

# Social Media: Changing the Paradigm for Surgical Education

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## Abstract

### Keywords

- ▶ surgical education
- ▶ social media
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- ▶ podcasts

The role of social media (SoMe) in surgical education is emerging as a tool that augments and complements traditional learning. As SoMe usage has steadily increased in our personal and professional lives, it is no surprise that it has permeated into surgical education. Different SoMe sites offer distinct platforms from which knowledge can be transmitted, while catering to various learning styles. The purpose of this review is to outline the various SoMe platforms and their use in surgical education. Moreover, it will discuss their effectiveness in teaching and learning surgical knowledge and skills as well as other potential roles SoMe has to offer to improve surgical education.

## Evolution of Technology and Social Media

The evolution of the World Wide Web from Web 1.0 to Web 2.0 technologies has revolutionized the way the world communicates. With the creation of social media (SoMe), internet users are able to interact and share information online in more dynamic ways through virtual communities compared with more traditional methods. Our use of technology has become an integral part of our daily lives. Recent statistics have shown that 88% of Americans use the internet<sup>1</sup> and 77% of adults use smartphones.<sup>2</sup> According to the Pew Research Center, the percentage of U.S. adults using at least one SoMe site has rapidly grown, with only 5% of the U.S. adults using SoMe in 2005 to now 69% of U.S. adults using it as of November 2016.<sup>3</sup> Within this cohort are the “digital natives”<sup>4</sup>—individuals who are accustomed to regularly accessing online material and turning to SoMe sites for learning or pleasure/entertainment.

Surgical education is increasingly embracing the SoMe movement, incorporating online discussion and collaboration using various online platforms. Medical students and postgraduate trainees are routinely turning to online resources for learning rather than the traditional printed material. Although SoMe in surgical education is still in its early stages of development, it has the potential to complement existing learning techniques. A main benefit is it allows people to connect, share ideas and knowledge, and engage in

educational dialogue without the restriction of geographical boundaries, a feature that is not as readily available in the traditional teaching arena.

This review will examine the common SoMe tools and platforms that provide surgeons with educational resources and further discuss whether SoMe is an effective tool for surgical education.

## Learning Theory Is Evolving

The strong presence of SoMe and Web 2.0 technologies in the last few years has not only changed the way information is shared but also challenged educational psychologists who study learning theory to understand how technology impacts learning. The evolution of the learning pedagogy throughout the 20th century has changed the way experts perceive learning.

In the early 20th century, behaviorists believed that learners are a “clean slate” (tabula rasa) who passively gain knowledge through positive or negative reinforcement known as “operant conditioning,”<sup>5</sup> implying that individuals learn through a “stimulus-response” pathway that is mainly provided by external stimuli. Subsequently, this theory was replaced by cognitivism, which perceived the learner as “information processors,” whereby internal processes such as thinking, memory, and problem solving are used as part of

knowledge acquisition. The focus of learning was not about what learners did but about what they knew and how they came to acquire knowledge through receiving, organizing, storing, and retrieving information in the mind.<sup>6</sup> Finally, the theory of constructivism emerged, which was a novel and more dynamic approach to learning theory that embraced the idea that learners construct their own knowledge by gathering and accepting new information that adds to their prior knowledge.<sup>7</sup> Their experiences, surroundings, and interactions with others transforms learning into an active rather than a passive process of knowledge acquisition.<sup>6</sup>

Alternatively, Bloom's taxonomy of learning behaviors divides learning into three categories: cognitive (knowledge), affective (attitude), and psychomotor (skills), wherein each category consists of a hierarchy to learning behaviors. At the top of this hierarchy are higher levels of cognitive abilities such as creating new programs or hypothesizing, which requires a higher level of understanding above simple comprehension, memorization, or recall.<sup>8</sup>

Connectivism, the most recent (21st century) and still controversial learning theory first introduced by Siemens and Downes, attempts to explain how people learn through sharing information across the World Wide Web using internet technologies.<sup>9,10</sup> Connectivism embraces continued learning through networking and connections that are made and maintained using technology with the goal of staying up-to-date with pertinent information and maintaining knowledge flow. Surgical education has the potential to embrace this theory for its learners as the overabundance of material currently being exchanged online has already become the go-to source for learners at any level, from the novice to experts in the field. Moreover, the millennial generation grew up with technology. The expectation of 24/7 access to information through a variety of platforms including cell phones and computers is a key component of their learners' expectations.<sup>11</sup> These tools may also have value for learners of previous generations.

## Surgical Education—What Has Changed?

A recent survey by Mattar et al published in the *Annals of Surgery* in which the senior author was a coauthor, found that the majority of fellowship program directors believe general surgery residents are not well prepared at the completion of their general surgery training.<sup>12</sup> Certainly, the implementation of duty hour restrictions has meant that trainees have limited time spent in hospitals, clinics, and operating rooms. As a consequence, an increasing amount of learning has been driven outside the hospital environment. So with less time to learn (and particularly to actively learn—not just read textbooks), trainees have needed to become more creative in the ways in which they acquire their training needs.

SoMe can play a significant role in filling in the educational gaps for knowledge acquisition for “time-poor” trainees. Simulation platforms, virtual technology, and visual media allow trainees to gain learner-constructed knowledge and perform self-directed learning. The latter modality has replaced the traditional approach to teaching and learning

such as didactic lectures and large, bulky textbooks. The vast majority of textbooks and journals are now accessible online. The millennial generation seems to prefer this modality compared to older individuals who “grew up” with bulky textbooks in hand. This transition to an electronic age mirrors what is happening in the world of print journals—a process described more in another article in this issue of this journal.

A systematic review performed by Cheston et al included 14 studies that assessed interventions using SoMe tools in medical education and found that these tools were associated with improved knowledge (examination scores), attitude (empathy), and skill (reflective writing).<sup>13</sup> Moreover, these tools promoted learner engagement, feedback, collaboration, and professional development. Although challenges included technical issues, variable learner participation, and privacy/security concerns, they concluded that SoMe brings opportunity for innovation and is an emerging field of scholarship that merits further investigation.<sup>13</sup> Surgical educators are forced to adapt to these new educational techniques and use them to meet the needs of the 21st century learner.<sup>14</sup> Within this group are current medical students and postgraduate trainees who have become accustomed to using online resources as an important part of their learning.

## Using Social Media for Surgical Education—What Is Out There?

SoMe encompasses a variety of different platforms, with different purposes of communication. A plethora of SoMe sites have been developed over the years, the most popular of which is the social networking site Facebook. Social networking is one of many branches of SoMe platforms. Others include blogging, microblogging (including Twitter), wikis, video-sharing, collaboration sites, virtual worlds, and more, which offer another dimension to learning and are all gaining momentum in the surgical world. The potential of SoMe to share thoughts and ideas from every corner of the world using the World Wide Web makes this a sophisticated e-learning educational tool and is the reason why educators worldwide are turning to SoMe for teaching and learning.

### Blogs, Microblogs, and Online Communities

#### Blogs

A blog is an interactive (usually narrative text-based) website, managed by an individual, group, or organization with the opportunity to interact through comments that are regularly posted and shared.<sup>15</sup> Although blogs are not often thought of as learning tools and are classified low on the scale of evidence, they do have the potential to create a learning environment for the reader. Wordpress (<https://wordpress.com>) and Blogger (<https://www.blogger.com/>) are publishing platforms used to create blogs and can be accessed by anyone.<sup>16</sup> Similar functionality exists on LinkedIn, another SoMe site. Surgical blogging is not only for individuals who want to write about their personal experiences and share their stories but also for those people who want to share and discuss interesting articles or

events pertaining to surgery as well as new surgical procedures from around the world. Blogging is a form of journaling meant to interest others who have the opportunity to actively comment and participate in the discussion—thus making it “social.” Traditionally, these discussions and exchanges took place only during medical/surgical conferences and society meetings or shared with medical students and residents during rounds. As a result, the “privilege of the podium” was restricted to certain key stakeholders and there was not an immediate injection of ideas or opinions from others. However, through the power of SoMe, these discussions have shifted, and can now occur in the palm of your hand with colleagues around the world, in real-time.

Blogs take on a variety of themes, based on the sponsoring individual or organization. *Insidesurgery.com* is one example. Societies, such as the American Board of Cosmetic Surgery, offer a blog filled with interesting questions directed not only to patients but also to perspective trainees. Sauer et al described their experience with using password protected blogs as a communication tool to share and discuss information for their research group<sup>17</sup> as a surrogate for face-to-face research meetings, which can be time consuming and difficult to schedule. New learners have benefited from having the opportunity to interact with other surgeons around the world through SoMe, for mentorship, guidance, pearls, and much more. In fact, knowing which blogs to follow can be overwhelming as they can be immersed in a sea of information. Just as creating these blogs takes time, so too can reading all that content. This may be why microblogging has been the go-to source for information among surgeons, who are the quintessential “time-poor” learners, given a variety of competing obligations.

### Microblogs

Unlike traditional blogs, microblogs are a fast and convenient way to share information. Microblogging sites, the most common of which is Twitter, have attracted both established surgeons and trainees with its short (140 character) messages. Although the “tweets” are by necessity brief, those skilled at manipulating the word limit to get their message across are often able to stimulate much discussion. Surgeons have turned to Twitter to disseminate valuable information pertaining to surgery, including videos, journal articles, up-and-coming research, and events due to its immediacy. This highly interactive platform is the ideal setting for learners because they are continuously being exposed to new and relevant information, shared by experts in their field. Surgeons interact with other fellow Twitter colleagues, discussing common interests and creating an expanding network of fellow surgeons and followers from around the world.<sup>18</sup> Not surprisingly, the more connected the individuals, the more influential they become. By utilizing Twitter handles and hashtags such as @surgery and #surgery, respectively, it allows users to interconnect with others posting about the same topic, as well as to network with other surgeons.

A recent prospective study used Twitter to educate surgeons on common infectious disease (ID) and antimicrobial

use. Goff et al<sup>19</sup> created online grand rounds using the hashtag #TwitterGrandRounds to engage surgeons. Pharmacists tweeted ID topics relevant to surgeons, and tabulated impressions and engagement over a 3-month period. Surgeons engaged in 72 tweets, retweeting 31 of them, and tabulating more than 15,000 impressions. Moreover, 81% rated the presentation as excellent, with 77% saying Twitter was relevant to their practice.<sup>19</sup> This scenario is an excellent example of how Twitter provided real-time, useful, and practical education to surgeons.

Through the Twitter network, information can rapidly disseminate. Photos videos, visual abstracts, and more have “gone viral” or been shared rapidly among a large number of SoMe users. This feature of allowing retweeting or sharing material creates a sea of interconnected information that disseminates over the “Twittersphere” and can then be viewed by personal followers who may not have had access to the original tweet. It is a valuable experience, one that would not be possible without the power of Web 2.0 technology. Recently, surgical conferences have turned to Twitter to disseminate knowledge by creating conference hashtags that disseminate into the Twittersphere and bring together a virtual audience, including those who are not physically at the conference. For instance, during a live panel discussion, a concomitant discussion can simultaneously be occurring on Twitter about the topic in question, raising interesting questions that can be seen and addressed directly by the panel.<sup>20</sup> Surgical societies and medical/surgical journals, most notably the *Annals of Surgery* using the handle @AnnalsofSurgery, have also turned to Twitter to announce important events and broadcast their most recent publications using visual abstracts to summarize important findings in a graphically concise way. Access to these abstracts is made possible by searching the handle or hashtag pertaining to the search such as #visualabstract or @JSurgEduc (*Journal of Surgical Education*).

There are hashtag movements that are being created on Twitter to help surgical specialties conglomerate and share information pertaining to their field. The #colorectalsurgery movement, created last year by a group of colorectal surgeons, has gained momentum and popularity and is growing at an exponential rate. Early statistics from the first 10 weeks since its launch demonstrated that the hashtag resulted in more than 5,200 tweets from 823 global users, with nearly 17 million views.<sup>21</sup> By using this hashtag, other Twitter users can link related information pertaining to the field of colorectal surgery without having to search very far (as similar to the blogging experience, the amount of information can be overwhelming). A recent review by Wexner et al looking at different uses of SoMe in colorectal surgery commented on its use in surgical education and the potential to change surgical training through the use of online discussions and journal clubs.<sup>18</sup> The technology has been used for a variety of goals, including sharing knowledge, discussing controversial topics, and educating the general public, trainees, and expert surgeons alike—all in an instant.<sup>18,22</sup> Logghe et al recently reviewed the use of Twitter in colorectal surgery using popular hashtags and Twitter handles and agreed that its global access and endless discussions with experts and peers in the field

offered many benefits to surgical education.<sup>22</sup> They also outlined other useful hashtags that are currently in use such as #SurgEd for topics related to surgical education and #SurgT-tweeting for anything related to surgery that the colorectal community can follow and learn from.<sup>21</sup> A similar movement is underway in the plastic surgery community with the #plasticsurgery movement that was created with the goal of disseminating evidence-based practice in plastic surgery.<sup>18,23</sup>

Twitter journal clubs have furthered this type of engagement, again using hashtags such as #IGSJC to link the discussions.<sup>20</sup> It is important to note that to be active on Twitter does not necessarily imply having to continuously tweet or retweet. Learners can simply “lurk,” as in follow threads of tweets without retweeting,<sup>20</sup> making this SoMe platform a valuable one for all levels of training.

### Online Communities

A similar form of discussion is found in online communities created by medical and surgical associations such as the American College of Surgeons (ACS). Members of the ACS have the opportunity to access “ACS Communities” (<https://www.facs.org/member-services/communities>), where members can use this networking tool to connect, engage, and share information and best practices in real time, participate in dynamic discussions and ask advice, share experiences, exchange resources, and build professional relationships. This commodity is an invaluable asset in any physicians' armamentarium.

### Video Channels, Podcasts, and Collaborative Projects

#### Video Channels

Video channels are very valuable teaching tools for surgeons. Video sharing sites such as YouTube, which has more than 1 billion users, allow users to search and watch surgical videos that are shared by others in the field. With more than half of the YouTube views coming from mobile devices, these videos are available to watch at anytime and anywhere in the world.<sup>24</sup> Vimeo is another site with similar capabilities. One may argue that watching a video does not necessarily teach the tactile and practical skills required for a surgical procedure when compared with simulation. However, it does provide the learner with the opportunity to learn the cognitive aspect of procedures in a step-by-step approach, and provides important visual learning points pertaining to decision-making and technical skill refinement that may not otherwise be available from static images or text alone.

Surgical trainees are expected to be well prepared prior to undertaking an operation and having access to this impressive video library allows learners to visualize and learn the key steps of a procedure at their own pace, with the ability to rewind or pause the video to capture important steps. Learners can revisit the steps of an operation as many times as needed until it is well understood without any time constraints or pressures that may arise in the operating room. This is key because this type of learning cannot be done live in the operating room. A survey by Rapp et al evaluated surgical preparation methods of medical students, residents, and

faculty and found that most respondents reported using videos as their preferred way of preparing for surgery with YouTube being the preferred source.<sup>25</sup> Moreover, many of the links to these videos are also shared through Facebook and Twitter, thus expanding the number of views. With any open source of education comes certain drawbacks, such as quality control of the viewing content that is often not peer reviewed or referenced as well as failure to disclose the source of the data.<sup>26,27</sup> Nevertheless, the power of video sharing for learning is beneficial and well accepted by those who use online videos as part of their surgical education.

Fortunately, educators have found novel ways to overcome these drawbacks by creating and designing specific channels and including videos that have been screened and deemed as acceptable for educational purposes. YouTube has helped medical students learn anatomy by creating a Human Anatomy Education channel as part of a problem-based learning program.<sup>28</sup> In surgery, the Advances In Surgery channel ([aischannel.com](http://aischannel.com)) and other surgical educational websites such as gilib.com, webSurg ([www.websurg.com](http://www.websurg.com)), the International Hernia Collaboration<sup>29</sup>—which is hosted via a closed Facebook group, and others have gained significant momentum within the surgical community. These interactive collaborative projects offer open classrooms, specialty courses, live surgeries, and live congresses, as well as archived footage and expert-performed video procedures, bringing together surgeons and trainees from all over the world. Members can log in at no cost and actively participate from any part of the world, interacting with leaders and experts in the field who discuss current hot topics as well as teach surgical technique for new surgical procedures.

#### Podcasts

Podcasts, a form of usually prerecorded internet radio, have rapidly gained wide popularity and can play an important role in surgical education. They are a series of digital media files that are made available on the internet for download.<sup>30</sup> Podcasts pertaining to surgery such as *Surgery101* or *BehindTheKnife* are lectures at ones fingertips and are excellent resources for surgical trainees and practicing surgeons. These cover a variety of topics including interviews with experts in the field designed to break down difficult topics in their area of expertise, lectures or reviews designed to prepare surgical trainees for the high stakes American Board of Surgery In-training Exam and board examinations, and more. These podcasts include tips, tricks, and personalized interactions that listeners may not be exposed to otherwise as this information may not be found in textbooks, making them valuable learning tools. Many journals also have started podcasts, including *Diseases of the Colon & Rectum*, the *New England Journal of Medicine*, and more. These podcasts follow a variety of formats, but the overarching goal is to increase distribution and exposure to journal-related content and provide a different format to gain access to the information.

#### Collaborative Projects

Collaborative projects are a very popular source of information among students. The most widely used, Wikipedia, is an



online encyclopedia available in more than 290 different languages.<sup>31</sup> It consists of “wikis,” which are collaborative webpages where users can contribute and edit information in real-time, which facilitates the sharing of online information from any part of the world.<sup>32</sup> The few studies that have evaluated the role of wikis in medical education have shown a positive outcome. One study demonstrated how students at the University of Minnesota collaborated using wiki technology by editing their classroom notes to create an online medical textbook which generated more than 1 million views.<sup>33</sup> Another study demonstrated that engaging students in problem-based learning using wikis helped them to learn about professionalism by creating a positive group dynamic, encouraging collaboration, and increasing confidence.<sup>34</sup> Wikipedia was ranked highest among students learning anatomy as the preferred website among all computer-assisted learning resources.<sup>35</sup> Established societies have realized the benefits of “wikis”. For example, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) has created a “SAGES wiki,” where members can log into the SAGES webpage and access a valuable resource created by its members. Moreover, SAGES actively encourages its member to participate and contribute to the wiki by either creating a new topic, improving an existing topic, or participating in an online discussion about a specific topic. This astonishing resource is accessed by more than 2,500 people per month seeking information about minimally invasive surgery. Regardless of the level of training, this is a great educational tool that allows for knowledge acquisition of disease processes, as well as technical tips pertaining to an operation.

### Virtual Worlds

Virtual worlds are a computer-based, simulated multimedia environments designed so that users can “inhabit” and interact via their own graphical self-representations known as avatars.<sup>36</sup> These avatars can interact with others and navigate in this online world that encourages social interaction and networking. Second Life (Linden Research, Inc, San Francisco, CA, <http://secondlife.com>), created by Linden Laboratory, is one of the most popular three-dimensional (3D) virtual worlds and has attracted attention and has infiltrated the field of surgical education. Patel et al from the Imperial College in London created a virtual world using Second Life to help novices become more familiar with the operating room environment. They randomized a group of 60 novices to 4 intervention groups (control, didactic lecture, Second Life environment, and a simulated operating room) and found that all novices outside of the control group had significantly higher behavior, skills, and knowledge scores. The Second Life virtual world was well accepted and had the advantage of being easily accessible from any computer at any time, without the need for educators to be present and training could be repeated as many times as needed until the learner felt confident of the lesson learned.<sup>37</sup> Another study by Cohen et al looked at the feasibility of using virtual environments to train hospital clinicians in emergency response preparation using three scenarios. Ninety-five per-

cent of their participants expressed a desire to use virtual environments for future training, but most importantly, they felt that this virtual environment allowed them to experience scenarios that would be inaccessible in real life.<sup>38</sup> Another study assessed the performance of surgical trainees at different levels of training and attending surgeons during the management of three common general surgery scenarios (lower gastrointestinal bleeding, acute pancreatitis, and small bowel obstruction) using Second Life. They demonstrated high face and content validity for the performance among different groups, with the attending surgeons scoring the highest, showing that virtual worlds can also be used as a form of assessment in surgical education.<sup>39</sup> Despite this impressive work, virtual worlds have not yet been shown to be more effective than other immersive experiences and the issue of cost is one to consider given the developers, technicians, and faculty required to create these scenarios.<sup>40</sup> Regardless, this is a promising venture that adds innovation to surgical education.

### Social Networking Sites

Social networking has become part of our daily lives and with a generation of “digital natives” on the rise, there is no doubt that they will naturally turn to these sites for information. There are many social networking sites that are created for different purposes so that users can engage in either general (Facebook), professional (LinkedIn), medical (Doximity), or research (ResearchGate) interactions.<sup>41</sup> According to the Pew Research Statistics Center, 79% of adults who are online use Facebook, 76% of whom access the site daily.<sup>3</sup> A recent survey of emergency residents and faculty found that there is a discrepancy between the different patterns and interests in the personal and professional uses of SoMe.<sup>42</sup> Residents were more likely to use SoMe for personal interactions with friends and family or for entertainment, with Facebook topping the charts with 86% usage.<sup>42</sup> Also, within the surgical community, the ACS conducted a survey and found that 55% of respondents used Facebook.<sup>43</sup> Despite the popularity of these sites, social networks are not well studied and used in the field of surgical education.<sup>41</sup>

Private or closed groups on social networking sites are platforms that require access by password or by invitation. These closed groups can be used as a forum for discussion for all levels of medical education (including discussion forums regarding residency or fellowship applications), as well as faculty development programs.<sup>41</sup>

### Mobile Applications

The use of mobile applications, better known as mobile “apps,” is growing with the increasing use of smart phones and tablets. These mobile apps are available through a variety of app stores and, according to Statista.com, there were 2.2 million available apps on the Google Play store and 2 billion apps available in the Apple’s App Store as of June 2016. Educators are teaming with graphic designers and gaming experts to create apps aimed to teach surgical trainees a variety of procedures. One example is the Touchsurgery app

(<https://www.touchsurgery.com>), designed and developed as a sophisticated virtual simulation tool, that claims to empower and connect the global surgical community by having users “Practice surgery anytime, anywhere.” This app is available in 226 countries with more than 1 million users who can practice more than 50 surgical procedures in more than 10 surgical specialties. Moreover, it provides an assessment tool that evaluates knowledge and tracks progress, which is an important component for learning. In addition, it has the capacity to connect with physicians all over the world through discussion boards, and who are available to answer questions and share knowledge. Another example is the iLappSurgery app (<http://www.ilappsurgery.com>), created to target surgeons at all levels of training who wish to learn advanced techniques in the field of laparoscopic surgery. By using the iLappVIP app, surgeons navigate through modules using visual educational material including detailed medical illustrations, 3D animations, and colorized video excerpts to demonstrate key concepts and reach out to experts from around the world who can comment and offer guidance for every procedure. This high-tech tool offers a model of mentorship and communication among peers and guidance to surgeons learning new techniques. Learning a new surgical skill (particularly outside of a structured residency or fellowship) is already challenging. This tool may serve as a framework for surgeons both in training and in practice to enhance technical skills with the help of another experienced colleague after a period of virtual education. Technology can allow feedback and technical pearls pertaining to a specific operation. In addition, training on these virtual simulators will likely boost confidence and ideally help improve surgical outcomes, given that surgeons will be better prepared when entering the operating room.

### Is Social Media an Effective Educational Tool?

The use of SoMe in surgical education is still in its infancy but is starting to gain popularity as SoMe sites that offer tools for better communication and networking expand. There is still a paucity of evidence related to the use of SoMe as a viable arena for learning surgical techniques; however, creative ways in which SoMe can complement surgical education are being explored and developed. Videos and virtual worlds play the most important roles in surgical skills training as they provide visual material that can be the basis for learning. For instance, a junior resident who is preparing for a first laparoscopic cholecystectomy can turn to YouTube or other video sharing sites and search for “how to perform a cholecystectomy” and be immediately presented with a multitude of narrated videos from which to choose. Trainees can use a step-by-step approach to learning and review. Trainees immerse themselves into a virtual world and navigate through virtual reality scenarios where they have the freedom and ability to make mistakes without any harm to the patient or liability. This safe environment allows trainees to push their limits without the real-life pressures of the operating room.

There is a significant amount of work describing the effectiveness of SoMe in medical education. To increase the effectiveness of SoMe sites in surgical education, educators must be consistent in integrating them into their teaching models. The science of this type of education is in its early stages of development and the book has yet to be written on the best methodology. Educators will have to decide on a curriculum to provide guidance through many options, which include creating closed groups or blogs, review of a series of videos within a peer-reviewed library, having a moderator or a designated monitor to oversee the activities, allowing comment and feedback from trainees for an optimal learning experience, and more. Since SoMe provides the opportunity for “anytime learning,” it can be used to fill in the educational gaps created by busy schedules and allows for self-regulation of knowledge to accommodate a variety of learning types. SoMe is easy to use and inexpensive, making it an attractive learning vessel. Specifically, the younger generation of trainees, who will be the surgeons of the future, are already well versed and immersed in the SoMe world and do not require any formal training on its use.

### Does Social Media Serve Another Role?

SoMe is here to stay. It has been incorporated into virtually every part of our lives and as we learn more about its potential use in medical and surgical education, we continue to unveil other applications for this sophisticated tool.

The idea of education through SoMe in people in low-income countries is one to consider given that access to technology, equipment, and internet is growing throughout these parts of the world.<sup>44</sup> People in low-income countries or rural areas can benefit from the use of SoMe to connect with the rest of the world, have access to conferences that they would otherwise be unable to attend, allowing discussion with colleagues or experts in the field. For instance, a study of the use of mobile phones by resident physicians in Botswana, Africa showed that access to smartphones with email and web access were effectively used to engage self-directed learning at home.<sup>45</sup> Okrainec et al created a tele-simulation program using simulators, computers, webcams, and Skype software to teach the Fundamentals of Laparoscopic Skills tasks and proctor 16 surgeons in Botswana. They showed that remote tele simulation is an effective as well as cost-effective method for teaching laparoscopic skills.<sup>46</sup> There is still much progress needed to be made with regard to resources and infrastructure to support the use of SoMe in these parts of the world; however, the future is promising.

In addition to remote education, SoMe can also be a useful tool to provide feedback, which is an essential component to learning. Carter et al looked at the effectiveness of providing online feedback to trainees regarding robotic simulator performance and technique. Fifty-three participants were randomized into a control group and an intervention group, where they used the “Google Plus” social networking site to upload their recorded robotic simulator session. All intervention subjects gave blinded feedback regarding peer

performance and received feedback on their own training session using open commentary and a structured skills assessment form. They found that those getting feedback were more comfortable with robotic surgery and, within the intervention group, 85% found peer feedback useful and 100% found it effective.<sup>47</sup> Another study used a mixed methods approach of qualitative methods and questionnaires to see whether Wikipedia and Facebook were effective platforms for peer feedback in a group of higher education students. Results showed that students benefited while engaging in the peer feedback process on both SoMe sites and incorporation of these tools as a peer feedback vessel improved critical thinking skills and materials produced.<sup>48</sup>

In a recent education article looking at the evolution of surgical training, Chand and Qureshi described the importance of “surgical replay.” This concept is based on the effectiveness of film study used by professional athletes who use video to breakdown and review their performances with a mentor, expert, or “coach” who provides ongoing feedback.<sup>49,50</sup> The act of reviewing a video and dissecting out areas of strength and weakness allows the learner to visualize their actions and learn from their mistakes. This tedious yet crucial process is often neglected in surgical training because of time constraints and availability. SoMe can facilitate this exercise such that trainees can share their videos and practice “surgical replay” with other surgeons or experts in their field, using video sharing and live commentary.

## Conclusion

Given the many SoMe platforms and the rate at which sites are created, there will certainly be more exciting developments in the field of education. SoMe developers continue to create and expand their SoMe sites providing an abundance of tools that can certainly be explored in surgical education. As the influx of surgical trainees who grew up in the millennial generation enter surgical specialties, educators will have to turn to SoMe to cater to their learning needs and eventually incorporate these sites as an integral part of medical and surgical education. As technology becomes more sophisticated, so will surgical education.

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