Gathering Dust—Resistance to Simulator-based Deliberate Practice in Microsurgical Training

Claire F. Temple-Oberle, MD, FRCSC, MSc, MMEd[1] A. Robertson Harrop, MD, FRCSC, MSc[1]
Carmen E. Webb, MA[1] Susan G. Somerville, RGN, PhD[2]

[1] University of Calgary, Departments of Surgery and Oncology, Section of Plastic Surgery Calgary, Alberta, Canada
[2] Centre for Medical Education & Dundee Institute for Healthcare Simulation, University of Dundee, Scotland

Address for correspondence Claire Temple-Oberle, MD, FRCSC, MSc, MMEd, University of Calgary, Department of Oncology, 1331-29 St NW, Calgary, AB T2A4N2, Canada (e-mail: Claire.temple-oberle@ahs.ca).

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Abstract

Background Despite unrestricted access to a simulated microsurgery model, learners have not consistently self-regulated their learning by completing practice. This paper explores the lived experience of learners regarding how practice is perceived and why it is resisted.

Methods A qualitative study was conducted, including recorded and transcribed focus groups and semistructured interviews. First and second pass coding was conducted by one reviewer, with feedback from another. Transcripts were analyzed with a constant comparative approach customary to thematic analysis. Theory was engaged to help explain and support the findings.

The study was undertaken at the University of Calgary plastic surgery residency training program in Calgary, Alberta, Canada, involving 15 informants (9 residents and 6 surgeons).

Results Four themes emerged: (1) barriers to practice, (2) motivation to practice, (3) owning learning/solutioning, and (4) expectations of practice. Competing priorities and time constraints were barriers. Motivation to practice ranged from extrinsic (gaining access to the next course) to intrinsic (providing optimal patient care). Learners described a range of ownership of learning and depth of effort at solutioning of practice opportunities. Learners expressed high expectations around model fidelity, ease of setup, and feedback. Learners self-regulating their learning, with surgeons acculturating practice at work, can overcome some barriers. As per self-determination theory (SDT), learners need explicit linkage to how the task aligns with their goals. Assessment may be required to motivate learners. In respect of adult learning theory, homework needs to be allocated by a respected trainer. Modeling simulation practice may encourage adult learners. Finally, the tenets of deliberate practice (DP) need to be explained in order that learners can optimize their practice time.

Conclusion Microsurgical simulation practice is valued but barriers exist that invite resolution. Assisting residents to overcome barriers, maintain motivation, take ownership, and assimilate DP will help improve their microsurgery practice.

Keywords
- microsurgical training
- deliberate practice
- resistance
- barriers
- motivation
- adult learning

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Microsurgical skills are a core competency for plastic surgery residents.[1] Even minor flaws can lead to the failure of a finger replantation or a flap covering critical exposed structures,[2] thus propelling microsurgical training to the simulation laboratory.[3]

The traditional University of Calgary microsurgical skills curriculum included an intense week-long animal operatory course in postgraduate years (PGYs) 1 and 2, and experiential workplace learning in PGYs 3 to 5.[4] Learners reported skill decay after the animal course.[5,6] More simulated opportunities were desired to support mastery.[7]

In response, an unrestricted practice microstation was established, but went unused. Hypothesizing that learners may not have the tools to engage in deliberate practice (DP), a second curricular revision leveraged a state-of-the-art simulation center (http://www.ucalgary.ca/atssl/) to offer a 2-hour, bimonthly, proctored, longitudinal component spanning all PGYs. In this adaptive curriculum,[8] the trainer employed a nonliving model, reviewed student video recordings, shepherded participant self-assessment,[9–11] and developed a 1-hour personalized DP plan. Over the next 2 years, the microstation gathered dust, signaling resistance to practice.

Curriculum design[12] and mapping[13] were reviewed to consider why mentored self-regulated learning (SRL) was not occurring.[14] A literature review confirmed similar limited commitment in other surgical fields.[15] Low personal drive, a lack of ownership of their training,[16] inertia, and competing priorities are cited as barriers,[17] whereas practice motivation was driven by approaching assessment.[18,19]

This study, intended to inform an evaluation of the local microsurgery curriculum,[20] seeks to determine whether expectation of self-regulated practice is realistic, what barriers exist, and what additional support may equip learners to drive their own microsurgical training.

Methods

Alignment

This study's epistemic and ontological perspectives derive from constructivism[21] and relativism.[22] Learning and knowledge are socially constructed interpretive products of culture, history, and society. Learning is meaning-making via the social interaction of the learner and the trainer.[23,24] Methodologically, thematic analysis was applied to gain insight into the participants' perspectives.[23,25]

Recruitment and Data Collection

Purposive sampling was conducted from residents and surgeons in the plastic surgery training program at the University of Calgary.[26]

A semistructured interview script informed by literature review, content expertise (C.F.T-O. and A.R.H.) and simulation expertise (S.G.S.), was deployed and underwent ongoing revision and refinement.[27] Initial open-ended questions[28] (►**Table 1**) were followed by focusing on barriers to practice and how practice is supported or hindered by the training program.

Residents were interviewed as focus groups in hopes of eliciting insights that may not surface in individual interviews.[29,30] Further, the group model can offer social support and affirmation for participants[31] when discussing sensitive topics and voicing dissatisfaction, particularly if the interviewer is viewed as hierarchically superior.[32] Surgeons were interviewed separately to avoid admixing resident and surgeons, wherein junior learners maybe be less vocal.[31]

Coding and Thematic Analysis

Interviews were recorded and transcribed verbatim.[33] An initial coding scheme was developed, reviewed, and cultivated by the coauthors followed by second coding pass. Theme identification and mapping[34] were undertaken in an iterative process until refinement was achieved and thematic saturation identified.[35]

Attention to identifying divergent voices was maintained and key themes were coidentified, member-checked, and reexamined to aid in analysis.[21] Reflexivity for personal biases was scrutinized and extensive analytic memo-writing[36] carried active reflection throughout the research process.[37]

Ethical Considerations

Ethical approval was granted by the University of Calgary Human Research Ethics Board, number REB180980. As residents are a vulnerable population being convenient, captive,[38] and feeling obliged to participate,[39] direct recruitment was avoided to minimize a sense of coercion.[40] Participants were twice given the opportunity to redact their quotes or others' quotes to increase their psychological safety. Given that anonymity can be hard to secure in small populations,[41] participants' quotes were not subclassified as utterance from a resident or surgeon.

Researchers' Context and Bias

Being an insider researcher[42] required nurturing a sensitivity to participants, adopting an emic perspective[43] ensuring empathic treatment of participants, engaging them, and protecting their insights.[44,45] When coding, a reflexive stance was used to avoid romanticizing the author's experience. Codes were scrutinized to ensure they reflected the participants' stance.[46]

Results

Two focus groups were conducted with a total of nine residents (six females/three males) representing all five PGYs. Six surgeons (three females/three males) participated in semistructured interviews. The surgeons had graduated from residency between 1 and 30 years prior with equal numbers having trained locally and at other Canadian universities.

Four themes emerged from the data: (1) barriers to practice, (2) motivation to practice, (3) owning learning/solutioning, and (4) expectations of practice.

Table 1 Semistructured interview script

Semistructured interview/Focus group questions	Possible prompts
1. Microtraining curriculum experience	
Describe your experience with microsurgical training as a resident.	In your view, what would be essential components of a microsurgical curriculum?
Reflect on the structure of the microsurgery curriculum that you have been through and what are your perceptions of this?	What worked well? What could have been improved?
I am interested in hearing how you feel the rat course prepared you for later workplace experiences.	Why did you feel that? In what way do you think we or you could have changed this?
2. Role of simulation in microtraining	
Reflect on the various simulated models you have used. I am interested in how you interacted with these models.	–
*Consider the anytime practice station, its equipment, microscope, and instruments. In your view, how could this station be optimized?	–
Visualize your preceptors—describe an experience that stands out with a preceptor during your microsurgical education.	–
[a]Consider the bimonthly preceptored ATSSL simulation sessions. What was that experience like?	Tell me more.
3. Role of deliberate practice	
Think of a time you practiced microsurgery on your own. What was that like?	I am interested to know how you chose what to practice. What was the experience like practicing without a trainer?
[a]Recall reviewing the video of your performance with your preceptor at the end of the 2-hour session. What was that like?	–
[a]Consider the practice prescription that you negotiated with your preceptor. How did you feel being provided a practice prescription?	Did you manage to complete your practice? If not, tell me why.
What barriers did you experience to completing your practice?	–
Any suggestions how to help residents design a self-directed facilitated practice session?	–

Abbreviation: ATSSl, Advanced Technical Skills Simulation Laboratory.
[a]Might delete these questions for practicing surgeons.

Theme 1: Barriers to Practice

Participants acknowledged that micropractice was important, but finding time was challenging. Trainees described "*a lot of competing priorities*" ***(P6)*** "*especially in our junior years where you're not going to be doing any microsurgery in quote unquote real life.*" ***(P6)***

Residents perceived a stigma attached to practicing at work, anticipating "*a lot of eye rolling.*" ***(P6)*** However, surgeons approved of residents practicing during working hours "*If it wasn't taking away from… either service requirements or obvious opportunities…to be in the OR.*" ***(P5)***

Residents described variable degrees of ownership of their learning. They remarked, "*I should've taken better notes*" ***(P7)*** from trainer feedback. Inertia was reported in having to procure a missing training item—"*the vessels… were very dried out, and then there's no saline, and then I had to go the ward.*" ***(P8)***

The perceived expertise of the trainer was integral to buy-in: "*Coming from someone who doesn't even do a whole lot of micro, it's probably just going to go in one ear and out the other….*" ***(P13)*** Learners might also interpret homework assignment as signaling subpar performance, despite its formative intent: "*Residents are such high achievers. I could see that possibly being perceived as a, as a failing grade rather than constructive, helpful feedback.*" ***(P14)***

Theme 2: Motivation to Practice

Some learners demonstrated creative and effortful attempts to practice: "*once a month I'd book a rat… I would go down there and fumble all day on a Saturday.*" ***(P15)*** Learners interested in a microsurgical career felt more motivation to practice: "*I wasn't getting as much time on the microsurgery side of things as I would've liked… so I was trying to create extra opportunities for me to, like, be able to do that.*" ***(P15)*** Surgeons described practicing to provide good patient care in a complex 8-hour microcase: "*It's very quick for your skills to deteriorate and you don't want to be, for instance, second-guessing your technical skills.*" ***(P11)***

Near peers were motivating for juniors who felt staff surgeons have "*been doing this for so long that it's easy to them,*

and they don't always necessarily have insight into what I'm struggling with…." ***(P15)*** One informant recalled an impactful mentor modeling practice.

> If he doesn't play his drums everyday he thinks that he'll deteriorate. Well what's the difference in microsurgery? You should do, you know, 15 minutes every day. I still practice. I have little barebones micro set at home. ***(P11)***

Readmittance to the longitudinal simulation lab was predicated on practicing: "*Having to do the homework component is a good thing and kind of does put that extra pressure on you prior to the sessions*." ***(P7)*** One trainer felt a summative evaluation was needed to motivate: "*For microsurgery skills specifically, some residents that are normally highly self-motivated might not be motivated at all unless there's a definite extrinsic motivator, like an exam….*" ***(P14)***

Theme 3: Owning Learning/Solutioning

Participants recalled solutions to gain more practice: "*Any time that I got wind of one of my senior residents doing some sort of micro case I'd always try to, like, to nudge my way in to assist them.*" ***(P15)*** Junior learners recognized at the beginning of microcases "*You are (idle) during that half hour*," and solutioned "*that would be a good opportunity or in the morning (to practice).*" ***(P5)***

Learners voiced reproach at model deficiencies, expecting a seamless practice experience and not wanting to own the setup.

> … the easier you can make it better. So if there was a room, punch your card in, and everything was right there, you just grab your tools, sit down and worked, set them on the counter and leave, it would be so much easier. ***(P7)***

Learners described confidence after a simulation session, but recalibrated when reality was harder than simulation: "*I was frustrated with myself because I was fumbling a little bit, more than I was in the lab.*" ***(P3)*** Learners recognized that massed practice instilled false confidence.

Though several learners resisted the homework assignment, one nonconforming voice appreciated the assignment as it was accomplishable and could be checked off a to-do list. Most described cramming the homework before the next course: "*I found too, you kind of remember that you have the homework assignment before your next teaching session.*" ***(P9)*** Some lost their homework.

Theme 4: Expectations of Practice

Learners expected to be told precisely what to practice: "*Rather than say 'go practice micro for the next time,' … these are the three things that I can work on to improve.*" ***(P7)*** Informants voiced concern that poor technique could develop when practicing solo: "*… you are improving in some areas but introducing training scars in others.*" ***(P4)*** Some informants described careless practice in absence of supervision: "*Like you can do a pretty sloppy anastomosis and it will still work.*" ***(P15)***

Learners wanted to check in with their preceptor, or alternatively to consult a video: "*It's nice to do practice on your own and then come back to someone.*" ***(P12)*** However, they recognized the learning value in solitary practice: "*… doing it alone, you don't have anyone watching you. I often feel like your hand is a lot steadier, your movements are more fluid, you're not as nervous.*" ***(P11)***

Some learners intuited the tenets of DP, working on tough areas: "*I do that, and then I do an end to side, or … I'd start trying to create a little bit of desirable difficulty.* ***(P15)*** Learners grasped that practice needed to focus on areas of weakness: "*… wasn't good at like twirling the needle or something. I did that I think a few more times.*" ***(P8)***

Residents recognized simulation was important for patient safety, but still expected staff to let them toil through an anastomosis in a patient: "*You were given the opportunity to work through things, and people were patient.* ***(P5)*** The patient safety expectations are best made explicit.

> If you are struggling a lot and I think that it's going to be harmful to the patient to let you keep struggling, then we are just going to abort," and kind of being up front with them at that stage. ***(P13)***

Discussion

Shorter work hours, the move to a competency model, and inappropriateness of practicing on patients have reduced resident operative experience.[47] Without simulation, trainees lack sufficient experience to perform operations expected of their level.[48] Simulation allows flexibility of learning that is no longer tied to the operating room.[49] Learning can be distributed over time, interspersing DP to attain mastery, rather than using massed sessions[50] that can produce false confidence.[51,52]

Despite unconstrained access to microsurgery simulation, learners at the University of Calgary were variably compliant at completing assigned practice. Resistance to practice is not unique to microsurgery—even delivering home trainers has yielded lackluster engagement.[53–55] There is little known about the perspective of the learner to explain the low uptake.

In our data, four themes arose, including barriers to practice, motivation, owning learning/solutioning, and expectations of practice. Linking to theory, barriers to practice are examined through a lens of self-regulated learning (SRL). Motivation to practice is viewed alongside self-determination theory (SDT). Owning learning/solutioning is presented with adult learning theory (ALT). Expectations of practice are connected to the theory of DP.

Barriers to Practice

SRL is a process of thinking about learning (metacognition), and includes goal setting, strategizing, coping with obstacles, and fueling motivation.[56] Participants voiced that family obligations and studying left little time for home practice, and that hospital consults and operative cases prevented workplace practice. One participant expressed it was nearly impossible to fit practice in, decrying no control over their time.

By teaching the tenets of SRL, trainers can empower learners with the agency to practice.[57] For instance, when one informant expressed frustration over a microsurgical detail, a trainer can empower them to be resourceful and seek extra information to solve the task.[58] Trainers can help learners find ways to balance microsurgical practice with other work activities. Trainers have the agency to acculturate learners and educators of the value of releasing learners from low learning value activities, to attend an hour of highly focused practice.[59] Turning hopelessness around is a trait of self-regulated learners.[60]

Learners reported anticipating a professional climate unfriendly to daytime practice, expecting eye-rolling in response to requests to leave the operating theater to practice. Self-regulated learners are able to be resilient to, and negotiate with, trainers with senescent ideas about daytime practice in place of low learning value clinical cases.[58] Senior residents can model this for juniors, given that this may be more difficult for junior learners where the learner/trainer power differential is more pronounced. Favorably, surgeons supported the concept of work-time practice, and wished to normalize this by assigning resident practice as their job.

Motivation to Practice

SDT posits that learners have a natural development tendency and want to fulfill psychological needs including autonomy, competence, and relatedness.[61] Mandating practice is unlikely to work, as SDT indicates that an authoritarian approach is counterproductive to internal motivation.[62] In our study group, purely external motivators, such as doing homework to regain admittance to the next session, met with some resistance. One learner exhibited identified regulation (understanding the rules) claiming that homework was a reasonable request and was possible to complete. Another informant demonstrated integrated regulation (promoting the rules) by admonishing another who lost their homework. Identified and integrated regulation are internalized external forces experienced as intrinsic motivation[63,64] representing ways a trainer can influence motivation.

Near peers are powerful motivators who can precisely provide the information to move the learner to the next level.[65] By capitalizing on others' experiences, learning is abbreviated.[66] Participants indicated that peers were the best trainers, having previously struggled and sorted a solution. One informant desired improving their skills to align with a near-peer, which represents a mastery orientation of practicing to emulate, rather than to surpass a peer.[67] Informants confirmed improved microsuturing efficiency with improvement annually. This growth mindset endorsed that technical ability could be improved through practice.[68]

Behavioral theories focus on external motivators, including reward and punishment.[69] One surgeon feared that the homework assignment could be construed negatively and might demotivate by removing the intrinsic drive to do well. Another participant was avoidant in response to their inner dialogue of not wanting to "*screw this up*" ***(P14)***. This avoidance has been seen in learners circumventing surgical skills competitive gaming competitions, not wanting publicly to seem technically weak.[70] One informant suggested setting an exam, which has worked to encourage home practice.[18]

Owning Learning/Solutioning

ALT posits that adults are self-directed and have experience and an enthusiasm to learn[62]; however learners needed to see direct payoff from practicing and are intolerant of postponed application of skills. ALT depicts the trainer as a facilitator who makes learning resources available, while planning and design of training falls to the learner.[59] Here the facilitator provided the bimonthly courses, the model, and the practice prescriptions,[64] and several informants matched these efforts by creative solutioning, such as monitoring theater lists for microsurgery cases, and designing a home practice model. However, some learners felt defeated having to procure a missing item or tidy up after practicing at work. Regarding homework assignments, the feedback interlocutor and their position of esteem was key,[71] with the assignment not taken to heart when dispensed by a nonexpert.

Further, although trainers may feel all plastic surgeons should be competent in microsurgery, resident goals differ based on subspecialty aspirations, reducing the utility value of the task.[72,73] If microsurgery does not fit the resident's plans, they will value practice less—without goal alignment, motivation to practice will be low,[74] whereas if practice aligns with self, then practice becomes autonomous.[75,76]

Expectations of Practice

Although inborn talent helps, it is insufficient to assure surgical expertise.[77] Of the five domains of learning (motor, verbal, intellectual, cognitive strategies, and attitudes), the motor domain specifically requires practice.[78] DP theory rejects innate talent and posits that hard work, using specific practice techniques, determines future performance.

Practice is not inherently enjoyable, and full attention is required throughout, limiting time of intense focus to about 1 hour per day.[79] The microsurgery prescriptions took 1 hour which participants found realistic and reasonable. Many participants followed DP unknowingly, focusing on difficult tasks and resting by mixing in less intense activities.[79] Most participants did not voice enjoyment practicing, but practiced based on introjected extrinsic motivation (accepting the rules),[61] trusting that practicing now would help in the future.

DP requires solitary practice,[78] yet residents worried about developing maladaptive habits without supervision.

Informants mentioned cutting corners and being sloppy when unobserved. Self-directed practice without feedback may hinder skills acquisition.[56,80,81] Feedback is a catalyst for self-regulation, as learners try to narrow the gap between the existing and desired performance.[82] Socializing that residents are welcome to circle back for feedback anytime, is needed. Contemporary learners have been shown to crave feedback and correction, and to desire technological solutions,[83] such as wanting videos to inform their solo practice. Intergenerational teaching requires understanding differences and adapting teaching styles that mesh with needs.[84]

Medical trainers value competence as underscored by Competency-Based Medical Education.[85] In contrast, music students strive for excellence.[86] Medical learners model themselves after successful practitioners, irrespective of whether the clinician is a good educator, and learn from masters tacitly. Music students prefer good teachers, regardless of virtuoso status, and ascribe a high value to DP.[86] Encouraging microsurgical learners to approach DP with a musician's lens could elevate them from competence toward excellence.

Limitations

Because one author is an insider researcher who knew the participants, social desirability bias[87] may have been at play. Prior relationships probably helped gain rich data, but are an indisputable source of bias. Checking in with the coauthors, discussing coding, and member checking were ways to minimize this effect. Despite trying to be reflexive and to constantly ensure the themes emerging were from the participants' vantage point and not the authors', it is possible that original disappointment in the uptake of practice colored the interpretation of the results. The selected participants were deliberately chosen to be data-rich. They were indeed fertile, but purposive sampling limits the results being applied to other subspecialties and institutions.

Conclusion

Employing a qualitative approach, the barriers behind two curricular revisions failing to engender practice are highlighted. There are time constraints and competing priorities, wherein supporting SRL will be helpful. Challenges with motivation may be aided by transitioning extrinsically motivated behaviors to identified and integrated regulators, in order that the learner will self-regulate these behaviors. The ownership taken, and the amount of solutioning undertaken to overcome obstacles were individual, based on the learner's subspecialty goals. Adult learners need to see immediacy in the reason to learn, and when assigning practice, this needs to be navigated by a respected trainer. Finally, empowering learners with the tenets of DP, coupled with improved self-regulation, will allow them to own their learning, and design what, when, and how to practice.

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Conflict of Interest
None declared.

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