Seminars in Pediatric Surgery 24 (2015) 124–129

Contents lists available at ScienceDirect

Seminars in Pediatric Surgery

journal homepage: www.elsevier.com/locate/sempedsurg

Modern, multi-media, advances in surgical information

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ARTICLE INFO

Keywords:
Surgical education
Telementoring
Teleconferencing
Virtual education
Multi-media
Online education

ABSTRACT

The need for education does not end with residency. Practicing surgeons must find ways to stay current. The boom in new technologic developments may significantly enhance our methods of teaching through the use of new mutli-media. Here we will explore some of the muti-media innovations that have or may have the greatest impact on surgical education. Live, interactive, and online forums have proven to be effective new methods of bringing people together to discuss and learn new concepts in medicine. These forums allow physicians to interact with key opinion leaders and flatten knowledge sharing, so that everyone may have a voice. The dynamic, fast paced, and interactive format allows for screen-based learning to be engaging and interactive. Information is now available online in multiple formats that are continuously updated, so that information is no longer outdated by the time it is published in a textbook. Multi-media is now being used to disseminate content through, archived video, live video, as well as audiocasts. All of these are creating more modern ways for physicians to stay up-to-date either at home, in the office, or when mobile. Lastly, new advanced, interactive, technology can allow experts to assist less-experienced surgeons as "virtual partners" through telementoring. With telementoring, an expert can be virtually present while another surgeon is performing a complex, new, operation, and the expert can help with voice suggestions and on-screen telestration. Pediatric surgical education has made a giant leap thanks to new developments in multi-media technology.

Introduction

Surgical education in the United States begins with residency training, during which the trainee must acquire both the medical knowledge as well as technical skill. Technical skill training is based on the traditional apprenticeship model, in which the trainee spends day after day with an expert, first observing and then performing under the watchful eye of the expert who can guide them. The knowledge is acquired by reading textbooks, conferences, lectures, and talking and interaction on rounds or in the operating room. In fact, the Accreditation Council for Graduate Medical Education (ACGME) very tightly regulates the educational model during residency.

However, the need for education does not end with residency. In fact, surgical concepts and techniques are continuously evolving, and surgeons must find ways to stay current. Unfortunately, the educational landscape changes once the surgeon leaves residency training and enters into practice. Once in practice, continuing medical education mostly consists of attending lectures at national or local conferences or from reading medical journals. These methods of learning are probably sub-optimal for several reasons. Firstly, most lectures are taught in a non-interactive, sermon-type format and may not lead to high retention of information. Secondly, travel to conferences is costly and time-consuming. Lastly, when surgeons want to adopt a new technique, lectures may not be adequate for those surgeons to truly acquire the new skill.

We have used these methods of learning because, until now, there was no better option. However, with the boom in technological innovations in the past two decades came new developments that may significantly enhance our methods of teaching through the use of new mutli-media. Here we will explore some of the muti-media innovations that have or may have the greatest impact on surgical education.

Basic teleconferencing and tele-education

A teleconference allows for interaction, including audio and video, and possibly other modalities, between at least two sites.

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http://dx.doi.org/10.1053/j.sempedsurg.2015.02.010
1055-8586/

Augestad and Lindsetmo found that teleconferencing among surgeons had wide applications, including use among multidisciplinary oncology teams (tumor board), rural trauma and emergency settings, postoperative follow-up, and outpatient consultation. The use of videoconferencing was found to be generally acceptable by patients and physicians, cost-effective, and was able to improve knowledge gaps.[1] Holland et al.[2] utilized teleconferencing as a tool for education of medical students during their pediatrics clerkship at remote locations. Overall, 98% of involved students agreed that having access to experts at the urban hospital via teleconferencing was valuable for their learning. Jain et al.[3] randomized staff nurses to either tele-education or classroom teaching for training in neonatal resuscitation, and found a comparable increase in knowledge and skill between the groups, with similar satisfaction scores. Loewen et al.,[4] used teleconferencing among health-care providers, who were randomized to teleconference or face-to-face instruction on neonatal stabilization. The increase in knowledge quantified by pre- and posttests were comparable between the two groups.

The use of tele-education in post-graduate training has also been evaluated. Hadley and Mars organized weekly seminars conducted by pediatric surgeons from the central teaching hospital in the KwaZulu-Natal province of South Africa, which were broadcasted to satellite hospitals for general surgical specialists, trainees, and medical officers. They then reported on their 18-month experience.[5] Survey responses indicated that the teleconferences were good or excellent teaching tools and an effective alternative to attending a seminar program. The authors also noted success in recording their seminars and distributing DVDs to four countries, in which lack of bandwidth precluded teleconferencing.[6]

Live, interactive, online, forums

So much of how we gain information in the modern era is through the internet. Computers and mobile devices have replaced newspapers and magazines. This is mostly because the information is more current, rapidly accessed, and presented in a way that is more engaging. Breaking news stories are seen through mobile apps, Facebook posts, or Twitter feeds. Someone wanting to learn to play a song on a guitar will now watch a YouTube Video. Recipes are accessed on Instagram.

Education must also adapt to keep up with modern technology. Within the past 10 years the use of tele-education has advanced rapidly, thanks to Web 2.0, high-speed internet, voice-over internet protocol software (VOIP), and ubiquitous webcams, allowing inexpensive and easily accessible tele-education.[7]

The problem now is not “can we do it” but “how do we do it.” The sermon type of teaching, in which a teacher stands in front of a room and talks while referring to slides on a screen, will likely not translate well to a computer screen. It is unlikely that the viewers will be engaged and focused for longer than a few minutes. Unfortunately, until recently, most of those, who have tried teaching through the internet have resorted to the standard “webinar.” This usually consists of a small video pod of the expert lecturing and referring to slides on the screen.

In the mid-1900s, when radio broadcasts were converted into television shows, all of the elements of production had to be rethought in order to adapt to the screen. Similarly, in order for educational content to be converted to the screen, the format must be modified. The only time that people can sit and stare at a screen with complete engagement is when watching a movie or television show. That is because these shows are produced in a way to keep the attention of the viewer. Education that will be broadcast on a screen must be produced in a similar fashion.

Anatomy of a live educational broadcast

Technology

No matter how good the content may be, with bad technology, the broadcast will fail. So many elements are involved in a sturdy broadcast but here we address a few.

Bandwidth: Streaming from a location with exceptional upstream bandwidth is essential. The best practice upstream bandwidth is twice the actual streamed content. For example, if three streams are sent up at 511 kbps, 1200 kbps and 2000 kbps, then the upstream bandwidth should be 7422 kbps. Unfortunately, a less controllable variable is the end-user’s *downstream* bandwidth. For an HD stream, a user should have at least 3 mbps *downstream* bandwidth. Usually, higher speed is required because an end-user’s computer has other things going on that require internet connectivity while they are watching the broadcasts.

Streaming Software: The video sent out to be streamed must travel through a *content delivery network* or content distribution network (CDN), which is a large distributed system of servers deployed in multiple data centers across the internet. The goal of a CDN is to serve content to end-users with high availability and high performance.[8]

The software that sends the streams out from the video switcher is equally important. Encoding or converting video for internet streaming is very stressful on the computer and requires stable and efficient computing power. Several streams must be encoded so that the viewers have many options of quality for viewing. This ensures that they can view a fluid video regardless of the type of connection they have. Choosing a hardware-based video switcher or software-based switcher with enough power is critical for obtaining broadcast quality content.

Web-conferencing software: Creating a dynamic event requires virtual speakers. These speakers need to be mixed into the main broadcast somehow. There are many ways to accomplish this without a satellite hookup. Combining web-conferencing software with live-video switching and a custom participant interface provides a novel method of creating live, interactive, and dynamic content while still maintaining control of the content, presentations, and video. Using a phone bridge as a fallback audio source ensures that despite internet connectivity problems, a speaker will still be able to participate. However, this setup introduces a different set of problems. The speakers need to be in multiple “systems” if they want to participate in the chatting and polling alongside the participants. To mitigate this, a “bridge” between the two systems needs to be created and this was accomplished using a custom chat area that exists between both the systems.

Polling software: Some webinar systems have polling built-in, but it is essential, for creating an interactive broadcast and recording, to capture audience feedback and display it in the recordings as well. Instantaneous feedback can also aid in the live discussion. For this reason, a streaming system that introduces a long delay, will not be effective in stimulating discussion. This is the single biggest problem with popular free options such as Google Hangouts On Air. The On-Air component introduces a substantial delay, which detracts from the audience participation.

Interactive phone lines: Foster a sense of community and easy access to key opinion leaders is essential. Enabling the participants to call in and speak with the presenters is essential. Having an operator, who is able to connect users into the meeting and triage calls, aids this process.

Chatting software: The custom interface has an embedded chat client that enables group and private chatting. The chatting should be archival and searchable and as stated above, should not deviate from the timeline of the event do to delay. Additionally, the speakers should be able to chat alongside the participants as well in a separate private area.