events-courses/course-details-basic-surgical-skills>.
- Team Teaching | PDST. Cited 30 Aug 2025. Available from: <https://pdst.ie/primary/stem/numeracy-team-teaching>.
- Adkins SE, Minchew HM, Sanner Dixon K, Chollet Hinton L, Kilgore LJ, Berbel G. A Hands-On Surgical Event to Improve Medical Student Operating Room Confidence. *Journal of Surgical Research.* 2023;290:156–63. Cited 20 Aug 2025. Available from: <https://www.journalofsurgicalresearch.com/action/showFullText?pii=S0022480423001981>.
- Bowers MF, Lopez AM, Thota J, Baechle J, Offodile R. Peer-to-Peer Basic Surgical Skills Training may be as Effective as Faculty. *J Natl Med Assoc.* 2020;112(5):S18. Cited 20 Aug 2025. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0027968420302285>.
- Ten Cate O, Ten DS. Dimensions and psychology of peer teaching in medical education. *Med Teach.* 2007;29(6):546–52. Cited 27 Aug 2025. Available from: https://scholar.google.com/scholar_url?url=https://www.tandfonline.com/doi/pdf/10.1080/01421590701583816%3Fcasa_token%3D11ijX7BDrBwAAAAA:lsiqLjF5oGXcgCA6BFXToCKdGfCMf42bdxpHBAm90Xy23Ffy-kcxPz_NxPyXSQ83AzMVsdq4_yj_g&hl=en&sa=T&oi=ucasa&ct=ucasa&ei=oXOvalf6D7_SieoPzJnIoAQ&scisig=AAZF9b-hu9ptJpXCcRIO0Fajsfkz.

16. Motivation reconsidered. The concept of competence. Cited 28 Aug 2025. Available from: <https://psycnet.apa.org/record/1961-04411-001>.
17. Achanga BSA, Bisimwa CW, Femi-Lawal VO, Akwo NS, Toh TF. Surgical Practice in Resource-Limited Settings: Perspectives of Medical Students and Early Career Doctors: A Narrative Review. *Health Sci Rep*. 2025;8(1):e70352. Cited 2 Sep 2025. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11729344/>.
18. Preece R, Dickinson EC, Sherif M, Ibrahim Y, Ninan AS, Aildasani L et al. SHORT COMMUNICATION Peer-assisted teaching of basic surgical skills. *Med Educ Online*. 2015;20(1). Cited 20 Aug 2025. Available from: <https://pubmed.ncbi.nlm.nih.gov/26044400/>.
19. Lee KS, Priest S, Wellington JJ, Owoso T, Osei Atiemo L, Mardanpour A et al. Surgical Skills Day: Bridging the Gap. *Cureus*. 2020 ;12(5). Cited 20 Aug 2025. Available from: <https://pubmed.ncbi.nlm.nih.gov/32550051/>.
20. Howie EE, Dharanikota H, Gunn E, Ambler O, Dias R, Wigmore SJ et al. Cognitive Load Management: An Invaluable Tool for Safe and Effective Surgical Training. *J Surg Educ*. 2023;80(3):311–22. Cited 28 Aug 2025. Available from: <https://www.sciencedirect.com/science/article/pii/S1931720422003415>.
21. Sammut M, Sammut M, Andrejevic P. The benefits of being a video gamer in laparoscopic surgery. *Int J Surg*. 2017;45:42–6.
22. Martin AN, Hu Y, Le IA, Brooks KD, Mahmutovic A, Choi J, et al. Predicting surgical skill acquisition in preclinical medical students. *Am J Surg*. 2016;212(4):596–601.
23. Straus SE, Paul G, WScott R, Haynes RBrian. Evidence-based medicine: how to practice and teach EBM. 2019;324.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.