ABSTRACT

As simulation technology is rapidly expanding, nursing programs are making large investments in this technology, which has great potential for undergraduate nursing programs. Unfortunately, this potential is underestimated and underused. With simulation technology, undergraduate students can gain and improve skills in a safe, non-threatening, experiential environment that also provides opportunities for decision making, critical thinking, and team building. This article describes how to use simulation technology to enhance undergraduate nursing education. The process for simulation technology instruction, leveling content from simple to complex, and faculty resources are discussed. An example of a simulation program is included.

Simulation is the reproduction of the essential features of a real-life situation. Although nurse educators strive to mimic reality in their practice laboratories, they find that nursing students often do not make the imaginative leap required to visualize a dummy model as a real patient. Consequently, students frequently experience difficulty making the transition from the learning laboratory to the real patient setting. To better facilitate this transition, nursing learning centers have recently begun moving from static, plastic models to costly, interactive, computerized models. However, it is not uncommon that, following the purchase of this equipment, the teaching style goes unchanged, the equipment is underused, and its potential remains unrealized. Several aspects of simulation technology suggest it is ideal for nursing education, especially for undergraduates.

Advantages for Nursing Education

Simulation technology offers many advantages for nursing education. Fletcher (1995) listed several, including:

- The clinical setting can be realistically simulated.
- There is no threat to patient safety.
- Active learning can occur.
- Specific and unique patient situations can be presented.
- Errors can be corrected and discussed immediately.
- Consistent and comparable experiences can occur for all students.

In addition to these benefits, communication, teamwork, and delegation can be simulated. Thus, a mix of technical and non-technical experiences can be offered.

Interactive Critical Thinking

Current uses of simulation technology have shown that it offers an excellent approach for developing interactive critical thinking. It has...
Scope of Use With Undergraduate Nursing Students

Many types of simulation equipment are available to nurse educators, so teaching through simulation can make use of a wide variety of methods and techniques. Models range from equipment that teaches a simple, single skill (e.g., inserting an intravenous access into an arm; assessing vital signs, such as heart, lung, and bowel sounds) to very advanced, realistic equipment that can simulate reality-based scenarios in a clinical setting, such as an intensive care unit. Fletcher (1995) described the term “fidelity” as the degree of accuracy depicted by the simulation, compared to the real experience. Whereas static or low-fidelity models are useful for practice and testing of specific skills, high-fidelity models challenge students to make clinical decisions based on data obtained from assessments and interventions.

High-fidelity models are often life-size mannequins with features such as palpable pulses, visible respirations, measurable blood pressure and pulse oximetry, vocal sounds, open orifices, and minimal movement, all programmed by computer. Through interface with the computer, the data emitted from the mannequin will change based on student interventions and decisions. A faculty member can manually control the computer, or small subprograms can be stored and programmed into the scenario. For example, a stored subprogram may alter blood pressure and heart rate in response to administration of a specific medication. These small programs are unlimited in scope and use.

To maximize the use of the high-fidelity equipment such as SimMan™ (Laerdal™ Medical Corporation, Wappingers Falls, New York), scenarios and case studies, which can be either simple or complex, can be developed by faculty and programmed into the simulation computer. These programs provide feedback and pathways for correct and incorrect interventions, giving students the consequences of those interventions, which lead eventually to either resolution of the problem or, in some cases, death of the patient. In this way, the high-fidelity, interactive simulation allows students to learn through critical problem solving.

Process for Instruction

While teaching methods will vary based on the teaching and learning objectives, the basic tenets for using simulation technology remain the same as for any teaching instrument. Educators need to:

- Determine the content best taught through simulation. The method of teaching should reflect the best and most resourceful approach to meeting teaching and learning objectives. Some topics do not lend themselves to simulation; for these, traditional teaching methods still work best.
- Determine the learning objectives. It is critical that objectives be very specific when developing a simulation learning experience. Two to four learning objectives are generally ideal, and both technical and non-technical objectives should be included. Technical objectives include knowledge, skills, and algorithms, while non-technical objectives include judgment, decision making, teamwork, and delegation (Raemer, 2003).

- Replicate reality as closely as possible through the environment and equipment. A simulated patient area should contain props such as medical records, patient care plans, a telephone for simulated conversations, drug and laboratory book references, and the equipment needed to complete the required tasks. Student roles should be taken seriously, as should team member roles if a group is participating in the activity.
- Use video equipment to record the activities for later use in debriefing conferences.
- Conduct a debriefing conference, which is a time for participants and observers to engage in group discussion and learning based on the actions taken by the participants. Rationales for clinical decisions can be discussed, suggestions for alternative actions made, feelings related to the situation shared, and mistakes identified. During the debriefing session, only selected portions of the videotape should be shown to make the desired point. Instructors should focus on the exact actions taken and evaluate the communication and interaction between participants.

The debriefing session need not be lengthy but should be carefully planned and led by an experienced faculty member who can engage students in this important time of learning, while not criticizing or making students feel inadequate. The debriefing seminar is essential and must not be omitted because most of the learning occurs at this time.

Leveling Content From Simple to Complex

Simulation equipment can be used on several levels for undergraduate education, progressing from simple skills practice and evaluation to complex scenarios involving teams of students and critical problem solving. Early use of simulation technology may begin with technical skills (e.g., blood pressure, pulse, respiration,
oral and nasal pharyngeal airways) and components of assessment (e.g., heart, lung, and gastrointestinal assessment, including identification of anatomical landmarks).

When students perform these assessments on their peers, findings are usually within normal ranges, and so-called “peer patients” can help students who are unsure. Simulation technology allows skills or assessments to be changed, performed, and documented for each student. In addition, it allows follow-up interventions or communications to be made as appropriate. The follow-up can be as simple as notifying the nursing faculty or staff nurse in a timely manner if a patient has an elevated temperature. Incorrect follow-up can result in negative patient consequences; if an intervention is not correctly accomplished, temperature rises, heart and respiratory rates increase, and family members and the physician become upset.

After simple programs are developed and used, they can become components of more complex scenarios. For example, vital sign or assessment simulations can be incorporated into other, more complex simulation lessons, such as proper use and assessment of a patient in restraints or administration of a blood transfusion. A scenario to assess a patient with a chest tube may be expanded to include detection of and care for a patient with a pneumothorax. Administration of antipyretic or antihypertensive medications and cardiac glycosides can also become simple enhancements for complex cases. Basic nursing scenarios can be used to develop situations specific to neonatal care, pediatrics, community health, or mental health. Simulation scenarios are limited only by the imagination.

Most nursing programs have a capstone course toward the end of their undergraduate curriculum that combines and synthesizes knowledge learned throughout the program. Students in this course are expected to demonstrate sound, safe clinical decision making. Again, with limited time and clinical resources, shortened length of patient stays, and high patient acuity, simulated technology with more complex scenarios offers a safe, controlled, and interactive environment for this capstone course. Simulated technology allows all students the opportunity to meet the same clinical objectives through varied scenarios.

**Complex Realistic Simulation**

To conduct a complex, realistic simulation experience for undergraduate students, students are first divided into two groups: one for participants with assigned roles and one for students to observe. The nursing learning center can be set up with a team of 4 to 6 patients, using both simulated models and live volunteers. Faculty members guide the session by observing simulator responses, which result from student interventions and clinical decisions. Student teams collaborate to provide necessary care, perform necessary procedures, and determine appropriate clinical decisions for their patients. This method allows students to make independent decisions and experience the consequences of their decisions without the possibility of harming patients. While the simulated environment can feel real, students know their patients are safe, which allows for learning with less anxiety for all involved.

**Faculty Resources**

Because high-fidelity simulators are very sophisticated, faculty members need time and instruction to become skilled in teaching with such models, to explore methods of application, and to develop scenarios. Preprogrammed simulated scenarios available for nursing are limited; most are intended primarily for medical interventions or emergency training, rather than for basic nursing education. Faculty must adapt preprogrammed scenarios to create new scenarios that maximize the benefits of simulation technology in undergraduate nursing education.

After scenarios are written, they must be programmed into the simulation computer. Experienced faculty are necessary to operate the simulator and manage the complexity of patient responses resulting from student interventions. With strong clinical and teaching backgrounds, faculty members can create realistic, challenging situations for students to develop clinical decision-making skills.

Faculty support can be augmented with technical and laboratory assistant personnel for videotaping and laboratory set-up. These staff members can also role play non-health care personnel, such as family members. Simulation technology does not necessarily decrease faculty assignment time, but it does provide comparable learning experiences across students, effective methods for clinical instruction, safe and realistic settings for learning, and protected opportunities for independent clinical decision making.

**Pursuing Opportunities for Collaboration**

Nursing faculty need not remain isolated while learning to use simulated technology. Departments within the school, and even faculty across the state and the nation, can collaborate and share successes. Web sites can be developed to share information and even simulated programs.

Finally, clinicians need to collaborate with researchers to validate the usefulness of simulation technology. Although many educators believe this method is superior, no data currently exists to validate the belief that undergraduate nursing students learn better through simulated technology. In a broader literature search of other disciplines, research to support improved learning from simulation is lacking, although some educational simulation programs report evaluative data. Even when pretest-posttest data were used, comparative methods were not included. No research that used a rigorous design to demonstrate differences in learning between traditional methods and high-fidelity simulation methods were found.
To show that simulation technology is superior to traditional teaching methods, comparative studies with high reliability and validity must be conducted. An example of a research question is: Is there a difference in a student’s ability to safely administer a blood product when information is learned in a didactic classroom setting, compared to information learned in a high-fidelity simulation environment? In addition, research must address the critical role of faculty and facilitators in simulation technology. It is not enough to only evaluate a specific approach. Educators and researchers must collaborate and cooperate to show that learning through simulation produces superior outcomes.

**Conclusion**

The time to use simulation technology for creative undergraduate nursing education is now. Although simulated models are present in many nursing learning centers, failure to maximize the use of this equipment wastes available resources and a valuable opportunity for innovative teaching. Each nursing faculty group needs a champion for simulated technology use, a faculty member who believes in the technology, is informed and excited about its use, and has a “contagious” effect on other faculty members. Projects must start small, avoid skipping essential phases (e.g., realistic settings and debriefing sessions), demonstrate effectiveness, and, with the addition of other faculty champions, continue to spread into all areas of the nursing undergraduate curriculum. Simulation technology is an exciting approach for meeting the clinical objectives of undergraduate nursing programs.

**References**

