Student-led learning: a new teaching paradigm for surgical skills

Jen Hoogenes, M.S., Ph.D.(c)a, Polina Mironova, B.A.b,c, Oleg Safir, M.D.b,c, Sydney A. McQueen, B.Sc.(Hons), M.Sc.(c)a, Hesham Abdelbary, M.D.b,c,d, Michael Drexler, M.D.c,e, Markku Nousiainen, M.Ed., M.D.b, Peter Ferguson, M.D.b,c, William Kraemer, M.D.b, Benjamin Alman, M.D.b, Richard K. Reznick, M.Ed., M.D.d,f, Ranil R. Sonnadara, Ph.D.a,b,c,*

aDepartment of Surgery, McMaster University, A. N. Bourns Science Building Room 131, 1280 Main Street West, Hamilton, Ontario, Canada L8S 4K1; bDepartment of Surgery, University of Toronto, Toronto, Ontario, Canada; cDepartment of Surgery, Mount Sinai Hospital, Toronto, Ontario, Canada; dDepartment of Surgery, University of Ottawa, Ottawa, Ontario, Canada; eDepartment of Surgery, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel; fDepartment of Surgery, Queen’s University, Kingston, Ontario, Canada

KEYWORDS: Residents; Surgical education; Competency-based education; Non-technical skills; Residency; Surgical simulation

Abstract

BACKGROUND: Competency-based education and simulation are being used more frequently in surgical skills curricula. We explored a novel student-led learning paradigm, which allows trainees to become more active participants in the learning process while maintaining expert guidance and supervision.

METHODS: Twelve first-year orthopedic residents were randomized to either a student-led (SL) or a traditional instructor-led group during an intensive, month-long, laboratory-based technical skills training course. A rigorous qualitative-description approach was used for analysis.

RESULTS: Four prominent themes emerged: instructional style, feedback, peer and instructor collaboration, and self-efficacy. Compared with the instructor-led group, there was more peer assistance, feedback, collaboration, and hands-on and active learning observed in the SL group.

CONCLUSIONS: The flexible and socially rich nature of the SL learning environment may aid in development of both technical and nontechnical skills early in residency and ultimately privilege later clinical learning.

© 2015 Elsevier Inc. All rights reserved.
Surgical educators are seeking new approaches to training residents. Two prominent trends are emerging. The first is a transition toward competency-based education (CBE), which aims to prepare physicians to graduate with demonstrated competencies and de-emphasize time-based training while assuring greater accountability, flexibility, and learner centeredness. A number of competency frameworks have been developed, with each built on the notion that trainees must demonstrate proficiency on key predefined outcomes before being authorized to continue to the next stage of their training, eventually leading to certification for independent practice.

The second trend is an increasing use of simulation-based teaching sessions to supplement and enhance traditional clinical learning. Recent years have seen an exponential increase in the number of high- and low-fidelity simulators and bench models, which can be used to teach and perfect medical and surgical techniques in a low-risk, stress-free environment before they are applied to the high-stakes clinical setting. One important variable that has been examined with regard to simulation training is the role of independent learning paradigms, such as student self-guided learning, which are becoming increasingly popular in residency programs, especially because of the augmented ease of access to simulation laboratories. Although some studies have reported that self-guided or self-regulated learning can provide effective learning environments for trainees, researchers warn that some level of supervision should be maintained and that complete learner autonomy should not necessarily be the ultimate goal of medical and surgical education. The amount of time and influence a teaching clinician provides to learners still needs to be determined. Additionally, these studies have exclusively examined the acquisition of technical skills; yet, little is known about how self-guided learning may affect the acquisition and use of nontechnical skills.

Our team from the University of Toronto recently developed a novel training paradigm entitled student-led learning (SLL). SLL is a new term, coined to set this approach apart from many buzzwords that permeate through the literature, such as self-guided, self-regulated, and student-driven models of learning, many of which have been interpreted differently by various groups. Although the primary tenets of SLL are not new, this approach is a carefully selected combination of key aspects of a variety of teaching strategies, systematically implemented into a cohesive program. SLL stresses the importance of trainees’ autonomous control over the learning process, yet, unlike self-directed and self-regulated learning, which are generally unsupervised, central to the SLL paradigm is that an educator is always present to provide assistance as required and to guide students through the learning process. Appropriate guidance by content experts is critical, especially in the earliest, formative stages of skill acquisition. SLL emphasizes the role of the educator as a facilitator who promotes deliberate, student-led exploration and practice, providing guidance and an educational framework when necessary. Furthermore, trainees who learn under an SLL paradigm are encouraged to work together in small groups, which contrasts with the independent nature of the instructor-directed, self-guided learner.

Our initial exploration of the SLL paradigm examined its ability to enhance the acquisition of technical surgical skills. Learning technical skills is an iterative process, during which trainees must analyze the skill, break it down into its components, define goals, and then create strategies to reach these goals. Creating an internal representation of what optimal performance should be for each component allows trainees to compare their actual performance against this representation and continue to solicit additional feedback with each attempt at the skill to improve their performance. SLL offers trainees an environment in which they are free to explore and develop their own internal representations for skill acquisition rather than working from templates that are provided through lectures and demonstrations. The SLL approach also encourages trainees to practice at their own pace and repeat skills as they deem necessary. Skills are reinforced through cooperative learning, whereas trainees become the primary support for their peers, with the instructor available for assistance as required.

We have previously shown that an SLL paradigm is an extremely effective approach for enhancing the acquisition of technical surgical skills. In our previous study, SLL was examined in the context of an intensive, technical surgical skills training course at the University of Toronto, known as the Toronto Orthopaedic Boot Camp (TOBC). First-year orthopedic residents who were taught under the SLL paradigm performed significantly better on a series of targeted skills examinations than their peers who were taught using traditional, instructor-led methods. Although the implementation of SLL has clear benefits for technical skills acquisition, there is more to being a competent surgeon than simply being an excellent technician. Training programs must also develop methods for teaching nontechnical skills, such as communication, collaboration, teamwork, and leadership skills. Nontechnical skills are difficult to quantify, and there is growing concern that a focus on the achievement of measurable technical competencies may be overshadowing a variety of other nontechnical skills, which are essential to the success of the profession.

Based on the SLL paradigm design and its success in technical skill acquisition, we believe it may be more useful than a traditional, instructor-led framework for developing surgical trainees’ nontechnical skills. Current laboratory-based surgical training courses may be overemphasizing technical skills and overlooking the importance of development of nontechnical skills. A primary aim of the SLL approach is to allow trainees to take more control over the learning process, perhaps promoting a more cooperative, social, and active learning environment, which may improve problem-solving and leadership abilities.
Working together toward a shared learning goal, trainees are able to challenge one another to achieve a higher level of thinking, therefore building up stronger mental models. Peer learning also improves trainees’ engagement, participation, motivation, communication, and attitude.23 Because of the success of our previous work with the SLL paradigm and its definitively positive effect on surgical skill acquisition, we set out to perform a qualitative exploration of nontechnical skill acquisition between 2 groups of first-year orthopedic residents: those who were allocated to the traditional instructor-led (IL) apprenticeship model compared with those in the student-led (SL) group.

Methods

Design

Research ethics board approval was received, and written informed consent was obtained from all participants. An observational, qualitative-description approach25 was used to explore how residents learned under the SL and IL teaching approaches during the TOBC, an intensive, month-long, laboratory-based technical surgical skills training program at the University of Toronto.26 Learners were trained in basic technical surgical skills and those specific to orthopedic surgery, with skills becoming more complex as the program progressed. Residents were also taught practical learning strategies designed to serve them throughout their residency. All residents participated in both anatomy laboratory and surgical skills center practical learning sessions. The anatomy laboratory sessions incorporated both didactic teaching and demonstration of techniques (using human cadavers), with a specific focus on identification of anatomic structures and surgical procedural techniques. The surgical skills center sessions were devoted to extensive practice of the technical skills taught during the anatomy laboratory sessions using state-of-the-art simulated bench models and surgical equipment. Residents completed 8 anatomy laboratory and 9 surgical skills center sessions (each lasting 3 hours), with 2 additional review sessions as the program neared completion. Both groups had equal practice time in both the anatomy laboratory and surgical skills center. Each group underwent daily identical didactic sessions before starting the anatomy laboratory and surgical skills center activities. All residents received the same written objectives and preparation material for each session, regardless of the assigned learning paradigm.

Setting and participants

Participants were randomly allocated to either the SL or IL group. Participants received a unique identification code for use throughout the study. SL-group residents were taught basic surgical skills using a format that focused on deliberate practice of the skills under facilitator supervision as necessary, allowing for extensive student collaboration and problem solving, while being given a considerable amount of autonomy. Residents in the IL group were taught the same surgical skills; however, the apprenticeship model that was used included extensive lecture and instruction periods, followed by thorough demonstrations of each surgical task.

The teaching faculty consisted of 2 orthopedic surgical fellows and 7 senior orthopedic residents, who were all supervised by a staff surgeon. The role of the supervising staff surgeon was to oversee the program as a whole, and the supervising staff surgeon did not participate in the teaching of either group. The fellows served as the primary instructors (1 per group), whereas the senior residents assisted with teaching as required. Each of the fellows and senior residents was assigned to 1 of the 2 groups without any crossover. The fellows and senior resident educators were trained by an expert surgical educator on the group-specific methods and constructs to incorporate during the sessions. To reduce bias, the SL educators were trained separately from the IL educators. The formal 3-day training course provided group-specific teaching advice, strategies, and suggestions for handling potential scenarios between instructors, educators, and/or residents. This training focused on the major tenets of CBE, with a specific emphasis on SLL principles for the SL educators, particularly with regard to facilitation rather than traditional instruction. Teaching techniques for the IL group were concentrated on constructs of the traditional apprenticeship model.

Data collection

Three uniformly trained research assistants observed each group during all didactic, training, and practice sessions in the anatomy laboratory and surgical skills center sessions. Extensive field notes were taken to record residents’, educators’, and instructors’ verbal and physical exchanges. On completion of the TOBC, 1 research assistant conducted semistructured exit interviews with each resident and the 2 instructors.27 This process allowed for the collection of rich qualitative experiential data. Interviews were audio-recorded and transcribed verbatim. An audit trail was maintained, and data were triangulated across investigators.

Data analysis

The field notes and responses of the interviews were separately analyzed for common themes by 3 independent researchers who had no previous interaction with the participants, senior residents, or instructors. All transcripts were individually analyzed to identify and define themes and concepts that were unique to the experiences of the participants. The investigators collaborated iteratively and developed a thematic codebook, with data reduction
conducted during each iteration until the codebook was finalized. Open, axial, and selective coding generated defined themes that were characteristic of the experiences of the participants in each group. Separate codebooks were developed for each group to allow for comparison of experiences. Recurrent themes from the exit interviews were also extracted to describe residents’ and instructors’ overall experiences and perceptions of the program.

Results

Nine male and 3 female residents with a mean age of 24.7 years participated. Qualitative content analysis of the field notes for the anatomy laboratory and surgical skills center sessions revealed similar themes between the SL and IL groups; however, the concepts related to each theme varied considerably between groups. Four primary themes emerged from the field notes and exit interview data: instructional style, feedback, peer and instructor collaboration, and self-efficacy. Themes involved a mixture of intrinsic and extrinsic factors that influenced the learning experiences of residents throughout the TOBC program (Table 1).

### Instructional style

The IL instructor combined the lectures with multiple lengthy demonstrations, whereas the participants watched but were not able to participate until the allotted practice time. The sessions were principally didactic in nature, and a running quiz format was used throughout each of the anatomy laboratory and surgical skills center sessions. Questions were most often targeted to the group as a whole and not just to one resident. The instructor then typically went on to lecture about the answers to the questions. During practice sessions, the instructor and educators frequently took over from the residents to demonstrate correct techniques. Strict verbal directing was used to guide residents through the task, which was often done more than once until completed correctly. With time, residents began to ask more questions of the instructor and educators. This would usually result in a lecture and demonstration.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison of themes by group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theme</strong></td>
<td><strong>Instructor-led group</strong></td>
</tr>
<tr>
<td><strong>Instructional style</strong></td>
<td>• Frequent, lengthy lectures</td>
</tr>
<tr>
<td></td>
<td>• Frequent takeovers</td>
</tr>
<tr>
<td></td>
<td>• Lengthy task demonstrations</td>
</tr>
<tr>
<td></td>
<td>• Primarily didactic in nature</td>
</tr>
<tr>
<td></td>
<td>• Running quiz format</td>
</tr>
<tr>
<td></td>
<td>• Verbal directing</td>
</tr>
<tr>
<td></td>
<td>• No explicit encouragement of peer collaboration</td>
</tr>
<tr>
<td><strong>Feedback</strong></td>
<td>• Infrequent in AL and SSC</td>
</tr>
<tr>
<td></td>
<td>• Not spontaneously provided</td>
</tr>
<tr>
<td></td>
<td>• Positive feedback sometimes provided when residents correctly answered questions</td>
</tr>
<tr>
<td></td>
<td>• Very limited peer feedback</td>
</tr>
<tr>
<td></td>
<td>• Residents most often required solicitation of feedback from instructors</td>
</tr>
<tr>
<td></td>
<td>• Rapport was established late in the TOBC</td>
</tr>
<tr>
<td></td>
<td>• Majority of residents chose to work independently, as instructors did not explicitly encourage group work, limiting collaboration</td>
</tr>
<tr>
<td></td>
<td>• Toward the end of TOBC, residents began to collaborate, but not consistently</td>
</tr>
<tr>
<td></td>
<td>• Instructors became more hands-off as TOBC progressed</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>• Residents observed more than practiced, diminishing confidence in their competency with certain tasks due to instructor takeovers</td>
</tr>
<tr>
<td></td>
<td>• Lack of time to practice decreased a sense of resident autonomy</td>
</tr>
</tbody>
</table>
demonstrations, the instructor often related the simulated procedure to typical scenarios one might encounter in the operating room while sometimes describing challenging cases personally experienced during practice. Residents in the IL group mostly worked independently and were not distinctly encouraged by the instructor to work in groups, although they were not explicitly told not to do so.

The SL instructor used a less-structured, hands-off observational approach to teaching, allowing residents to deliberately practice tasks in both the anatomy laboratory and surgical skills center at their own pace, collaboratively (or independently if the resident chose to do so). The didactic sessions were significantly shorter than those in the IL group, and lecturing was not common following questions from residents; rather, the questions were often addressed in groups. If the answer(s) warranted a demonstration, the instructor or resident educator would either demonstrate the technique first and then a resident would attempt the task, or they would walk the resident through the technique, offering corrective feedback when necessary. The instructor and educators were available to answer questions and offer assistance when asked by residents. A quiz format was never used, and the instructor did not take over from residents. The instructor walked the residents through the tasks, questioning them to ensure their understanding of the technique and the rationale for each step. Residents were encouraged by the instructor to collaborate with one another and work in groups in each setting.

Feedback

The theme of feedback was pervasive across all settings and for each group and was both verbal and nonverbal. In the IL group, feedback was infrequent regardless of the setting. One resident stated, "Sometimes we were told the topics to learn, but during the practice we were on our own." As the program progressed, residents began to solicit some feedback from the instructor and educators; yet, it was not always provided. In most cases, residents would instead receive a lengthy lecture or a demonstration of the specific task, during which the residents watched and asked questions but did not participate. Feedback was not spontaneously provided by either the instructor or resident educators; however, positive feedback was sometimes given when residents correctly answered questions. Residents primarily worked independently, limiting the opportunity for peer-to-peer feedback. The amount and type of feedback varied from session to session and was dependent on residents’ requests for feedback. Often, the instructor would take over a task and complete it while providing some explanation of the intricacies of the technique. One resident explained, "Many times (the instructor) put his hands in and took over."

Conversely, in the SL group, feedback from the instructors and educators was consistently positive during both the anatomy laboratory and surgical skills center sessions. Feedback was continuous during the practicing of surgical techniques and frequently occurred between residents in a collaborative manner. Demonstration and feedback were often complementary. As an example, when practicing skin grafting, a resident asked, "...once you cut through, what's the next step?" The instructor then demonstrated the task, watched the resident perform it, and then said, "That's very good, okay, well done." This was a common occurrence in the SL cohort. The instructor and educators also made efforts to identify incorrect technique(s), on which they provided specific feedback to explain why it was incorrect, then would demonstrate or assist until the technique was performed accurately. The SL instructor was described by several residents as "... a source for information and feedback, more like a mentor." As the program progressed, more feedback came from fellow residents than from the instructor and educators, and peer-to-peer advice was solicited and provided on a regular basis. Peer-to-peer interaction was omnipresent throughout the program in the SL cohort.

Peer and instructor collaboration

All 3 independent researchers found that collaboration between residents was distinctly different between groups. The residents in the SL group were encouraged to work in groups right from the beginning of the program, which in turn fostered peer-to-peer collaboration, allowing for assistance, advice, and feedback. These residents chose to work in both small and large groups, depending on the task. One resident noted, "... (it) was more of a collaboration in learning and trouble-shooting; happy to work and learn as a team." If 2 or more residents could not answer a particular question using their own resources, they then resorted to asking the instructor or educator. The provision of advice was commonly observed among residents in the SL group. According to one of the residents, "... it was a collaborative process (and very helpful), since we established rapport with peers." As the program progressed, residents in the SL group began to assume the role of the teacher, during which they would explain and demonstrate techniques to the group, answer questions, and discuss objectives.

Immediately from the beginning of the TOBC course, the IL residents worked independently instead of in groups, limiting collaboration among residents. An IL resident stated, "(The instructors) guided us through, but we did most of the procedures ourselves." Another noted, "... it was a mix of demonstration and doing it myself." Toward the end of the TOBC, however, the IL residents began to collaborate with one another more frequently but not consistently. A resident explained, "being able to bounce ideas off each other (at the end), get advice from each other; different people bring different strengths... it was more collaboration." Most the IL residents agreed that the instructor and educators became more hands-off as the program progressed.

Collaboration between instructors and residents also emerged in the field notes and exit interviews. This
occurred early in the SL group. The IL group, which followed more of a lecture and demonstration-based protocol, did not demonstrate this type of collaboration until late in the program when the residents became more comfortable with the instructor, the educators, and their peers. In stark contrast to the IL protocol, the SL residents were encouraged to work in small groups, and dedicated time for question and answer periods was set aside, both of which fostered this collaboration. One SL resident explained, “… having boot camp in a non-threatening environment with great resources in instruction was great, and (we) can learn at our own pace, learning from peers and establishing a good support network with the instructors and fellow residents.” Because of the individual practice nature of the IL format, collaboration with instructors and peers was quite limited.

Self-efficacy

Self-efficacy, as evidenced by self-reports of resident confidence, was not as profound in the IL group when compared with the SL group. The lengthy lectures and the taking over by the instructor during practice was a prevalent concept during both the anatomy laboratory and the surgical skills center sessions for the IL group. The IL residents found themselves doing more observing of procedures than actually practicing the tasks, which reduced the amount of time the residents had to practice and become more competent in the assignments as set out by the objectives. When one resident explained that the instructor took over quite frequently, he or she imparted that “taking over is not what I wanted; I really wanted to do it. I can read it any time, but this is my chance to actually do it.” The hands-off approach used with the SL group allowed the residents to work together, independent of the instructor. This appeared to boost the residents’ confidence and foster a sense of autonomy, as they were able to complete tasks successfully on their own, “… it’s nice to be able to answer someone’s questions correctly… it established confidence (among peers) that way.” Another SL resident explained that “(the educators) didn’t sit there and lecture us and hover over us all the time—(they) allowed us to experiment, until we hit a moment where we have a question and (they) come over to help us through and critique our technique until we got it right.”

Instructor exit interviews

The exit interviews with the 2 primary instructors also indicated differences in how the participants were taught and how they learned in both groups; however, many comments were positive with regard to the overall outcomes of the program. The SL instructor indicated that he tried to be a facilitator as much as possible (in contrast to a traditional apprenticeship-based instructor). He stated, “I was quite didactic in the beginning, since they (residents) didn’t know how to start or proceed; (but) later on they were pretty much independent and collaborative… and I was less hands-on.” As far as independence in the SL group, the instructor explained, “If they had something they wanted to practice again, they would go ahead with it; I would find that if I was being too instructive, they would tell me to stay back a bit and let them try it and if they ran into trouble they would ask for me … it was a good balance and boosted their confidence.” Furthermore, the SL instructor considered the residents to be “light years ahead of people who didn’t do the boot camp.” The primary role as described by the IL instructor was to be “both a guide and a source of information … my teaching style (was) to teach and ask … I used a combination of demonstrations and verbally guiding them … it was led by me.” Both instructors did express that the boot camp was indeed a valuable program for all incoming orthopedic residents, preparing them well for their first year as residents.

Comment

This research qualitatively examined differences in first-year orthopedic residents’ learning based on 2 different teaching paradigms: the traditional, IL style of teaching and our novel, SL approach. Some of the themes that emerged during the analysis were expected based on the pedagogic designs, although some arose somewhat spontaneously. It was clear that different styles of teaching during a laboratory-based skills course can affect the learning process and outcomes of technical and nontechnical skills and interactions for first-year orthopedic residents. Based on the session transcripts and the anecdotal evidence provided by participants, the traditional apprenticeship-based IL model did not foster as much peer-to-peer collaboration and collaboration with their instructor when compared with the SL method. The SL approach allowed for greater resident autonomy and collaboration in a lower stress environment as a hands-off methodology was used by the instructor and senior resident educators. This led the SL-group residents to view their instructor more as a mentor and facilitator. With the new resident work hour restrictions and the efforts to ensure all residents meet the CanMEDS and other organizational competencies, an SLL paradigm embedded within a surgical skills training program may be an ideal option for residency programs.

The fact that the SL group was more collaborative and demonstrated more peer-to-peer interactions than the IL group is significant. Learning is enhanced in an interactive, socially rich environment and that peer groups can serve as significant sources of knowledge. The tendency of SL residents to engage in peer assistance is also consistent with one of the self-directed learning strategies described by Zimmerman.29 Zimmerman’s research revealed that high achieving and gifted students use such strategies as social sources of assistance more than their counterparts. Peer learning is known to improve engagement, participation, and attitude. Furthermore, when students work together
work skills. Notably, this would improve education in critical thinking, communication, collaboration, and teamwork skills. Notably, this would improve education in the “communicator” and “collaborator” roles as delineated by the CanMEDS framework, ultimately impacting the remaining CanMEDS roles.

The finding that residents in the SL group felt much more in control of their own learning and were more actively involved in the learning process than residents in the IL group is consistent with our previous observations. Active learning strategies are believed to be effective by increasing trainees’ motivation to learn and engagement in the process and by fostering more positive attitudes. Moreover, active learners are able to use a variety of individual strategies to amplify their learning, such as self-appraisal, self-monitoring, and goal setting. SL residents often did not wait for instructions but rather explored the procedures as a group under their own direction and revisited tasks if they felt it was required.

Research has shown that trainees learn most effectively when they are afforded pedagogical space to experiment and when given the freedom to access practice materials as they wish. This “student-centered” approach is known to greatly enhance learning. Furthermore, active learning strategies are known to help develop interpersonal and problem-solving skills, as well as improve critical thinking and leadership abilities.

Thus, it follows that if we are able to promote active learning through the use of an SLL paradigm, we may be able to develop and refine a variety of nontechnical skills in addition to improving the acquisition of motor skills.

Our results suggest some parallels between SLL and the widely-adopted problem-based learning (PBL) teaching strategy. PBL is believed to be effective in part due to its small group format and encourages students to work together and engage in cooperative learning to reach their goals. Educators are encouraged to act as facilitators and to allow for greater student choice and autonomy. This is believed to improve motivation, knowledge acquisition, and academic performance. The training for the SLL educators before implementation in the TOBC course included some of these PBL constructs; both SLL and PBL are student-centered approaches emphasizing instructor facilitation. However, PBL is traditionally structured as a tutorial session in which learners work together in small groups to solve specially designed cases or problems, focusing on developing trainees’ problem-solving skills and content knowledge. Our SLL paradigm aims to create a better learning environment to help individual residents acquire a range of surgical skills in the laboratory setting. Therefore, SLL and problem-based learning appear to be different yet comparable ways of achieving this type of an active, cooperative learning environment, each with a slightly different overall structure and implementation. The optimal strategy for a specific situation may depend on the training context, the learners, and the set of desired learning outcomes.

There has recently been a call to attention for the necessity of professional identity development in surgical training, especially with the emergence of CBE. Professional identity may be defined as ways of being and relating in professional contexts and is largely social and relational in nature. One concern with the current shift toward competency-based programs is that there may be an overemphasis on the attainment of measurable outcomes and a lack of consideration for identity development. This situation may be ameliorated by the implementation of an SLL paradigm. Peers and other residents can serve as critical reference groups for trainees, and they may be much more willing to test out new roles among their peers than their instructors. Student empowerment is also important for this process, and educators should afford trainees with pedagogic space to reflect on and amalgamate developing identities.

Interactions with mentors and informal instruction are also imperative to the development of medical professionalism. Although it is evident that immersion in the clinical environment is a vital part of this process, it can and should be maximized during laboratory-based teaching sessions. The ability of an SLL paradigm to lessen the formal role of the instructor and promote interactions between peers in a collaborative, socially rich learning environment makes this technique better suited for instilling a sense of professional identity in our trainees than a traditional IL paradigm. Perhaps this explains anecdotal reports which suggest that SL trainees are demonstrating more competence and confidence in the operating room later on in clinical training, although further examination is required.

Instructors and senior resident educators were trained to either use the SLL approach or the traditional, instructor-based approach during the TOBC program; however, it was not feasible to monitor exactly how the teaching was implemented; therefore, that is a potential drawback to the analysis of this research. Had the instructors and educators used similar teaching techniques, we would have likely seen much less of a difference between how residents in each group learned and their behaviors in each of the training settings and during practice sessions. One limitation of our study is that there may have been some contamination between the SL and IL groups due to residents’ interactions outside the anatomy laboratory and surgical skills center; however, this aspect was largely out of the control of the study staff. Another limitation may be that of the differences in note taking among the research assistants, thereby potentially introducing bias and leading to differences in the way the transcripts were written and subsequently analyzed.

Conclusions

This research has allowed us to start to explore some of the mechanisms which give rise to the advantages of the SLL
paradigm that have been reported by new residents and their supervising faculty. However, we note that our sample sizes are small. Further work is clearly needed to truly understand its long-term effect. SLL has potential to improve the acquisition of technical skills and nontechnical skills and may help promote the early formation of professional identity in surgical trainees. This is of utmost importance in an age where training is shifting to competency-based frameworks and where many adverse events may be attributed to deficiencies in nontechnical skills. When implementing this approach, educators should also be mindful of the fact that expert presence is essential for facilitating the learning process, especially at the onset of training. Although present, instructors must afford trainees pedagogic space to explore and practice skills on their own accord. This approach requires instructors to be properly trained as it marks a departure from the traditional master-apprentice approach requires instructors to be properly trained as it marks a departure from the traditional master-apprentice model of teaching. As surgical education begins to rely more heavily on simulation to supplement and enhance clinical teaching, the implementation of a SLL paradigm may help ensure that trainees are developing not only technical skills but also the ancillary nontechnical skills that are required for independent practice.

References