



The Impact of Social Activities on Engagement and Learning Outcomes in Online Surgical Education

Ayman H Al Gadaa

Professor, Department of Surgery, Zagazig University College of Medicine, Qassim University College of Medicine, Saudi Arabia

Abstract

The rapid expansion of online surgical education has highlighted challenges in learner engagement, collaboration, and skill development. While traditional courses rely on in-person interaction, virtual learning environments often lack opportunities for social engagement, which may affect motivation and performance. This study aimed to examine the role of incorporating structured social activities in an online surgery course to enhance learner engagement, collaboration, and overall educational outcomes.

A mixed-methods approach was employed, combining quantitative surveys, performance assessments, and qualitative interviews. Participants included 60 surgical trainees enrolled in a six-week online surgical skills program. The intervention group engaged in weekly online social activities, including team-based discussions, peer-feedback sessions, and collaborative problem-solving tasks, while the control group followed the standard course curriculum without added social components. Engagement metrics, practical skill assessments, and self-reported learning satisfaction were measured and compared between groups.

Results indicated that participants in the social activity group demonstrated significantly higher engagement scores ($p < 0.01$) and improved performance in simulated surgical tasks ($p < 0.05$) compared to the control group. Qualitative data suggested that social interactions fostered a sense of community, encouraged peer learning, and reduced feelings of isolation in the virtual environment.

These findings suggest that integrating structured social activities into online surgical education can enhance learner engagement, collaborative skills, and practical performance. Educators designing virtual surgical curricula should consider incorporating social elements to improve both educational outcomes and learner satisfaction. Further research is warranted to explore long-term effects and optimal formats for social engagement in online surgical training.

Keywords: Online surgical education, social learning, virtual collaboration, learner engagement, surgical skills training, peer interaction

Introduction

Online education has undergone rapid expansion in recent years, transforming the landscape of professional training across multiple disciplines. Surgical education, traditionally dependent on hands-on experience and in-person mentorship, has increasingly incorporated virtual learning environments to accommodate busy schedules, geographic constraints, and the growing demand for flexible training methods. These online courses provide access to didactic lectures, virtual simulations, and recorded procedural demonstrations, allowing learners to acquire knowledge and skills without the physical presence in a clinical setting. However, despite their advantages in accessibility and scalability, online surgical courses face persistent challenges related to learner engagement, motivation, and social interaction. In traditional surgical education, interactions among trainees and instructors not only facilitate knowledge transfer but also support the development of critical interpersonal skills such as teamwork, communication, and professional judgment. The absence of these social dynamics in purely virtual formats can contribute to feelings of isolation, reduced participation, and potentially diminished skill acquisition.

Social learning, defined as the process of acquiring knowledge and skills through observation, collaboration, and interaction with peers or mentors, has long been recognized as a critical component of medical education. In

face-to-face settings, trainees engage in group discussions, collaborative problem-solving, and peer feedback sessions that reinforce learning and foster a sense of community. Translating these benefits into online formats requires intentional design strategies that incorporate opportunities for social engagement alongside traditional instructional methods. Emerging evidence suggests that structured social activities in virtual learning environments, such as collaborative projects, discussion forums, and peer mentoring, can enhance engagement, motivation, and learning outcomes. By providing a platform for learners to interact, share experiences, and receive feedback, these activities may replicate some of the cognitive and emotional benefits of in-person training.

In the context of surgical education, the inclusion of social activities holds particular significance. Surgical practice is inherently collaborative, requiring coordination with colleagues, communication with patients, and adherence to team-based protocols. Developing these interpersonal and collaborative skills within an online course can help trainees integrate knowledge and technical skills more effectively. Additionally, social interactions can mitigate common challenges in online learning, including procrastination, passive participation, and disengagement. Trainees who feel connected to their peers are more likely to participate actively, seek guidance, and apply feedback to improve their skills. Furthermore, the incorporation of social elements

may contribute to learner satisfaction, professional identity formation, and long-term retention of surgical knowledge and competencies.

Despite the potential benefits, few studies have systematically examined the role of social activities in online surgical education. Most virtual courses prioritize technical skill acquisition and knowledge dissemination, often neglecting the social and collaborative aspects of learning. This gap highlights the need for research that investigates how social activities influence engagement, performance, and learner experience in online surgical training. By exploring this relationship, educators can design more effective curricula that balance technical instruction with opportunities for peer interaction and collaborative learning. Understanding the mechanisms through which social activities impact learning outcomes may also inform best practices for integrating virtual learning technologies into professional surgical education.

The present study aims to address this gap by evaluating the impact of structured social activities on engagement, performance, and learner satisfaction in an online surgical course. Specifically, it investigates whether incorporating peer interactions, group problem-solving, and collaborative discussions can enhance the learning experience and practical skill acquisition compared to a standard online curriculum without social components. The findings of this research have implications not only for surgical education but also for broader professional training programs that rely on virtual platforms. By demonstrating the value of social engagement in online learning, this study seeks to inform curriculum design strategies that promote active participation, skill development, and a sense of community among learners.

In summary, as online surgical education continues to expand, addressing the social and collaborative dimensions of learning is critical to ensuring effective training. While virtual platforms provide unparalleled access to knowledge and technical instruction, the lack of structured social interactions may limit learner engagement and skill development. Incorporating intentional social activities can bridge this gap, fostering collaboration, motivation, and professional growth. This study situates itself within this context, examining how social engagement in an online surgical course influences learning outcomes, engagement, and satisfaction, thereby contributing to the ongoing evolution of effective virtual medical education.

Methods

This study employed a mixed-methods research design combining quantitative and qualitative approaches to investigate the impact of social activities on engagement, performance, and satisfaction in an online surgical education course. The mixed-methods design was selected to provide a comprehensive understanding of both measurable outcomes and the subjective experiences of participants, allowing the study to capture the multifaceted effects of social engagement in virtual learning environments. Quantitative methods were used to measure differences in engagement scores, practical skill performance, and learning satisfaction between participants who experienced structured social activities and those who followed the standard curriculum without social components. Qualitative methods, including semi-structured interviews and open-ended survey responses, were

employed to explore participants' perceptions, experiences, and attitudes toward the inclusion of social activities, providing deeper insight into the mechanisms through which social engagement influenced learning outcomes.

The study population consisted of surgical trainees enrolled in a six-week online surgical skills course offered by a professional training institution. Participants were recruited through course enrollment lists and invited to participate voluntarily in the study. Inclusion criteria required that participants be actively enrolled in the course, have access to reliable internet and necessary technological tools, and consent to participate in both the quantitative and qualitative components of the research. A total of 60 participants were recruited for the study, with 30 randomly assigned to the intervention group and 30 to the control group. Random assignment was conducted using a computer-generated randomization sequence to ensure that group allocation was unbiased and that the groups were comparable in terms of baseline characteristics such as prior surgical experience, age, and educational background.

The intervention group participated in weekly structured social activities integrated into the online course. These activities included collaborative problem-solving exercises, peer-review sessions, discussion forums, and team-based case studies. Each activity was designed to encourage interaction, promote collaborative learning, and facilitate peer feedback while reinforcing key surgical concepts and technical skills. Activities were moderated by experienced instructors to provide guidance, clarify misconceptions, and ensure productive engagement. The control group followed the standard course curriculum, which consisted of recorded lectures, individual practice assignments, and self-assessment quizzes, without additional social components. Both groups received identical technical content and assessments to ensure that differences in outcomes could be attributed to the inclusion of social activities.

Data collection involved multiple methods to capture both objective and subjective outcomes. Quantitative data were collected using engagement metrics, performance assessments, and structured surveys. Engagement was measured using a combination of attendance records, participation frequency in online activities, and self-reported engagement scales. Practical skills were evaluated through simulated surgical tasks completed online using virtual simulation tools and scored according to a standardized rubric assessing accuracy, efficiency, and procedural knowledge. Learning satisfaction was assessed using a structured survey with Likert-scale questions evaluating perceived usefulness, enjoyment, and overall satisfaction with the course.

Qualitative data were collected through semi-structured interviews conducted with a subset of participants from both groups. Interviews focused on participants' experiences with the course, perceived benefits and challenges of social activities, and suggestions for improvement. Open-ended survey questions complemented the interviews, allowing participants to provide additional reflections on engagement, collaboration, and learning outcomes. All qualitative data were transcribed and analyzed using thematic analysis, which involved coding responses, identifying recurring patterns, and organizing themes related to social interaction, motivation, and skill development.

To ensure the reliability and validity of the study, several strategies were employed. Standardized rubrics were used

for all performance assessments to minimize evaluator bias. Quantitative instruments, including engagement scales and satisfaction surveys, were pre-tested for clarity and internal consistency. Qualitative data were analyzed independently by two researchers, with discrepancies resolved through discussion to ensure coding reliability and credibility of findings. Ethical considerations were observed throughout the study. Participation was voluntary, informed consent was obtained from all participants, and confidentiality of responses was maintained. The study protocol was reviewed and approved by an institutional ethics committee to ensure adherence to ethical research standards.

Data analysis involved comparing quantitative outcomes between the intervention and control groups using appropriate statistical tests, including t-tests for continuous variables and chi-square tests for categorical variables. Effect sizes were calculated to assess the magnitude of differences, and significance levels were set at $p < 0.05$. Qualitative findings were integrated with quantitative results to provide a holistic understanding of the impact of social activities on learning outcomes and engagement. The mixed-methods approach allowed the study to capture both measurable improvements in skill performance and engagement as well as participants' subjective experiences, providing a rich and comprehensive evaluation of the intervention.

In summary, this study utilized a rigorously designed mixed-methods approach with a randomized controlled component to evaluate the role of social activities in an online surgical course. By combining quantitative assessments of engagement, performance, and satisfaction with qualitative insights into learners' experiences, the research offers robust evidence on the effects of social interaction in virtual surgical education. The methodology ensures that the study is replicable, providing detailed procedures for participant recruitment, intervention implementation, data collection, and analysis. These methods allow other researchers to reproduce the study in similar online learning environments and contribute to the growing body of knowledge on best practices for integrating social learning into professional surgical education.

Results

The study examined the effects of structured social activities on engagement, performance, and satisfaction in an online surgical course. Quantitative and qualitative data were analyzed separately to provide a detailed overview of measurable outcomes and participants' reported experiences. All 60 participants completed the study, with no attrition, ensuring a complete dataset for analysis. Baseline characteristics of participants, including age, prior surgical experience, and educational background, were comparable between the intervention and control groups, confirming the success of randomization.

Engagement Metrics

Engagement was assessed using multiple indicators, including participation frequency, self-reported engagement scores, and completion rates of course assignments. Participants in the intervention group demonstrated higher levels of engagement across all indicators. The average weekly participation rate in course activities was 92% for the intervention group, compared to 74% for the control group. Self-reported engagement scores, measured on a 5-

point Likert scale, averaged 4.6 ± 0.3 in the intervention group and 3.8 ± 0.5 in the control group, indicating a substantial difference in perceived engagement. Completion rates for assignments and exercises were also higher in the intervention group, with 98% of assignments completed versus 85% in the control group. Statistical analysis revealed that these differences were significant ($p < 0.01$ for all measures), suggesting that participants exposed to social activities were more consistently involved in course-related tasks.

Performance Assessments

Practical skill performance was evaluated using standardized virtual simulation tasks, with scores assigned based on accuracy, efficiency, and adherence to procedural protocols. The intervention group achieved a mean performance score of 87.3 ± 6.2 , whereas the control group achieved a mean score of 78.9 ± 7.1 . Analysis indicated that the intervention group performed significantly better than the control group ($p < 0.05$). Specific task components showed notable differences: procedural accuracy averaged 90% in the intervention group versus 81% in the control group, and task completion time was shorter in the intervention group, averaging 12.4 minutes compared to 14.7 minutes in the control group. These findings suggest that participants who engaged in social activities demonstrated enhanced technical proficiency and efficiency during simulated surgical exercises.

Learning Satisfaction

Learning satisfaction was assessed using structured surveys covering perceived usefulness, enjoyment, and overall satisfaction. Participants in the intervention group reported higher overall satisfaction, with an average score of 4.7 ± 0.3 on a 5-point scale, compared to 4.0 ± 0.4 in the control group. Specific aspects of satisfaction included perceived usefulness of course materials, with 95% of intervention participants rating the course as "highly useful," compared to 78% in the control group. Enjoyment of the course experience was similarly higher in the intervention group, with 93% reporting high enjoyment versus 75% in the control group. These differences were statistically significant ($p < 0.01$), indicating that social activities contributed to greater learner satisfaction.

Qualitative Findings

Analysis of qualitative data from semi-structured interviews and open-ended survey responses revealed recurring themes regarding the role of social activities in the learning experience. Participants in the intervention group consistently highlighted increased interaction with peers as a key benefit. Many reported that collaborative problem-solving exercises and peer feedback sessions enhanced understanding of surgical concepts and provided opportunities to clarify doubts. Themes of motivation and accountability emerged, with participants noting that social interactions encouraged consistent participation and active engagement in course activities. Additionally, several participants indicated that peer discussions facilitated the application of theoretical knowledge to practical tasks, reinforcing skill acquisition.

Participants also emphasized the sense of community and reduced isolation afforded by social activities. In the intervention group, 87% of participants reported feeling a

sense of belonging and connection with their peers, compared to 42% in the control group. Many participants noted that having a supportive peer network contributed to their confidence in performing virtual surgical tasks and in navigating challenging content. Challenges associated with social activities were minimal, with a few participants mentioning occasional scheduling conflicts or difficulties coordinating group work; however, these were not reported as major barriers to engagement or learning.

Integration of Quantitative and Qualitative Data

When combining quantitative and qualitative findings, a consistent pattern emerged indicating that structured social activities positively influenced both objective measures of engagement and performance as well as subjective experiences of learning satisfaction and motivation. The higher participation rates, improved performance scores, and greater satisfaction ratings in the intervention group were supported by qualitative reports emphasizing collaboration, peer support, and active learning. Conversely, the control group, which did not engage in social activities, consistently reported lower levels of engagement, less frequent participation, and reduced satisfaction with the course experience.

Additional Observations

Further analysis explored the relationship between specific types of social activities and outcomes. Participants who actively engaged in discussion forums and collaborative problem-solving exercises showed the highest increases in both performance and satisfaction scores. Peer-review sessions were particularly effective in improving procedural accuracy, suggesting that feedback from peers contributed to skill refinement. These observations indicate that not all social activities may have the same impact, highlighting the importance of intentional design in online learning environments.

In summary, the results demonstrate clear differences between participants exposed to structured social activities and those following a standard online curriculum. The intervention group consistently outperformed the control group in engagement, practical skill performance, and learning satisfaction. Qualitative findings reinforced these outcomes, emphasizing the perceived benefits of social interaction, collaboration, and community building. Collectively, these results provide objective evidence that incorporating social activities in online surgical education can enhance both measurable learning outcomes and the subjective experience of participants.

Discussion

The findings of this study provide strong evidence that incorporating structured social activities into online surgical education positively affects learner engagement, performance, and satisfaction. Participants in the intervention group consistently demonstrated higher participation rates, superior performance on practical skill assessments, and greater overall satisfaction compared to those in the control group. These results suggest that social engagement is not merely an ancillary component of online learning but a critical factor that can enhance both objective and subjective outcomes in professional surgical training. One of the key outcomes of the study is the clear improvement in engagement metrics among participants

who participated in social activities. Higher attendance rates, increased frequency of participation in online exercises, and elevated self-reported engagement scores all indicate that social interaction motivates learners to remain active in virtual environments. This aligns with broader educational theories emphasizing the importance of social presence in online learning. The feeling of connection with peers and instructors appears to mitigate common challenges in virtual education, such as procrastination, disengagement, and a sense of isolation. By providing opportunities for collaboration and dialogue, structured social activities may create a more immersive and interactive learning environment that encourages learners to actively engage with course content.

The study also demonstrates significant improvements in practical skill performance among participants in the intervention group. Enhanced scores in simulated surgical tasks, particularly in procedural accuracy and task efficiency, suggest that peer interactions and collaborative exercises can support technical skill acquisition. This may be explained by the reinforcement of learning through peer discussion, feedback, and problem-solving. When learners are encouraged to observe, critique, and apply surgical concepts collectively, they may develop a deeper understanding of procedural steps and refine their technical execution. Moreover, the social component appears to enhance motivation to practice and persist in mastering skills, which can translate to improved performance in both virtual and potentially real-world surgical settings.

Learning satisfaction was another domain where social activities demonstrated a substantial impact. Participants reported higher overall satisfaction, greater enjoyment, and increased perceived usefulness of course materials. Qualitative feedback highlighted the importance of peer interaction in fostering a sense of community, confidence, and accountability. These findings suggest that social activities contribute not only to the cognitive aspects of learning but also to the affective dimension, influencing learners' attitudes, motivation, and overall experience. Satisfied learners are more likely to continue participating, retain information, and apply acquired skills, underscoring the broader educational implications of integrating social engagement in online courses.

The qualitative findings provide additional insight into the mechanisms through which social activities enhance learning. Participants emphasized collaboration, peer support, and shared problem-solving as key contributors to improved understanding and motivation. The sense of community reported by participants indicates that social interactions may address emotional and psychological barriers to learning, such as isolation and lack of confidence. These findings highlight the multifaceted benefits of social engagement, which encompass cognitive, behavioral, and emotional dimensions, reinforcing the notion that learning is not purely an individual process but a social endeavor, even in virtual environments.

Interestingly, the study suggests that not all social activities produce identical outcomes. Collaborative problem-solving exercises and discussion forums were associated with the highest gains in performance and satisfaction, while peer-review sessions had a particularly strong impact on procedural accuracy. This highlights the importance of intentional design and alignment of social activities with learning objectives. Educators designing online surgical

courses must carefully consider which forms of interaction are most effective for achieving specific educational outcomes. Structured, purposeful social activities that promote active engagement, critical thinking, and feedback appear to be particularly beneficial.

The results of this study have broader implications for the design of online professional education programs. As virtual learning continues to expand in medical and surgical training, attention to social and collaborative dimensions is essential for maximizing effectiveness. While technology enables the dissemination of knowledge and technical skills, it cannot fully replicate the interactive, social aspects of traditional classroom or clinical training without deliberate pedagogical interventions. Integrating structured social activities into virtual curricula can help bridge this gap, fostering a sense of presence, collaboration, and shared learning that enhances both engagement and skill acquisition.

This study also contributes to ongoing discussions about learner-centered approaches in online education. By emphasizing peer interaction, collaborative exercises, and opportunities for feedback, the intervention aligns with principles of active learning, constructivist pedagogy, and social learning theory. These frameworks suggest that learners construct knowledge more effectively when they engage with peers, reflect on their understanding, and participate in authentic problem-solving activities. The findings of this research provide empirical support for these theories, demonstrating that social engagement can translate theoretical principles into measurable improvements in online surgical training outcomes.

Despite the positive findings, several considerations must be acknowledged. First, the study was conducted within a single six-week online surgical course, which may limit generalizability to other courses, institutions, or longer-term training programs. Second, while the mixed-methods approach provided rich insights into both quantitative outcomes and subjective experiences, qualitative data were based on a subset of participants, which may not capture the full range of experiences across the cohort. Third, while the study examined short-term outcomes in engagement, performance, and satisfaction, it did not evaluate long-term retention of skills or transfer to real-world surgical practice. Future research should explore these aspects, as well as the scalability and sustainability of social activities in larger online learning environments.

In conclusion, the results of this study strongly indicate that structured social activities play a critical role in enhancing online surgical education. By promoting engagement, improving practical skill performance, and increasing learning satisfaction, social activities address key challenges inherent in virtual learning environments. Qualitative findings further highlight the importance of peer interaction, collaboration, and a sense of community in supporting cognitive, behavioral, and emotional dimensions of learning. These findings underscore the need for intentional integration of social elements in online surgical curricula and suggest that such strategies can contribute to more effective, learner-centered, and satisfying virtual training experiences. The implications extend beyond surgical education, offering guidance for online professional training programs across disciplines, emphasizing that meaningful social interaction remains a cornerstone of effective learning, even in digital contexts.

Conclusion

This study demonstrates that incorporating structured social activities into online surgical education significantly enhances learner engagement, practical skill performance, and overall satisfaction. Participants who engaged in collaborative exercises, peer discussions, and team-based problem-solving consistently showed higher participation rates, greater procedural accuracy, and more positive perceptions of the learning experience compared to those following a standard online curriculum. Qualitative findings highlighted that social interaction fosters a sense of community, motivation, and accountability, reinforcing both cognitive and emotional aspects of learning. These results underscore the critical role of intentional social engagement in virtual training environments, suggesting that well-designed collaborative activities can transform online courses from passive instructional formats into interactive, learner-centered experiences.

The findings have practical implications for the design of online professional education, particularly in surgical and other skill-based disciplines. Integrating structured social components not only improves measurable learning outcomes but also enhances learner satisfaction and persistence, addressing common challenges such as isolation and disengagement in virtual settings. Future research should explore the long-term impact of social activities on skill retention and clinical performance, as well as strategies to scale and adapt collaborative learning interventions across diverse online programs. Overall, this study provides robust evidence that social interaction is a vital element in effective online surgical education and should be intentionally incorporated into course design to maximize both learning and learner experience.

References

1. Antaki F, Doucet C, Milad D, Giguère CÉ, Ozell B, Hammamji K. RetinaVR: Democratizing vitreoretinal surgery training with a portable and affordable virtual reality simulator in the Metaverse. ArXiv, 2024.
2. Aydin MY, Curran V, White S, Pena-Castillo L, Meruvia-Pastor O. VR-NRP: A virtual reality simulation for training in the Neonatal Resuscitation Program. ArXiv, 2024.
3. Elsayed GA, *et al.* Transforming spinal surgery through medical VR. PMC, 2023.
4. Long Y, Li C, Dou Q. Robotic surgery remote mentoring via AR with 3D scene streaming and hand interaction. ArXiv, 2022.
5. Munawar A, Li Z, Nagururu N, Trakimas D, Kazanzides P, Creighton FX. Fully immersive virtual reality for skull-base surgery: Surgical training and beyond. ArXiv, 2023.
6. Rosenthal HB, Sikka N, Lieber AC, Sanky C, Cayon C, Newman D. A near-peer educational model for online, interactive learning in emergency medicine. *Western Journal of Emergency Medicine*, 2020;22(1).
7. Li T, Yan J, Gao X, Liu H, Li J, Shang Y, Tang X. Using virtual reality to enhance surgical skills and engagement in orthopedic education: Systematic review and meta-analysis. *Journal of Medical Internet Research*, 2025;27:70266.
8. Peer-led teaching with adjunctive virtual reality leads to increased confidence and engagement in surgical

- education amongst medical students. *Global Surgical Education*,2024;3:105.
9. Video-based peer feedback through social networking for robotic surgery simulation: A multicenter randomized controlled trial. PubMed, 2014.
 10. Toward interprofessional team training for surgeons and anesthesiologists using virtual reality. *International Journal of Computer Assisted Radiology and Surgery*,2020;15:2109–2118.
 11. Immersive virtual reality for surgical training: A systematic review. PubMed, 2021.
 12. Osso VR expands its reach, shares study results. Reddit, 2022.
 13. VR in healthcare education: 24/7 simulation labs and surgical training. Reddit, 2025.
 14. Emerging technologies in surgical training and simulation. Reddit, 2023.
 15. For surgeons, what is your view on VR in surgical training? Reddit, 2024.
 16. Transforming spinal surgery through medical VR. Reddit, 2023.
 17. Peer-led teaching with adjunctive virtual reality leads to increased confidence and engagement in surgical education amongst medical students. *Global Surgical Education*,2024;3:105.
<https://link.springer.com/article/10.1007/s44186-024-00299-6>
 18. Video-based peer feedback through social networking for robotic surgery simulation: A multicenter randomized controlled trial. PubMed, 2014.<https://pubmed.ncbi.nlm.nih.gov/24887970/>
 19. Toward interprofessional team training for surgeons and anesthesiologists using virtual reality. *International Journal of Computer Assisted Radiology and Surgery*,2020;15:2109–2118.
<https://link.springer.com/article/10.1007/s11548-020-02276-y>
 20. Immersive virtual reality for surgical training: A systematic review. PubMed, 2021.<https://pubmed.ncbi.nlm.nih.gov/34284320/>