



## Actions to enhance interactive learning in surgery

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### ABSTRACT

**Introduction:** Many educational institutions and academic organizations provide concise and highly organized educational material for the trainees and training programs, while others do not. The role of interactive technology-enhanced learning in surgical education is not entirely explored and disseminated despite common knowledge of such interactive educational technology. Utilizing such technology in the place of textbooks could replace a peer trainee and a teacher examiner.

**Evidence:** Maximizing involvement, participation, and interactivity from both surgical trainees and their faculty has been shown to improve the quality and outcomes of surgical education. Given that there is an increasing trend towards shifting from traditional unidirectional teaching to learner-centered interactive teaching. Improving the educational activities setting from the traditional – didactic unidirectional lecture to multi-directional, interactive, engaging, and stimulating activity can enhance learners' educational outcomes. With the advent of educational technology, interactive and shared learning became more feasible and creative. Various educational technology platforms, instructional designs, and tools serve different educational purposes guided by educational activity's objective. Educational systems have integrated numerous widely technologies such as smartphones, tablets, and cloud-based services that greatly facilitate instructional strategies and teaching methods. Many institutions and programs have embraced the new technologies to enhance the overall learning process. Educational technology offers new concepts and applications in learning beyond faster communication or storage of digital resources. Furthermore, active and interactive learning in surgical education has been found to carry a strong and implied impact depending on how it is structured. To enhance and promote interactive surgical education on a broad scale, the following initiatives will be reviewed; interactive adult learning worldwide, wide sharing of knowledge and skills, and use of educational technology where it is pertinent.

**Conclusion:** Residents and surgical training programs need assistance with the process of learning amid ongoing technological innovations. This guidance would leverage the training programs' educational efforts toward effective surgery training. Interactive educational learning technology is expected to fulfill this need by promoting knowledge sharing, skills learning to enhance educational outcomes.

### 1. Introduction

Educational institutions and academic organizations provide substantial, concise, and highly organized learning materials to surgical training programs. Diverse educational resources and designs greatly enrich surgical training curricula and provide a useful guide to follow by the surgical trainees and programs on what/where/how to study. The American College of Surgeons, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), The American Board of Surgery and surgical council on resident education (SCORE), SESAP, and the

Association for Surgical Education are among the leading organizations to lead these efforts. Over the past several decades, their resources and guidelines have been evolving to accommodate the ongoing and newly developing needs. However, the use of educational resources and learning materials depends largely on the programs and the trainees. When rich resources are properly and efficiently used, the outcomes are expected to improve. But how to encourage and facilitate effective use of technology to enhance the learning process? Can the academic organizations be involved to facilitate the learning process, and how? How helpful would that be to trainees and residency programs?

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Residents often learn through various educational modalities during their training. In addition to acquiring knowledge through reading textbooks, they discuss, share experiences, ask questions, search, and construct their learning through their experiences. In other words, they construct their knowledge through interacting to understand, apply, analyze, evaluate, and create (Bloom's taxonomy, 1956) [1]. Interactive learning is grounded on the commonly used learning theories – Constructivism, Cognitive, and Social connectivism – and the accumulated practical experience in education [1–6]. However, the extent of the interactive learning activities is variable and unpredictable among the training programs due to the busy nature of surgical service, duty hours restrictions, and the busy teaching faculty schedule. Therefore, organizing and facilitating learning through structured interactive educational activities that can be made readily available will enhance the educational process.

The scope of educational technology was initially focused on tools and devices to deliver information and resources [7]. At the same time, its role in interactive surgical education can still be enhanced and disseminated. Building management systems and interactive activities using educational technology to support learning can fill this gap [8]. Educational technology provides resources that can be formatted to take the place of the book, the peer learner, the teacher, and the examiner.

## 2. Evidence

Enhancing engagement, participation, and interactivity for both the learners and faculty can improve medical education quality and outcomes. There is a growing trend towards shifting from traditional unidirectional didactic teacher-centered to interactive multi-directional learner-centered education [5].

Active learning is one of the essential building blocks of adult learning, using technology in interactive lectures. It involves engaging learners to reflect on their ideas and how they apply them [9]. With this engagement and participation, learners will build their knowledge, skills, and attitudes. Several concepts and applications of active learning were described and debated, such as active construction of meanings, specificity, and generality of learning contexts, the advantage of learning in groups, and achieving meaningful learning by articulating explanations [10]. There are different approaches to active learning, all utilized to enhance learning outcomes in adult learners.

One of the leading approaches is learning by sharing. This is a powerful educational tool to maximize learning outcomes [11]. Sharing information processing, understanding, thinking, and learning skills improve learning [12]. This is seen by learning, which occurs through discussing and sharing knowledge with more than one learner [11]. Thijssen and colleagues have shown that learning can be experienced by a sharing model, an example of learner-centered education. In which one learns through interactions, no matter what the subject is [13]. Learning by interaction remains one of the most appealing learning techniques [3]. Therefore, the evidence behind contemporary learning represents educational activities focusing on stimulating discussions and participants' input. This is especially true and important in a large community of residents who are eager to learn and share their experiences. The effect of sharing will be amplified with the abundance of participants' shared input nationwide and worldwide.

Interactive and shared learning became easier with educational technology. Various platforms, instructional designs, and tools serve different educational purposes. Educational systems have integrated numerous technologies such as smartphones, tablets, and cloud-based services that simplify modifying the instructional strategies and teaching methods [14]. Many institutions and programs have embraced the new technologies to enhance the overall learning process [15]. Educational technology offers new concepts and applications in learning - more than merely faster communication or efficient digital resources storage.

To enhance and promote interactive surgical education and support

the process of learning (more than just the resources) on a wide scale, we propose the following three initiatives, (1) organizing widescale interactive and active adult learning, (2) facilitating widescale sharing of knowledge and skills and attitudes, and (3) promoting the use of educational technology where it is pertinent.

### 2.1. Proposed activities to enhance interactive learning

The following activities are ideas to implement the above initiatives:

1. **Hosting and coordinating open interactive educational activities.** Efforts should be directed toward enhancing learning through initiating and facilitating interactive, engaging, and knowledge-sharing active learning. Examples of these activities are:

a. **Open discussion platforms.** These discussion platforms enable learners to post comments, questions, interesting experiences and run discussions. This activity opens wide doors for continuous and self-fed learning that is engaging and joyful for all residents across the country. Instead of waiting for scheduled education activities, residents can interact at any time and from anywhere rather than being limited to the local program members.

To make it more engaging, responses and comments are rated by users, and the trending of the discussion post is displayed. The highest-rated posts or comments can be rewarded. Unfortunately, academic physicians are increasingly using social media for such discussions. Even though these social media platforms are available and straightforward to use, they provide limited academic or scientific interactivity. Educators have the foundational elements to run scientific and educational discussions and interactions that facilitate learning and advance our understanding of learning and provide ample research materials. Some organizations have initiated this feature and platform, like the American College of Surgeons (ACS) communities. But the use is limited to posts and replies only.

One of the possible concerns about this activity is the responsibility of information accuracy or correctness. It is important to realize here that the platform's purpose is to support a wider community of learners and educators to conduct the daily interactive discussions that traditionally occur within teams, groups, departments, or programs and become open to national and perhaps international programs and trainees.

b. **National Morbidity and Mortality Conferences (MMCs).** Carefully selected complications and interesting teaching cases are discussed at a broader scale of participants to share their learning experiences and experts' input. The needed technology and users' familiarity support this use. It can be done asynchronously and synchronously.

i. **Asynchronous posted presentations.** Residents and programs are invited to send their cases in video-recorded presentation slides format with voice narration to sharing. To enhance the presentation's education component, trainees are encouraged to incorporate 1–2 questions before the scenarios' critical points. Presentations are evaluated and selected for posting to become available for continuous asynchronous interactive input and learning. This activity may require time and effort to review and evaluate the cases. Volunteer faculty may participate in these efforts. Periodically, the best/winning presentation can be rewarded for academic contribution and knowledge sharing.

ii. **Synchronous MMCs.** Programs are invited to send to their requests/desire to present the weekly MMCs live. Selected programs are scheduled to present at a designated time of the week. All users are encouraged to participate and interact. This achieves a significant transformation of learning opportunities between all programs and residents. Studies show that a key aspect of enhancing academic learning is the collaboration of universities and practitioners [10].

Every trainee can learn from every program. Programs can share their high quality of education. There could be potential ethical issues that should be carefully addressed in advance. The quality control part should be excluded from the presentation to eliminate criticism and confidentiality issues

- c. **Surgical educational videos.** Videos of operative procedures with educational components from all programs are shared to maximize learning quality and diversity. Sharing is followed by the discussion and input from trainees and faculty. Raising teaching points and explaining specific points can enhance cognitive surgical skills. These interactive discussions differentiate this activity from the readily and widely available videos of surgical procedures. This activity can also be conducted asynchronously and synchronously.
1. **Asynchronous (posted) surgical videos.** Videos of operative procedures are shared by faculty or residents with narration, texts, or embedded questions. The selected educationally valuable and high-quality videos are posted on the training website. The video produces moderate asynchronous discussions and input to explore the educational points and initiate learning queries for trainees. Best videos of the series are rewarded annually with academic acknowledgment.
  2. **Synchronous operative discussions.** Live video-recordings-based discussions of operative procedures led by volunteer academic faculty with open/controlled interactions. The synchronous style of the activity provides immediate feedback or answers to the questions and simulates the in-person environment that some participants may prefer. The sessions are saved and made available for future viewing and continuous discussions.
  2. Journal review/club

Reviewing selected journal articles relevant to general surgery training and practice set the ground for a universal/national journal club that maximizes outcomes and unifies efforts. Collaborative work among programs and educational institutions can be easily facilitated to maximize educational outcomes. Regional or national journal clubs can be conducted in a synchronous or asynchronous format.

- a. **Best article review (asynchronous)** provides a summary and an appraisal of general surgery recent articles of the month. Participating residents share narrative and textual review summaries of selected, recent, and relevant articles. Selected journal reviews are posted for interactive discussions, evaluation, and comments. Discussions are extended to research methodology, critical appraisal, and application in practice.
- b. **Monthly live interactive journal review** directed/moderated by volunteer programs, authors, editors, or faculty. Key papers for the surgical practice and training are selected for an interactive discussion with facilitated input from all participants. The activity is saved and made available for future learning. To get participation credit, the residents have to answer three related questions at the end of the session.
3. Miscellaneous interactive educational activities

Programs/faculty/residents are to choose the educational activity of choice for synchronous presentation and interaction. Examples of such activities are complex cases, innovative techniques, learning skills, research skills, preparation for the exams, practice tips, ethics, jeopardy in surgery, international surgery, Telehealth, etc. In addition to covering uncommon topics, these sessions aim to fill the knowledge gaps and build bridges between trainees worldwide.

Lastly, the use of mobile learning and devices is trending high among higher education students [16]. It is therefore crucial to create and introduce mobile applications to facilitate access and enhances utility.

### 3. Implications

The current focus on providing an enriching learning material should be complemented with measures supporting the learning process. Facilitation of learning and training can be significantly enhanced to help educators and program efforts throughout the training period. Collaborative efforts can be easily supported with the application of educational technology. By widescale sharing of educational material, replicating efforts could be avoided. Local programs shouldn't be restricted to their own educational resources. Interactive learning utilizing educational technology provides these necessities by promoting knowledge-sharing, learning skills, and expertise across the country and the globe.

### 4. Conclusion

This review discusses the challenges facing current surgical educational activities with the absence of an interactive learning mindset despite the significant boom in advanced assistive technology. We've reviewed some evidence supporting interactive educational activities and proposed some interventions to help enhance interactive learning. These proposed interventions can be applied across programs and may be helpful in broader programmatic planning by residency program directors and Graduate Medical Education.

#### Author contribution

Please specify the contribution of each author to the paper, e.g. study concept or design, data collection, data analysis or interpretation, writing the paper, others, who have contributed in other ways should be listed as contributors.

Faiz Tuma; concept, and discussion, writing the paper.  
Aussama Nassar; discussion, writing the paper, editing.  
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Name of the registry:

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#### Guarantor

Faiz Tuma.

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No conflict of interests for the entire team.

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