
Nursing Simulation: A Review of the Past 40 Years

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Simulation, in its many forms, has been a part of nursing education and practice for many years. The use of games, computer-assisted instruction, standardized patients, virtual reality, and low-fidelity to high-fidelity mannequins have appeared in the past 40 years, whereas anatomical models, partial task trainers, and role playing were used earlier. A historical examination of these many forms of simulation in nursing is presented, followed by a discussion of the roles of simulation in both nursing education and practice. A viewpoint concerning the future of simulation in nursing concludes this article.

Keywords: *anatomical models; computer-assisted instruction; health care education; high-fidelity patient simulation; low-fidelity patient simulation; nursing education; nursing practice; nursing research; objective structured clinical experience; partial task trainers; standardized patients; virtual reality*

Throughout time, nursing educators have sought effective ways to help students to become competent nurses. Since learning takes place through cognitive, psychomotor, and affective domains, nursing education has taken place in the lecture room, the psychomotor laboratory, and in the health care delivery setting. To enhance theoretical learning, simulation, in its many forms, has been added. The types of simulation used in nursing education include anatomical models, task trainers, role playing, games, computer-assisted instruction (CAI), standardized patients, virtual reality, and low-fidelity to high-fidelity mannequins. For the most part, these types of simulation, with the exception of anatomical models, task trainers, and role playing, have been introduced to nursing education in the past 40 years, which coincides with the 40th anniversary of this journal. With increasing numbers of nursing students and decreasing numbers of available clinical sites and nursing faculty, the use of simulation has become an integral part of nursing education. In this article, each of these types of simulation and their use in nursing education is discussed. This is followed by a description of the roles of simulation in both nursing education

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and nursing practice. The final section predicts the future of simulation in nursing education.

Historical Examination of Simulation in Nursing

In this section, each of the forms of simulation that have been used in nursing education is explored. The information presented is limited to published nursing literature. Each form has been used to different extents to improve knowledge, clinical skills, clinical judgment, affective learning, communication skills, and confidence. Examples of specific content taught and nursing research involving each form is discussed, if available. The findings of the research across time are mixed, due to sample sizes, variation in (and often lack of) appropriate valid instruments, and the difficulty in measuring performance in a controlled setting as compared to the real-life clinical setting where unpredictable and simultaneous events occur, preventing control of all extraneous variables. It is interesting to note that each form evolved in nursing education as the technology was available.

Anatomical Models

Anatomical models can be two dimensional or three dimensional. The use of these models can be in the form of static pictures, slides, models (e.g., a skeleton or the model of an eye), and three-dimensional computer models. One of the first examples of the use of anatomical models in nursing education was described by Lees (1874) when she advocated for the availability of a “jointed skeleton” (p. 34) and models to be in every nursing school. In 1919, the Committee on Education of the National League of Nursing Education (now the National League for Nursing) detailed lecture topics and lists of equipment and materials for demonstration of skills in their national standard curriculum for nursing programs. No nursing research studies were found that measured the efficacy of anatomical models in learning.

Task Trainers

Task trainers have been used in nursing education for the development of clinical skills for more than a century. For example, Lees (1874) discussed the use of a “mechanical dummy” and “models of legs and arms to learn bandaging” (p. 34) in her textbook. Other examples include pelvic models used for the insertion of catheters, abdomen models used for stoma care, and arm models used for the insertion of intravenous needles and fluids. The most notable task trainer is Mrs. Chase, a full-body, static mannequin (see Figure 1). She was introduced in 1910 and was modeled after the real Mrs. Chase. A baby model was introduced in 1913. By 1914,

Figure 1
Mrs. Chase



Note: Photo courtesy of the Hamilton Archives at Hartford Hospital in Hartford, CT.

Mrs. Chase had an injection site for needles in her arm and an internal device that allowed for procedures involving the rectum, urethra, and vagina. In 1939, Mrs. Chase was modernized with a more pleasing face and hair, metal joints, more appropriate body shape, and a better internal reservoir. Mr. Chase was introduced in the 1940s and was used by the armed services. These mannequins continued to be produced until the 1970s (Herrmann, 1981, 2008). Mrs. Chase is even mentioned in the first book of the popular *Cherry Ames* series, first published in 1944 (Wells, 1944). Today, many of the original two dimensional pictures or drawings have been converted to three dimensional computer models via optical illusion, and the mannequins range from low-fidelity to high-fidelity models (to be discussed later in this article), and their use in the curriculum is based on need according to the course objectives.

Role Playing

Nursing educators have used role playing to supplement their teaching in order for the student to learn about human interaction and empathy. Schoenly (1994) called it “teaching in the affective domain” (p. 209). She emphasized that it allowed students to practice with minimal risk and stressed the importance of debriefing. Jenkins and Turick-Gibson (1999) felt that it allowed students to examine their “own metacognition” (p. 11). Lilley (1988) in her doctoral dissertation conducted a qualitative study to examine the element of role play in the nursing skills laboratory. The three themes that emerged were that students learned skills, socialized to the nursing role, and identified with the group of students in which they enacted their roles. She stated that students felt that it was safe to make errors, had good opportunities to practice the nursing role that they would assume, and built group skills. Kuipers and Clemens (1998) found that role playing appeared to increase assertiveness and self-confidence in their students, whereas Blau (1983) discussed its use in helping students deal with anxiety prior to beginning their psychiatric rotation. Swart (1992) asked the question of whether the use of role playing in the curriculum could replace clinical practica under certain conditions and found that it could.

Nursing educators have described the use of role playing in a variety of simulated settings and as a method to facilitate the discussion of various concepts. Settings in which nursing educators have described role-playing experiences for their students include air raid shelters (Goble, 1982), the home (Campbell, Themessl-Huber, Mole, & Scarlett, 2007), and the community (Crowley, Westcot, Westcot, & Standefer, 1986). Campbell et al.’s (2007) article discussed the use of a home setting to teach interdisciplinary cooperation and collaboration between nursing and social work students as they assessed the family members and the home setting. Tapp, Moules, Bell, and Wright (1997) discussed the use of role playing to deliver instruction on caring for families through better interviewing skills, and Newcomb and Riddlesperger (2007) detailed how improvisational theater could provide an effective strategy to teach students about genetics. Newcomb and Riddlesperger found that having students improvise the roles of the individual receiving news of their genetic condition, their family members, and the health care professional providing the news allowed faculty to ascertain the student’s knowledge gaps, apply genetic concepts, and assist the students to develop teaching strategies in such situations.

Role playing can be simple, such as a dialogue between the students portraying the nurse and the patient, or it can be more complex, using a variety of audio-visuals. Johnson, Zerwic, and Theis (1999) discussed a role-playing experience that involved in-person dialogue, telephone communication in which a faculty member was in the office several floors away, and videotaping.

Games

Ullione (1983) stated that games were beneficial to nursing education because they helped the student to learn decision-making skills and aided the nursing faculty in theory development, research, and policy formation. She stated that games were similar in some ways to role playing but differed because games are based on a theoretical framework and have more structure. Moreover, she noted that games are composed of goals, rules, roles, interactions, and a debriefing time.

Several nursing educators have listed advantages and disadvantages to the use of games in nursing education. Advantages include the following:

- Increases student motivation (Corbett & Beveridge, 1982; Greenblatt & Duke, 1975),
- Increases cognitive knowledge (Corbett & Beveridge, 1982; Greenblatt & Duke, 1975),
- Increases affective learning (Corbett & Beveridge, 1982; Davidhizar, 1977; Greenblatt & Duke, 1975),
- Increases active participation by students in learning (Clark, 1976; Corbett & Beveridge, 1982; Davidhizar, 1977; Greenblatt & Duke, 1975),
- Apply theoretical knowledge to practice (Davidhizar, 1977), and
- Allows students to desensitize anxiety-prone situations in a safe environment (Clark, 1976; Davidhizar, 1977).

Disadvantages include as follows:

- Not all of the games are well structured or designed,
- Can be time consuming to plan and implement, and
- May be an unfamiliar teaching modality (Clark, 1977).

Nursing educators, for example, have described games to explore therapeutic relationships between the nurse and patient (Clark, 1977), attitudes toward the elderly and the aging process (Chaisson, 1977; Marte, 1988), burn care (Burns, 1984), codependency (Farnsworth & Thomas, 1993), ethical and legal decision making (McDonnell, 1992), psychiatric care (Cosgray, Davidhizar, Grostefon, Powell, & Wringer, 1990; Davidhizar, 1977), and management skills (Lev, 1998). The only research study found in the nursing literature on gaming involved a game called "Name that Nursing Diagnosis" (p. 5), in which the students learned to make clinical judgments. The researcher found that students who played this game were better able to identify various means of obtaining patient information than those who participated in a similar case study ($F = 4.61, p < .04$; Goetz, 1994).

CAI

CAI is a term consistently used in nursing. Other disciplines have used computer-assisted simulation. CAI surfaced in nursing education in the 1980s with the advent and increased usage of the computer by faculty, although de Tornyay (1971) predicted that simulations could be used on the computer almost a decade earlier. In 1986, the American Nurses Association noted that CAIs allow nursing students to learn more efficiently than they can in the classroom. In the same year, Hebda (1986, as cited in Thiele, 1988) found that approximately half of the baccalaureate nursing programs in the United States were using CAI as part of their teaching modalities. For example, CAIs have been developed to instruct nursing students on community assessment and intervention (Bareford, 2001; Bryans & McIntosh, 2000), patient assessment (Bradburn, Zeleznikow, & Adams, 1993; Sweeney, O'Malley, & Freeman, 1982), labor and delivery (Weiner, Gordon, & Gilman, 1993), and decision-making skills (Grossman & Hudson, 2001; J. Wong, Wong, & Richard, 1992). An excellent example of a CAI is the one developed by Giddens (2007) that describes a family and their virtual neighborhood and is used throughout the undergraduate nursing curriculum. In all, there are 30 characters that represent different ethnicities and socioeconomic backgrounds with a variety of health conditions and the need to interact with different types of health care agencies.

Advantages to the use of CAIs have been listed as follows:

- Student can work independently at their own rate (de Tornyay & Thompson, 1982; Howard, 1987; Taylor, 1980),
- Mistakes can be made in a safe environment (Dooling, 1987; Howard, 1987),
- A common set of experiences can be provided to each student (Dooling, 1987; Grobe, 1984; Sweeney et al., 1982),
- Focuses on the problem (de Tornyay & Thompson, 1982; Dooling, 1987; Taylor, 1980),
- Provides cognitive and affective learning (de Tornyay & Thompson, 1982; Dooling, 1986; Taylor, 1980),
- Provides immediate feedback (de Tornyay & Thompson, 1982; Taylor, 1980), and
- Is cost-effective (de Tornyay & Thompson, 1982; Taylor, 1980).

Disadvantages include as follows:

- Can be time-consuming to develop and implement, and
- Difficult to develop valid scoring system that accurately draws correlation of clinical decisions to patient outcomes (Dooling, 1987).

Nursing research looking at the efficacy of CAIs over other means of instruction has revealed mixed results. Grobe (1984), in a sample of 97 nurses, found that the CAIs had practical value, interest value, and emotional appeal. In an integrative review of the literature on CAI usage in nursing education, Ravert (2002) found that 75% of the studies she examined at found a positive effect on knowledge and/or skill performance. Weiner

et al. (1993), in a study that involved nursing student use of a video disc on a labor and delivery case and clinical experience versus nursing students who only had clinical experience, found that the students completing the video disc and clinical experience had significantly greater confidence and an increase in knowledge. Schleutermann, Holzemer, and Farrand (1983) found no differences between graduate family nurse practitioner student performance using a CAI and a paper-and-pencil exercise. Henry and Holzemer (1993), in an evaluation of CAIs versus a knowledge test and a self-evaluation of competence, found that the constructs were not synonymous and that it was difficult to statistically compare the value of simulation through CAIs in comparison to clinical performance. J. Wong et al. (1992) also reached this conclusion. In 1994, Cohen and Dacanay completed a meta-analysis of research studies involving CAIs in nursing education and concluded that the overall effect size for achievement in 26 studies was a medium-sized effect at 0.45. In a survey of 135 nurse practitioner programs in the United States, Kelley, Kopac, and Rosselli (2007) found that 58.5% ($n = 79$) of the programs used CAIs and 39.3% ($n = 53$) used standardized patients in their programs.

Standardized Patients

Standardized patients have been used in medical education for a number of years but have been used less often in nursing education (although that trend has changed in recent years). Standardized patients are used to evaluate communication, interviewing, and assessment skills (Ebbert & Connors, 2004; Kruijver et al., 2001). Implementing the use of standardized patients includes setting goals and objectives, development of the scenario to be used, identification and training of the standardized patients, preparatory work for the students, and the facilitation of the scenario by faculty with debriefing occurring at the end of the scenario (Bosek, Li, & Hicks, 2007; O'Connor, Albert, & Thomas, 1999). Standardized patients can be used for a single experience or as part of an objective structured clinical experience (Vessey & Huss, 2002). Nursing educators, for example, have discussed the use of standardized patients for the teaching of violence prevention skills (Gates, Fitzwater, & Telintelo, 2001), minor surgery (Nestel, Kneebone, & Kidd, 2003), assessment of risk for HIV and care of patient with HIV (Konkle-Parker, Cramer, & Hamill, 2002), cultural competency (Rutledge, Garzon, Scott, & Karlowicz, 2004), psychosocial concepts (O'Connor et al., 1999), and health assessment (Gibbons et al., 2002). Westberg, Adams, Thiede, Stratton, and Bumgardner (2006) developed an interdisciplinary activity with a standardized patient that required students from different disciplines to interview the patient, and together, based on their assessments, the students devised a care plan for the patient. Miller, Wilbur, Montgomery, and Talashek (1998) developed the Student Clinical Performance Scale to standardize the measurement of a student's assessment skills with a simulated patient.

Several nursing educators have identified advantages and disadvantages of using standardized patients in nursing education. The advantages include as follows:

- Can be designed to meet curricular objectives (Vessey & Huss, 2002),
- Can provide immediate feedback from the patient's perspective (Theroux & Pearce, 2006; Vessey & Huss, 2002),
- Improves clinical reasoning (Thomas, O'Connor, Albert, Boutain, & Brandt, 2001),
- Allows for unique experiences that may not be commonly experienced by all students (Thomas et al., 2001),
- Increases student confidence (Theroux & Pearce, 2006; Thomas et al., 2001),
- Decreases anxiety (Theroux & Pearce, 2006), and
- Provides for student accountability for learning (O'Neill & McCall, 1996).

Disadvantages include as follows:

- Costs can be prohibitive, ranging from \$20 to \$400 per student (Colliver & Swartz, 1997; Ebbert & Connors, 2004; King, Perkowski-Rodgers, & Pohl, 1994), and
- Special populations, such as children, can be difficult to recruit and train (Lane, Ziv, & Boulet, 1999).

Research conducted by nursing educators on the efficacy of using standardized patients has produced mixed results. For example, Curran, Mugford, Law, and MacDonald (2005) found that students from different health professional backgrounds learned more about the different disciplines and how to work together through an AIDS education program involving standardized patients. Coleman et al. (2004) found that health care providers, including nurses in the military, experienced a significant improvement in their skills involving interviewing and conducting clinical breast examinations after the experience with standardized patients. Razavi et al. (2002) found improvement in empathy among nurses who worked with standardized patients who had cancer. Yoo and Yoo (2003) found improvement in the performance of communication skills, clinical skills, and clinical judgment with the use of standardized patients over the control group. Becker, Rose, Berg, Park, and Shatzer (2006) stated that nursing students found the experience with standardized patients to be meaningful and creative, but there were no significant differences between those who had the experience and those who did not on measures of therapeutic communication, knowledge, and interpersonal skills. Foley, Nespoli, and Conde (1997) found no significant differences between the use of videotaped case studies and standardized patients. In both of these studies, the authors speculated that their instruments were not sensitive enough to measure differences.

Virtual Reality

The use of virtual reality in nursing education has been limited due to the cost, although advances in the technology in recent years should decrease the cost for wider use of this form of simulation in the near future. Phillips (1993) first described virtual reality in the nursing literature and discussed its use in nursing research. Merrill and Barker (1996) presented the prototype for the intravenous catheter insertion model that

was developed at the State University of New York in collaboration with High Techsplanations, a company from Rockville, Maryland. Today, this type of virtual reality model is commercially available. Skiba (2007) discussed the use of Internet-based, interactive virtual worlds in which the performance of nurses within a classroom or anywhere in the world can be observed and assessed individually or within a team approach to a patient situation. In the future, these virtual nurses can provide the following:

- Instruction on a procedure,
- Guidance, feedback, encouragement, and information to students, and
- Opportunities for interdisciplinary health professional team experiences (Lashley & Nehring, 2008).

Low-Fidelity to High-Fidelity Mannequins

Fidelity refers to the degree that the object mimics reality. Thus, a low-fidelity mannequin is less realistic than a high-fidelity mannequin. The history of the development of computerized mannequins, from low to high fidelity, is found in Rosen (2004) and Cooper and Taqueti (2004). In nursing education, the full range of low-fidelity to high-fidelity simulation has been used primarily at the undergraduate level to teach (e.g., critical care; Brady, Molzen, Graham, & O'Neill, 2006; Morton, 1997), cardiac care (Hravnak, Beach, & Tuite, 2007; Rauen, 2004), labor and delivery skills (Bantz, Dancer, Hodson-Calton, & van Hove, 2007; Cioffi, Purcal, & Arundell, 2005; Robertson, 2006), critical thinking (Rauen, 2001), and clinical judgment (Lasater, 2007a, 2007b), and at the graduate level to teach nurse anesthesia skills (Fletcher, 1998; Monti, Wren, Haas, & Lupien, 1998; O'Donnell, Fletcher, Dixon, & Palmer, 1998). At the practice level, the full spectrum of low-fidelity to high-fidelity simulation has been used, for example, for new nurse orientation (Ackermann, Kenny, & Walker, 2007; Morris et al., 2007; Sinz, 2004; Zekonis & Gantt, 2007), continuing education for teaching acute and critical care skills (Kappus, Leon, Lyons, Meehan, & Hamilton-Bruno, 2006; Landry, Oberleitner, Landry, & Borazjani, 2006), skills competency (Winslow, Dunn, & Rowlands, 2005), patient safety (Nelson, 2003), and for a nurse residency program to assess clinical competency (Beyea, von Reyn, & Slattery, 2007).

Several advantages and disadvantages of low-fidelity to high-fidelity patient simulation have been described in the nursing literature. The advantages include as follows:

- Provide connection to course objectives and learner outcomes (Bremner, Aduddell, Bennett, & VanGeest, 2006),
- See physiological effects on the patient that are not available by book or in real life (Lasater, 2007a; Monti et al., 1998; Nehring, Ellis, & Lashley, 2001; O'Donnell et al., 1998),
- Ability to make errors in a safe environment (Monti et al., 1998; Nehring et al., 2001; O'Donnell et al., 1998),
- Improve confidence, critical thinking, and decision-making skills (Monti et al., 1998; Nehring et al., 2001; O'Donnell et al., 1998),

- Provide standardized patient situations (Krautscheid & Burton, 2003; Lasater, 2007a; Nehring et al., 2001),
- Provide immediate feedback (Feingold, Calaluce, & Kallen, 2004; Lasater, 2007a),
- Improve knowledge and communication skills (Lasater, 2007a; Nehring et al., 2001), and
- Improve interpersonal, psychomotor, technical, and interdisciplinary teamwork skills (Krautscheid & Burton, 2003; Lasater, 2007a).

Disadvantages include as follows:

- Variable cost of the mannequins prompting some schools to purchase lower fidelity models over more technologically realistic mannequins, plus the costs of maintenance and upgrading (Monti et al., 1998; Nehring et al., 2001; O'Donnell et al., 1998),
- Time needed to develop and implement scenarios (Monti et al., 1998; Nehring et al., 2001),
- Inability to provide facial movements or demonstrate swelling or many color changes (Lasater, 2007a),
- Small number of students who can interact with the mannequin at one time (Henrichs, Rule, Grady, & Ellis, 2002; Monti et al., 1998; Nehring et al., 2001; O'Donnell et al., 1998), and
- Increased anxiety in some students plus student inability to see the full picture of the patient and instead focusing on one or few elements (Henrichs et al., 2002).

One nursing research study involved a low-fidelity mannequin (Shepherd, Kelly, Skene, & White, 2007). The authors found that the patient assessment skills were higher in the nursing students who used the simulator as compared to groups of students who used a self-directed learning packet or a scenario-based PowerPoint session.

Since 2001, there have been 26 published nursing research studies involving high-fidelity patient simulators. Twenty-two of these studies dealt with nursing education (most often in school settings but one was in practice) and four with team management.

Ten of the studies focused on high-fidelity patient simulation as an adjunct to traditional methods of teaching (Bremner et al., 2006; Childs & Sepples, 2006; DeCarlo, Collingridge, Grant, & Ventre, 2008; Henrichs et al., 2002; Jeffries & Rizzolo, 2006; King, Moseley, Hindenlang, & Kuritz, 2008; Lasater, 2007b; Nehring & Lashley, 2004a; Rystedt & Lindstrom, 2001; Schoening, Sittner, & Todd, 2006). In general, these researchers found that both students and faculty found high-fidelity patient simulation to be a positive experience that helped to increase confidence. In the practice setting, nurses displayed more anxiety if they had less experience with the types of patients found in high-fidelity patient simulation (DeCarlo et al., 2008).

Eight studies specifically addressed competence in basic knowledge and technical skills (Alinier, Hunt, & Gordon, 2004; Alinier, Hunt, Gordon, & Harwood, 2006; Feingold et al., 2004; Hoffmann, O'Donnell, & Kim, 2007; Kuiper, Heinrich, Matthias, Graham, & Bell-Kotwall, 2008; Radhakrishnan, Roche, & Cunningham, 2007; Scherer, Bruce, & Runkawatt, 2007; T. K. S. Wong & Chung, 2002). In general, these nurse researchers found improvement in clinical and assessment skills and basic knowledge. Wong and Chung found no significant differences between university nursing students and hospital nursing students on the identification of differential diagnoses for three patient conditions. In addition, Scherer et al. (2007) found no significant differences between nurse practitioner students using a high-fidelity patient simulator for learning about a cardiac event and those students who learned the same information using a case study approach.

Four studies examined team performance (Davis et al., 2007; Gilligan et al., 2005; Jankouskas et al., 2007; Morgan, Pittini, Regehr, Marrs, & Haley, 2007). In general, these studies found improvement in skills and team functioning. Morgan and colleagues (2007) found some scenarios more difficult to assess with the instruments they were using.

Two studies examined the use of simulation as a replacement for hours in a clinical setting (Bearnson & Wiker, 2005; Nehring, 2008). Bearnson and Wiker found that students rated their high-fidelity patient simulation very positively; and Nehring surveyed the individual state boards of nursing in the United States, Puerto Rico, and the District of Columbia, for the existence of or planning for regulation changes involving the use of simulation as a replacement for clinical hours.

Finally, one research study was found that examined clinical judgment (Lasater, 2007a), and one research study studied self-directed learning versus instructor-directed learning when using a high-fidelity patient simulator (LeFlore, Anderson, Michael, Engle, & Anderson, 2007). As a result of the research, Lasater (2007a) developed a rubric to measure clinical judgment with the use of a high-fidelity patient simulator. LeFlore et al. found inclusive results and recommended that the study be replicated with a larger sample, as they had used only 16 students divided among three groups.

Overall, the nursing research, like the medical research (Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005) in the use of high-fidelity patient simulation, is inconclusive and is hampered by low sample sizes, different samples, different constructs, and instruments with questionable validity. Similar to the nursing research in all forms of simulation, the general consensus is that simulation is useful as an adjunct to traditional teaching and both students and faculty find the experience to be positive but that the statistical measurement of its efficacy is hard to measure, especially its application to performance in the actual clinical setting.

Theoretical Foundations for Use in Nursing Education

Theoretical frameworks have been used by nursing educators to support their usage of simulation in the curriculum. The most common application of a nursing theory is that of Patricia Benner's (1984) theory on clinical competence that describes the stages of novice to expert (Larew, Lessans, Spunt, Foster, & Covington, 2006; Long, 2005). Waldner and Olson (2007) discussed their use of Benner's novice to expert theory in conjunction with D. A. Kolb's (1984) theory of experiential learning. Decker (2007) discussed the use of reflective thinking by Schon (1983). Kuiper et al. (2008) explored the use of the outcome present state test model of clinical reasoning (Pesut & Herman, 1999) in their study on debriefing. Lasater (2007a) applied Tanner's (2006b) theory of clinical judgment in the development of a rubric by which clinical judgment can be assessed during a student's participation in a scenario involving high-fidelity patient simulation. Jeffries and Rogers (2007b) developed the *Nursing Education Simulation Framework*, which describes teacher and student characteristics combined with educational practices that effect student outcomes and simulation design characteristics. Nehring and Lashley (2004b) developed *Critical Incident Nursing Management*, modeled after the conceptual framework for anesthesia developed by Gaba, Fish, and Howard (1994). In this model, the nurse and his or her actions are influenced by the patient, the physician, members of the health care team, and the environment as he or she acts to identify the antecedents of a critical patient incident (e.g., cardiac arrest) and successfully intervene prior to any untoward consequences (Nehring & Lashley, 2004b, Nehring, Lashley, & Ellis, 2002).

Roles of Simulation in Nursing Education

Until recently, the use of simulation in the nursing literature has been primarily focused on nursing education rather than on nursing practice. In this section, the use of simulation in instruction and evaluation is discussed. In each area, the use in didactic, clinical, and debriefing sessions is highlighted.

Instruction

The use of simulation in its many forms in education has been detailed in previous sections. In this section, the recent work by nursing educators is emphasized.

Didactic

In recent years, the work of Pamela Jeffries and her colleagues (e.g., Jeffries, 2005, 2006, 2008; Jeffries & Rogers, 2007b) has defined the process for implementing and

integrating simulation in the undergraduate nursing curriculum. Jeffries' (2008) article on starting a simulation program provides the needed detail on administrative and faculty challenges, resource issues, and appropriate steps for a successful outcome. Spunt (2007) provided needed instruction on how to set up a simulation laboratory. Harlow and Sportsman (2007) also gave a detailed report of the economic analysis that they underwent in the development of their collaborative, regional simulation program between two nursing programs and a hospital. This information is important because the National Advisory Council on Nurse Education and Practice has recommended that all faculty be oriented on the use of simulation (Health Resources and Services Administration, 2002) and the Practice Education and Regulation Committee of the National Council of State Boards of Nursing (2006) have recommended that simulation be one example of a variety of teaching strategies that can be used in nursing education.

To assist faculty to develop their expertise in the use of high-fidelity patient simulation, Medical Education Technologies, Inc., a manufacturer of such simulators, published the *Program for Nursing Curriculum Integration*, in which over 100 scenarios for use with high-fidelity patient simulators can be integrated across the undergraduate nursing curriculum. The National League for Nursing in collaboration with Laerdal, another manufacturer of high-fidelity patient simulators, have launched the *Simulation Innovation Resource Center*, a Web site that provides resources for successful simulation integration in the undergraduate nursing curriculum. In addition, nurse authors have begun to discuss their experiences in assisting faculty to develop this expertise (Jones & Hegge, 2007; Meakim & Wahl, 2007).

In 2004, we advocated for regional simulation centers so that all nursing programs might have an opportunity to use this technology to supplement their instruction (Nehring & Lashley, 2004a). Instead, the popularity of this technology has increased to the point that it is most likely a majority of nursing programs in the United States have at least one low- to high-fidelity patient simulator. Additional survey research is needed to confirm this assumption.

Clinical

Tanner (2006a), as editor of *The Journal of Nursing Education*, asked the readership of her journal to consider the need to transform clinical education for undergraduate nursing students. She asked readers to examine the following:

- the current learning outcomes for students;
- the current variety of learning activities that students undertake;
- the need for education research;
- opportunities for residencies;
- theories and conceptual frameworks to inform clinical instruction, such as situated learning; and
- the need to integrate simulation as a complement to traditional clinical teaching methods.

Tanner called for faculty to address these areas because nursing programs are faced with these situations:

- limited and decreasing numbers of appropriate clinical sites,
- lack of “time on task” (p. 100) in the clinical setting,
- lack of opportunities for appropriate patient choice and numbers of patients for each student to care for,
- increasing patient acuity and short stays,
- lack of opportunities to work as a member of a health care team, and
- other critical factors.

It is interesting that these exact sentiments were expressed by Whitis (1985) two decades earlier.

Debriefing

Debriefing is a critical component of the simulation experience. As noted in the discussion of the different forms of simulation, the need for debriefing was expressed for every form of simulation that required active participation by students. Johnson-Russell and Bailey (in press) provided a thorough look at debriefing for nursing education and practice purposes. In this chapter, these authors discuss the goals of an effective debriefing session; environmental considerations; the faculty role; and best practices in conducting a debriefing session, including the introduction, personal reactions, detailing the steps of the simulated event and allowing for reflective learning. Kuiper and colleagues (2008) found that during debriefing, undergraduate nursing students in their study were better able to list important interventions and laboratory data, identify appropriate nursing diagnoses, and show improved clinical reasoning when using simulation.

Evaluation

Didactic

With the renewed effort to improve safety measures and quality of practice in health care, a need to examine competence in graduating nursing students is imperative. Decker, Sportsman, Puetz, and Billings (2008) stated that “nursing competence involves the acquisition of relevant knowledge, the development of psychomotor skills, and the ability to apply the knowledge and skills appropriately in a given context” (p. 74). Faculty need to review course, level, and terminal student outcomes to determine if they are using the appropriate measures to assess completion of the objectives. Simulation in its various forms is an appropriate adjunct to appropriately measure these outcomes.

Jeffries and her colleagues have detailed various means, such as questionnaires, checklists, anecdotal notes, journal or diary, and so forth, to evaluate educational outcomes using simulation (Jeffries & McNelis, in press; Jeffries & Rogers, 2007a).

They have also described two instruments that use Likert-type scales: Educational Practices in Simulation Scale (developed to evaluate educational practices, such as active learning and collaboration, using simulation) and Simulation Design Scale (developed to assess objectives, student support, decision making, fidelity, and debriefing).

Clinical

Nursing educators have not written about how simulation can be used in the clinical setting, but Haskvitz and Koop (2004) have written an article about using simulation for students who need remedial work. The National Council of State Boards of Nursing released the preliminary results of their research study in August 2008 in which researchers examined the effectiveness of simulation on student learning in 46 senior nursing students (Li, Hicks, & Bosek, 2008). Three groups were randomly assigned: the high-fidelity patient simulation group, a clinical group without simulation, and the simulation and clinical group. Student knowledge, clinical performance, and self-confidence were measured. The authors found that after preliminary analysis, the clinical group retained more knowledge and performed better but that the students in the simulation group had more self-confidence. These results were not statistically significant. Information was not provided to ascertain whether the groups were different prior to starting the study that could explain any of the results. The authors do acknowledge that the low sample size may have affected the results and thus no conclusions should be reached.

In 1984, S. E. Kolb and Shugart expressed the concern that nursing educators are still struggling to determine the best means to evaluate clinical competence. This is still true today.

Debriefing

Traditionally, the clinical experience includes either a preconference and/or a post-conference session in which the faculty member and the students review what should or did happen during the clinical experience. It is often the case that these sessions are canceled, reduced in time, and/or all students do not attend. Therefore, debriefing in the clinical site does not always occur, and when it does, it has variable quality. As Tanner (2006a) stressed, it is time for an overhaul of how the practice component of the nursing educational curriculum is conducted. Nursing faculty will need to be knowledgeable of debriefing techniques and the theory behind them (e.g., Lederman, 1992).

Roles of Simulation in Nursing Practice

Instruction

In recent years, the use of simulation, especially with high-fidelity patient simulators, has exploded in the health care setting. This has certainly been influenced by the Institute of Medicine reports regarding safety and quality in health care practice

(e.g., Aspden, Corrigan, Wolcott, & Erickson, 2004; Page, 2004). In this section, more detail is given on how the practice settings are using simulation.

Didactic

As noted earlier, much of the past nursing literature on the use of simulation in practice settings had to do with continuing education, primarily in the area of critical care (Hynes, 2006) and obstetric emergency situations (Freeth, Ayida, Berridge, Sadler, & Strachan, 2006). More recently, the shift has been made to describing the benefits of using simulation to cut down on the cost and time for orientation (Beyea et al., 2007; Ferguson, Beeman, Eichorn, Jaramillo, & Wright, 2004; Morris et al., 2007; Sinz, 2004). Sinz found that the time needed for orientation to a high-acuity unit was cut in half, as was the cost, when simulation was used. Beyea et al. (2007) also found a decrease in time and cost. Ferguson and colleagues (2004) developed an orientation model based on Benner's (1984) novice to expert model.

Clinical

The nursing practice literature has focused on individual skills and team performance when using simulation, and several of these studies have already been reported. This mandate as spelled out, for example, with the Joint Commission annual national patient safety goals, will guarantee a place for simulation in the practice setting. Future research and practice-focused articles by nurses will also assist to inform nursing education. An example is the recent article by Arnold and colleagues (2008) that explored a standardized process for designing simulation experiences for nurses and other disciplines. It is the collaborative efforts by nursing education and practice that will continue to advance our discipline.

Debriefing

The details of the debriefing session in the nursing practice setting have not been described in the nursing literature. The nursing practice literature discusses the use and importance of debriefing to the use of simulation, especially high-fidelity patient simulation, but the detail lacks on to how this essential component is used.

Evaluation

Didactic

Many of the orientation programs that are now being described in the nursing literature that involve simulation focus on the components of the program and their cost-effectiveness. The evaluation piece is usually composed of positive reactions by staff using self-report measures who participate in them. In the coming years, more evaluation of these programs using more objective measures will be available, as is also the case with the continuing education programs done for staff development.

Clinical

Jordan, Thomas, Evans, and Green (2008) stressed that nursing must resolve “agreement on identification of minimal competencies, appropriate time lines for the evaluation of competencies, and assurance that the methodologies to determine competencies are evidence-based, protect the public, and promote patient safety” (p. 86). They go on to advocate for simulation centers where these competencies could be documented. This is the practice in some simulation settings already (Decker et al., 2008).

Debriefing

The evaluation of debriefing efforts in the practice setting has not been described in the nursing literature. This is a fruitful area for future research.

Certification and Licensing

There have been discussions that competency testing should be done in conjunction with license renewal, but that discussion has not progressed, either for basic or advanced nursing practice. The American Nurses Association (2000) continues to note that continued competence is the responsibility of the individual nurse. In many states, hours of continuing education are required for renewal of licenses to indicate continued competence. The National Council of State Boards of Nursing (2005) also struggle with how to evaluate continued competence.

Future of Simulation in Nursing

The future use of simulation in nursing education and practice has great potential; we see no bounds to the direction that this technology can lead educational efforts. The caution lies in the quality of its use. Nursing practice is monitored by outside agencies, such as the Joint Commission, which regulates and measure benchmarks on a regular basis with real consequences to the health care setting. This oversight is not as prescribed in nursing education as in practice. We perceive a distinct need for a revolutionary change in how nursing education is delivered and evaluated, and simulation does have an important role in its new implementation. A number of current and emerging nursing leaders in the field of simulation are making their voices heard in this reconstruction of nursing education. We must consider faculty competencies and how we measure novice to expert faculty. Expertise in new strategies of delivering content and skills must be recognized and awarded. As Prensky (2001) stated, “today’s students are no longer the people our educational system were designed to teach” (p. 1). It is time that nursing education is put on a par with nursing practice in its efforts to meet the quality of health care that is the right of every citizen, and simulation has an increasing continued role in this time of change.

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