EDUCATION NEWS

Nina Turcato, CRNA, DNP
Cliff Roberson, CRNA, MS
Karl Covert, PhD

Simulation-Based Education: What's in it for Nurse Anesthesia Educators?

This column presents an overview of the current state of the art of simulation-based training. It shares the results of a recent national survey, describing the current use of simulation technology among nurse anesthesia programs. It reviews the theoretical advantages of simulation-based instruction. Barriers to the development of simulation in nurse anesthesia programs are discussed, as well as strategies educators can use to overcome these challenges.

Keywords: Crisis resource management, experiential learning, nurse anesthesia education, simulation-based training.

New technologies are revolutionizing healthcare education across many disciplines. "High fidelity" simulation now allows students to learn in an environment representative of actual operational conditions. These tools are engendering an important paradigm shift that presents unique challenges to nurse anesthesia educators. This column presents an overview of the current state of the art of simulation-based training, results of a national survey about use of simulation technology among nurse anesthesia programs, and a brief summary of the advantages of simulation as a pedagogic strategy. Barriers and strategies to overcome them are identified, with the goal of promoting this tool in the education of safe, competent nurse anesthetists.

Simulation Defined

Simulation is defined as any activity that reproduces a task environment with sufficient realism to serve a desired pedagogic goal.[1] The outcome for high-skill professions is to improve student competence in both technical and nontechnical domains.[1,2] Modalities vary from role-playing scenarios, to task trainers, and to high fidelity, robotic simulation systems (Table 1).[2] Simulation is not new to healthcare education, yet new technology has allowed simulators to replicate human physiology in an extraordinarily realistic manner. They can now interface with actual monitoring equipment and anesthesia machines. Learners can manage uncommon clinical scenarios or be allowed to make errors in routine decision making and have those errors reach their natural conclusions. The result allows students to learn from decisions without the risk of harming patients.[1]

Simulation in Nurse Anesthesia Programs

To what extent are nurse anesthesia educators using simulation-based instruction? We disseminated a survey to program directors asking them to describe simulation modalities they currently use (Figure 1). Of the 95 directors invited to participate, 52 responded. Ninety-six percent (91) indicated they use some form of simulation in their curriculum. Task trainers are frequently used across programs; the most common are intubation manikins (98.1%, 52) and spinal models (92.5%, 50). In the area of high fidelity simulation, there is a significant drop in program utilization rates. The 2 most widely available simulation systems,

Simulation mode	Examples
Low fidelity	Patient actors
	Simulated interviews
	Written problems
Task trainers	Intubation manikins
	Invasive monitoring and spinal trainers
High fidelity	SimMan[a]
	HPS[b]

Table 1. Simulation Modalities
[a] Laerdal Medical Corporation, Wappingers Falls, New York
[b] Medical Education Technologies, Inc, Sarasota, Florida

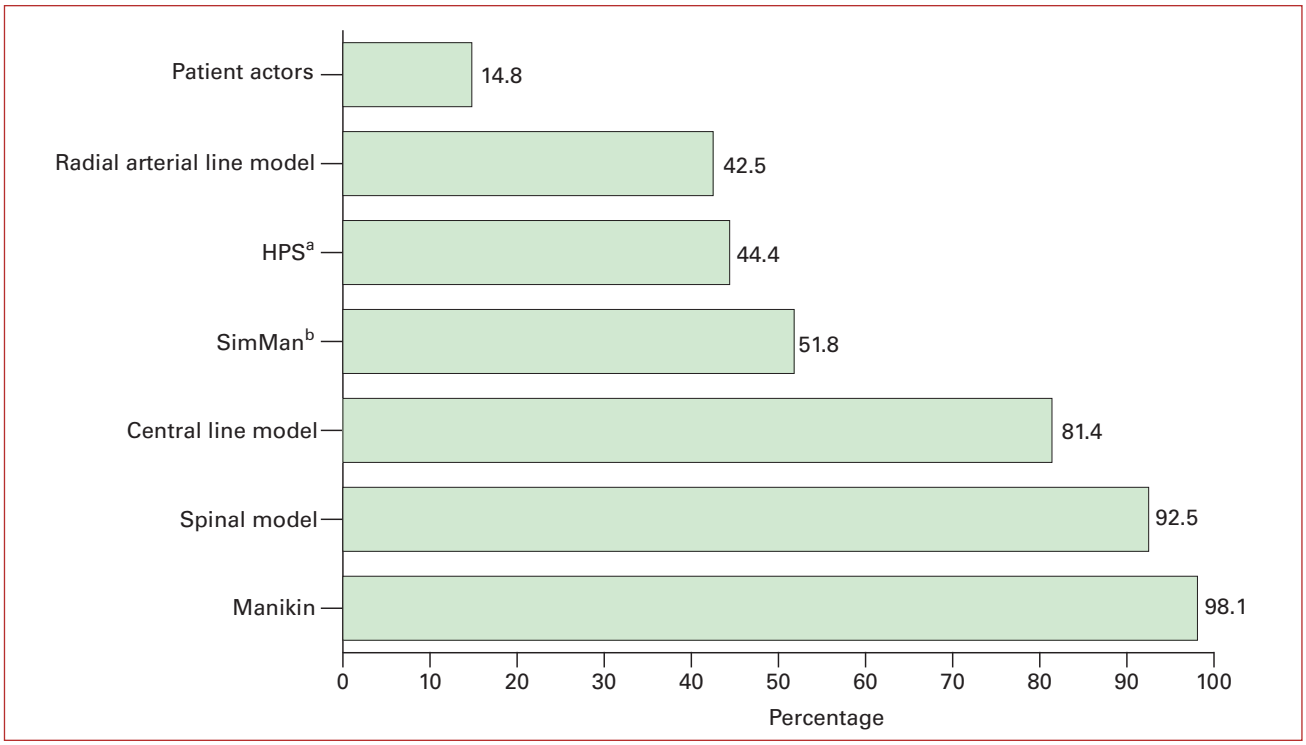

Figure 1. Percentage of Nurse Anesthesia Programs Using Various Simulation Modalities

[a] Medical Education Technologies, Inc, Sarasota, Florida

[b] Laerdal Medical Corporation, Wappingers Falls, New York

SimMan (Laerdal Medical Corporation, Wappingers Falls, New York) and HPS (Medical Education Technologies, Inc, Sarasota, Florida), were integrated into the curriculum of programs at 51.8% (28) and 44.4% (24), respectively. Results indicate the newer technologies are only used in half of the programs that responded.

The survey also queried respondents about barriers preventing them from using the latest technologies (Table 2). The most common constraint was cost. High fidelity simulation equipment requires a significant financial investment. The current model of SimMan lists for $26,995; HPS costs $245,000. These systems also require considerable outlays for peripherals, technical support, media equipment, and physical plant allocation. Faculty costs are unavoidable; courses designed to train educators at nationally recognized centers range from $685 to $1,995.

Time commitment was another barrier to integrating advanced simulation. Scheduling puts demands on instructors who already have teaching obligations, as well as scholarship and service requirements. Simulation-based instruction can also represent a time-intensive endeavor for the entire program. Current literature suggests ideal staffing for high fidelity simulation sessions is a *minimum* of 2 to 3 instructors.[3] High fidelity simulation exerts pressure on an already congested program schedule.

Value-Added Learning

Utilization rates suggest adoption of high fidelity simulation is far from universal, despite the general trend in healthcare education. The critical question is: Does high fidelity simulation provide a learning experience worth the cost, time, and effort? The answer to this question is complex and has at least 3 important dimensions. Simulation must offer educators a methodology that fosters critical skills not readily acquired through traditional approaches. It must also present learning opportunities not possible in the classroom or clinical arena. In addition, it should assist educators in addressing external realities that impinge on the formation of safe, competent nurse anesthesia graduates.

1. Time
   - Faculty development
   - Implementation
2. Cost
   - Equipment
   - Faculty development
3. Distance from program
   - Travel to access simulators
4. Scheduling
   - Competition with other learners
5. Lack of technical support
6. Lack of laboratory space
7. Lack of full-time equivalents
8. Administration unsupportive

Table 2. Rank of Barriers to the Use of Simulation in Nurse Anesthesia Programs

Enhancing Higher Order Skills

The cognitive sciences help us understand the advantages high fidelity simulation-based learning offers. Cognitive skills are hierarchical; that is, students must develop proficiency in lower order skills before tackling more complex learning behaviors. Bloom's taxonomy offers a useful classification of the intellectual processes essential to learning (Figure 2).[4] We can easily facilitate lower order skills with traditional classroom methods. Creating learning activities that aid in the development of higher order skills is more difficult and requires educators to engage students in a participatory experience. Simulation scenarios may be easily designed to emphasize the higher order cognitive skills.

Experiential learning may be one of most effective means to help students gain the most from their clinical training. Scientists have described the process whereby knowledge is produced through the transformation of experience. Learning by doing takes place when the student moves through a cycle of 4 distinct phases (Figure 3).[5]

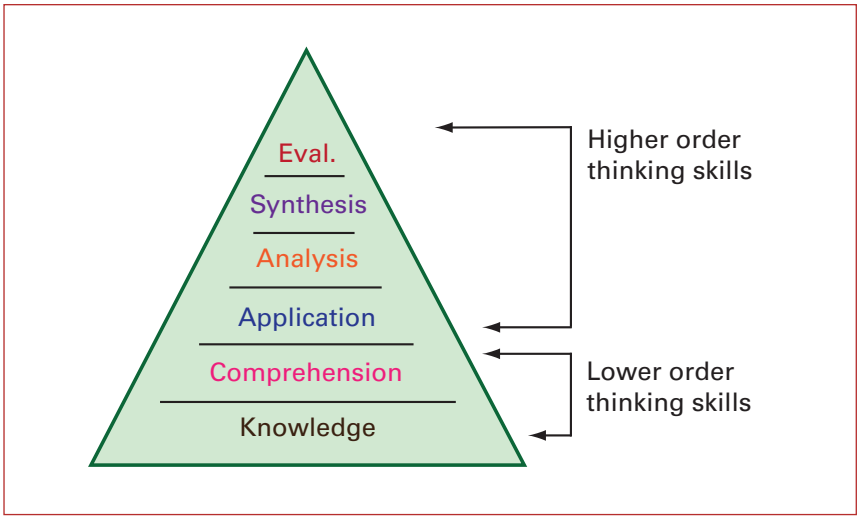

Figure 2. Bloom's Taxonomy of Cognitive Skills

Eval. indicates evaluation.

(Adapted from Anderson LW, Sosniak LA, eds. *Bloom's Taxonomy: A Forty-Year Retrospective*. National Society for the Study of Education: Chicago, IL; 1994.)

Reflection is critical, and it is least likely to take place in the busy clinical world in which students train. Simulation not only provides students with a realistic clinical experience but also offers an opportunity for structured reflection. In addition, experiential learning assists the student in learning *how* to learn from experience, gaining awareness of strengths and vulnerabilities.[6] Advanced simulation optimizes current training and provides a template for lifelong learning to facilitate professional development.

A Unique Learning Environment

Educators should also consider the environment that is *best suited* for learning the content and assessing outcomes. Anesthesia Crisis Resource Management (ACRM), for example, is not easily taught in the clinical arena, as critical events are infrequent and ill suited for the active participation of learners.[7] High fidelity simulation is uniquely adaptable to this content; the crisis situation is simulated without jeopardizing the well-being of the patient. Expert opinion suggests simulation-based ACRM should be a *compulsory* facet of *all* anesthesia curriculums and continuing education programs.[8] And yet, only 48% (26) of our survey respondents incorporate ACRM

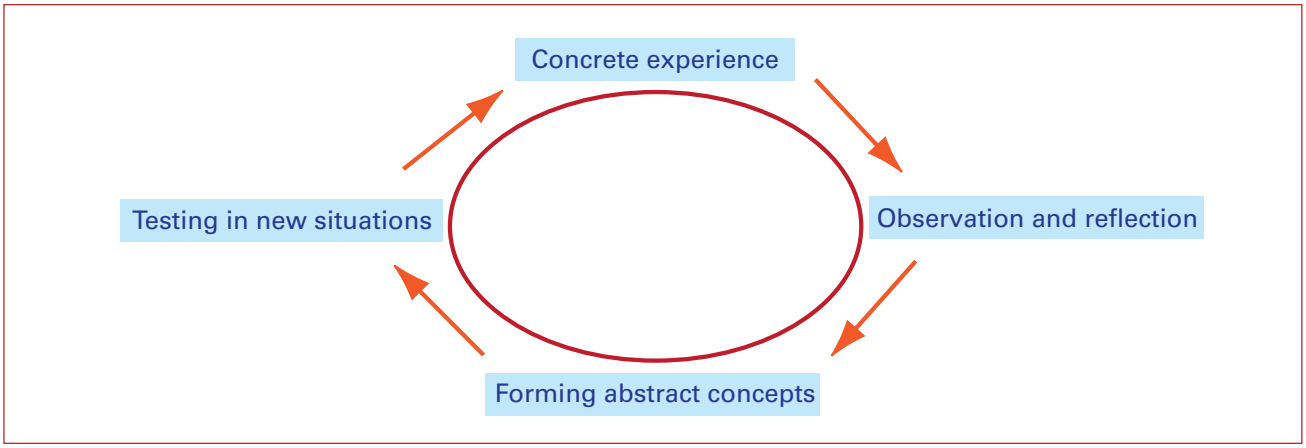

Figure 3. Experiential Learning Model

(Adapted from Smith MK. David A. Kolb on experiential learning. In: the encyclopedia of informal education. http://www.infed.org/biblio/b-explrn.htm. Accessed June 10, 2008.)

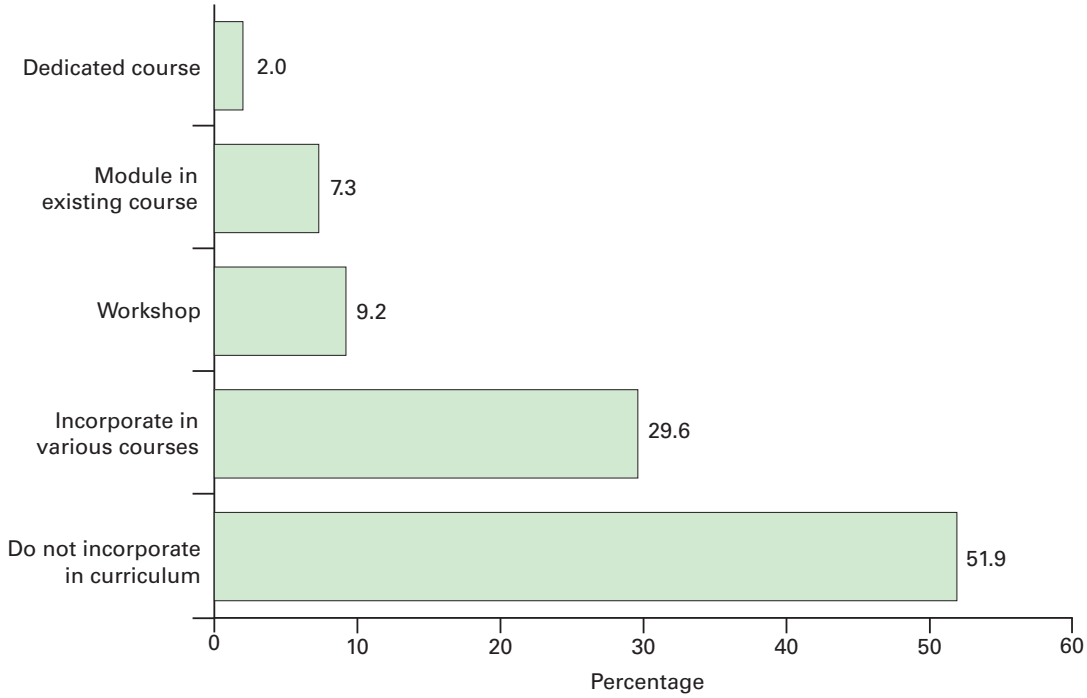

Figure 4. Nurse Anesthesia Programs and Crisis Resource Management Teaching

instruction in their curriculum (Figure 4). Of these, a little more than a third (39%, 21) use simulation to teach these principles. While students can be taught how to manage critical events in a classroom setting, it has definite limitations. ACRM with simulation can illuminate errors in care and decision making, which can identify further educational needs.[1]

Simulation is also well suited for assessing student clinical performance. Problem behaviors can be identified in a realistic setting so the student can gain insights in a meaningful way.[9] A student whose clinical evaluations indicate the learner routinely fails to exhibit due vigilance during cases can be placed in a simulated situation. The student's performance can be videotaped and reviewed during the debriefing process. This process promotes self-awareness, helps validate clinical issues, and permits faculty to facilitate the student's active reflection on problem behaviors. The student and faculty can then create a meaningful remediation plan.

External Forces

Simulation-based teaching must support educators in addressing external forces that have an impact on their ability to prepare graduates. One is the shortage of nurse anesthetists. It is estimated the demand for CRNAs will exceed 35,000 by 2010, and the number of graduates may not satisfy this need.[10] The shortfall places pressure on educators to meet the demand, without a corresponding increase in the resources to do so. Healthcare systems will have limited personnel to support the clinical training of students. The current apprenticeship system has already become burdensome in the face of newer standards of quality and efficiency in the 21st century operating room; a shortage of nurse anesthetists will only compound the problem. Simulation can help educators meet some of these challenges. It will allow students to gain a considerable degree of mastery of anesthesia skills *before* entering the clinical environment. High fidelity simulation may, in fact, accelerate student learning.[11] This creates an enormous advantage in a tight labor market, by allowing preclinical training to promote a level of competency unseen before and by preparing safe and competent graduates of a quality unmatched by the current educational system.

Another external force is the increasingly complex environment in which healthcare is delivered. Perioperative services have become a more strategically important component of the financial and operational well-being of healthcare organizations. Clinical decision making not only has an impact on the health and safety of the patient but also on system function. A delayed emergence, for example, can echo throughout the organization in terms of cost and manpower. The operating room staff has evolved into a complex, multidisciplinary team that requires a high degree of competency in interpersonal communication. Advanced simulation-based teaching is ideal for the instruction of the skill sets necessary to negotiate this environment. Scenarios may be designed to foster situational awareness, decision mak-

ing and team communication, and allow students to develop strategies they can apply to multiple situations along their professional practice continuum.[12]

Promotion of anesthesia safety has always been an important component of nurse anesthesia education. In recent years it has also become a significant external force from an institutional and regulatory perspective. The Institute of Medicine has urged educators to confront the problem of human error and strive to limit negative outcomes.[13] The Joint Commission has highlighted patient safety by asking providers to improve communication among caregivers.[14] The key question is: Does simulation-based teaching serve to reduce errors and improve safety? The verdict is still out, but preliminary data are promising. Procedural simulation studies in surgery show intraoperative errors can be reduced with simulation training.[15] Many organizations are proceeding on the assumption that simulation does indeed improve safety. Malpractice carriers, recognizing the impact of poor team communication and crisis management on claims, are offering significant reductions in insurance for teams who undergo simulation-based training.[16] Nurse anesthesia educators can make the same assumptions in adopting simulation-based learning in their programs.

Confronting Barriers

How can educators confront the barriers to integrating advanced simulation in their curriculum (Table 3)? Strategies begin with disseminating the merits of simulation-based education. Administrators must be made aware of the growing body of evidence suggesting simulation accelerates the speed and quality of learning and may improve patient safety and outcomes. Moreover, it is poised to become a standard methodology by which programs will be judged by prospective students and faculty, as well as accreditation agencies. Organizations, such as the Society of Simulation in Health Care, publish peer-reviewed research on the utilization and effectiveness of simulation-based education across a number of disciplines, which can be a useful source of information to share with decision makers.

Goal	Strategies
Disseminate benefits to decision makers.	Educate administrators.
	Impart peer-reviewed state of the evidence.
	Emphasize accreditation and certification trends.
Generate enthusiasm among colleagues.	Organize faculty information sessions.
	Tour a simulation center.
	Report simulation specific outcome data.
Pool resources with colleagues.	Share faculty training costs.
	Negotiate contracts with preexisting centers.
	Codevelop scenarios.
	Create user groups.

Table 3. Goals and Strategies to Confront Barriers to High Fidelity Simulation

Strategies that can generate enthusiasm for simulation among colleagues are key. Faculty workshops can be used to educate and persuade others to consider simulation in their curriculum. Interest can be generated with presentations at local, state, regional, and national meetings. While articles and case reports about simulation are an essential means of understanding high fidelity simulation, nothing can define the methodology and spark interest better than viewing "live clips" of simulation-based teaching scenarios. The ideal situation is to entertain colleagues in a simulation laboratory so they may see for themselves what it is like to be a learner.

Collaboration between nurse anesthesia programs is essential. Mechanisms to share resources can be negotiated among programs with geographic or institutional similarities. Nurse anesthesia programs without access to advanced simulation can share resources with those who do by arranging fee-for-service contracts and sending students to engage in specific learning activities. These arrangements can be mutually beneficial as students from one institution are afforded meaningful learning experiences, while the other can use external fees to offset the often high maintenance costs associated with high fidelity simulation. This revenue source can be essential to a simulation center's survival, as equipment often needs to be updated or replaced after 5 years.[17]

Other mechanisms for promotion of advanced simulation may involve recruitment of staff from clinical sites to serve as simulation instructors. This collaboration can solidify the link between the simulation curriculum and the clinical arena, as well as improve faculty workload problems. Links may also be extended between programs by the formation of simulation task forces, whose goal is collaboration and sharing of resources to promote simulation among member programs. The pooling of energies can be further enhanced with external funding grants to support collaborative teaching enterprises.

Interdisciplinary collaboration can also reduce simulation costs. Strength in numbers keeps simulation on the radar screen of administrators and decision makers. Areas of collaboration may include development of research projects and case scenarios. Multidisciplinary simulation user groups also offer an opportunity to update faculty on policies, equipment, software, and Internet resources. Taped learning cases can be presented at meetings to discuss the nuts-and-bolts of advanced simulation teaching and learning. Members may also cross disciplines to participate as "actors" in each other's clinical scenarios and as facilitators in debriefings. Cross staffing offsets the time and costs associated with simulation-based instruction throughout the institution.

Summary

Simulation-based instruction can help educators meet the challenges of training nurse anesthetists in an increasingly complex world. It is based on sound pedagogy that fosters the acquisition of critical skills. Simulation allows replication not only of the complex interplay between patient physiology, anesthetics and equipment but also the dynamic clinical environment in which students must function. Tentative but growing evidence suggests simulation accelerates the speed and quality of student learning and may enhance our capacity to prevent human error. Practice may indeed make perfect, as deliberate learning experiences allow students to hone critical skills in an authentic learning environment. The creation of collaborative alliances may help surmount the barriers to universal use of advanced simulation-based instruction in our programs. Curtailment of time and financial constraints are essential, so that more student nurse anesthetists can be exposed to this valuable teaching tool and the unique and important learning experience it offers.

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AUTHORS

Nina Turcato, CRNA, DNP, is director at the School of Nurse Anesthesia, University of New England, Portland, Maine. Email: nturcato@une.edu.

Cliff Roberson, CRNA, MS, is assistant director, School of Nurse Anesthesia, University of New England, Portland, Maine. Email: jroberson@une.edu.

Karl Covert, PhD, is adjunct professor at the University of New England, Portland, Maine.

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