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Choosing the new normal for surgical education using alternative platforms

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Abstract

The traditional methods for surgical education and professional development are changing, from a variety of external factors. The COVID-19 pandemic accelerated the pace innovative alternative tools are introduced into clinical practice, creating a new normal for teaching and training. In this new normal is the challenge to create durable changes for the future of surgical education. Social media (SoMe), a tool that uses electronic communications and applications to allow users create and share information in dynamic ways, can meet this challenge. SoMe is reshaping how we communicate and learn, and offers great benefits for effective, individualized surgical education. The limits for SoMe appear endless, and elements have already help establish digital surgery to help improve the precision and outcomes of surgery. As we work to define the new normal in surgical education and professional development, SoMe digital surgery will be critical for continued growth and progress.

Keywords Augmented reality (AR); COVID-19; digital surgery; mobile apps; professional development; social media (SoMe); surgical education; video based review; virtual reality (VR); visual abstract

Introduction

The term 'the new normal' gained popularity from technology investor Roger McNamee, describing a time of substantial possibilities as long as one resists succumbing to urgency, and plays by novel rules created in response to the current environment. In a sense, the new normal is the new standard of baseline expectations or experiences. The term has since been used in a variety of other contexts to imply that something which was previously abnormal has become familiar. It is commonly now used to describe our personal and professional lives amidst the COVID-19 pandemic, and can be applied to how we will return to surgical practice. The pandemic has impacted surgical education,

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and no one can say with certainty if there is an end in sight, or when to start measuring the consequences. New normals may emerge, in which novel systems and assumptions will replace others that are long established and taken for granted. Currently, however, the new normal represents a challenge in how to create durable changes for the future of surgical education.

The paradigm for surgical education is shifting from multiple external pressures. The traditionally used Halstedian apprenticeship-style approach to teaching was challenged by duty-hour restrictions and limitations in time available for in-person mentorship and skills acquisition amid mounting administrative responsibilities.¹ The resulting time in the hospital can resemble shift work, with implications for adequate training exposure and professional development. The COVID-19 pandemic invoked additional challenges by limiting the number of surgeons in-house, case volumes, and in-person learning opportunities while highlighting surgeon safety. Our COVID-coerced state has transitioned the question from, 'How do we ensure appropriate surgical training and professional development in the current environment?' to 'How do we maintain the integrity of surgical training while also protecting our trainees and simultaneously ensuring the sustainability of a critical workforce for our healthcare systems?'.²

In *The Republic*, Plato wrote that 'Necessity is the mother of invention'. The COVID-19 pandemic has indeed created an abrupt need for new and innovative end-to-end training solutions, as well as a greater willingness for trainers and trainees to use novel technologies for surgical education. In this environment, surgeons and trainees need to pioneer alternative forms of surgical education in order to develop the same level of cognitive and technical skills. Social media and digital learning tools may be the ideal alternative platforms to meet the changing needs in surgical training and professional development.

How do surgeons learn?

Surgical competence is a complex, multifactorial process that takes ample time and training to develop. The best way to achieve this is still up for debate. Instead of asking how to *teach* surgical skills, the real question should be, how do trainees and surgeons *learn* surgical skills? The answer is that there is no single answer. Learners respond differently to different methods of teaching, and acquire knowledge at different speeds and levels of repetition. But there are absolutes in the process. First, appropriate acquisition of knowledge, psychomotor skills and cognitive skills together form the basis for optimal training. The deliberate practice of tasks, combining repetition with tailored feedback, is crucial for surgeons learning new procedures and advancing their skill set with new techniques.³ Pre-training skills in a non-clinical setting can increase patient safety, maximize individualized learning and task mastery, and alleviate financial and external constraints associated with traditional teaching models. However, this skills acquisition should be individualized, as not all learners start at the same level of experience and knowledge. Once in the operating room, proctoring and mentorship is necessary to safely implement new techniques into clinical practice and truly achieve competence. Despite changes in the training environment, the same standards for quality and competency remain. Learners need to be motivated and take the

initiative to do pre-training, simulation and use alternative tools prior to the operating room and after cases to develop the same level of cognitive and technical skills.

Social Media (SoMe) and digital learning applications are ideal tools to meet these needs. Having platforms available for learning outside of the traditional schema is invaluable for meeting the varied needs of individual learners. Adding the compulsory limitations of physical distancing from COVID-19, the use of these alternative platforms will become increasingly important and their inclusion in surgical training and professional development should become a part of the normal curriculum during these times and beyond.

Introducing alternative platforms for surgical education

We live in an age of information abundance. The global accessibility of the internet has redefined how we access information. SoMe is reshaping how we communicate that information online.⁴ It is broadly defined as a tool that uses electronic communication, including websites and mobile applications, to enable users to create and share information. SoMe permits internet users to interact in more dynamic ways through virtual communities. In general, SoMe is widely accepted and extensively used. In 2020, there are nearly 4 billion #SoMe users reported worldwide, with global penetration rates estimated at 71% in East Asia, 69% in North America, and 67% in Europe, and the usage rates are continuously growing.⁴ There are multiple types of SoMe platforms with different primary purposes, including social networking, disseminating knowledge and content, blogging, microblogging, wikis, video-sharing, collaboration sites, messaging, and virtual worlds. Commonly used platforms for those applications include Facebook, Twitter, YouTube, Instagram, LinkedIn, WhatsApp, and WeChat.

Surgeons initially lagged behind other sectors in the use of SoMe for professional purposes; however, the online surgical community has since flourished.⁵ Applications of SoMe specific for surgical education include live dissemination of research from peer-reviewed journals, live tweeting at medical conferences, online journal clubs, transmission of news from professional societies and surgical departments, coordination of research collaborative groups, and consultations/general discussion to further medical learning. Digital learning platforms are continuously developing to meet the changing needs of learners.

Twitter remains the most popular #SoMe app for surgeons. Twitter is a microblogging application where users post character-limited messages, known as tweets that may contain links, images, polls, or video clips. Twitter provides immediate access to a constant feed of the most current research and news, as well as opinions of experts, surgical societies, organizations, and any reader. Users can receive immediate feedback on the interactions with their tweets and quantify their impact. Two key processes favour the use of Twitter in creating global surgical communities over other social networks: 'connection', where individual nodes establish an unlimited number of bidirectional communication links, and 'contagion', where ideas are copied, disseminated and incorporated by connected nodes.⁶ These posts from individual surgeons, surgical societies, and journals contribute to the digital transformation of surgical education and professional development on a global scale.

Why alternative platforms are better for surgical education

Certain aspects of SoMe make it idyllic for surgeons and surgical education. As a learning tool, SoMe uses connectivism, a contemporary education theory that embraces acquiring and maintaining knowledge flow through networking and connections made using technology.⁷ In connectivism, media is the content and tool for cognitive engagement. This theory is intuitive for those that grew up with such technology, use online sources as the go-to source for learning, and are skilled at filtering the overabundance of material online.⁸

The wide availability and convenience of SoMe platforms and their content is another major factor. Surgeons can access SoMe on any device with internet access, anywhere, at any time. This flexibility is ideal for the demanding and unpredictable schedule of surgeons and trainees. Furthermore, the information is up-to-date, as results are published instantly and appear in real-time, with the ability to update in the same fashion. No textbook or traditional didactic classroom curriculum can compete with this immediacy. SoMe can harness this convenience and immediacy to disseminate research papers, case studies, ideas, and thoughts more effectively than any other model.

Furthermore, SoMe allows learners to personalize the educational experience to meet their needs. Learners can select their preferred method or use multiple resources to acquire information, which allows better retention of knowledge than when presented through a single channel. There is the capability for self-directed learning, with simulation platforms, virtual technology, and visual media that allow trainees to gain learner-constructed knowledge that can be interactive. The self-direction is critical for learners to achieve proficiency and shorten the learning curve based on their individual needs; they may not otherwise be proficient over a short period of practice. In addition, the interactive nature of SoMe permits active learning and increased engagement over passive learning methods, such as live classroom lectures or independent reading. Microblogs such as Twitter may promote greater student-staff engagement by developing an ongoing academic conversation as an additional, or alternate, teaching intervention. As the vast majority of trainees have smartphones and have used Twitter before, it was reported to be a user-friendly educational tool to supplement and enhance the experience of students on a medical school surgery clerkship.⁹ A systematic review of 14 published studies on the impact of SoMe as an educational tool for physicians and physicians-in-training found that SoMe was associated with improved knowledge, and incorporating SoMe tools promoted learner engagement, feedback, and collaboration and professional development.¹⁰ The platform has also been shown to help students become more interactive and seek feedback from their mentors without resistance or hesitation.¹¹ This timely feedback can be essential for personal growth in surgery.

The scale for communication on SoMe is unprecedented. On social media platforms, there is a near limitless ability to connect and interact with other users. One of the most powerful ways SoMe has affected surgical education is by harnessing this potential to create a forum for collaboration and consultation.¹² This provides a uniquely rich learning experience, where global real-time community discussions on any topic can occur at any time, including use of images and video.¹² Participants can

include renowned experts from all over the world, who are openly accessible. The resulting collective expertise of SoMe users can ultimately influence patient care, and the learning experience of all involved. A prime example of this communication ability is a closed Facebook group the Robotic Surgery Collaborative, which allow surgeons to share de-identified cases, post informal polls, and exchange questions and experiences regarding particular techniques or practices (Figure 1). This group has thousands of members that are vetted before being able to access the site, and generates numerous online discussions daily among surgeons worldwide. Users have integrated this site into their workflow to post questions, photos or videos of their techniques for feedback, learning or discussion.

The ability of SoMe to reach a wider audience and have the participants widely accessible provides an unparalleled opportunity for networking with subject matter experts and thought leaders.⁵ These principles have thrust SoMe into the role as a disruptive technology for collaborative research and mentorship. In this vein, SoMe uniquely facilitates communication, exposure and development of relationships that would not have otherwise been possible for academic and professional development. International collaboratives such as PelvEx (@PelvEx) and GlobalSurg (@GlobalSurg) have relied on SoMe platforms for recruiting investigators, participating centers and streamlined data entry and analysis, with great success. This ability was exemplified by the COVIDSurg (@CovidSurg) collaborative that came together at an unprecedented pace at the onset of the COVID epidemic to collect, analyse, and disseminate data on how the pandemic affected surgical care.

For research, the SoMe content can also be personalized for the user in every experience. Adjuncts such as hashtags (# - metadata tags) on microblog platforms can be used both as a guided search tool and to create a research repository, which

filters content for specific topics or research, reducing the overwhelming noise inherent to internet-based platforms.¹³ Current widely used hashtags that exemplify this ability include #colorectalsurgery, #colorectalresearch, #crsrials, and #SoMe4surgery.^{5,6,13} For mentorship, SoMe breaks down barriers of time, space and academic position; everyone has a seat at the table. This communication model allows trainees to identify mentors and role models to engage and sponsor them, especially in underrepresented and minority groups.^{14,15}

These defining characteristics of SoMe have challenged conventional disparities in access to surgical education. Essentially, anyone with internet capabilities can participate on SoMe platforms at nominal costs. This could reduce issues with disparity and connectivity of educational tools in low-income countries and rural areas. The InterSurgeon collaboration (www.InterSurgeon.org) is an example of using a SoMe-based platform to lower the barriers to information access and facilitate global surgical partnerships between surgeons across and between high-income and low/middle-income countries for exchange of knowledge and expertise. While currently linking urologists and neurosurgeons, the success of the dynamic social model will undoubtedly spur expansion across other surgical specialties.

The impact of SoMe

SoMe is revolutionizing how we read, engage with, and disseminate surgical research, forcing traditional channels onto SoMe platforms to retain learners. The traditional methods relied on in-person conferences, textbooks and published papers to disseminate research and information. This model can hinder advancing science from limitations in time, money, and access. Research needed to transform from this passive model, where

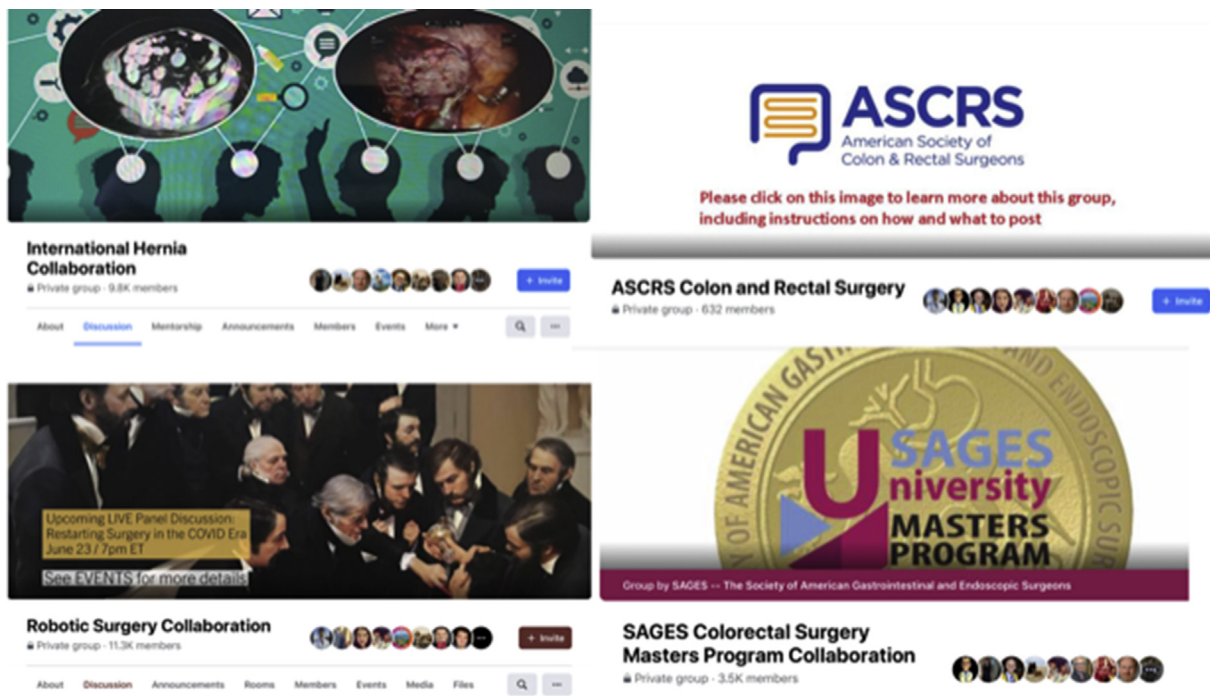


Figure 1 Closed Facebook meeting groups. Examples of a popular closed Facebook meeting groups with surgeons.

information is restricted and communication in silos, to a more engaged active model. Recognizing the need for this shift, the vast majority of textbooks, surgical societies, departments of surgery, and journals are now accessible online. Conferences cancelled live gatherings as a consequence of the pandemic, but learning continued via streaming sessions and interactive webinars. While the social and networking opportunities are not the same, the time and money saved, as well as the greater accessibility, are major benefits.

As a result, journals and surgical societies are expanding their SoMe presence, to Facebook, Instagram and Twitter to meet the changing demands of learners. The number of subscribers reading paper journals is dwindling, and the use of alternative platforms continues to grow, where a paper can be offered in forms ranging from a digital link to a visual abstract, increasing its reach. The prestige of work has traditionally been evaluated by citation number, impact factor and journal subscribers. To stay current, the impact of research can now be measured using alternative metrics ('altmetrics') such as impressions, downloads, likes, shares, retweets and mentions across social media platforms. Research has demonstrated that the size of a journal's Twitter following is strongly associated with traditional metrics, such as impact factor and citations, showing the correlation between scientific and social media impact.¹⁶

Social media tools for surgical education

There are universal gaps in surgical education and practice improvement from cost restrictions, lack of institutional support, and lack of time. With these current educational restrictions, SoMe could be argued as a necessity for surgical education and the delivery of academic work.¹² While SoMe platforms have a powerful impact on education in normal circumstances, its fundamental virtual state has solidified SoMe as essential during the COVID pandemic. SoMe can bridge and enhance gaps in training from any internal or external restrictions encountered. SoMe tools commonly used for surgical education are detailed below, and the technologies continue to grow.

Podcasts

Podcasts are prerecorded audio files available to download or stream to a computer or smart phone. Examples of surgical podcasts include those produced by the *British Journal of Surgery*, the Royal College of Surgeons of England, and Behind The Knife. These are a useful way of staying up to date on surgical topics, with the advantage that trainees can listen while for example commuting, enabling their learning to be supplemented in a time-efficient manner.

Webinars

Webinars are interactive online mini conferences where a speaker or group delivers a presentation or journal club via live video stream to an audience who engage by watching, asking questions, responding to polls and other interactive elements. They are commonly held by surgical societies, training groups and medical device companies, with a wide selection of topics, and options for playback after the live streaming event. They allow surgeons an opportunity to select content that best matches their interests and learning needs.

Closed social media groups

Member-only online communities provide physicians with a free platform to collaborate and discuss clinical scenarios using text, images, videos, and live streaming content. They are most commonly found on Facebook, e.g. the Robotic Surgery Collaboration, the International Bariatric Club and the International Hernia Collaboration. Such platforms are increasingly used for cooperative education, to get expert input on case presentations, and to disseminate clinical information, all with the goals of furthering surgeon education and optimizing patient care.

Digital classrooms

Online platforms can provide high-quality, innovative content from subject-matter expert surgeons in scheduled and continuously available formats across surgery service lines, as well as online case libraries. An example of this platform is the AIS channel (www.aischannel.com).

Mobile apps

Software application developed specifically for use on small, wireless devices, like smartphones and tablets, that can provide cognitive skills training through simulation apps, such as iLappSurgery™, Touch Surgery™ and Think Like A Surgeon™. These mobile apps offer real-time, easy access to comprehensive models by procedure for an effective new model of surgical training. These adaptive SoMe tools use videos, three-dimensional animations and keynote lectures in a dynamic format that allows deliberate practice, repetition, and interval learning as 'pre-training' for surgery, as well as to help work toward expertise when out of the operating room.

Video-based review

Video-based review is an increasingly utilized technique for knowledge acquisition, operating room preparation and performance improvement. Video-based review uses objective assessment tools to evaluate both global and procedure-specific skills from cases performed for trainees and surgeons in practice alike. In this format, the learner can compare their current technical skill against both their own performance and an expert's performance for objective clinical skills assessment and a standard to model their technique after. Particular merit may be seen in minimally invasive surgery, where instant skills assessment can be performed objectively in the operating room, and procedures are easily recorded for post-procedure performance review. While video-based coaching may increase technical performance of surgical trainees, there is a need to standardize video-based coaching tools. Currently there is a wide variety of video-based review tools (outside of watching one's own), that range from curated journal YouTube channels (Colorectal Disease), expert surgeon self-maintained sites (Dr Mark Soliman), surgical society repositories (SAGES, American College of Surgeons), and subscription services with expert video catalogues (WebSurg, GIBLIB).

Surgical communities

Curated on-demand learning content and end-to-end SoMe-based surgical tools enable subscribers to access material on any device. These include live peer-to-peer discussions, video recording, cataloging and expert feedback for telementoring and

coaching. An example of a community is the C-SATS service (<https://www.csats.com>).

Virtual and augmented reality

Virtual reality (VR) uses technology to create and place the user inside a simulated environment, with which they are able to interact. VR has revolutionized simulation for learning and training outside of the operating room. User-friendly immersive environments, such as Oculus Rift, have been used to simulate anatomy lessons, procedures, and the OR experience in an accessible, effective, and affordable fashion. Augmented reality (AR) differs from the VR experience by augmenting and overlaying information in the actual environment rather than transporting the surgeon into a virtual world. Using just headset or heads-up display systems can combine imaging to create a three-dimensional model that surgeons can see, manipulate and even overlay on the physical anatomy in the operating room, guiding them in a three-dimensional space. AR can also provide an unrivaled telementoring experience, allowing the expert to see what the surgeon is seeing in real-time, providing guidance during the procedure to increase the case precision, surgeon competence and patient safety. Certain systems can also record video during the case, mining the data for personalized annotated assessment post-procedure and, with the assistance of machine learning, automated recommendations to refine the precision and safety of the procedure. An example of this advanced AR system is ProximieAR™ (www.proximie.com), which allows learners to virtually 'scrub in' on any device for the live collaborative experience or the post-procedural review, allowing surgeons and trainees to prepare, perform, and work towards mastery in a safe environment (Figure 2). Given the capabilities of AR, this platform will likely have input in training proficiency, credentialing, and privileging for surgeons.

Risks and drawbacks

Despite the growing recognition of SoMe as an integral tool for surgical education, there are downsides. Some platforms lack rigorous peer review. Evidence-based management is typically not provided and unsafe recommendations often go uncontested. The application and liability remains the responsibility of the user. Information on SoMe can be presented bypassing

traditional privacy protections and other regulatory firewalls. Users should ensure they obtain appropriate patient and institutional permissions, and use caution to maintain patient confidentiality and personal accountability. Conflicts of interest must always be declared. Issues of informed consent and patient privacy still need to be refined, and ensuring SoMe use abides with all institutional and patient obligations remains the responsibility of the surgeon.

Moving towards digital surgery

Digital surgery is the product of the marriage between SoMe and technological solutions for surgical education. It is the convergence of surgical technology and real-time data and intelligence, which may increase the precision and outcomes of surgery. Digital surgery is hailed as the next disruptive technology in surgery, following waves of disruption from laparoscopic and robotic surgery. While these inflections were based on technical improvement, digital surgery has roots in data. There is tremendous power from the data produced during surgery. Details on confidence, efficiency, economy of motion, and competency can be gathered from each procedure performed. By compiling volumes of procedural data and linking that data to Artificial Intelligence models, patterns can be recognized, expert steps acknowledged, and standards defined for safe surgery and surgical mastery. Though key aspects are already in place from the expansion of SoMe, digital surgery offers great potential to impact on the way surgeries are performed, reducing variability in the surgical process and outcomes. The prospects for surgical education and development with digital surgery are innumerable; they include improvements in surgical quality and patient outcomes while reducing cost and inefficiencies, delivering more personalized surgical care, and increasing access to care while reducing disparities between populations. Seeing the potential, stakeholders across all sectors are working to accelerate the development of digital surgery. As we work to define the new normal in surgical education and professional development, digital surgery will be critical for continued growth and progress.

SoMe in a post-COVID world

While these SoMe principles and applications were useful for supporting surgical education pre-COVID, they have become essential since the pandemic. Elective surgery ceased nearly completely, surgeons were redeployed outside of their usual practice, and trainees were effectively barred from being physically present in the hospital, patient room and operating suite. Surgeons needed innovative methods to deliver safe, effective surgical care and training. Given the immediate need, SoMe solutions were implemented more quickly than ever before to ensure surgeons and trainees had access to learning materials and remote expertise. With the successful application of SoMe during this time of necessity, it should be incorporated into the curriculum for surgical training and professional development in the 'new normal' phase. There will be a continued need to minimize live exposure and healthcare resources while seamlessly providing high-quality care and training outside of the OR. SoMe has proven it can seamlessly and successfully provide these tenets, and should have solidified its place in surgical education. ◆

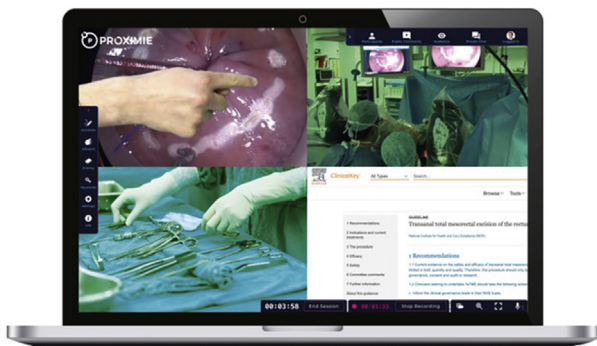


Figure 2 Augmented Reality system. Example of the ProximieAR system used across multiple social media platforms that allows surgeons to virtually scrub in and receive critical performance feedback.

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