

# Being an Effective Surgical Educator

Jonathan D'Cunha, MD, PhD<sup>a</sup>, Connie C. Schmitz, PhD<sup>b</sup>,  
Michael A. Maddaus, MD<sup>c,\*</sup>

## KEYWORDS

- Residency • Education • Modern trainee
- Thoracic surgery • Mentorship

## THE CURRENT TRAINING PROBLEM

During the pre-work-hour limitation era, the world of surgical training was one best described as survival of the fittest: extremely long work hours, little if any regard for the trainee's personal or emotional health, call rooms in janitors' closets, and the reality that we had to prove ourselves day in and day out. The primary demands of this surgical training paradigm were the raw volume of work and the resilience needed to endure the process. We believe that most surgeons of the previous era fully recognize that there was real value in their training experience: demonstrating proof of commitment, learning to manage physical fatigue, and recognizing that we were capable of much more than we thought. In other words, we proved our resilience and total commitment to our career. But we also acknowledge, whether openly or not (more likely the latter), that it came with a price. The process was dehumanizing, often mean-spirited, and typically devoid of any formal education in so many areas (ie, the six Accreditation Council for Graduate Medical Education [ACGME] competencies) critical to the development of a compassionate and effective surgeon.

"The good old days," however, are gone. The current training paradigm incorporates work-hour restrictions, with its inherent potential for shift-work

mentality, and a strong emphasis on the six ACGME competencies. These seismic shifts have been forced on the surgical education community, and many surgeons of our era—those currently responsible for educating the next generation of surgeons—are learning to contend with these changes and to embrace them along with the characteristics of the new trainees we encounter.

Despite the changes in surgical education, training to become a thoracic surgeon remains a demanding and challenging process. Equally as demanding is trying to teach the current trainee given the limitations placed on us. To accomplish this ambitious goal, we must abandon the very powerful nostalgic draw of the ways in which we were trained. We need to look to other disciplines, such as the fields of education and business, for guidance. In other words, we need to think outside of our surgical box but still maintain the focus on the patient. What surgeon product is the best for the patient? What attributes would we want in a surgeon caring for one of us?

To start this process and be successful, we must first completely divorce ourselves from the embedded notion that the number of work hours, and lots of them, is the only true litmus test of a resident's physical and mental capabilities and commitment to the field. This issue is so profoundly central to our thinking, either overtly or subconsciously, that it

---

Conflicts of Interest: None.

Funding Source: None.

<sup>a</sup> Division of Thoracic and Foregut Surgery, Department of Surgery, University of Minnesota, MMC 207, 420 Delaware Street Southeast, Minneapolis, MN 55455, USA

<sup>b</sup> Department of Surgery, University of Minnesota, MMC 195, 420 Delaware Street Southeast, Minneapolis, MN 55455, USA

<sup>c</sup> Division of Thoracic and Foregut Surgery, Department of Surgery, University of Minnesota Medical School, University of Minnesota, MMC 207, 420 Delaware Street Southeast, Minneapolis, MN 55455, USA

\* Corresponding author.

E-mail address: [madda001@umn.edu](mailto:madda001@umn.edu)

Thorac Surg Clin 21 (2011) 359–368

doi:[10.1016/j.thorsurg.2011.04.009](https://doi.org/10.1016/j.thorsurg.2011.04.009)

1547-4127/11/\$ – see front matter © 2011 Elsevier Inc. All rights reserved.

prevents or clouds our openness to new ways of thinking or new ideas. Only after passing this hurdle will we be able to think clearly and search for new ways to construct an equally demanding, but different, training paradigm.

With this as an introduction, we should really identify the characteristics of the “perfect trainee.” If we understand this definition at its root, educating the modern trainee becomes easier, because we can agree on the ideal product that we are aiming to produce. We must hold trainees to the highest expectations, as this will set the stage for their future careers. Each trainee must be prepared for every endeavor of daily work life: knowing the history of each patient, reading about all cases in advance with a focus on the disease process and indications for the operation, reviewing the technical details of the procedures before operating, conducting the operation safely, understanding options for unanticipated intraoperative findings, effectively managing postoperative care, identifying and managing complications of surgery, and dictating appropriate follow-up. All of these patient care-related tasks must be executed within the context of the other core competencies, such as professionalism and systems-based practice. The key goal here is to raise the bar high enough to produce a consistently demanding educational environment that requires residents to perform at the highest level, in the same way that they were demanded to work long hours in the past. Adapting our current educational process with these concepts in mind will be critical for the viability of quality surgical training given the current external pressures. These concepts must be held at the forefront of our training objectives, as outside forces continue to erode into the already compressed training time. It is critical that we keep ourselves from the slippery slope of surgical mediocrity in terms of the product we produce. We owe our patients and our profession these high standards.

### THE MODERN TRAINEE

It is true, and there is no denying it: today's trainees simply are not the same as they used to be. Most current medical educators are Baby Boomers (born 1946–1964) or early members of Generation X (born 1965–1981); modern trainees tend to fall into the cohorts of late Generation X or Millennials, also known as Generation Y (born 1982–2000).<sup>1,2</sup> These new members of the surgical community possess their own attitudes toward authority, lifestyle, and social values. While they have high expectations for themselves, they also have very high expectations for their work

environment, requiring individualized approaches to personal growth and mentorship.<sup>1</sup>

Today's learners grew up in the era of multiculturalism, international terrorism, and technological boom, all under the watchful eyes of “helicopter parents,” hovering over them at life's junctures, both large and small.<sup>3</sup> Having been exposed to an entirely different set of values and experiences, it is only fair to expect these individuals to develop traits consequent to their previous environments. Millennial learners have been noted to require highly structured educational directives, with absolute clarity of expectations.<sup>4</sup> They want to do well, but they may misperceive effort as achievement, having been told that “everybody's a winner” and having received sports trophies for participation alone.<sup>3,4</sup> Further, having been told that they can “do anything,” these individuals sometimes seem arrogant or overly confident in their skills or knowledge base.<sup>4</sup>

The typical modern trainee seems like a handful, but these individuals come with a number of strengths which we can potentially leverage to our advantage. These learners work well in teams and make positive use out of their social networks. They are generally comfortable with new technology, particularly when it is used for interactive educational purposes.<sup>5,6</sup> They are excellent at multitasking and can take on a number of simultaneous duties.<sup>4</sup> They are accustomed to diversity and respond well to a wide array of team members and environments.

The question remains, how do we meet the needs of these trainees? First and foremost, we need to understand them and their viewpoints, and use our knowledge of their strengths and weaknesses to most effectively deliver educational content.<sup>7</sup> These new learners are respectful of regulations and authority, when the rules are objective and transparent.<sup>4</sup> Provide ample feedback, set clear expectations, and communicate changes in plan.<sup>3</sup> Millennials tend to be community-focused team players, and they will respond well to problem-based educational challenges, particularly in a small group setting.<sup>8</sup> Allow them to work in teams, and empower them with opportunities to find solutions. Use case-based teaching conferences to bring them the practical perspective that they desire.<sup>1</sup> These trainees are technologically savvy, and they prefer active rather than passive means of knowledge acquisition.<sup>3,6</sup> Provide them with access to skills simulation, and deliver educational content in Web-based, readily accessible formats whenever possible.<sup>1</sup> Most importantly, recognize that today's learner *is* different, and that generational disparities can lead to challenges in the workplace and infringe upon transfer of

educational information. Be prepared for the new generation of trainees, attempt to meet their unique needs, and take advantage of the potential of their numerous strengths.<sup>1,9</sup>

### **THE EVER-CHANGING LANDSCAPE: INTEGRATED TRAINING**

As we have discussed, training our future surgical colleagues is an evolving challenge, requiring adaptation of our historical styles of teaching to meet the needs of the trainee in a limited period of time. We have considered new tools for simulation, content presentation, assessment, and feedback, and we have taken into account the unique needs of the modern trainee. We must also provide consideration to the changing landscape of surgical training, as the concept of integrated training has grown explosively and appears to be the face of future specialty training, with thoracic surgeons among those leading the way in this realm.<sup>10</sup>

In 2003, a second pathway to thoracic surgery board certification was revealed, with the introduction of a categorical-integrated 6-year thoracic surgery residency track.<sup>11,12</sup> This concept was established with the notion that candidates matriculating into this pathway would spend their entire surgical training under the direction of the thoracic surgery program director, with the ultimate goal of an educational package that would place both focus and emphasis on the trainee's eventual field of surgical practice.

The integrated training track is believed to offer several potential advantages for the resident: the opportunity for a more streamlined training experience; access to more extensive training in advanced technologies; exposure to adjunct medical fields relevant to multidisciplinary care of cardiothoracic patients; and, of course, a shorter training period.<sup>13,14</sup> For educators and leaders in the field of thoracic surgery, the integrated training programs provide access to highly successful students at an earlier stage, allowing us to recruit the best and brightest into our specialty.<sup>11</sup> Clearly, the concept of integrated training bares many attractive advantages. However, in order to embrace this new paradigm for training thoracic surgeons, we must be prepared to handle those challenges associated with training residents straight out of medical school.

Medical school graduates are exposed to heterogeneous educational experiences that do not uniformly prepare them for the transition to the responsibilities and expectations of residency training. Significant recent attention has been directed toward bridging this critical gap in surgical education.<sup>15-18</sup> In order to be effective educators

for trainees coming through integrated programs, we are faced with two important challenges: (1) we must take an active interest in improving the training provided during medical school, in order to ensure that future trainees are ready for the transition to thoracic surgical residency; and (2) we must consider the unique needs of these individuals as they join our programs (ie, characteristics of the modern trainee). They may lack the experience and maturity of general surgery program graduates,<sup>13</sup> and we must be prepared to provide these individuals with patient instruction in more basic surgical and clinical skills. We must offer mentorship that is appropriate for their level of experience and stage of their career. These trainees will be joining us at an earlier chronologic age, and we must support them through personal challenges that may be different from those of trainees in years past; these efforts will hopefully help minimize potential attrition, which remains a concern with regard to integrated trainees.

Although the specific needs of first postgraduate year (PGY-1) general surgery residents have been thoroughly defined, the unique objectives (and content) relevant to integrated trainees will need further tailoring, and, likewise, many of the tribulations of teaching residents in these types of integrated programs are, as of yet, unclear. However, in order to function as effective surgical educators for many years to come, we must be prepared to adapt our teaching styles, with careful consideration of the integrated thoracic surgical trainee's progression in the postgraduate experience.

### **THE FORMULA FOR IMPROVEMENT: UNDERSTANDING THE TRAINEE EXPERIENCE**

Since its Halstedian origins, surgical education, including training in the field of thoracic surgery, has been rooted in the apprenticeship model. Apprenticeship still remains the primary approach to surgical training, with clinical rotations serving as the structural scaffolding of the training environment. Historically, this has clearly been a successful approach for producing competent surgeons. The recent pressures challenging education are seriously encroaching upon the efficacy of this model. Thus, when one couples the systematic and political variables, along with the concept of the Net Generation trainee, it is generally accepted that a more structured approach to training will be valuable for the pupil. If one takes a step back to consider the ways in which we currently train residents and deliver material on rotations, the problems which are immediately apparent include the highly variable nature of the content delivery and the dependence

upon faculty engagement, which, unfortunately, is becoming increasingly fragmented.

When one considers the time limits of our educational interactions with trainees, the change in the type of trainee that we are seeing, and the optimal characteristics of the ideal trainee as outlined above, the principles of an effective rotation can begin to be explored. Those principles which we believe to be critical to effective teaching on a rotation are shown in **Box 1**.

If one takes these principles and applies them to a trainee's experience, we predict with a high level of certainty that the trainee will view the faculty as effective surgical educators. These steps highlight several important areas in the future of postgraduate education: (1) establishing clear goals and objectives, (2) providing access to educational materials in alignment with the needs of the learner, (3) delivery of interactive teaching, (4) conveying timely feedback, and (5) conducting formal assessment of knowledge congruent with established goals and objectives. We further believe that an online component to educational materials is particularly relevant to today's learner, and our early experience with this model<sup>19</sup> is now evolving into the norm for curricula. Not surprisingly, national curricula for thoracic surgery training are maturing, and the Thoracic Surgery Directors Association (<http://tsda.org>) is taking

the lead on this mission for residents. What must not be lost in this equation is that trainees deserve and require the interactive teaching component to fully master what is required to be optimally prepared in accordance with American Board of Thoracic Surgery standards.

## WHAT ABOUT SIMULATION?

The unique forces compounding the challenges of providing surgical training possess the potential to negatively impact thoracic surgery even more than any other specialty. Patient safety issues, a heightened emphasis on comparative outcomes, the complexity of today's patients, and the limitations of work hours have led us to postulate that the operating room (OR) may not be the best initial place for the technically inexperienced trainee. Simulation-based learning has the potential to provide the needed training and practice outside of the OR. This concept is a topic of increasing interest and growing popularity as simulation curricula mature.<sup>20–27</sup> In fact, some experts have advocated that a trainee should be approved in the simulation laboratory before assuming the surgeon role in the real OR. Surgical simulation has been incorporated quite nicely into most general surgery training programs, and advancements in simulation are coming at a rapid pace. Thoracic surgery as a specialty has been heavily involved in this process, and several recent reports have heralded the success of simulation at the Boot Camp<sup>22,24</sup> and other areas of simulation in thoracic surgery.<sup>28</sup> The next challenge is to find the right fit for this technology in training of the resident and, perhaps even more importantly, to educate the educators on how to incorporate this expensive technology optimally.<sup>29</sup> To be a better surgical educator, one cannot just send the trainee to the simulation center to practice. The whole experience must be structured according to the same principles that are applied to other aspects of education.

A complete discussion of the field of simulation is obviously beyond the scope of this article. However, as we think about how to be better educators, we must consider simulation and how we can uniquely apply it, not only to teach technical skills but also how to enhance other areas of education. For example, simulation has been effectively used to enhance the cognitive components of training, such as simulating critical postoperative emergencies in surgical patients.<sup>18</sup> Its application to complication disclosure and family end-of-life discussions is also another potential great use of this technology.<sup>30</sup> There has been extensive development in the execution of these

### Box 1

#### Principles for effective teaching on a rotation

1. Formal orientation to the rotation with introduction of clinical and educational goals and objectives
2. Weekly case-based presentations that cover core topics in the specialty (ie, rotation-based core curriculum with online access to reading assignments and other necessary educational materials)
3. Weekly teaching rounds to integrate core topics with important issues in clinical management
4. Scrub sink teaching: reviewing the case with the trainee preoperatively to discuss the workup, the technical details of the operation, and the important factors in postoperative care for the procedure performed
5. Graded technical responsibility in the operating room based on the goals and objectives appropriate for the level of the trainee
6. Mid-rotation evaluation of performance
7. End-of-rotation evaluation of performance
8. Examination at the end of rotation, including both written and oral components of the material to be mastered

educational areas desperately needing attention, as well as in the standardized approach to their evaluation. The road to being an effective surgical educator requires more than just familiarity with the known potential uses of a technology; it demands recognition of unique attributes that can be harnessed to bridge educational gaps.

### PROMOTING ACTIVE LEARNING IN THE MODERN TRAINEE

Those entering thoracic surgery residencies are at the top of the academic achievement pyramid. They have typically found that concepts come to them in a very easy way, as their raw intellect has carried them through both structured and more nonstructured environments. This is not to say they have not worked hard over many years; rather, the thoracic resident is generally a highly independent learner who has excelled in all aspects of academic life. Thoracic residents are individuals who may have hit bumps in the road from time to time, but they know how to get themselves reoriented to keep moving forward. In the context of the above discussion regarding the evolution of the modern trainee, we need to be aware that the resident who will be coming into training will have experienced a very different world of graduate medical education. In fact, with the onset of integrated training, these trainees may not have had any learning beyond medical school. Nonetheless, helping these smart people who were successful in the previous schooling become better at the job of learning during residency is vitally important.<sup>31</sup>

In evaluating how we teach the trainee, a useful starting point is with the question of why highly accomplished stellar general surgery trainees might struggle when they get to thoracic residency. The answer lies not only in understanding the excellence in judgment required in the preoperative assessment, the technical skillfulness needed during an operation, and the attention to detail demanded in the postoperative setting, but also in the mastery of the incredible level of detailed knowledge of thoracic and foregut pathology needed to be a competent thoracic surgeon (as delineated by the American Board of Thoracic Surgery). This knowledge is especially important in thoracic residency, because the clinical proficiency that one requires is the pinnacle of surgical expertise, and the qualifying and certifying examinations to demonstrate mastery of this complex content are the most difficult tests the graduate will ever encounter. It is our duty as educators to put our residents in a position to conquer these concepts. The pace of training

and the limited work hours will force us to be more efficient in the ways that we teach and motivate via enhancing self-directed learning. No longer can you look the trainee in the face and inspire motivation simply by saying “you need to read more.” Why this is the case is likely a multifactorial issue, but the culture of training has changed, and, for better or for worse, this is a stark reality. Further, this Internet generation has so much material available that they are tempted away from structured approaches to problems, such as reading a chapter from start to finish. This paradox is very interesting, and will likely plague us for years to come unless we actively adapt our methods within this environment.

The vast majority of what is needed for cognitive competency during surgical training is acquired in the clinical setting or at home. Specialty conferences, core didactic sessions, Grand Rounds, Morbidity and Mortality conferences, and skills laboratories may account for as many as 5 hours per week, but topics taught during those hours will not necessarily all be appropriate for the level of all thoracic trainees in their individual academic developments. Studying occurs in interrupted fragments of time and competes with service obligations.<sup>31</sup> To illustrate this point, one of the authors (JD) once went to a review course after the completion of thoracic training. The course instructor started by asking the graduates in the room, “How many of you are opening the textbook in a formalized way for the first time?” It was shocking to see roughly two-thirds of the 200 or so people raise their hands. It was 2 months before the qualifying examination!

To thrive, especially in thoracic residency because of the unique demands, residents must become strategically opportunistic (ie, learning from every encounter), but also more proactive and skilled in their approaches to learning.<sup>31</sup> Self-directed, self-regulated learning (SRL) has been a subject of great interest to educational psychologists for more than 100 years. Most educators can easily recognize SRL learners; they are motivated, confident, diligent, strategic, goal-oriented, resourceful, and persistent.<sup>32</sup> They are aware of *how* they learn, and can find ways to learn. They are not challenged by the circumstance or obstacles encountered. They are not necessarily brighter, and this is an important concept as it relates to the thoracic trainee in the modern era.<sup>33</sup> What sets them apart is the degree to which they take ownership of their own learning, along with their use of a variety of strategies to achieve academic goals. In education terms, they are “metacognitively, motivationally, and behaviorally active participants in their own learning.”<sup>33</sup>

As discussed in the authors' previous work, two things influence how new information gets encoded and moved from short-term working memory to long-term memory in retrieval form for the learner: *How* one reads (or listens, in the case of lectures; or observes, in the case of watching others), and *what one does* with what was read (or heard, or seen).<sup>31</sup> We firmly believe that although a fair amount of straightforward detail is provided in what follows, it is this detail that may be of very practical use for the thoracic educator or mentor.

First, the trainee must be alert. You have to be focused. You have to pay attention, which is not easy in a distracting environment and when one is fatigued. Sitting in a comfortable chair in a warm room after a long day in the hospital is a prescription for disaster. This experiment has been tried and routinely failed. Next, you have to DO SOMETHING with new information to give it meaning, accommodate it with what you already know, and remember it later on. 'Deep learning' means getting information encoded in memory in multiple ways. This is most effectively done when you actively do something to *interact* with the information. In the case of reading, at the very least, this means highlighting, underlining, or jotting notes on the margin of a page. Whatever the strategy, the trainee should be engaged and be active in their process of mastering the information.<sup>31</sup>

Encourage the trainees to make their minds truly process the information. This means not just taking notes for the sake of taking notes, but rather actually thinking about the concept and recording the critical points to capture the essence of the concept being tested. As the educator responsible for their training, hold them accountable. Test them on these points at your core curriculum conference or other venue. This process can be formal or informal through direct questioning. This level of engagement is critical to probe them as to whether they have mastered the goals and objectives of the topic. Be prepared for the level of work involved as the teacher, as it will force you to truly master the material, too!

## EXPLORING TEACHING IMPROVEMENT

As mentioned above, the vast majority of what is learned during residency or fellowship training is learned outside of formal, structured teaching venues, such as Morbidity and Mortality conferences, Grand Rounds, or specialty conferences. Programs can greatly influence the educational value of that 95% of unstructured time by articulating clear goals and objectives for each rotation,

holding regular teaching rounds, using case-based teaching methods, and supporting learning with Web-based learning resources. However, to improve overall teaching effectiveness, we must look at what we as faculty do (or do not do) "on the ground."

It is our experience that some faculty members posit that learning is the responsibility of the trainee. Truly, residents and fellows are adult learners who need to own their learning process. As adults they can (and do) learn from observation; their readings; trial and error; and independent practice, discovery, and self-reflection. But most cannot learn through these efforts alone, nor is their unguided discovery as efficient or effective as discovery that is guided by expert faculty.<sup>34</sup> From a developmental perspective, trainees need considerable guidance early in their careers, to be tapered gradually to more autonomous learning. The role of the clinical teacher therefore shifts as the trainee matures. This fact is especially important for cardiovascular and thoracic surgeons to recognize, as they may be more accustomed to working with fellows and senior residents, and fail to recognize the degree of guided discovery needed at the junior level.

Effective clinical teaching is characterized both by general personality traits and by general teaching behaviors (**Box 2**). Significant research exists on these traits in the clinical setting (ie, hospital ward, clinic)<sup>35</sup>; less exists on effective teaching in the surgical theater, but a body of descriptive and qualitative work is emerging. Most research on teaching effectiveness is based on resident or student ratings of their attending faculty members. This is due to the lack of validated outcome measures for successful learning (aside from standardized test scores) and the difficulty of attributing performance to individual faculty members. One example using test scores found that the average score of medical students on the National Board of Medical Education examination was significantly associated with teacher behaviors in three areas<sup>36</sup>: explanation of diagnostic reasoning, providing feedback, and role modeling. Although critics contest that ratings of faculty teaching by trainees amount to a popularity contest, well-constructed instruments have been found to be reliable and useful.<sup>35,37</sup>

Physician faculty members tend to overestimate how much teaching they actually do in the clinical setting and OR.<sup>38-40</sup> We learned this the hard way in 2006, when we administered comprehensive surveys of faculty and residents from our own program (data not shown). In response to a series of questions about the frequency at which a host of teaching and assessment practices occurred,

**Box 2****General traits and teaching behaviors of effective clinical teachers**

- General traits
  - Enjoys teaching
  - Is clinically competent
  - Knows the literature
  - Is enthusiastic about the subject matter
  - Exudes confidence in role as teacher
  - Is curious and a life-long learner
  - Respects patients
  - Cares about the learner
  - Is a role model for professionalism
- General teaching behaviors
  - Makes time to teach; prepares for teaching
  - Provides clear goals and objectives
  - Communicates expectations
  - Answers questions clearly
  - Actively involves learner
  - Deconstructs complex tasks into component parts
  - Demonstrates skills clearly
  - Explains reasoning behind decisions
  - Uses questioning skills
  - Elicits trainee's own thought processes and questions
  - Assesses the learner honestly, fairly
  - Guides and monitors practice
  - Provides constructive feedback
  - Encourages self-assessment and reflection

faculty consistently reported that they delivered more teaching than residents reported receiving. The pattern of discrepancy between faculty and resident perceptions was striking in its breadth (statistically significant differences were found on 30 of 38 practices) and in the size of the gaps (perceptions of frequency differed by as much as 40, 50, and up to 80 percentage points).

We are not alone. A study examining surgeon and resident recall of good and poor intraoperative teaching found that both groups agreed on attributes of effective teaching (training autonomy, teacher confidence, and communication) and negative teaching (contemptuous, arrogant, accusatory, or uncommunicative behavior), but the groups disagreed on how often both sets of these behaviors occurred.<sup>41</sup>

Currently, there is growing interest and research on teaching in the OR. Although the OR represents the sine qua non of experiential learning with high potential educational outcomes, it remains the "least structured and studied format for teaching surgery."<sup>42</sup> Additionally, with duty hour restrictions and pressures for clinical productivity, concern is increasing about the eroding opportunities for

faculty to teach and for residents to experience sufficient autonomy in the OR. A national survey of 998 residents from 148 residency programs found that most residents agreed that attending surgeons explain their verbal approach before the operation (55%), include residents in intraoperative decisions (61%), and offer technical advice (84%).<sup>43</sup> Most did not think that their attendings provided any guidance on preoperative reading materials (85%), nor did they discuss personal learning goals prior to the case (59%). More than half of all residents logged their procedures as primary surgeon between 76% and 100% of the time, although they believed that they performed at that level significantly less often.

In addition to highlighting disparities of perception between faculty and trainees about the frequency of teaching, research is illuminating different aspects of the attending role. In one recent paper, focus groups with 53 surgeons were held to elicit their expectations, experiences, and perceptions about how they teach in the OR. Results reflected core themes related to teaching intentions and strategies for managing the learning environment, such as internal distractions, barriers to teaching, need to protect patients, time pressures, and advocating with other staff to support teaching.<sup>44</sup> Highly effective intraoperative educators have been perceived to be calm, courteous (provides feedback without "belittling"), and fair with respect to providing equal opportunities to residents ("plays no favorites").<sup>42</sup> "Ideal" surgeon educators in the OR have also been described as having an "instructional plan," able to "facilitate surgical independence," and able to "show support and empathy for the resident."<sup>45</sup>

What should be taught during an operation? What would an "instructional plan" include? What learning goals are appropriate for an event that, by definition, cannot be scripted in advance? Interviews with faculty and residents on appropriate learning goals for the OR suggested that both groups identified similar content areas: learning patient anatomy, basic and advanced surgical skills, general and specific procedural tasks, steps leading to technical autonomy, and preoperative, intraoperative, and postoperative considerations.<sup>46</sup> Faculty generated more potential learning goals than did the residents, however, and the groups stressed somewhat different goals. While the most frequent goal area for both groups was that of "general procedural tasks," the area "preoperative considerations" was frequently identified by faculty but more rarely by residents.

But does having an idea of potential learning goals for an upcoming operation lead to shared communication about the goal, or teaching

directed to that goal? Several investigators have cataloged verbal interactions between attending faculty members and trainees in the OR. A qualitative field study by Irani and colleagues<sup>47</sup> of the amount and content of medical student teaching in the OR found that, on average, only 9.8% of the total case time was spent teaching content relevant to clerkship goals. An observational study by Roberts, Williams, and Kim presented at the Spring Meeting of the Central Group on Educational Affairs in 2008 found that although faculty and trainees frequently engaged in conversation, their interactions focused principally on getting through the operation quickly, safely, and effectively.<sup>48</sup> Additionally, the teaching information given by faculty was offered in an opportunistic fashion, with real-time events triggering a stream of associated thoughts, ideas, and advice. Little evidence was seen of an overt plan regarding what the faculty member wished the resident to learn, or what the resident wished to accomplish. Other studies, however, have analyzed the content of surgeon "war stories" and found them to be instructive in key areas such as intraoperative technique, decision making, error identification, therapeutic/treatment options, and resource management.<sup>49</sup>

What should the thoracic surgeon interested in education take away from this discussion on intraoperative teaching? Surgeon educators are seeking simple ways to teach more deliberately in the OR while maintaining their main obligation to the patient. For example, an intraoperative teaching model advanced by Roberts and colleagues<sup>50</sup> describes three steps: (1) a briefing (2-minute scrub sink discussion focused on what the trainee wishes to practice, and what the attending wants the trainee to learn); (2) intraoperative teaching (explicit focus on the learning goals established at the scrub sink); (3) followed by a 5-minute debriefing (review of what was learned, along with feedback, reinforcement, and recommendations for future steps).

## **MENTORSHIP: THE CATALYST OF THE REACTION**

The concept of mentorship has been all the rage in the past several years, and it is clearly a critical component to any career. Although the term *mentor* has been used in and around thoracic surgery (and other organizations outside of health care) for many years, most people think that the role of mentor is fulfilled by one person, someone who is more senior and experienced than the mentee. One should keep in mind several important concepts regarding mentorship. No one is so self-

sufficient that they do not need help or direction. A mentor can play many vital roles in a thoracic surgical career, including everything from clarity of goals, creating a successful clinical practice, and defining guiding principles within an organization. Often the mentor can be a model of how to carry oneself successfully in a particular environment, whether a private or an academic setting. A mentor can provide critical feedback or help in times of unanticipated difficult situations. A broader and more useful understanding of the mentor role is this: anyone can be a mentor for anyone else. Further, we recommend that people use several mentors who have strengths in different areas. These mentors can be found up, down, or even laterally within the structure of a surgical practice or organization, each supporting an area of need and development.

Another important concept is that the mentor should remind the mentee that, as a professional, he or she is constantly in the learning business. The biographies of the most accomplished individuals in history will show that they were in a constant learning mode. Even when one achieves perceived mastery in a field or area, there is always something new to learn, consider, and think through. This advancement may often draw on information from areas outside of the medical literature, such as professional development, leading change within an organization, and how to make the jump from good to great. The old modality of mastering a profession and then basing your work on this expertise is long gone, and learning new concepts and tools can really keep one in proper evolution with the changing times. A mentor's guidance through this process can be invaluable.

Career development areas that are often the most important are those that have grown out of mentorship. The formalization of this type of program is important in addressing the other areas of competency that the ACGME values in postgraduate education. We have begun a program of personal and professional development for residents. Through assessment and coaching/mentoring they develop self-awareness and leadership skills that will benefit the organization and patient care. Our patients and our specialty demand that we train the surgeon of the future, one who is self-aware, who is a leader in the place of practice and specialty, and who has been inculcated with the intellectual rigor we demanded during residency, much like work hours were demanded of us.

## **CONCLUDING THOUGHTS**

In summary, research on effective teaching highlights a consistent set of teacher attitudes,

qualities, and behaviors. To improve teaching, we need to look first at any subconscious attitudes we have about teaching and trainees, because whether we know it or not, these attitudes are transmitted during the first few moments of any teaching encounter. Second, we can remember to make our teaching as transparent and overt as possible. We should not assume that just because we are talking, we are teaching; we need to check to see that messages are understood and relevant to the trainee's stage of development. Third, we can try to teach more intentionally in the OR using a simple three-step model such as that described here. Lastly, we can commit to developing self-awareness and greater curiosity about teaching. Why curiosity? Because teaching and learning are complex social interactions. If we can remain curious about how it all happens, then we are more likely to enjoy it, and more willing to accept its challenges and our occasional failures on the road to becoming effective surgical educators.

## ACKNOWLEDGMENTS

The authors wish to thank Mara B. Antonoff, MD, for her research and editorial support of this manuscript.

## REFERENCES

- Moreno-Walton L, Brunett P, Akhtar S, et al. Teaching across the generation gap: a consensus from the Council of Emergency Medicine Residency Directors 2009 academic assembly. *Acad Emerg Med* 2009;16(Suppl 2):S19–24.
- Shangraw RE, Whitten CW. Managing intergenerational differences in academic anesthesiology. *Curr Opin Anaesthesiol* 2007;20:558–63.
- Schlitzkus LL, Schenarts KD, Schenarts PJ. Is your residency program ready for Generation Y? *J Surg Educ* 2010;67:108–11.
- Venne VL, Coleman D. Training the millennial learner through experiential evolutionary scaffolding: implications for clinical supervision in Graduate Education Programs. *J Genet Couns* 2010;19:554–69.
- Sandars J, Morrison C. What is the net generation? The challenge for future medical education. *Med Teach* 2007;29:85–8.
- Sandars J, Homer M. Reflective learning and the net generation. *Med Teach* 2008;30:877–9.
- Swanson JA, Antonoff MB, D'Cunha J, et al. Personality profiling of the modern surgical trainee: insights into generation X. *J Surg Educ* 2010;67:417–20.
- Borges NJ, Manuel RS, Elam CL, et al. Differences in motives between Millennial and Generation X medical students. *Med Educ* 2010;44:570–6.
- Clarke JT, Marks JG, Miller JJ. Mind the gap. *Arch Dermatol* 2006;142:929–30.
- Bell RH. Graduate education in general surgery and its related specialties and subspecialties in the United States. *World J Surg* 2008;32:2178–84.
- Crawford FA. Thoracic surgery education—responding to a changing environment. *J Thorac Cardiovasc Surg* 2003;126:1235–42.
- ABTS. Certification by the American Board of Surgery (ABS) is optional rather than mandatory for residents who begin thoracic surgery training in July 2003 and after. Last revised Oct 29 2002. Available at: <http://www.ctsnet.org/doc/6678>. Accessed April 21, 2011.
- Stephens EH, Halkos ME, Nguyen TC. Integrated and fast-track cardiothoracic surgery training programs. Available at: [http://www.ctsnet.org/sections/residents/fearesarticles/res\\_ed-.html](http://www.ctsnet.org/sections/residents/fearesarticles/res_ed-.html). Accessed April 21, 2011.
- Crawford FA. Thoracic surgery education—past, present, and future. *Ann Thorac Surg* 2005;79:S2232–7.
- Esterl RM, Henzi DL, Cohn SM. Senior medical student “Boot Camp”: can result in increased self-confidence before starting surgery internships. *Curr Surg* 2006;63:264–8.
- Boehler ML, Rogers DA, Schwind CJ, et al. A senior elective designed to prepare medical students for surgical residency. *Am J Surg* 2004;187:695–7.
- Antonoff MB, Swanson JA, Acton RD, et al. Improving surgery intern confidence through the implementation of expanded orientation sessions. *Surgery* 2010;148:181–6.
- Antonoff MB, Shelstad RC, Schmitz C, et al. A novel critical skills curriculum for surgical interns incorporating simulation training improves readiness for acute inpatient care. *J Surg Educ* 2009;66:248–54.
- Whitson BA, Hoang CD, Jie T, et al. Technology-enhanced interactive surgical education. *J Surg Res* 2006;136:13–8.
- Carpenter AJ, Yang SC, Uhlig PN, et al. Envisioning simulation in the future of thoracic surgical education. *J Thorac Cardiovasc Surg* 2008;135:477–84.
- Fann JI, Caffarelli AD, Georgette G, et al. Improvement in coronary anastomosis with cardiac surgery simulation. *J Thorac Cardiovasc Surg* 2008;136:1486–91.
- Fann JI, Calhoon JH, Carpenter AJ, et al. Simulation in coronary artery anastomosis early in cardiothoracic surgical residency training: the Boot Camp experience. *J Thorac Cardiovasc Surg* 2010;139:1275–81.
- Hicks GL Jr, Brown JW, Calhoon JH, et al. You never know unless you try. *Ann Thorac Surg* 2008;86:1063–4.
- Hicks GL Jr, Gangemi J, Angona RE Jr, et al. Cardiopulmonary bypass simulation at the Boot Camp. *J Thorac Cardiovasc Surg* 2011;141:284–92.
- Feins RH. Expert commentary: cardiothoracic surgical simulation. *J Thorac Cardiovasc Surg* 2008;135:485–6.

26. Carter YM, Marshall MB. Open lobectomy simulator is an effective tool for teaching thoracic surgical skills. *Ann Thorac Surg* 2009;87:1546–50 [discussion: 51].
27. Ramphal PS, Coore DN, Craven MP, et al. A high fidelity tissue-based cardiac surgical simulator. *Eur J Cardiothorac Surg* 2005;27:910–6.
28. Solomon B, Bizekis C, Dellis SL, et al. Simulating video-assisted thoracoscopic lobectomy: a virtual reality cognitive task simulation. *J Thorac Cardiovasc Surg* 2011;141:249–55.
29. Verrier ED. Joint Council on Thoracic Surgical Education: an investment in our future. *J Thorac Cardiovasc Surg* 2011;141:318–21.
30. Chipman JG, Webb TP, Shabahang M, et al. A multi-institutional study of the Family Conference Objective Structured Clinical Exam: a reliable assessment of professional communication. *Am J Surg* 2011; 201:492–7.
31. Schmitz CC, Antonoff MB, D'Cunha J. Developing self-regulated learners can help residents be better learners. In: Residency Assist Page. American College of Surgeons; 2010. Available at: <http://www.facs.org/education/rap/schmitz1110.html>. Accessed June 1, 2011.
32. Weinstein CE, Husman J, Van Mater Stone G, et al, editors. Teaching students how to become more strategic and self-regulated learners. 12th edition. Boston: Houghton Mifflin; 2006.
33. Zimmerman B. Self-regulated learning and academic achievement: an overview. *Educ Psychol* 1990;25:3–17.
34. Mayer RE. Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. *Am Psychol* 2004;59:14–9.
35. Sutkin G, Wagner E, Harris I, et al. What makes a good clinical teacher in medicine? A review of the literature. *Acad Med* 2008;83:452–66.
36. Blue AV, Griffith CH III, Wilson J, et al. Surgical teaching quality makes a difference. *Am J Surg* 1999;177:86–9.
37. Cohen R, MacRae H, Jamieson C. Teaching effectiveness of surgeons. *Am J Surg* 1996;171:612–4.
38. Scallon SE, Fairholm DJ, Cochrane DD, et al. Evaluation of the operating room as a surgical teaching venue. *Can J Surg* 1992;35:173–6.
39. Rose JS, Waibel BH, Schenarts PJ. Disparity between resident and attending surgeons' perceptions of pre-operative preparation, intra-operative teaching, and post-operative feedback. Presented at the Annual Meeting of the Association of Program Directors in Surgery. Boston, March 25, 2011.
40. Vollmer C, Newman N, Guang G, et al. Perspective on intraoperative teaching: divergence between learning and teacher. Presented at the Annual Meeting of the Association of Program Directors in Surgery. Boston, March 25, 2011.
41. Butvidas LD, Anderson CI, Balogh D, et al. Disparities between resident and attending surgeon perceptions of intraoperative teaching. *Am J Surg* 2011;201:385–9 [discussion: 9].
42. Iwaszkiewicz M, Darosa DA, Risucci DA. Efforts to enhance operating room teaching. *J Surg Educ* 2008;65:436–40.
43. Snyder RA, Tarpley M, Tarpley JL, et al. Teaching in the operating room: results of a national survey. Presented at the Annual Meeting of the Association of Surgical Education. Boston, March 23, 2011.
44. Dath D, Hoogenes J, Szalay DA, et al. An exploration of the intra-operative teaching responsibilities of the surgeon as teacher. Presented at the Annual Meeting of the Association of Surgical Education. Boston, March 23, 2011.
45. Vikis EA, Mihalynuk TV, Pratt DD, et al. Teaching and learning in the operating room is a two-way street: resident perceptions. *Am J Surg* 2008;195:594–8 [discussion: 8].
46. Pernar LI, Breen E, Ashley SW, et al. Preoperative learning goals set by surgical residents and faculty. *J Surg Res* 2011. [Epub ahead of print].
47. Irani JL, Greenberg JA, Blanco MA, et al. Educational value of the operating room experience during a core surgical clerkship. *Am J Surg* 2010; 200:167–72.
48. Roberts N, Williams R, Kim M. Adapting the one minute preceptor concept for the operating room. Presented at the Central Group on Educational Affairs Spring Meeting. Columbus, Ohio, April 12, 2008.
49. Hu YY, Peyre S, Arriaga A, et al. War stories and other narrative teaching strategies in the operating room: a qualitative analysis. Presented at the Annual Meeting of the Association of Surgical Education. Boston, March 23, 2011.
50. Roberts NK, Williams RG, Kim MJ, et al. The briefing, intraoperative teaching, debriefing model for teaching in the operating room. *J Am Coll Surg* 2009;208:299–303.