

Editorial

Why Every Orthopedic Residency Program Needs a Virtual Reality Strategy!

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During my residency, I assisted a surgeon in performing a femoral nailing procedure. The surgeon handled all the critical steps requiring judgment and precision. They managed the reduction, identified the correct start point for the guidewire, and skillfully inserted it. Once the critical start was achieved, I was handed the reamer to perform the preparatory steps. The surgeon then placed the femoral head guidewire in the exact location and passed me the instruments to ream and insert the screws. For the distal locking screws, they meticulously aligned the circles for perfect lateral views using the C-arm, drilled the holes themselves, and finally handed me the measuring device and screws to place. I was elated that I got to do the case.

At the time, I left the case feeling like I had contributed significantly. However, on reflection, I realized that my participation was limited to non-essential, less critical steps. The most technically demanding and outcome-defining portions of the case—the reduction, guidewire positioning,

and alignment for distal locking—were completed by the surgeon. While I was involved, I wasn't advancing my ability to independently perform this procedure in the future. In fact, I didn't actually improve my decision-making ability or judgment, a skill that is not only critical for surgeons, but an essential element for patient care and outcomes.

This experience underscores the distinction between critical and non-critical steps in surgical procedures. Critical steps—those that directly impact (in some cases) the implant position and, ultimately, patient outcomes—require precise execution and deep judgment. Allowing trainees to engage in these key aspects is vital for skill development and the confidence needed to perform independently. Conversely, relegating residents to the non-critical steps risks creating a false sense of accomplishment while delaying their progression toward true competence. Recognizing this balance and providing incremental opportunities for residents to take on critical responsibilities is es-

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sential in surgical education. Herein lies the challenge we face as educators and, importantly, training the next generation of surgeons. That was then, this is today. But today, there are so many additional variables making this experience more likely and increasing the challenge of training tomorrow's surgeon.

The journey to becoming an orthopedic surgeon has always been a rigorous and demanding process, requiring a blend of intellectual acumen, technical skill, and thousands of hours of hands-on experience. But the traditional pathways for residency training are no longer sufficient to meet the challenges of modern surgical practice. There is a new reality that I think as educators we need to be aware of. A combination of reduced clinical hours, increased pressures for efficiency, a recent declining exam pass rates underscores the urgent need for a transformative approach to orthopedic education.

THE NEW REALITY OF ORTHOPEDIC TRAINING

1. A LOSS OF 5,000 CLINICAL HOURS OVER 5 YEARS

Duty-hour restrictions have reduced the average resident's clinical exposure by 5,000 hours—essentially an entire year of training has been removed. This reduction, while important for physical and mental health of trainees and patient safety, means residents graduate with significantly less hands-on experience, leaving critical gaps in their preparation for independent practice. I think you would agree that time = experience, so with less time you will have less experience.

2. A SHIFT AWAY FROM CRITICAL OR TASKS

To preserve efficiency, avoid disrupting workflows and the heightened litigious environment, residents are often assigned less critical tasks as per my example above. This deprioritization of decision-making and hands-on surgical skills stifles their growth and hinders their ability to develop autonomy. A study by Joffe et al clearly identifies how resident education in the OR is not what it seems.

3. THE RESIDENT WHO STRUGGLES, WILL GET WORSE

Every resident comes with strengths and weakness to the OR. When certain areas of strength are highlighted, it's natural for that experience to become a focus during surgery. What happens to the skills they need practice on? There is currently no model for them to practice with purpose in a safe, non-threatening environment.

4. THE RISE OF AMBULATORY SURGICAL CENTERS (ASCS)

The proliferation of ASCs has positively transformed surgical care for patients. However, in prioritizing efficiency and outpatient procedures, this shift has an inverse relationship with resident education. ASC's driven by efficiency often exclude residents from participating in cases to ensure case volumes are met.

4. INCREASING FAILURE RATES ON THE ABOS PART II EXAM

The failure rate for the American Board of Orthopaedic Surgery (ABOS) Part II exam has increased by 200–300% in the past two years. There could be many reasons for this however, it's a data point that can't be ignored. While learning and passing the Orthopaedic In-Training Exam (OITE) is valuable and has direct correlation to the Part I exam, the rising failure rates of the most critical certification exam perhaps signals a systemic issue in current training methods and the maturation of judgement.

5. FELLOWSHIPS AREN'T A SAFETY NET

Fellowships were once considered a way to fill training gaps due to the intense autonomy provided to the fellow. Those days are diminishing (and in some areas gone) with that safety net is fraying. Many fellowship cases, from spine to arthroplasty, have now also shifted to outpatient facilities, limiting opportunities for in-depth learning. Residents who are inadequately trained during residency may not come to rely on fellowships to bridge the gap—they must enter fellowship programs fully prepared. How will they do that if fellowships are becoming more outpatient, also subject to the efficiency and profit pressures while being under the watchful eye of preventing completely autonomous surgery.

6. SURGEONS ARE DOING MORE, BUT MAKING LESS

From declining reimbursements per case to a healthcare system increasingly driven by efficiency, the economics of modern surgical practice work against robust resident education. Certain ORs prioritize fast turnovers, leaving little room for teaching. Everyone in the healthcare ecosystem—nursing teams, medical device companies, and administrators—are aligned on improving efficiency, often at the expense of traditional training models.

THE URGENT NEED FOR TRANSFORMATION

Orthopedic residents and programs must rethink their approach to education. Reliance on sporadic clinical exposure or online resources may not be sufficient. Access to cadavers (a luxury) that is mostly industry-driven is not possible for all programs as they (medical device companies) have their own financial pressures. A deliberate, comprehensive strategy is required—one that prioritizes developing judgement, 3D spatial intelligence, and decision-making. Virtual reality (VR) offers a solution that is accessible, scalable, and designed to bridge the gaps in traditional training.

HOW VR CAN TRANSFORM ORTHOPEDIC TRAINING

1. BUILDING 3D SPATIAL INTELLIGENCE

What is 3D Visual-Spatial Intelligence?

3D Visual-Spatial Intelligence is the ability to perceive, understand, and mentally manipulate objects or environments in three dimensions. It involves recognizing spatial relationships, visualizing movements, and solving problems related to how things fit together or interact in physical space.

This type of intelligence is essential in activities that require understanding depth, distances, orientation, and how objects move or align in 3D space. Think about how one adjusts a wire driver in their hand when they interpret the C-arm image during a fracture? That is 3D visual spatial intelligence.

2. BRIDGING THE GAP LEFT BY REDUCED OR HOURS

With fewer opportunities in the OR, VR allows residents to repeatedly simulate procedures until they achieve mastery. This ensures they gain the confidence and competence needed to perform independently when given the chance. While the complete replication is not possible, the principles of the procedure can become second nature before stepping foot in the operating room.

3. PREPARING FOR EFFICIENCY-DRIVEN OR'S

Today's ORs prioritize efficiency, leaving less room for real hands-on learning. VR enables residents to perfect these core skills outside the operating room allowing them to enter surgeries prepared to contribute meaningfully.

4. PRACTICING COMPLEX CASES

Residents may miss exposure to rare or complex cases during training. VR provides access to a wide range of scenarios, from routine procedures to less commonly encountered scenarios, ensuring comprehensive preparation and exposure. There is much to be learned from a simulation with 8-9 different pathologic bone deformities in VR.

5. AFFORDABLE, SCALABLE TRAINING

Unlike costly cadaver labs, large physical simulators or limited-access OR cases, VR offers an affordable and repeatable solution. Residents can access training modules anytime, anywhere, ensuring consistent progress.

6. EXAM-READY PREPARATION

Beyond clinical skills, VR can help residents prepare for exams like the ABOS Part I and Part II by integrating hands-on simulations with core surgical principles improving judgement, an essential skill for both exams and life in practice.

7. THE SURGEON EDUCATOR ALSO HAS A LEARNING CURVE

The field of orthopedic surgery is evolving rapidly, with new procedures, techniques, and technologies constantly being introduced. Practicing surgeons must adapt to these innovations, but this learning curve often excludes trainees,

as attending surgeons must prioritize mastering the innovations themselves. This exclusion leaves residents with fewer opportunities to learn cutting-edge methods.

Virtual reality (VR) ensures that residents aren't left behind. By providing access to up-to-date simulations, VR allows trainees to learn and practice the latest techniques concurrently, staying on the cutting edge alongside their mentors. This proactive approach prepares residents to seamlessly transition into modern practice, equipping them with the skills needed to excel in an increasingly innovative field.

8. MORE PROCEDURES, LESS TIME

The volume of procedures that residents are expected to learn continues to grow, while the time available to master them is shrinking. The traditional methods of learning through observation or occasional practice are no longer sufficient to ensure competence.

VR offers an efficient and scalable solution to this challenge. It allows residents to practice an array of procedures—from the most common to the rarest—as many times as necessary. By providing unlimited opportunities for deliberate practice, VR ensures that residents develop the confidence and proficiency required to handle the full spectrum of cases they will encounter in their careers.

NOT LEAVING ANYTHING TO CHANCE

With over 30% of all US Orthopedic Programs now integrating virtual reality into their programs (and rapidly growing), it signals a response to the need to reimagine how orthopedic trainees are educated. The challenges facing orthopedic training are systemic and are buried in the details noted above. The challenge is real and it's been a discussion at many leading society meetings from the American Academy of Orthopedic Surgeons, American Orthopedic Association and Council of Orthopedic Directors. Residency programs must embrace innovation to ensure their graduates are prepared for the realities of modern practice. By integrating VR into their training strategies, programs can:

- Address lost clinical hours.
- Use virtual reality to practice fundamental and core skills so when given the chance, perform higher value skills in the OR
- Prepare residents for a future of efficiency-driven ORs.
- Build critical skills, judgment, and independence outside the OR
- Support their educators to maintain their efficiency in today's financial climate.

The path forward is clear: Orthopedic programs and residents must embrace tools that reimagine education. VR is no longer a luxury—it is a necessity. The future of patient care through surgical excellence depends on graduating residents who are equipped to meet the demands of a rapidly evolving field. It's time to rethink how we train,

adapt to new challenges, and ensure that no resident is left unprepared.

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