Simulation Methodology in Nursing Education and Adult Learning Theory

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Abstract: Simulation is often used in nursing education as a teaching methodology. Simulation is rooted in adult learning theory. Three learning theories, cognitive, social, and constructivist, explain how learners gain knowledge with simulation experiences. This article takes an in-depth look at each of these three theories as each relates to simulation. Pedagogical approaches as well as ties to simulation of each theory are addressed. Finally, the implications for research and practice in healthcare and adult education are discussed.

Keywords: adult education, learning theory, simulation

Simulation has been defined by McGaghie (1999) as “a person, device, or set of conditions which attempts to present education and evaluation problems authentically. The student or trainee is required to respond to the problems as he or she would under natural circumstances” (p. 198). The history of simulation stretches back for centuries. The earliest use of simulation can be traced to the fields of military, aviation, and nuclear power (Blackburn & Sadler, 2003; Bradley, 2006; Issenberg, McGaghie, Petrusea, Gordon, & Scalese, 2005). The military has used simulation the longest, dating back to the 18th century (Bradley, 2006). Aviation pioneered the modern day use of simulation in the 1930s (Scherer, Bruce, Graves, & Erdley, 2003). Simulation has been used in these fields due to the fact that training or testing in these areas in the real world would be too dangerous or costly.

Major movements of the late 20th century drove the impetus toward the use of simulation in the medical and nursing communities. Changing clinical experiences, shorter times in training, and working time restrictions created skill deficiencies in medical students (Bradley, 2006; Issenberg et al., 2005). In nursing, educators struggled with questions of how best to prepare competent nurse clinicians and how to adequately assess clinical skill performances (Ebbert & Connors, 2004; Gibbons et al., 2002; Stroud, Smith, Edlund, & Erkel, 1999). Then in 1999, the Institute of Medicine (IOM) published To Err Is Human (Kohn, Corrigan, & Donaldson, 1999), a report that brought patient safety issues to the forefront of health care and education. The report estimated that 45,000 to 98,000 patients die each...
year in the United States as a result of medical error. Based on this staggering number, the IOM called for systemic change in health care practices and argued that interdisciplinary training should be a top priority in educational institutions. The report highlighted the potential benefits of teamwork and identified simulation as a resource to address the needed reform.

Nishisaki, Keren, and Nadkarni (2007) declared, "Healthcare, especially the complex hospital care required to treat serious diseases, falls into the category of a high-hazard industry like aviation, chemical manufacturing, nuclear power generation, and the military" (p. 226). Simulation provides a safe supportive educational venue that cannot always be attained with live humans (Blackburn & Sadler, 2003; Seropian, Dillman, & Farris, 2007). With simulation, students are able to practice a variety of tasks and skills, and implement knowledge and decision making without the fear of causing harm to the patient. In addition, students attain the acquisition of skills through a genuine life-like environment (Brannan, White, & Bezanson, 2008; Decker, Sportsman, Puetz, & Billings, 2008; Lasater, 2007; Leigh, 2008; Wolf, 2008).

Simulation is now touted as a wonderful methodology to use in teaching and evaluation. One of the reasons for this is because simulation draws on a variety of adult learning theories. But which learning theories best explain and support how students learn from simulation experiences? What is the process of learning that occurs according to these theories? How is simulation rooted in the learning theory? This article discusses three learning theories related to simulation: cognitive learning theory, social learning theory, and constructivist learning theory. Each theory is examined in terms of its basic assumptions related to learning. The ways in which simulation is embedded in each learning theory is described and explained. Finally, simulation as it is currently used in medical and nursing education is discussed along with the need for further research in these areas as well as the field of adult education.

Cognitive Learning Theory

In cognitive learning theory, the key to learning and behavior involves the individual's cognition, meaning a person's perception, thought, memory, and ways of processing and structuring information. Hence, cognitive learning theory focuses on the internal mental processes that are under the learner's control (Feden, 1994; Merriam, Caffarella, & Baumgartner, 2007). In contrast to the passive behaviorist view related to learning and the external environment, the cognitivist sees learning occurring within the individual's internal environment and is more concerned with what the knowledge means to an individual versus the change in behavior that may occur as a result of the knowledge.

Bode (1929), a Gestalt psychologist, was one of the first to challenge the behavioral learning theory as merely looking at partial events versus the whole scenario to explain learning. Out of this thought grew what is now known as the cognitive or information-processing learning theory. Gredler (1997) summarized the basis of cognitive learning theory as follows: "Essential components of learning are the organization of the information to be learned, the learner's prior knowledge, and the processes involved in perceiving, comprehending, and storing information" (p. 144), and he contends that two key assumptions underlie the cognitive or information-processing learning theory: "(1) the memory system is an organized processor of information, and (2) prior knowledge plays an important role in learning" (p. 144).

Four perspectives outline the cognitive orientation (Bastable, 1997; DeYoung, 2007). The first perspective is perception. Learners may have various perceptions of information. Because of this, the second perspective of the theory, information processing, may differ from individual to individual. In the cognitive learning theory, the learning is influenced by the learner's goals, expectations, and experiences. In fact, experience often decides how an individual learns and is the key to learning.

The second perspective of the cognitive learning theory involves information processing (Bastable, 1997; DeYoung, 2007). Information processing occurs in stages; these stages include attention, processing, memory storage, and action. After attention is given to the information, the learner will begin to process the information through sensory processing. Here, information may be fleeting or it can proceed to the next stage, memory storage. In memory storage, information is encoded for short-term memory. If information is not disregarded or forgotten at this point, it is organized and stored into long-term memory. The fourth and final stage of the information-processing perspective is action. Here the individual responds to
the information based on how it was processed and stored.

Cognitive development is the third perspective of cognitive learning theory. Cognitive development refers to the qualitative changes in cognitive function that occur as an individual grows and matures (Bastable, 1997). The most widely known psychologist to produce work in this area is Piaget (1972). Utilizing aspects from the behavioral and cognitive orientations, Piaget expounded on the changes related to cognitive function. Piaget not only believed that maturation accounted for some of the internal cognitive structure changes but also concluded that interaction with the environment and exposure to increased experiences played an important role. Piaget's theory includes the concepts of assimilation, or incorporating information to fit an individual's own cognitive framework, and accommodation, changing one's own cognitive structures. Piaget identified and developed four stages of cognitive development (sensorimotor, preoperational, concrete operations, and formal operations); these stages encompass infancy through adulthood.

The fourth and final perspective in cognitive learning theory is called social cognition perspective, and it ties the influence of social context to cognition (Bastable, 1997). Attribution theory, a well-known theory in education, speaks to the social cognition theory (Weiner, 1985). It incorporates behavior modification by emphasizing the idea that learners are strongly motivated by the pleasant outcome of being able to feel good about themselves. Attribution theory incorporates cognitive theory and self-efficacy theory by emphasizing that learners' current self-perceptions will strongly influence the ways in which they will interpret the success or failure of their current efforts and hence their future tendency to perform these same behaviors.

Ties With Simulation

Characteristics of a cognitivist-oriented learning approach are seen when students participate in simulation-type experiences. Here the learner has control of the knowledge that is conceived. The locus of control is internal, and learners are able to utilize previous knowledge in the simulation experience. In these ways, the essential components of cognitive learning theory manifests itself. Simulation provides excellent teaching environments that link instruction with the cognitive processes of perceiving, thinking, and processing information. For example, the concept of meaningful learning is achieved in simulation experiences. Students are able to create knowledge using prior knowledge; they assimilate new knowledge in the learning environment. Reflective thinking can also be encouraged and used in the simulation environment. Students can recall the encounter, reflect on what happened, review what was learned from the experience, and contemplate what could have been done in other ways.

Finally, the educator in the simulated learning environment structures the content of the learning activity by creating an environment in which the learner can process the skills or knowledge he or she has mastered along with the skills or knowledge in which he or she needs additional practice, instruction, and comprehension. In this regard, the instructor is facilitating a learning how to learn environment within a cognitive construct.

Social Learning Theory

Social learning theory can be thought of as a combination of ideas from the behaviorist and cognitivist orientations (Merriam et al., 2007). In social learning, people learn by observing others. This learning may even be done by observation alone without the need for rehearsal and imitation of the behavior. The cognitive aspect of this approach surfaces when the individual stores the image of the modeled behavior and retrieves the image when later motivated. Although Miller and Dollard were the first to explore this theory of learning through observation, their ideas stayed within the behaviorist orientation (Merriam et al., 2007). Bandura (1977), who is credited for many of the assumptions related to social learning, expounded on the theory of social learning and included cognitive processes into the approach, which separated the theory from a purely behaviorist approach.

In his early studies, Bandura (1977) focused on the aggressive behavior of children, believing aggression is learned through a process called behavior modeling. Bandura found that adolescents whose parents modeled hostile attitudes demonstrated the same hostility. This example of behavior modeling occurred without the adverse conditions typically thought to cause behavior.
problems and conflicted with the then popular Freudian belief that direct punishment for aggressive acts would suppress such behavior.

These findings led to the famous Bobo doll experiment (Bandura, 1977). In this experiment, one group of children watched a video in which a model aggressively attacked a plastic inflated clown called the Bobo doll, whereas the other group of children was exposed to models demonstrating no violent behavior toward the doll. Children who viewed the violent behavior of the models repeated this behavior to the Bobo doll, whereas children who were not exposed to the violent behavior did not. These results revealed that observational learning occurs in the absence of reinforcement, leading Bandura and colleagues to conclude that new learned behaviors can occur without rewards or actual performance.

This type of observational learning or modeling is influenced by characteristics exhibited in the behavior of the observer following the witnessed behavior. The processes are attention, retention, motor reproduction, and motivation (Bandura, 1977, 1993). Bandura contends that humans learn by observing others, but pointed out that role modeling is not simply mimicking a response but a learned behavior psychologically embedded into the brain. Bandura also contends that people use the modeled behaviors they have learned and apply them to situations as needed, going beyond what has been seen and heard in the modeled behaviors. Bandura emphasizes that although observation starts the learning process, expertise is developed through practice with external and internal (self-regulatory) feedbacks.

**Evolution to Social Cognitive Theory**

Bandura later studied human adaptation and change that occurs through cognitive, vicarious, self-regulatory, and self-reflective processes. The theory is rooted in agentic perspective, meaning people are self-organizing, proactive, self-reflecting, and self-regulating (Bandura, 1986, 2001). "Broadly speaking, agency is the capability of individual human beings to make choices and to act on these choices in ways that make a difference in their lives" (Martin, 2004, p. 135). Furthermore, it is a dynamic interplay between personal, behavioral, and environmental influences that affect human functioning. People are not just reactive organisms shaped and shepherded by environmental forces or driven by concealed inner impulses but are producers as well as products of social systems.

Bandura (1986) realized that the breadth of this research and theory extended beyond the boundaries of social learning, so relabeled his theoretical approach from social learning to social cognitive theory. He explained, "The social portion of the terminology acknowledges the social origins of much human thought and action; the cognitive portion recognizes the influential causal contribution of thought processes to human motivation, affect, and action" (p. xii).

One of the core features of human agency in social cognitive theory is the human ability to have intentionality and forethought (Bandura, 1986). This allows people to direct their own course of action as well as set goals and challenges for themselves. Based on the consequences of the course of action, people are then able to regulate their behavior and motivation. If the consequence of their action is felt in a positive light, then people will continue those actions. Perceived negative reactions will have the opposite effect and deter people from continuing those actions.

Social cognitive theory contends that the idea of self-efficacy, or the belief that one is capable of performing in a certain manner to attain certain goals, is the foundation of human agency. "Unless people believe they can produce desired results and forestall detrimental ones by their actions, they have little incentive to act or to persevere in the face of difficulties" (Bandura, 2001, p. 10). Self-efficacy dictates many facets of life—thinking, motivation, vulnerability, and decision making.

**Ties to Simulation**

Students in health education are often expected to model the behavior of the instructor. This is the backbone of apprenticeship training—learning in the social context by observing techniques, skills, and behaviors. However, changes in patterns of health care and decreased exposure to patients are giving students less opportunity for apprenticeship training. Simulations can be a viable solution to this problem. With simulation, a clinical atmosphere can be constructed to create a life-like environment where apprenticeship training can occur. Instructors can role model and mentor, and students can emulate the procedures, skills, and behaviors that have been modeled. In this regard, students combine role modeling behavior
with cognitive learning in a simulated environment to deepen their understanding of knowledge.

**Constructivist Learning Theory**

Constructivists believe that knowledge is constructed when an individual attaches meaning to an experience or activity (Merriam et al., 2007; Torre, Daley, Sebastian, & Elnicki, 2006). This is the basic assumption of the constructivist learning theory, but constructivist theory branches into more perspectives than most other learning theories. Regardless of the perspective, constructivists agree that learning is an active versus passive endeavor that includes dialogue, collaborative learning, and cooperative learning (Merriam et al., 2007).

There are two different thoughts as to where constructivism occurs—personally or socially. With personal constructivism, learning is constructed within the individual and based on prior knowledge, whereas social constructivism posits that learning is constructed in a social environment. The foundation of personal constructivism can be traced back to Piaget (1972), whereas Vygotsky (1978) is responsible for much of the ideas related to social constructivism.

With personal constructivism, the learner attaches meaning using previous knowledge and experience; an internal change in cognitive schemata occurs as a result of the learner's connection to the current environment. However, social constructivism results from individuals dialoguing about problems in a social environment. Here is where Vygotsky's activity theory (also known as situated cognition) surfaces. Activity theory surmises that a participant's relationship with the objective world is always mediated by activity (Vygotsky, 1978; Wilson, 2005). People do not simply passively absorb, and react to, stimuli from the environment; they actively explore and transform their material and social environments. In this active process, people produce and reproduce culture and consciousness.

**Other Constructivist Learning Perspectives**

As previously mentioned, the constructivist learning theory has numerous ties to other perspectives in learning. This is especially true in adult learning where a constructivist nature is manifested in transformational learning, experiential learning, reflective practice, and situated learning.

Personal transformation and social transformation involve a cognitive change in the way meaning is constructed; therefore, it is easy to connect transformational learning theory to the constructivist paradigm. Experiential learning, including the methods associated with the reflective and situative paradigms (reflective practice and situated cognition), is also connected to constructivist learning theory.

Experiential learning is learning by doing. Here the individual attaches meaning while experiencing the situation and constructs knowledge; in this way, experiential learning is intertwined with constructivist theory. Dewey (1938), who studied the idea of experiential learning, posits that learning occurs when there is continuity and interaction. This means that the individual takes each experience and connects what was learned to current and future events.

Scholars agree with Dewey (1938) that people learn from experience, but there is disagreement about how learning occurs in experience (Merriam et al., 2007). Because of this, two additional frameworks, reflective practice and situated cognition, developed from experiential learning theory—both with a focus toward reflection and how it fosters learning, and both with a construct of meaning. One of the frameworks is a model developed by Kolb (1984), who believes learning from experience involves a concrete experience with reflective observation, cognition, and behavior. Kolb sees experiential learning as a cyclical phase involving these concepts.

Boud and Walker (1991) augment Kolb's (1984) reflective practice model related to experiential learning. They include context as an additional aspect that shapes an individual's learning in experience, along with emotion and the influence that it exerts on reflection. This reflective practice model—further developed by an earlier source, Schon (1983)—involves returning to and replaying the experience, attending to the feelings the experience provoked, and reevaluating the experience. "This process of reflection may occur during or after the experience in question. Reflection on action is thinking through a situation after it has happened. Reflection in action is thinking about actions as they are performed" (Torre et al., 2006, p. 904).

Situated cognition is the second framework that stems from experiential learning theory. As previously mentioned, situated cognition (activity theory) is one
form of social constructivism where the focus of learning is tied to the situation and the community of practice in which it occurs (Bradley & Postlethwaite, 2003; Vygotsky, 1978). Fenwick (2003) contends that knowledge is not transferred to another situation after it is learned but rather “part of the very process of participation in the immediate situation” (p. 25); a person learns when there is a combination of interaction with the community, “the tools at hand” (p. 25), and the activity at hand. As opposed to the reflective practice model that is viewed as an internal process of learning, the situated cognition model focuses on the external relationships that process learning.

Ties With Simulation

How does the constructivist orientation relate to simulation? It connects in a variety of ways. Simulation creates an environment for active learning to occur; the student constructs knowledge by attaching meaning to the simulation experience and connecting the knowledge learned to a current or future situation with a patient. This construction of knowledge can be from a personal constructive orientation or a social constructive orientation. Simulation can be created for one person or a group of students who work together. Either way, there is certain to be dialogue, collaborative learning, and cooperative learning between the student and instructor, or the student with other students and the instructor.

Simulation provides an opportunity for experiential learning to occur. It creates an atmosphere where internal and external processes of learning can occur. It constructs an environment for reflective thinking to take place, challenging the student to contemplate how he or she might act and think differently if approached with a similar situation in the real-world setting. Debriefing after the simulation experience can give a student or group of students the opportunity to recall the encounter, reflect on what happened, review what was learned from the experience, and contemplate what could have been done in other ways.

In the literature, the ties between simulation and constructivist learning theory are evident. Haigh (2007) analyzed the learning of undergraduate students in a midwifery program based on human activity theory. She found that because these students participated in a simulated clinical experience, they were more apt to experience deliberation and deep learning. Research by Zigmont, Kappus, and Sudikoff (2011b) provided a theoretical foundation in adult and experiential learning that can be used by educators to develop and facilitate simulation courses. Duggan, Bradshaw, Carroll, Rattigan, and Altman (2009) found that medical students who participated in a self-reflective exercise after a simulated learning experience were more apt to recognize attitudes about disability in relation to pain, everyday life, and treatment. In fact, debriefing after a simulated experience has been found to be the most important part of the learning experience because it provides time for reflection to occur (Arafeh, Hansen, & Nichols, 2010; Morgan et al., 2009; O'Brien & Pedicino, 2011; Zigmont, Kappus, & Sudikoff, 2011a). In all these studies, the foundation of learning is constructivist learning theory.

Implications for Research and Practice in Health Care and Adult Education

The use of simulation in medical and nursing education has occurred for years (Bradley, 2006; McFetrich, 2006; Sinz, 2007). Yet, there are gaps in the literature pertaining to the use of simulation in these areas. In a critical review of the research on simulation-based medical education found in the literature from 2003 to 2009, McGaghie, W. C. (1999) identified 12 features and best practices that educators should know and use. These include feedback, deliberate practice, curriculum integration, outcome measurement, simulation fidelity, skill acquisition and maintenance, mastery learning, transfer to practice, team training, high-stakes testing, instructor training, and educational and professional context. However, with each of these areas, the authors also acknowledged gaps in understanding warranting more study. Some of the gaps include quality and models of feedback, dose–response relationships, best learning modalities, measures of outcome, conditions of training, mechanisms and conditions related to skill maintenance and decay, mastery standards, pathways of learning from the simulation laboratory to the patient bedside, team training skills, test mechanisms, and teaching skills of instructors.

In nursing education, simulation is being used more frequently in the classroom and in clinicals to combat
the diminishing numbers of clinical sites, fewer clinical hours, and the shortage of nursing faculty and preceptors (Simpson & Courtney, 2002). The National Council of State Boards of Nursing (2011) is now conducting a landmark, national, multisite, longitudinal study of simulation use in prelicensure nursing programs throughout the country to examine the knowledge and clinical competency outcomes of students when simulation technology is used in the place of clinical experiences. The National League for Nursing (2011) has launched a 3-year study that will lay the groundwork for the use of simulation-based assessment in prelicensure nursing programs. Brewer (2011) acknowledges the need for additional research related to simulation, citing the scarce quantitative research that exists and the shortage of proven tools to use for validation. Virtually no studies, outside of Bramble (1994), have investigated transfer of learning from the simulation laboratory to the patient bedside. Other authors (May Park, & Lee, 2009) note the need for additional studies that have more rigorous designs with control or comparison groups with certain types of simulation.

Adult education encompasses medical and nursing education. Although calls for additional research in these areas tend to focus on teaching and learning outcomes with students when simulation is used, the field of adult education can be broadened by further research to determine additional learning theories applicable with simulation. Research is also needed to determine how adult learners process information during simulation exercises and to determine whether simulation is superior to other methods of instruction.

Conclusion

Simulation is a technology used in a variety of educational curriculums. With its strong ties to adult learning, it can enhance instructor teaching and facilitate student learning. Used for decades in medical and nursing education, simulation is now standard practice in many programs. However, there is a critical need for continued evaluation of the use and effectiveness of simulation in improving learning outcomes and performance in actual clinical practice in health care education. There is an additional need for adult education to understand the learning processes that surround simulation.

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Bio

Tonya Rutherford-Hemming is a faculty and Skills Lab and Simulation coordinator at the University of Pittsburgh School of Nursing, working collaboratively with faculty to design and utilize simulation in nursing education in the classroom and clinical arena. She also produces and disseminates research in the area of simulation in nursing education. Her area of interest in simulation research is related to transfer of learning, specifically whether and how transfer of learning occurs from the simulation laboratory to the clinical bedside—a topic that is seriously lacking in the nursing literature.