# The Scope of Simulation-based Healthcare Education

*S. Barry Issenberg, MD*

(*Simul Healthcare* 2006;1: 203–208)

Simulation-based healthcare education has expanded tremendously over the past few years, as witnessed by the creation and growth of the Society for Simulation in Healthcare and its journal. These developments represent a turning point at which simulation is no longer seen as a novelty whose existence needs to be justified or defended by a few staunch believers. We can now move beyond reporting on the *potential role* of simulation or how it compares to other more traditional (yet often unproven) methods of training, and focus instead on the *most effective use* of simulation for healthcare education.

From the perspective of the training program, the effective use of simulation may be seen as the product of three components (Fig. 1): training resources, trained educators, and curricular institutionalization. It is important to note that if any of these components are missing or deficient, the product will become zero and effective training will not occur. For example, it is not rare for an institution to obtain a simulator only to see it collect dust because faculty members were not properly trained in its operation or did not know how to introduce it into the curriculum. These components include the following.

## Training Resources

This component refers to having appropriate simulators, task trainers, standardized patients, and computer software that meet a program's needs. In addition, it includes having the necessary physical space and associated equipment (eg, monitors, beds, cameras, microphones, recording and playback equipment) for simulation-based training. It also encompasses the associated curriculum (eg, crisis resource management,[1] advanced life support, laparoscopic surgery), outcome measures (eg, checklists, rating forms), learning strategies (eg, experiential learning, deliberate practice[2]), and curriculum management systems (to schedule and track learners' time and performance).

## Trained Educators

This component includes healthcare professionals trained in the proper use of simulation-based medical education. It also includes individuals involved in the operation, management, and administration of simulation-based training, as well as researchers dedicated to advancing the field.

## Curricular Institutionalization

This component includes elements necessary for full adoption and integration of simulation-based medical education into an institution's mission and culture. It involves the decision of an institution to fully embrace its goal of improving patient care and patient safety through reducing and preventing medical errors, as well as more individual goals of improving a wide range of competencies (eg, acute care skills, surgical skills, crisis resource management, teamwork, and communication).

During the past four decades of simulation use in healthcare, the literature has focused almost entirely on the first component of training resources. To illustrate, a recent systematic review of the literature on high-fidelity simulation identified 10 features that led to effective learning (Table 1).[3] Nine out of the 10 features are related to training

From the Michael S. Gordon Center for Research in Medical Education, University of Miami Miller School of Medicine, Miami, FL.
Reprints: S. Barry Issenberg, MD, CRME, PO Box 016960 (D-41), Miami, FL 33131 (e-mail: barryi@miami.edu).

ISSN: 1559-2332/06/0104-0203


**FIGURE 1.** Formula for the effective use of simulation-based medical education: Effective Simulation-based Healthcare Education = Training Resources × Trained Educators × Curricular Institutionalization

resources/strategies, and only one is related to curricular institutionalization. Most surprising is that none addressed the expertise/attributes of the educators involved in the process, yet we often know from experience that the faculty often determine the success and effectiveness of simulation-based training. Published reports and studies often describe the features of the simulator, the curricular content, learning environment, teaching strategies, and outcome measures, but provide few details on the knowledge or expertise of the faculty, or details related to how simulation gained acceptance and adoption at the local institution. It is time to address more formally the other important components of simulation-based healthcare education—educators and curricular institutionalization.

How does simulation become adopted and integrated into an existing curriculum that is already overcrowded with content? Rogers[4] provides a model that describes five stages for innovation adoption that we can adapt here for simulation.

## Stage 1 (Awareness)

Institution is exposed to information about simulation-based healthcare education but lacks knowledge about it.

## Stage 2 (Interest)

Institution becomes interested in simulation-based healthcare education and seeks additional information about it through attending meetings, visiting other simulation facilities or inviting experts to the institution.

## Stage 3 (Evaluation)

Institution mentally applies the use of simulation to its present and anticipated future situation, and then decides whether or not to try it. This is often done with a local "champion" or through an expert consultant.

## Stage 4 (Trial)

Institution makes first use of simulation, typically in a course headed by the local "champion."

## Stage 5 (Adoption)

Institution decides to continue the full use of simulation throughout its curriculum based on the experience and feedback from the trial and/or additional opportunities or needs that arise from increased exposure to the simulation.

For each of these stages, the "institution" is usually represented by one or more educators who provide the link between the training resources and institutional adoption and implementation of simulation. What type of individual is key to making this happen? Ryan and Gross[5] initially classified individuals who ultimately choose to implement innovation and Rogers further described their qualities.[4] These categories (with relative proportions) include:

## Innovators (2.5%)

These are risk takers with the initiative and willingness to expend time, effort, and resources in trying something

**TABLE 1.** Features of Simulations that Lead to Effective Learning

| Variable | Feature | Description |
|---|---|---|
| Teaching resources/ strategies | Feedback | Feedback provided during the learning experience is the most important feature of simulation-based education to promote effective learning. |
| | Repetitive practice | Learners should engage in focused, repetitive practice where the intent is skill improvement, not just idle repetition. |
| | Range of difficulty level | Learners should engage in skills practice across a range of difficulty levels, beginning with basics and advancing to progressively higher difficulty levels based on objective measurements. |
| | Multiple learning strategies | Simulation-based learning strategies should include but not be limited to: instructor-centered formats, small group tutorials and independent study, depending on the learning objectives being addressed. |
| | Clinical variation | Simulations should represent a wide variety of patient problems to provide more sampling than simulations that only cover a narrow patient range. |
| | Controlled environment | Simulations work best when embedded in controlled educational settings where (unlike real clinical environments) learners can make, detect, and correct patient care errors without negative consequences. |
| | Individualized learning | Educational experiences should be reproducible and standardized for individualized learner (or team) needs where learners (or teams) are active participants, not passive bystanders. |
| | Defined outcomes/ benchmarks | Educational goals should have tangible, objective measures that document learner progress in terms of training benchmarks. |
| | Simulator validity/realism | The simulation and the behavior it provokes come close to, but never exactly duplicate, clinical challenges that happen in genuine patient care contexts. |
| Curricular integration | Curricular integration | Simulation-based educational experiences are a routine feature of the normal educational schedule and are grounded in learner performance evaluation. |

From Issenberg et al.[3]

new. These are individuals such as Gaba, Gordon (see related article in this journal issue), Gravenstein and others within the simulation community responsible for its creation and development. These individuals dominated the field of simulation during its first 25 years.

## Early Adopters (13.5%)

These tend to be respected group leaders, the individuals essential to adoption by the whole group. These include many of the current leaders in the Society for Simulation in Healthcare and on the editorial board for *Simulation in Healthcare* who have been instrumental in the field's growth over the past 10 years.

## Early Majority (34%)

These are careful, safe, deliberate individuals unwilling to risk time or other resources without demonstrated evidence of the innovation's effectiveness. These are individuals just recently involved in simulation-based education, and they represent the largest audience for the Society and journal.

## Late Majority (34%)

These individuals are suspicious of or resistant to change and are difficult to move without significant influence. These individuals will eventually "come aboard," but can sometimes provide a critical viewpoint that prevents wholesale adoption of innovation without slow, careful consideration and planning.

## Laggards (16%)

These are individuals who are consistent or even adamant in resisting change. Pressure is often needed from leadership to force change.

Rogers argues that the "Early Adopters" and "Early Majority" are the most important groups for an innovative technology to reach its tipping point for successful adoption and implementation.[4] Table 2 illustrates characteristics of individuals in these two groups. The educators comprising the "Early Majority" are the largest target audience for the Society and this journal and are receptive to guidance and support as they look to implement simulation at their local institutions. We should not underestimate the importance of this group as it represents the greatest chance for the long term success of simulation-based healthcare education.

**TABLE 2.** Characteristics of Early and Successful Adopters/Implementers of Simulation Technology

| Early Adopters | Early Majority |
|---|---|
| Technology focused | Not technology focused |
| Proponents of revolutionary change | Proponents of evolutionary change |
| Visionary users | Pragmatic users |
| Project oriented | Process oriented |
| Willing to take risks | Averse to taking risks |
| Willing to experiment | Look for proven applications |
| Self-sufficient | May require support |
| Tend to communicate horizontally (focused across disciplines) | Tend to communicate vertically (focused within a discipline) |

From Rogers.[4]

Many different approaches have been taken by institutions that have adopted simulation. The above stages can be achieved through a measured, deliberate process as part of a school's strategic plan or obtained in a matter of a few days. For example, a relative novice can attend the International Meeting on Simulation in Healthcare and gain tremendous awareness, insight, and understanding of the use of simulation for training. Furthermore, the adoption of simulation can range from integrating a task trainer into a component of a course (eg, airway training during an emergency medicine clerkship) to creating a simulation-based curriculum such as Anesthesia Crisis Resource Management,[1] or establishing a simulation center that serves multiple disciplines and professions both locally and regionally. At any level of integration, there should be certain minimum criteria that are met to better ensure success. This includes identifying the training needs for a given population, defining the outcomes that are expected from these learners, using the appropriate type of simulation that is based on the defined outcomes rather than the technical features, and measuring outcomes. At some point, there should be buy-in or formal adoption by the institution's curriculum committee (or whatever body determines new curricula) so that early on it becomes a stakeholder in the process.

What will it take for institutions to make that first step toward curricular adoption of simulation? Many of the institutions, hospitals, and agencies that have fully operational simulation-based training programs were started and maintained by the "Innovators" and "Early Adopters" who recognized the promise and potential value of simulation. However, Gaba points out that there are several other driving forces besides motivated teachers, researchers and simulation societies that will ultimately "push" or "pull" an institution toward full integration of simulation.[6] This includes local institutional pressure from students, residents, and faculty who feel competition from other schools as well as professional societies, professional licensing/accrediting bodies and health care organizations. In addition, it also includes healthcare insurers, liability insurers, accrediting organizations, government agencies, and ultimately the public. In his commentary, Gaba predicts and describes how each of these driving forces may contribute to the successful integration of simulation throughout healthcare.

One of these predictions has already occurred. Clinical societies have begun to establish processes to provide accreditation to training programs that offer healthcare providers a wide range of learning opportunities through the use of state-of-the-art educational methods and advanced technology. The accredited institution is expected to ensure achievement of clinical competence and development of expertise through the use of bench models, simulations, simulators and virtual reality.[7] The American Society of Anesthesiologists recently approved the process for formal designation of simulation training programs[8] and the American College of Surgeons (ACS) has already instituted a process to grant formal accreditation to programs that meet and demonstrate

 

**TABLE 3.** Roles of the Healthcare Educator[12] (for Simulation-based Training)

| Role | Description |
|---|---|
| Information provider | • Lecturer: Uses simulation (using simulators, virtual patients, traditional lecturers), reflects understanding of the advantages of simulation. |
| | • Clinical teacher: Uses simulation in the clinical (or simulated) setting, reflects understanding of the benefits (and limitations) of simulation over real patients. |
| Role model | • On-the-job role model: Shows enthusiasm for specialty, demonstrates excellent clinical practice skills, treats "whole" patient. |
| | • Teaching role model: Expresses enthusiasm for teaching, actively involves learners, communicates effectively with learners. |
| Facilitator | • Learning facilitator: Guides learners' use of simulation in constructivist approach to learning; guides feedback during debriefing. |
| | • Mentor: Uses simulation to support mentor role. |
| Assessor | • Learners assessor: Able to evaluate learner performance (eg, uses checklists/rating scales when evaluating performance on a simulator); able to develop valid, reliable and practical outcome measures, provides constructive feedback. |
| | • Curriculum assessor: Able to monitor and evaluate the effectiveness of the training program. |
| Planner | • Curriculum planner: Understands that simulation serves the goals and outcomes of the curriculum. |
| | • Course planner: Able to develop a course with objectives that are aligned with learning opportunities and outcome measures. This includes designing a blended curriculum that integrates face-to-face learning (lectures, small groups, simulator scenario) with independent learning. |
| Resource developer | • Resource material creator: Able to develop simulation cases, virtual patients. |
| | • Study guide producer: Able to develop study support materials that facilitate learners' use of simulation. |

From Harden and Crosby.[11]

compliance with established standards and criteria.[7] To date, seven institutions have successfully met the program requirements and, as a result, are designated as Level I ACS Accredited Education Institutes.[9] Although the criteria related to training tools, administrative resources, technical support, and curricula are well defined, criterion 2.4, related to educators, simply states, "uses faculty/preceptors that are appropriately trained."[10] Clearly, there needs to be better guidance and opportunities to develop educators who are prepared to optimally use simulation.

The role of the healthcare educator is arguably the most important component to ensure effective simulation-based healthcare education and, although often implicit in studies of simulation-based training, many of the skills required of these educators are ill-defined. Harden and colleagues[11] have formally outlined the teaching roles of the healthcare educator (Table 3); one of these explicitly acknowledges the role of resource developers. Along these lines, simulation case scenarios such as the one by Singh and colleagues[12] published in this issue of the journal represent a valuable and practical resource for our "Early Majority." The cases are peer-reviewed and represent an additional opportunity for healthcare educators to demonstrate the many roles they serve, in addition to providing evidence of scholarship. Simulation case scenarios take considerable time, effort, and experience to develop and test, and are examples of the proven applications individuals in the "Early Majority" need.

Although these cases represent one type of resource for educators, the academic healthcare community needs to develop and manage competency-based programs of faculty training. The goal of these programs should be to produce healthcare educators certified in simulation-based training. Many "Early Adopters" in the field have already addressed this need and have created courses on developing and operating a simulation program and training educators. Table 4 lists just a few of the institutions and organizations that offer formal training for the simulation-based healthcare educator. Although none of these are officially "accredited" to provide formal certification, they do offer excellent faculty training and development opportunities. In my personal opinion, the Society for Simulation in Healthcare (SSH) is in a unique position to take a leading role in establishing formal criteria for certified training expertise in simulation-based healthcare education. Adopting the ACS model, I believe the SSH should aim to create a network of SSH-approved institutes that would offer individuals certified training on the essential skills of simulation-based healthcare education. These centers could in turn work with their own graduate programs to develop certificate, diploma, or masters degree opportunities for faculty who are committed to careers in simulation-based education. Just as the weight of evidence shows that clinical experience alone is not associated with the quality of delivered health care,[13] educator competence in the expert use of simulation must be assured, not assumed.

While the above vision may take some time to be realized, there are already several measures centered around the International Meeting on Simulation in Healthcare (IMSH) that the SSH has instituted to provide support for educators. The Society established a series of specialty tracks at the IMSH related to simulation center operations, nursing and prehospital education, and a full-day, postgraduate course on setting up a simulation center. Another novel approach would be to use the annual meeting as a venue to provide a formal certification course in simulation-based education. This has been done with success by the Association of Medical Education in Europe with its accrediting the Essential Skills in Medical Education (ESME) program,[14] which provides an entry-level teaching qualification for those becoming involved in medical education for the first time, or who have been given some new responsibilities relating to teaching. The ESME program is organized to coincide with international medical education meetings. Typically, regis-

**TABLE 4.** List of Institutions and Organizations that Offer Formal Training for the Simulation-based Healthcare Educator*

| Institution/Organization | Course/Type of Training |
|---|---|
| Center for Advanced Medical Simulation Karolinksa University Hospital (http://www.simulatorcentrum.se/) | Several courses for faculty training on crisis resource management in anesthesia and emergency medicine. |
| Center for Medical Simulation, Boston (http://www.harvardmedsim.org/cms/) | A variety of courses including week-long immersive experience for those who want to develop and maintain healthcare simulation programs. Other courses offer training for instructors who teach with simulators and those who have leadership positions. |
| Hertfordshire Intensive Care & Emergency Simulation Centre University of Hertfordshire (http://www.health.herts.ac.uk/hicesc/) | One-day course for participants to learn how to train and teach with simulators and courses on multidisciplinary simulation-based training. |
| Mainz Simulation Centre (http://www.simulationszentrum-mainz.de) | Several train-the-trainer courses covering simulator operations and programming, crisis resource management, teamwork, communication skills and debriefing techniques. |
| Mayo Multidisciplinary Simulation Center (http://www.mayo.edu/simulationcenter/) | Course for participants to develop knowledge and skills in planning, designing, building and maintaining a simulation center. |
| SIMS Medical Academy (www.healthprograms.org) | Beginner and intermediate level courses for participants to learn how to develop and implement patient simulation scenarios into their local curriculum. |
| Society for Education in Anesthesia (http://www.asahq.org/) | A variety of courses and workshops on developing teaching skills including the use of innovative simulation technologies. |
| Simulation Center at VA Palo Alto HCS, Stanford (http://www.med.stanford.edu/VAsimulator/) | Faculty development courses on anesthesia and emergency medicine crisis resource management. |
| TuPass Center for Patient Safety and Simulation (http:www.tupass) | Several courses for instructors aimed at the competencies necessary to conduct simulation based training in acute medical care crisis. |
| University of Miami Michael S. Gordon Center for Research in Medical Education (http://www.crme.med.miami.edu) | Several "train-the-trainer" courses for participants to learn to use a variety of simulation tools for a wide range of courses (acute stroke, disaster and terrorism response). |
| University of Pittsburgh WISER (http://www.wiser.pitt.edu/) | A variety of courses covering the foundations for simulation in healthcare, including simulator programming, creating and developing a simulation center as well as faculty facilitator and technical specialist preceptor training. |

This list covers a number of well-known programs at the time of this writing but is not exhaustive. No endorsement of the activities of these centers or programs by the Society for Simulation in Healthcare is implied.

trants participate in 1- or 2-day preconference workshops learning about the fundamentals of medical education. During the main conference they attend a wide range of sessions that not only cover broad topics applicable to all healthcare providers but also specific discipline-based tracts that address focused needs. Throughout the 2- to 3-day conference, ESME faculty members meet with course participants to review what they have learned from attending plenary and panel sessions, abstract presentations and workshops. The program concludes with a half-day postconference session in which participants report on what they have learned throughout the conference and how they will apply this to their local setting. They are also given the opportunity for further development in healthcare education by enrolling in an educator portfolio program. Participants spend the following year working with ESME faculty via email developing their portfolios as they provide evidence of their skills as an educator. A similar program could be developed around the IMSH and would provide the foundation for a more formal credentialing process.

As the use of simulation for training continues to grow, there is an increasing need to focus on the institutional environment that encourages adoption and integration of simulation, and on the local faculty who must deliver the training. Another important role for the Society for Simulation in Healthcare and this journal is not only to disseminate information regarding the validity, reliability, and feasibility of the training resources, but also to provide assistance for the faculty who must use these resources and optimally integrate them into the programs of their local institutions. Finally, certified competence in healthcare education needs to be acknowledged and rewarded as a valued component of an academic career. Thus promotion and tenure processes at academic medical centers need to recognize the expression of educational expertise using simulation as legitimate work by healthcare educators.[15] Healthcare professionals who research, develop, use, and evaluate simulation toward the goal of improving clinical competence and expertise and enhancing the quality and safety of patient care must be rewarded for their work.

## ACKNOWLEDGMENTS

*The author thanks Professor Ronald Harden for his assistance with the commentary's concept, William McGaghie for his contribution on educator development, and Ross Scalese for his constructive feedback on early drafts.*

## REFERENCES

1. Gaba DM, Fish KJ, Howard SK. *Crisis Management in Anesthesiology.* Philadelphia: Churchill Livingstone Inc., 1994.
2. Ericsson KA: Deliberate practice and the acquisition and maintenance of

 

expert performance in medicine and related domains. *Acad Med* 2004; 79:S70–S81.
3. Issenberg SB, McGaghie WC, Petrusa ER, Gordon DL, Scalese RJ: Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Med Teach* 2006;27:10–28.
4. Rogers EM. Diffusion of Innovations, 4th Ed. New York: The Free Press, 1995.
5. Ryan B, Gross NC: The diffusion of the hybrid seed corn in two Iowa communities. *Rural Sociol* 1943; 8:15–24.
6. Gaba DM. The future vision of simulation in health care. *Qual Saf Health Care* 2004;13:i2–i10.
7. American College of Surgeons Division of Education: Accredited Education Institutes. Available at: http://www.facs.org/education/accreditationprogram/. Accessed August 30, 2006.
8. ASA Workgroup on Simulation Education. ASA Approval of Anesthesiology Simulation Programs. The American Society of Anesthesiologists 2006. Available at: http://www.asahq.org/ASASimWhitePaper 031506.pdf. Accessed August 30, 2006.
9. American College of Surgeons Division of Education: Listing of Accredited Education Institutes. Available at: http://www.facs.org/education/accreditationprogram/list.html. Accessed August 30, 2006.
10. American College of Surgeons Division of Education: Listing of Accredited Education Institutes. Available at: http://www.facs.org/education/accreditationprogram/requirements.html/. Accessed August 30, 2006.
11. Harden RM, Crosby J: AMEE Guide No. 20: The good teacher is more than a lecturer – the twelve roles of the teacher. *Med Teach* 2000;22: 334–347.
12. Singh S, Sinz EH, Henry J, Murray WB. Trauma and Awareness. *Simul Healthcare* 2006;1:XXX–XXX.
13. Choudhry NK, Fletcher RM, Soumerai SB: Systematic review: the relationship between clinical experience and quality of health care. *Ann Intern Med* 2006;142:260–273.
14. Essential Skills in Medical Education. Available at: http://www.esmeprogramme.org/. Accessed August 30, 2006.
15. Fleming VM, Schindler N, Martin GJ, DaRosa DA: Separate and equitable promotion tracks for clinician-educators. *JAMA* 2006; 294: 1101–1104.