

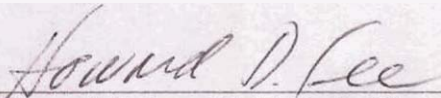
Associate Degree Nursing Students' Perceptions of Learning Using a
Human Patient Simulator

by

Kathleen A. Kuznar

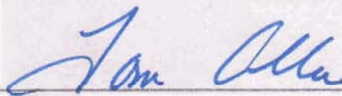
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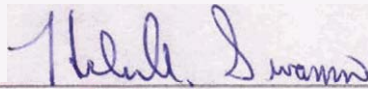


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ABSTRACT

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Nursing educators have historically employed classroom and clinical practicum along with skill practice to train nurses. Recently, nursing has looked to technology to provide new teaching strategies. With future significant nursing shortages, very acutely ill patients with complex health conditions, and the growth of error prevention strategies within health care, human patient simulation (HPS) is now being employed as a teaching strategy for nursing students. HPS allows students to learn in a complex, realistic yet risk-free environment. Unfortunately, little research has been performed to evaluate satisfaction and effectiveness of this new technology. HPS was first used in medical training, specifically with anesthesiology. Nursing is relatively new to HPS use. This

study measured associate degree nursing students' perceptions of satisfaction with learning using HPS.

A 21-item Likert-type survey was developed to determine students' perceptions of satisfaction in the areas of nursing skill development, confidence and motivation building, and overall satisfaction. Also, evaluation was done to determine if differences existed between the level of satisfaction with HPS use and select demographic variables. Thirty-seven associate degree nursing students who had HPS experiences in three separate courses completed the survey.

The results determined that associate degree nursing students are highly satisfied with learning using HPS. In all areas analyzed, students reported satisfaction. Few significant differences were found between level of satisfaction and the demographic variables. Those with a higher level of previous education did report a higher level of satisfaction than did those with high school or limited technical education. Overall, the results of the study indicate that HPS use is seen as a satisfactory method for student learning. Recommendations include continued HPS research with larger sample sizes to further evaluate satisfaction. In addition, evaluation of the effectiveness of this teaching strategy is recommended via controlled experimental study of cohort groups of nursing students.

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Chapter I: Introduction

Health care training requires students to learn a great deal of theoretical content and quickly put the learning into practice in an efficient and competent manner. Students in professional health care training programs must learn anatomy and physiology, physical assessment skills, clinical reasoning, technical procedures, pharmacology, health promotion, disease conditions, critical thinking, communication, and teamwork (Nehring & Lashley, 2004). All of this content must then be applied through practice in the school's laboratory and ultimately in the actual clinical setting with real patients. Integration and development of competence in all content areas is necessary to produce practitioners ready to take on the challenges of the health care arena of the 21st century.

To successfully make the transition from content learning to practice, a clinical practicum is a required component of most health care training programs. In nursing education, students spend many hours in hospitals, clinics, nursing homes, and other community settings providing care to clients under supervision of their instructors and other nurses in order to apply their learning. Students are placed in predictable, stable situations as they begin their training and progress to more advanced situations where some degree of unpredictability exists.

During nursing students' experiences, they are active participants in many aspects of patient care. They do have limitations, however, not only experiential but also legal (Kozier, Erb, Berman, & Snyder, 2004). Nursing students must work under the direction of a licensed nurse when in the clinical setting. Despite working as active members of the health care team during clinical experiences, students are limited in decision-making, delegation and management responsibilities. For example, a student cannot independently

contact physicians for medical orders, administer parenteral medications, or coordinate and manage crisis situations. As one can imagine, these are not times that skilled practitioners feel comfortable stepping aside and allowing students to independently practice. However, a graduate of a nursing program would be expected to function competently and independently in these areas a very short time after graduation. This fact has great consequences for both the quantity and the quality of the clinical practicum offered to students in health care programs such as nursing.

Nursing educators do not take their responsibility to develop competent practitioners lightly. They plan practice in the school setting for such aspects of nursing care as assessment, psychomotor skills, communication and critical thinking skills. Role-playing and review of case studies help students to learn the communication and decision-making roles of the nurse. Technical skills can be repeatedly practiced in the laboratory setting. However, students and instructors now realize that this type of practice may still not allow students to feel they have adequately learned the skills. The practice may not seem realistic enough. Often, practice scenarios at the school incorporate a few aspects of care but cannot often include all aspects.

The question arises: How can student nurses learn to care for a patient independently without one-to-one supervision or risk to clients? An innovative teaching method is being introduced in some schools of nursing to allow students the ability to practice all aspects of nursing care in a realistic yet safe environment. This method is the human patient simulator.

Simulators have been used in training for many years and are available in many disciplines. Connors (1985) from National Aeronautics and Space Administration pointed

out, "low fidelity discrete task assessment techniques are at one end of the continuum and measurement of performance during actual missions are at the other end of the spectrum" (p. 110). Simulators allow students to more easily make the transition from one end of the continuum to the other. Many people have learned to drive using a driving simulator. Pilot training has relied heavily on this methodology since Edward Link patented the first pilot training simulator in 1930 (Riley, 2000). Those training in aeronautics, nuclear power, engineering and the military often utilize simulators (Jha, Duncan, & Bates, 2001).

The concept of simulation has also been applied to health education for decades using basic models and mannequins. Models of all or part of the human body have been used to train health care students in performing technical procedures such as intravenous therapy, dressing changes, and urinary catheter insertion. The most commonly used mannequins are low fidelity models, simulating the human body yet not incorporating technology in any way. Fidelity refers to the accuracy with which the model or simulator reproduces the domain (Riley, 2000). Low fidelity mannequins do not provide feedback or respond to interventions. Their correlation to performing procedures on a human is somewhat limited in this respect. As Issenberg (2004) pointed out, these training tools are useful for students' early practice with simple skills when learning techniques of a procedure are vital and repetition is required.

Since the 1960's, however, health care educators have begun combining computer technology with the basic human models (Denson & Abrahamson, 1969). Today, advanced, high-fidelity human patient simulators—models enhanced with computer technologies—are available. These simulators provide health care students with the

ability to practice complete care including assessment, decision-making, technical skills, teamwork, delegation and management in a risk-free environment. The human patient simulator method was first used in medical training, particularly in anesthesiology. Simulators are now available for training in a variety of health care professions, including nursing. These simulators are life-sized mannequins integrated with computer software to model various disease states and respond to medications and other treatments as a human would respond.

Statement of the Problem

Chippewa Valley Technical College has incorporated human patient simulation into health care training programs, including nursing, emergency medical technician and paramedic programs. The purpose of developing the simulation laboratory was to enhance clinical practice by offering hands-on clinical experience in a true-to-life environment (Chippewa Valley Technical College, 2004). The simulated environment offers students the opportunity to practice independently without risk to human life. The effectiveness of patient simulation has not been determined.

Purpose of the Study

The purpose of this study was to examine nursing students' perceptions of the use of patient simulation in an associate degree nursing program at Chippewa Valley Technical College. A survey was developed and administered to determine students' feelings about the use of patient simulation.

Research Questions

The research questions for this study were:

1. What is the level of associate degree nursing students' overall satisfaction with clinical learning using a human patient simulator (HPS)?
2. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them realistic clinical experiences?
3. To what degree do associate degree nursing students believe HPS experiences improved their confidence and motivation?
4. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them real-world clinical experiences in regard to:
 - a. Assessment;
 - b. Clinical decision-making;
 - c. Implementation;
 - d. Technical skill performance;
 - e. Prioritization
5. Is there a difference in student perception of satisfaction based on prior experience with other simulators?
6. Is there a difference in perception of satisfaction based on:
 - a. Age
 - b. Gender of the student
 - c. Prior work and educational experience?

Importance of the Study

The following issues of importance are noted for this study:

1. In a world of constantly changing technology and medical advances, teaching methods implemented for teaching health care students must be augmented and updated. These methods must allow students to function at the application, analysis, synthesis, and evaluation levels of learning (Bloom, 1956). Students must know how to safely care for patients suffering life-threatening illnesses while managing the ever-changing technological aspects of this care. New teaching methodologies such as human patient simulators may play an important role in this training.

However, new methodologies incorporating advanced technology are expensive. Current health care training programs are in an era of budgetary constraints. New teaching methods must be critically evaluated and found effective in order to be promoted. Incorporating an advanced methodology without adequate research could be negligent with regard to student learning and available funding.

2. Since the Flexner Report to the Carnegie Foundation in 1910 established the paradigm for health care education as having two components, a post-secondary-based scientific curriculum and a clinical practicum, instructors have searched for effective means to actively involve students in learning in both realms (Lupien & George-Gay, 2001). Balancing the two components has been a challenge. Simulation may be an acceptable alternative to achieve this balance. The human patient simulation

experience may prove to be a student and instructor-friendly method to teach theoretical concepts and allow students to actively apply them to various simulated clinical situations. If this teaching method is found effective, it may be definitely worth its cost.

3. Nurses are the largest group of health care providers in the United States, numbering 27 million. Nurses practice in virtually all health care settings and communities (American Nurses' Association, 2002). However, a significant shortage of nurses exists today and is predicted to worsen over the next few decades. Penn, Shoen and Berland Associates (2001) in a national public opinion poll funded by Johnson and Johnson found that 93% of Americans feel that the nursing shortage jeopardizes the quality of health care. The United States Bureau of Labor Statistics (2004) has identified registered nurses as the top occupation according to growth through the year 2012. Nurse educators are charged with increasing the amount of nurses provided to meet the society's current and future health care.
4. The education of various health disciplines requires client experiences. The consumers of health care require health care professionals that are able to provide care that is accessible, high quality, free of errors and affordable (Morton & Rauen, 2004). Professional leaders and organizations also demand excellence in health care professionals' practice (American Nurses Association, 2002, Nehring & Lashley, 2004). In order to satisfy society's expectations, health care programs must

incorporate client experiences into the curriculum. Technology can enhance these experiences.

5. Today's nursing educators face unparalleled challenges that include an increasingly diverse student population who are often well versed in technology and frustrated with the overuse of traditional lecture methods of instruction (Morton & Rauen, 2004). Not only are traditional didactic methods of instruction not preferred by students but they also cannot provide the critical thinking skills necessary to deal with acute crisis situations in the clinical setting (Murray, Boulet, Ziv, Woodhouse, Kras, & McAllister, 2002). Varied teaching methods must be incorporated to meet the needs of the students and ensure clinical competency. This study will assist health educators to determine students' perceived satisfaction with a technology-based teaching method that simulates reality.

Limitations of the Study

The study focused on associate degree nursing students at a technical college in a moderately sized Midwestern city. Associate degree nursing programs arose in the 1950's driven by a growing demand for nurses and coupled with the growth of community and technical colleges after World War II. In 1951, Mildred Montag published her doctoral dissertation outlining a two-year educational program for registered nurse training in the technical and community colleges. Soon afterward, associate degree programs in nursing were developed and today provide training to a large portion of the nursing workforce (Kozier, et al, 2004). The following delimitations have been identified:

1. This study only focused on nursing students in an associate degree nursing program enrolled at CVTC. Results may not be generalizable to other two-year nursing programs or baccalaureate or masters' level nursing students who may also use human patient simulator technology. This study also did not include other health care disciplines' students. The sample size was relatively small. Although many teaching methods exist, this study only focused on the human patient simulator as method of instruction.
2. The tool used for the study was partially developed and designed by the researcher. A portion of the instrument was based on an existing tool by Feingold, Calaluce, and Kallen (2004). Professional nursing educators familiar with human patient simulation methodology evaluated the tool for content validity and program outcomes for associate degree nursing programs. However, the tool was used for the first time in this study so other methods to determine reliability and validity have not been determined.
3. The associate degree nursing curriculum at CVTC offers HPS experiences at predetermined times throughout the curriculum. Limited access in the HPS lab may have altered the responses of the participants. Time and funding to provide further access to the HPS lab was limited and may have limited the study. Also, faculty members using the HPS methods have had two years to implement the HPS components of the curriculum. A technician assists faculty in the operation of the simulator. Limited time with use of the simulator may have altered the perceptions of the students

to some extent. Despite these limitations, this study is unique in evaluating nursing students' perceptions of HPS learning.

4. The time allotted for each simulation was two to three hours per session. Each of the last three clinical courses at CVTC includes one or two sessions. The time allowed for simulations may also be a limitation.
5. A variety of students attend the associate degree nursing program at CVTC. There is a large range in ages of the students, from 19-50 years. The students are from the Midwestern district in Wisconsin that is served by CVTC. Currently the student population is approximately 90% female. The primary ethnic group is Caucasian. These factors may certainly limit the study and decrease its generalizability.

Definition of Terms

Associate Degree Nursing Student: Student completing a two-year program at a technical or community college in the study of the profession of nursing. The student will be eligible to take the licensure examination for employment as a registered nurse.

High-Fidelity Simulation: A simulator made to incorporate technology so that it greatly replicates reality.

Human Patient Simulator (HPS): A computer-driven, life-sized mannequin that is programmed to respond physiologically as a human would to disease processes and pharmacologic and medical intervention.

Low-Fidelity Simulation: Basic models for practice that may do not completely replicate reality.

Perceptions: Beliefs, impressions, and degree of satisfaction or dissatisfaction with what is observed and/or experienced.

Registered Nurse (RN): Professional nurse that performs for compensation any act in the observation or care of the ill, injured, or infirm, or for the maintenance of health or prevention of illness of others, that requires substantial nursing skill, knowledge or training or application of nursing principles based on biological, physical and social sciences (Wisconsin Board of Nursing, 2003).

Simulation: A teaching strategy that seeks to “replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more easily understood and managed when it occurs for real in clinical practice” (Alspach, 1995).

Technology: Applications of science and industry that include electronics, computer hardware and software, models, simulations, and other tools.

Outline of this Paper

This paper presents a study done to determine associate degree nursing students' perceptions of learning using a human patient simulator. A review of the literature outlines previous use of simulation in health care and nursing and documented evaluation of human patient simulator technology. An overview of the study and discussion of the methodology follows. All findings and research results are presented. The conclusion of the paper includes a summary of the study and recommendations for future research.

Chapter II: Review of Literature

Introduction

This chapter provides an overview of the development of simulation in health care training and current simulators available to health care educators. The research published on use of human patient simulation is then reviewed. This research emphasizes both effectiveness of simulation training and satisfaction with this methodology. Much of the published simulation research has been done in the area of anesthesiology. The use of high-fidelity human patient simulation is relatively new in nursing education and studies are limited. A majority of the simulation studies in all areas of health care have significant limitations due to small sample size.

History of Simulator Use in Health Care Education

Medical educators realized over 100 years ago that didactic education must be balanced with clinical practicum. William Osler, Physician-in-Chief at Johns Hopkins School of Medicine in the 1870's, introduced this concept into his medical instruction and is felt to have revolutionized medical education with his method of teaching students at the patient's bedside (Johns Hopkins, 2004). In a fashion unique for the time, Osler "not only required his students to perform autopsies but took them with him to observe his treatment with patients" (Houle, 1976).

In 1910, the Flexner Report, a report sponsored by the Carnegie Foundation and named for author Abraham Flexner, proposed that medical schools combine the instruction of science with clinical subjects taught by scholarly physicians (Hiatt & Stockton, 2003; Hotez, 2003; Papa & Harasym, 1999). The report, "Medical Education in the United States and Canada: A Report to the Carnegies Foundation for the

Advancement of Teaching," summarized Flexner's suggestions about the state of medical education after he visited 155 schools. He noted that medical education at the time was predominantly either completely didactic instruction or a type of apprenticeship without didactic instruction. He also noted that there was no consistency in the adequacy and quality of laboratories as well as the training and qualifications of laboratory instructors. This landmark report created great changes in medical education.

As the Flexner Report pointed out, the apprenticeship model of medical education was not effective. Dr. Floyd Burroughs chronicled experiences of medical students at the turn of the twentieth century (Burroughs, 1966). He reminisces that medical students would sit on wooden benches waiting to peer over the shoulder of the surgeon during surgery to learn as much as they could about the procedure until they had enough information to perform surgery themselves.

Health care educators have since noted the benefits of allowing students to practice in a simulated environment as they learn procedural skills prior to performing them on real patients. John S. Lundy of the Mayo Clinic proposed the establishment of an anatomy laboratory in 1925 to provide medical students the opportunity to practice surgical techniques (Ellis & Bacon, 2003). Cadavers were used for anatomical study. Lundy observed that surgical fellows that practiced surgical techniques in the anatomy lab later performed more skillfully in the operating room. He then developed a simulation program by recreating an operating room environment in the anatomy laboratory. Surgical fellows were observed in performing procedures under conditions similar to those in the operating room and were given valuable feedback on their performance. At the time, however, use of cadavers was limited to large medical teaching facilities.

Without the use of cadavers, practice was done during actual surgical experiences.

Medical educators in the early twentieth century recognized the need for better medical training methodologies.

Consequently, as manufacturing techniques improved, low-fidelity models were developed to simulate the human body and allow students the ability to learn invasive procedures. One of the first models used by nursing students was "Mrs. Chase," a life-sized mannequin used during the early 20th century (Herrmann, 1981; Nehring & Lashley, 2004). Other models were made to simulate all or parts of the body for use in learning specific skills.

As technology has advanced so have health care simulators. The development of screen-based simulation models grew as computer technology has advanced. These simulation programs allow students to use on-screen text and graphics to assess simulated client cases, choose therapeutic actions, and evaluate the effects of the chosen actions. Programs such as "Body" (Smith, Zwart, & Beneken, 1972) and "Gasman" (Philip, 1986) allow students to learn in a virtual reality environment and elucidate pharmacokinetic and pharmacodynamic processes of medication administration. Doyle (2004) points out that strength of this type of simulation is the ability to help students to learn abstract concepts. Also, the screen-based simulations are portable and relatively inexpensive.

Lack of realism and practical "hands on" skill training are criticisms of screen-based computerized simulations (Doyle, 2004). These limitations have led to the development of the mannequin/model-based high fidelity computerized simulator. One of the first simulation models to incorporate computerization was Sim-One. Developed for training of anesthesiologists at the University of Southern California in 1967, this early

patient simulator had pulses, could breath, and responded to medications (Abrahamson, 1997; Denson & Abrahamson, 1969). In the 1970's, "Harvey," a cardiology patient simulator was introduced. This simulator is able to recreate many physical aspects of the cardiology examination and continues to be used today in health care education. The American Heart Association introduced "Rescusi Anne" about the same time as cardiopulmonary resuscitation protocols were introduced. The early prototype focused on airway management and basic life support techniques (Lane, Slavin, & Ziv, 2001; American Heart Association, 1997).

Currently, patient simulators are available that incorporate the computer technology of today with a full-sized mannequin. Two primary manufacturers are Laerdal, who produce Sim Man, and Medical Education Technologies, Inc. (METI), who have developed the Human Patient Simulator. Specialized simulators are also available. An example of a specialized simulator is the NOELLE birthing and maternal simulator. The simulator and teaching system, manufactured by Guarnard Scientific Company, Inc., can provide health care students with the complete experience of assessing and caring for a patient during childbirth. A resuscitation infant is also included with the simulator to allow students practice in emergency care of the neonate.

METI's Human Patient Simulator is a high-fidelity simulator. It is a life-size mannequin that breathes, has palpable pulses, heart and lung sounds, pupils that react to light, and the ability to produce urine. It may be altered to be either male or female. The simulator is programmed to respond to medications and other treatments as a human would. The default setting is programmed to respond as a healthy young male, labeled Standard Man or Stan, for short. Other health condition settings are programmed into the

simulator and the instructor using the simulator can develop health condition scenarios and alter the simulators responses accordingly. A child-size simulator is also available for pediatric simulations (METI, 2004).

Human patient simulators have moved beyond offering students just the ability to learn anatomy or practice techniques or procedures. Today's students learn the aspects of true patient care when working in the simulation laboratory. They see the simulators' responses to actions and the consequences of decisions made and actions delivered. Students develop critical thinking and the diagnostic skills as they react to the simulators' responses.

Another type of medical simulation found in the literature refers to the simulated or standardized patient. This teaching strategy requires that a person play the role of a patient. The health care student interviews the patient and may perform certain aspects of physical assessment (Yoo & Yoo, 2003; Gibbons, Adamo, Padden, Ricciardi, Graziano, Levine, & Hawkins, 2002). Care for the simulated patient may be proposed but actual hands-on treatment is limited. Training is required for the standardized individuals to allow them to portray certain types of patients accurately and consistently (Lane, Slavin, & Ziv, 2001; Ebbert & Connors, 2004). This type of simulation requires little technology.

Computerized Simulation in Medical Education

Computerized patient simulators were first used in medical education, specifically in anesthesiology, cardiology and emergency trauma management (Sanders, Haas, Geisler, & Lupien, 1998; Marshall, Smith, Gorman, Krummel, Haluck, & Cooney, 2001; Treloar, Hawayek, Montgomery, & Russell, 2001; Holcomb, Dumire, Crommett, Stamateris, et al, 2002). Studies have shown benefits and positive effects of simulation.

Issenberg (1999) and his associates identified many benefits of simulation training and assessment and are as follows: (a) predictable behavior; (b) simulators are not stressed or embarrassed as real patients are; (c) findings can be accurately recorded; (d) simulators can be repeated frequently with fidelity and reproducibility; (e) can be used without risk to humans in case of error; and (f) procedures can be practiced that would cause risk to a human if a life-threatening event were not in place. Many reports in the literature explain how to establish a HPS program in health care education programs and provide examples of case scenarios and other curricular issues that need to be addressed (Halamek, Kaegi, Gaba, Sowb, Smith, Smith, & Howard, 2000; Salas & Burke, 2002; Gordon & Pawlowski, 2002; Friedrich, 2002; Gordon, Oriol, & Cooper, 2004; Ziv, Wolpe, Small, & Glick, 2003; Multak, Euliano, Gabrielli, & Layon, 2002; Kiriaka, 2000; Wantman & Chinn, 2003).

Gaba and DeAnda (1989) used a screen-based simulation program in anesthesia training to evaluate anesthesia students response to simulated critical incidents (endobronchial intubation, occluded intravenous catheter, atrial fibrillation with hypotension, breathing circuit disconnection, and cardiac arrest). The most life-threatening incidents—cardiac arrest and breathing circuit disconnection—were discovered quickly by all 29 subjects and correction achieved quickly, within 53 seconds $\pm$ 39 seconds. IV catheter occlusion was the incident noted with the least speed (238 seconds average) but once discovered, was quickly corrected by all subjects. Students in the study were of different levels of education and this was found to be a significant factor in speed of detection of problems ($p < 0.005$). Both students and instructors who participated in the study felt that the screen-based simulator was highly educational.

Bearman and Cesnik (2001) and Bearman (2003) also studied medical students' reactions to learning activities with a "virtual patient." Two types of computerized simulations were evaluated—one with a narrative structure and another with a problem-solving structure. Findings revealed that students responded to the "virtual patient" as they would a real patient. Students rated the narrative structure as qualitatively better than the problem-solving structure. There was no quantitative difference in acceptability between the two structures.

When using the high-fidelity human patient simulator, health care educators realize the need to find if this learning is as effective as traditional laboratory and clinical learning. Byrne and Greaves (2001) found only four studies prior to 2001 that examined validity and reliability of tools to measure student performance in anesthesia simulation. Another group of researchers surveyed users of patient care simulators worldwide and found that use of simulators for assessment of performance was underutilized (Morgan & Cleave-Hogg, 2002). This was felt to be partially due to lack of research on simulator implementation for performance assessment and lack of standardized, reliable and valid testing methods. Girard and Drolet (2002) postulate the same and encouraged schools utilizing simulator technology to work together to develop and evaluate assessment tools. Research evaluating the reliability and validity of such tools continues to be conducted. (Murray, Boulet, Ziv, Woodhouse, Kras, & McAllister, 2002; Devitt, Kurrek, Cohen, Fish, Noel, & Szalai, 1998; Morgan, Cleave-Hogg, DeSousa, & Tarshis, 2004).

Both Chopra, Gesink, DeJong, Bovill, and Speirdijk (1994) and Gaba, Howard, Flanagan, Smith, Fish, and Botney (1998) evaluated the clinical performance of anesthesia personnel during crisis situations using HPS systems. Noting that paper and

pencil testing may not be able to accurately assess what an examinee would do in an actual setting, these authors realized the need to evaluate actual clinical practice. They also recognized that retrospective recall of crisis events may not provide completely accurate interpretations of events and lend poorly to comparison of events.

Both also additionally studied the ability to rate such scenarios. Chopra, et al used only a single rater and could not measure variability between raters. The latter researchers trained five raters. Using the HPS technology, Gaba and his associates videotaped 14 teams of anesthesia providers through 2.5 hour HPS sessions. All practitioners encountered the same scenarios. In one scenario, a surgical patient suffered a myocardial infarction and cardiac arrest and in the other, malignant hyperthermia developed. The five raters were instructed on evaluation of the videotapes on two aspects, technical skills and crisis management behavior. The technical scores of all groups were high in this study. Ratings of crisis management behavior varied between the groups. Agreement between raters was varied with most agreement in technical skills. The authors felt that the study proved that technical and behavioral aspects of patient care could successfully be evaluated using HPS scenarios.

Schwid, Rooke, Ross, and Sivarajan (1999) evaluated the effectiveness of a computer-simulated Advanced Cardiac Life Support (ACLS) simulation. Forty-five anesthesia students and faculty were divided into two groups—a simulator training group and a textbook-trained group. Participants were tested 10-11 months after their training in videotaped Mega Code sessions scored by two trained evaluators. Participants who used the ACLS simulation programs were shown to have significantly improved retention of the ACLS guidelines.

In a similar study, Schwid, Rooke, Michalowski, and Ross (2001) studied results of computer anesthesia simulation after use of a mannequin-based anesthesia simulator. Thirty-one anesthesia residents were randomized into two groups. One group received handouts to read prior to use of the screen-based anesthesia simulator. The other received mannequin-based training prior to the computer screen-based simulation. Students who received the mannequin-based simulator training performed better than the other group, mean of 52.6 of 95 possible points versus 43.4 points, $p < 0.004$. The authors concluded that "computer simulations with feedback are effective as supplementation to traditional residency training methods for the management of medical emergencies"

Forrest, Taylor, Postlethwaite, and Aspinall (2002) discovered that anesthesia students were found to improve their skills after training with a patient simulator. A group of six novice anesthesia students who had intermittent experiences in a HPS lab were followed. Scores for novices on rapid induction of anesthesia improved greatly over a 12 week period. These scores were compared to a group of seven post-fellowship anesthesiologists who had not received HPS lab training and were found to be significantly higher for the HPS group ($p < 0.05$).

Another group of researchers (Tan, Ti, Suresh, Ho, & Lee, 2002) also studied the effectiveness of an HPS experience in medical education. Two-hundred-ten first year medical students were divided into groups of 19-25. All received a lecture on the physiologic changes of hypovolemic, septic and cardiogenic shock. Then, each student was given a true/false test followed by the HPS session covering the same content. The true/false test was repeated after the HPS session. Marked improvement was seen following the HPS session (82.1% versus 64.6%, $p < 0.001$). Ninety-four percent (94%)

of the students felt that the HPS was a better teaching tool than the lecture and 76.5% of the students felt the HPS session raised more questions than the lecture. Ninety-six percent (96%) of the students felt other content areas could be enhanced using the HPS but requested more time in the HPS lab and to work in smaller groups.

Another aspect to consider in use of high-fidelity HPS systems is the student and instructor response to this type of learning strategy. Gordon (2000) studied medical students' response to using a human patient simulator. He found medical students rated the HPS experience highly and recommended simulation should be a required part of medical education. Twenty-seven students were mentored individually by faculty instructors through two scenarios, a trauma patient with hemorrhagic shock and tension pneumothorax and the second, a cardiac patient with marginally stable ventricular tachycardia. After the semester, students who had participated in the human patient simulator learning were surveyed to compare their knowledge with students who had not participated in the simulations. Evidence from both groups suggested better retention of key clinical knowledge among the students in the simulator group. However, differences between the simulator group and the non-simulator group were not statistically significant. The author does point out that 89% of the students in the simulator group rated the simulation experience positively.

Gordon, Wilkerson, Shaffer, Williamson, and Armstrong (2001) evaluated the perceptions of 27 medical students and 33 medical educators after their experience with a high-fidelity HPS session. The students were individually mentored through two simulation scenarios and the instructors worked in groups of six to eight with similar scenarios. The participants then completed a two-part questionnaire about their

perceptions of the experience. Eighty-five percent (85%) of the students rated the session excellent and indicated that simulation should be a mandatory component of their curriculum. The educators also rated the session as excellent or good (combined 85%) and 82% of them felt the experience should be mandatory. Thirty percent (30%) of the students commented on the realism of the scenarios. Forty-four percent (44%) of the participants rated "practice without risk" as the primary advantage of the simulator. The main identified disadvantage (66%) was cost.

Devitt and his colleagues (2001) evaluated the responses of 33 practicing university-based anesthesiologists, 46 community-based practicing anesthesiologists, 23 final-year anesthesia students, and 37 final-year medical students to the HPS experience. They identified using a 10-item scale that participants found simulation scenarios and use of a patient simulator highly realistic. Likewise, Bond, Kostenbader, and McCarthy (2001) found that pre-hospital and hospital-based personnel accepted simulation training and were generally satisfied with simulator training. Realism and the ability to see immediate and appropriate response to treatment were two of the most frequently identified responses. These researchers found that the most common negative comments dealt with logistics of the training rather than the simulator itself.

Block, Lottenberg, Flint, Jakobsen, and Liebnitzky (2002) evaluated student reaction to use of HPS for an advanced trauma life support (ATLS) course. Fourteen participants completed the skill stations using the HPS. Students reported that the HPS was superior to other methods of teaching airway management. They felt that HPS should remain as an option for ATLS training (mean 4.07 on a 5-point scale). Other researchers

in medical education have found that students feel HPS training is valuable (Weller, 2004; Wyatt and Fallows, 2004).

Do students need to have hands on practice with the simulator to benefit? How can distance education students benefit from HPS? Via, Kyle, Trask, Shields, and Mongan (2004) set out to explore these questions. They combined use of a patient simulator with distance education. The instructor actually manipulated the simulator and medical students linked in real time via a distance education network observed. The instructor used the simulator to demonstrate the physiologic effects of anesthetics. A post-test survey indicated that 95% of the students felt this was a valuable experience. Eighty-three percent (83%) of students reported that they preferred this type of review over didactic review. Some of the students had attended a hands-on experience with the simulator prior to the distance education experience and 92% of these students felt the distance education experience was as good. Similarly, Treloar, Hawayek, Montgomery, and Russell (2001) found that military personnel in remote areas could receive continuing medical education using a HPS via distance education. Participants in this study rated use of the HPS higher than non-interactive continuing education. Off-site training was accomplished using internet and telephone service.

Only a few medical studies have reported negative response or results of students working with HPS. Graydon, Blum, Cooper, Feinstein, Lowenstein, Malov, Raemer, and Russell (2004) followed eight students who attended a three-day simulation course prior to entering their anesthesiology residency. These attendees reported strong satisfaction with the three-day preparatory course. However, once the residency began, these students showed no increase in comfort level or decrease in anxiety when compared with others

who had not attended the simulation pre-program. The pre-program participants also did not feel satisfied with their initial performance in their residency despite the simulation experience.

Kim, Kim, Min, Yang, and Nam (2002) compared 57 senior medical students studying ACLS. Half of the group received lecture and textbook instruction on ACLS guidelines. The other half received written material in addition to use of a computer simulation program. A pretest was given prior to instruction. On the day of the examination one week later, both groups were given 150 minutes to review prior to the exam. Results showed no significant difference in scores. Both groups showed improvement in post-test versus pre-test scores. Also, there was no significant difference in satisfaction levels in study materials between the two groups.

As the high-fidelity simulators become a more prevalent tool in medical education, it has also begun to be used in medical research. Simulators are now being used in studies evaluating patient safety issues and licensed practitioner competence (Jha, Duncan, & Bates, 2001; Epstein & Hundert, 2002). One group of researchers (Howard, Gaba, Smith, Weinger, Herndon, Keshavacharya, & Rosekind, 2003) used the HPS to study the effects of sleep deprivation on anesthesiologists' competence. The 12 subjects were tested twice, after 25 hours of sleep deprivation and four days later after two hours of additional sleep for four consecutive nights. Both simulated scenarios took four hours each. In this study, although psychomotor performance and mood were impaired by sleep deprivation, clinical performance was not altered.

High-Fidelity Simulation in Nursing Education

Use of the high-fidelity HPS with nursing students has developed over the past decade. Much of the published literature on the subject describes the simulators on the market and their use (Bove, 2001; Lupien & George-Gay, 2001; Peteani, 2004; Underberg, 2003; Beyea & Kobokovich, 2004). Some of the articles describe planning to develop an HPS program including writing a business plan, purchasing advice, infrastructure and training, and curriculum and faculty development (Hamo, 1994; Seropian, Brown, Gavilanes, & Driggers, 2004; Seidel & Franko, 2004; Morton & Rauen, 2004). A variety of authors have described learning activities or case scenarios developed for HPS learning (Nehring, Lashley, & Ellis, 2002; Rauen, 2001; Spunt, Foster, & Adams, 2004). Anecdotal evidence suggests that simulation is a very good method for learning in nursing (Lupien, 1998; Kovalsky, 2004). HPS has been used with a variety of levels of nursing students. Sherer, Bruce, Graves, and Erdley (2003), for example, described use of a simulator in training of acute care nurse practitioners. Use of simulation in training new graduate nurses in a simulated military medical unit was described by Eaves and Flagg (2001).

Nehring and Lashley (2004) reported the results of an international survey used to examine use of HPS in nursing curricula and to evaluate students' opinions on such use. Surveys were sent to 66 schools of nursing and 150 simulation centers, hospitals, and other higher education programs that had schools of nursing nearby. Respondents consisted of 34 schools of nursing (18 university-based and 16 community college-based) and 6 simulation centers. The survey consisted of 37 items designed by the authors. They found that community college programs used HPS for more hours in all courses except

maternity than other types of programs. HPS was used least often in graduate nursing programs with only 6 of 18 programs incorporating some type of HPS experience. Thirty of the schools reported less than 25% of their faculties used HPS. Seventy five percent (75%) of the schools reported that one faculty member had primary responsibility for running the simulator. Information on student opinion toward the HPS use was received from 21 schools. Respondents reported that they felt HPS was useful for developing critical thinking skills, applying theory to practice, providing for better transition to clinical experience, and providing a safe experience without risk to patients. Forty-one percent (41%) of respondents felt HPS should be used for competency evaluation, 11% felt HPS should be used for competency verification in some circumstances, and 23% felt that HPS should not be used to evaluate competency. Also of note is that only three schools reported that they conducted research about their use of HPS.

Hotchkiss, Biddle and Fallacaro (2002) videotaped 42 student nurse anesthetists exposed to short but intense simulated crisis situations. Students were evaluated by trained observers. The observers noted anxiety in the students. The observers/reviewers also felt that despite the anxiety, the simulation experience was "legitimate and authentic."

Nehring, Ellis, and Lashley (2001) evaluated 42 students, as well, in their study of the effects of HPS on learning. The students were studying medical-surgical nursing content. They were placed into groups of five to six students and all received a one hour lecture on the content. A pre-test was given after the lecture. All groups then participated in three case scenarios with the HPS. Immediately after the HPS experience, a post-test was completed. Approximately one week later, a second post-test was administered.

Results showed a significant difference existed between the pre-test and the first post-test ($z = -5.84, p < 0.05$). No significant difference was found between the two post-tests. The authors attributed this to retention of information after the HPS experience.

In another study of 70 nursing students, perceptions of interactive, self-paced learning with content from multimedia CD-ROM which provided simulated case scenarios was compared to perceptions of learning with traditional didactic and skills training. The participants were found to be significantly more satisfied with interactive learning versus traditional lectures and demonstrations (Jeffries, Rew, & Cramer, 2002). This study did not show significant differences between the two learning methods in regard to pre- and post-test educational assessment scores. There was a trend toward high self-efficacy in the interactive group. Although this study did not utilize an HPS, it did show benefits of an interactive, computerized method in nursing education.

Two similar doctoral dissertations studied the response of graduate nurse anesthetists' learning when using HPS technology. In a study of competency-based education, Sorenson (2002) studied simulation use with 15 graduate nurse anesthesia students using a quasi-experimental, one group, time series design. Students were evaluated in three different core competencies on three separate occasions—after didactic coursework, after a simulation experience, and following 4 weeks of real clinical experience. All students demonstrated an improvement in skill when time was used as a measure of learning success. For example, all students were able to successfully perform endotracheal intubation in less than 30 seconds. The author proposes that evidence-based competence would be an alternative or addition to current licensure protocol.

Oswaks (2002) replicated Sorenson's study. She found that 73% of novice anesthesia providers ($n = 15$) were able to successfully intubate on first attempt (within 30 seconds) after simulation training than prior to it. All participants were able to successfully intubate by the second attempt.

Feingold, Calaluce, and Kallen (2004) evaluated undergraduate nursing students' and faculty perceptions of using an HPS. These researchers hypothesized, based on a literature review, that clinical simulation involving assessment, clinical decision-making, communication, and psychomotor performance would be an adequate evaluation of students' clinical competence. They also felt that simulation experience would provide transferability to clinical practice. A 20-item survey consisting of items mainly categorized into three areas (realism, transfer, and value) was used. Results indicated that students felt that the simulator experience was an accurate test of clinical skills and the item "The technical skills taught in this course are valuable" was rated highest. Lowest rated was that the simulator "improved my clinical experience." All faculty members felt that the principles taught in the HPS lab would be transferred to a "real world" situation. However, only half of the students agreed that there would be transferability. The authors referred to Benner's (1984) work on novice to expert practice to explain this finding. Benner had reported that novice nurses were found to focus more on individual bits of information and "lacked a unified view of the whole."

Ravert (2005) reported on her study comparing three groups of undergraduate nursing students: one group not using HPS technology but only enrichment activities in nursing education ($n = 13$), one group using HPS technology along with enrichment activities ($n = 12$), and a third using HPS technology along with only standard lecture, no

enrichment activities ($n = 15$). The three groups were compared in regard to critical thinking, self-efficacy with nursing skills, and perceptions of benefit with HPS. Learning styles of the members of each group were also analyzed. Overall, critical thinking and self efficacy improved for all groups but no statistically significant differences were found between groups. The author noted that sample size limited the power to detect the effects of the groups' differences. No statistical differences in learning styles between groups were found. The second group members were evaluated for their perceptions of working with the simulator. They were asked to rate the benefits of the simulator from 1 (of little benefit) to 5 (very beneficial). All areas evaluated were found to be perceived as beneficial: understanding physiology (4.08); performing nursing interventions (4.33); working as a team (4.42); developing confidence in abilities (4.58); and developing critical thinking (4.83).

Haskvitz and Koop (2004) propose that the HPS lab could be used as a remedial technique to assist students struggling in the clinical setting. In the field of anesthesia, this technique has been used (Rosenblatt & Abrams, 2002). Haskvitz and Koop discuss a systematic plan for remediation that includes assessment of the student' learning needs, planning of remedial lessons or case scenarios, implementation of simulation sessions with the student, and debriefing and evaluation of the learning experience.

Other nursing literature on HPS focuses on the advantages and disadvantages of such a strategy. Alspach (1995) pointed out that simulation can approximate the reality of the clinical situation more closely than other classroom teaching methods. Also, simulation allows instructors to modify the environment, removing extraneous factors that might interfere with learning. HPS instruction engages learners, can offer self-paced

instruction, and can afford immediate feedback. Rauen (2001) and Medley and Horne (2005) also point out that HPS offers no risk to patients. Mistakes are permitted and situations can be repeated so students learn aspects of care correctly. The HPS reduces the time required for learning by compressing into a single learning experience what may have taken days or weeks to obtain in a clinical setting. Events can be paused for reflection and problem-solving. Consistent and comparable experiences can occur for all students (Medley & Horne, 2005).

There are disadvantages, also (Alspach, 1995; Rauen, 2001). Cost is one of the main disadvantages. A computerized, high-fidelity simulator may cost \$200,000 or more. Once the simulator is purchased, ongoing upgrades, maintenance, and cleaning must be provided. Faculty preparation time must be considered. Once a simulator is available, faculty training and scenario/lesson planning must occur, often both quite time-consuming. Student performance anxiety may also be a problem. The HPS experience is most beneficial if a small number of learners are present per session and this may limit access to the simulator. Although the simulation scenarios are reality-based and can be widely varied, there is no way to replicate all possible events.

Conclusions

Conclusions drawn from the review of literature are:

1. Advances in technology and the need to provide realistic clinical experiences in medical education led to the development of the human patient simulator.
2. The medical literature, primarily in the areas of anesthesiology, cardiology and emergency medicine, supports the use of HPS in medical education.

3. Nursing educational research on the use of HPS is limited but does support use of this method.
4. Further research and replication of research in this area of nursing education is needed to establish important generalizations about this methodology.
5. Research is needed to prove that HPS technology can provide realistic and effective clinical practice in a risk-free environment.

Chapter III: Methodology

Introduction

The purpose of this study was to determine the perceptions of associate degree nursing students of learning using a human patient simulator. Technology allows a variety of new teaching strategies to be incorporated into health care education. A high-fidelity human patient simulator is such a strategy. Adequate analysis of effectiveness and value of the HPS must be done in order to justify the expense and use of student time with this methodology. This chapter outlines the methodology and design of this descriptive study. Subject selection and description are included. The data collection instrument, data collection procedures, data analysis, and limitations are also described.

Research Method

A descriptive design was chosen to study and explore the perceptions of associate degree nursing students of learning using HPS. Polit, Beck and Hungler (2001) have defined descriptive research as research whose main objective is the accurate portrayal of the characteristic of persons, situations, or groups, and the frequency with which certain phenomena occur. Descriptive research is important for exploring behavioral phenomenon and plays an important role in educational research. The purposes of descriptive research are: (1) to discover significant variables in the field situation; (2) to discover and explain relations among variables; and (3) to lay the groundwork for later testing of hypotheses (Kerlinger, 1986; Knupfer & McLellan, 1996; Fraenkel & Wallen, 2000).

Subject Selection and Description

A convenience sampling technique was utilized for this study. Convenience sampling procedures have both advantages and disadvantages. Due to the limited number of the subjects, a convenience sampling technique generally allows the researcher to get an adequately-sized sample. However, randomization—the most desirable method to select a sample—was not used. Due to the lack of randomization, convenience sampling may predispose the researcher to a biased or unrepresentative, convenience sample; thus, the results of a study using a convenience sample are very limited in their generalizability. Polit, Beck and Hungler (2001) suggest the convenience sample is the weakest form of sampling.

The subjects consisted of students enrolled in the final semester of the associate degree nursing program at a moderate-sized technical college in a Midwestern city. Forty-three students were enrolled in the class. Thirty-seven of the students chose to participate in the study (86 % response rate, $n = 37$). All of the students have spent time in the HPS lab at the college for three consecutive nursing courses. In the middle of the program, students take the “Intermediate Nursing Practice II” course. This course focuses on developing the skills needed to manage multiple clients and priorities. The next course is Intermediate Nursing Practice III course. This course allows clients to continue to learn management of complex clients and introduces management of clients with mental health issues. The final course offering HPS training is “Advanced Nursing Practice.” Students manage groups of clients with complex, life-threatening health alterations.

A variety of case scenarios have been developed for each course increasing in complexity from the intermediate course to the advanced course. During the first

intermediate nursing course, example case scenarios include a patient with kidney stones (nephrolithiasis) who has pain management concerns and requires diagnostic test preparation. The mid-level course includes such case scenarios as an emphysema patient who develops pneumonia and a patient who has taken a drug overdose. The advanced nursing course includes cardiac arrhythmia scenarios and scenarios involving shock states and respiratory distress requiring mechanical ventilation. Students work in groups of four to care for each of the simulated patients. Other students may be present in the lab and will either observe the activities or play roles of pharmacist, chaplain, etc. Case scenarios include initial report of patient status at onset of care, initial assessment and review of the patient's medical record, providing necessary care and treatment, and documentation of the care provided. Sessions are usually two hours in length. A short time is left for debriefing. During this time, students review the effectiveness of their actions and, if not effective, discuss ways that care could have been improved. This session is extremely important if the simulated patient has not improved or has died. (A benefit of the simulated experience is that the instructor can reverse an error or restart the scenario to allow the students to have a successful outcome.)

The students range in age from 19-50 years of age. They vary in amount of previous health care experience. All students have been trained and certified as nursing assistants but no work experience is required. A few of the students are returning licensed practical nurses who desire to advance to the registered nurse level. With graduation from the technical college with an associate degree, the graduates take the National Council of State Boards of Nursing state board licensing examination (NCLEX) for licensure as registered nurses.

The HPS lab is located in the health sciences building on the technical college's campus. The lab consists of a simulated hospital/ER room and a small anteroom with ambulance doors that open to simulate taking a patient from an ambulance and bringing him/her directly into the ER room. Lights and sirens are available to make the situation seem even more realistic. Attached to the patient room is a control room. The control room door can be closed to separate the operator/instructor from the students. However, a one-way mirror does allow observation of student activity throughout the simulations. Also, the room is set up with three video cameras to allow even further visualization of student activity and to enable instructors to tape the actions of the students for later evaluation. Adjacent to the lab is a small classroom for pre- and post-simulation discussion and debriefing.

The lab is staffed by two full-time technicians who operate the simulator and by one clinical instructor assigned to the clinical course using the lab. Nine different instructors have been active in these clinical courses at one time or another over the past two years. A majority of the faculty received initial training on HPS operation. With the technician actually operating the simulator, however, the instructors generally have only responsibility with selection and management of the case scenarios and not the basic control operation of the unit. The technician takes care of the operation of oxygen and other gases, fluids, and computer interfaces required by the simulator in addition to routine ordering of supplies, cleaning and maintenance of the simulator and other related equipment (cardiac monitor and defibrillator, mechanical ventilator, IV infusion pumps, etc). During the semester of data collection, a new technician was hired who is also a

registered nurse. He worked closely with faculty and the original technician who is well-versed in operation of the HPS and has a background as a paramedic.

The high-fidelity HPS is shared by the health programs at the technical college. The HPS is heavily used by nursing, paramedic, and emergency medical technician programs. The respiratory care technician program, new to the technical college, will also soon use the lab. The emergency medical services in the area have used the HPS for required competency certification testing. Also, physicians, nurses, and respiratory therapists from local hospitals have used the lab for team training and disaster preparedness training.

Instrumentation

A 20-item survey was used for this study. The survey was adapted from a version written by Feingold, Calaluce, and Kallen (2004). These authors gave the researcher permission to use their instrument. Parts of this tool were used as the tool also evaluated nursing students' perceptions of using a HPS and the degree to which students felt there was transferability of learning to clinical practice. Like the current study, Feingold, Calaluce, and Kallen chose similar aspects of clinical simulation to evaluate: assessment, clinical decision-making, communication, and psychomotor performance. Their 20-item survey did not contain all of the items chosen by this researcher to include (i.e., "the temperature of the room was comfortable") so was not used in its entirety. Instead the tool was modified by the researcher for this study.

No reliability or validity estimates are available for this tool. Other resources used in the development of the tool included similar surveys by Halamek, et al (2000) and Block, et al (2002). Twelve graduate nurses who had participated in HPS experiences

before their graduation were asked to review the survey and provide feedback. They agreed that the items listed were important aspects of simulation learning. There were no suggestions for additional items or changes in items. Additionally, the survey was reviewed by 20 nursing instructors that work in the simulation lab at the technical college to verify content validity. Overall, the instructors, varying from one year of teaching experience to over 25 years experience, made minor wording changes to the tool but otherwise supported the content of the tool and the introductory information given. The introductory paragraph discusses the rationale for the survey, citing a quote from the manufacturer on the benefits of HPS use.

The survey includes a Likert-type rating scale which lists the 20 items rated by subjects. Rating scales or attitude scales determine distinctions of the degree to which an attitude is possessed by individuals. The Likert-type scale (named after developer Rensis Likert), also called summative rating scale, consists of several declarative statements expressing a viewpoint on the topic being studied (Polit, Beck & Hungler, 2001). Rating scales allow attitudes and beliefs to be measured quantitatively and can be adapted to many needs of behavioral researchers (Kerlinger, 1986, p. 455.)

The tool for this study uses a 5 point scale: 5 (SA) = strongly agree; 4 (A) = Agree; 3 (N) = Neutral; 2 (D) = Disagree; and 1 (SD)= Strongly disagree. The twenty statements on the tool describe various aspects of HPS experiences and were drawn from the research questions. All of these aspects are vital to the role of the registered nurse and include physical assessment, decision-making, skill performance, and prioritization. In addition, of course, the tool asked about a key aspect of the study: student satisfaction with the HPS experience (See Appendix A).

Demographic data was also collected as part of the tool. Parameters of age, gender, previous educational experience, and previous nursing experience were included. The results of the survey are compared to the demographic parameters to answer some of the research questions.

Table 1

Comparison of Research Questions to Survey Items

Research Question	Item on Survey
1. What is the level of associate degree nursing students' overall satisfaction with clinical learning using a human patient simulator (HPS)?	5. I believe I was adequately prepared for the HPS experiences. 12. The pace of the simulation reflected the flow of an actual clinical setting. 17. The time offered in the HPS lab was adequate. 20. I am satisfied with the HPS experiences.
2. Do associate degree nursing students believe that working in the human patient simulator laboratory offers them realistic clinical experiences?	21. Overall the experience of working with the simulator enhanced my learning. 1. The simulator is a realistic tool for learning patient assessment. 2. The scenarios used with the simulator recreate real-life situations. 6. The HPS lab resembles an actual health care setting. 7. The simulator scenarios were realistic. 12. The pace of the simulation reflected the flow of an actual clinical setting.
3. Do associate degree nursing students believe HPS experiences improved their confidence and motivation?	10. The HPS experience increased my confidence about going into the real clinical setting. 14. Working with the simulator motivated me to learn. 18. The HPS lab experiences gave me confidence in my technical skills.
4. Do associate degree nursing students believe that working in the human patient simulator laboratory offers them real-world clinical experiences in regard to:	1. The simulator is a realistic tool for teaching patient assessment.

i. Assessment	19. Working with the simulator assisted me in gathering patient data.
ii. Clinical decision-making	4. The scenarios develop critical thinking and decision-making.
	9. The clinical decision making skills taught in the HPS lab are valuable.
iii. Implementation and technical skill performance	3. The scenarios improved my technical skills.
	11. My interaction with the simulator improved my clinical competence.
	13. The simulator allowed me to put theory into practice.
	16. The simulator helped me to manage clinical emergencies effectively.
	18. The HPS lab experiences gave me confidence in my technical skills.
iv. Prioritization	8. The prioritization skills taught by using the simulator are valuable.
	15. The simulator experiences helped me to determine priority aspects of nursing care.
	16. The simulator helped me to manage clinical emergencies effectively.
5. Is there a difference in student perception of satisfaction based on prior experience with other simulators?	Demographics
6. Is there a difference in perception of satisfaction based on:	
i. Age	Demographics
ii. Gender of the student	Demographics
iii. Prior work and educational experience?	Demographics

Data Collection Procedures

Every precaution was taken to protect subjects from any physical or mental harm. None was anticipated. Data collection was completed after approval of the Institutional Review Board at the University of Wisconsin-Stout. Approval for surveying of students

has been received from both the campus administrator of health and the program director of nursing at the technical college. The technical college had no institutional review board.

Forty-three students in the final semester of the associate degree nursing program were asked to complete the survey during a class period near the end of the ten-week clinical course, "Advanced Nursing Practice." During this course, all students completed the final three HPS scenarios. The researcher explained the study and reasons for data collection. Participation was voluntary. A separate consent form was provided to students to verify their consent. The survey did not include names or other identifying data. Students were given up to 30 minutes to complete the survey. However, no one took longer than 20 minutes. Surveys were separate from the consent forms. Students wishing to receive results of the study were provided contact information of the researcher to request a summary of the results. A summary will be mailed or sent vial e-mail by the researcher to any participants requesting feedback. Thirty-seven students chose to complete the surveys.

Data Analysis

Respondents rated each item according to the degree of agreement or disagreement. The items were then be scored by adding each item's rating (1 through 5) and computing the mean. Descriptive statistics and t-tests were used to answer the four research questions. This was completed using the Statistical Package for the Social Sciences for Windows (SPSS) program to look for relationships between the ratings and the demographic data.

Limitations

Limitations of social, scientific and educational research generally come from sampling inadequacies, methodological weaknesses and statistical deficiencies. This study is no exception. With any study using a small convenience sample, a certain degree of bias is possible. The sample size was small, 37 students. This limits the generalizability of the results. As discussed in Chapter One, this study only focused on nursing students in an associate degree nursing program enrolled at CVTC. Results may also not be generalizable to other two-year nursing programs, baccalaureate or masters' level nursing students or to students in other health care disciplines who may also use human patient simulator technology.

This study focused on the human patient simulator as method of instruction. The method is relatively new to the instructors at the technical college. This may have altered the students' level of satisfaction with the HPS. Although the students all were challenged with the same case scenarios, the instructors varied and this may have also altered students' satisfaction. The students spent time in the HPS lab during a time when the college was going through a building project and a temporary lab was set up over the summer months when one of the courses was held. This change in the simulation setting may have altered satisfaction with the learning.

The fifth research question asked, "Is there a difference in student perception of satisfaction based on prior experience with other simulators." Unfortunately, when the demographic item questions were developed, previous simulation use was inadvertently omitted. The students were asked about their previous educational experience but not

about their previous simulator use. This discrepancy did not allow this research question to be answered.

Another limitation may be the attitude and cooperation of the students. Students were asked to complete the survey during their final semester of the associate degree nursing program, all of which are very busy and difficult for many students. This may have affected the willingness of students to participate. Also, some students may not have truthfully answered the questions. Seven of the 43 students did not wish to participate. One student completed the first ten items on the tool and the demographic data but not questions 11-21. Another seven students did not complete the demographic data sheet. This further decreased the sample size or the usability of some of the surveys.

Rating scales also have weaknesses. As with any attitude measure, the reliability and validity of such tools can be questioned. This survey was partially developed by the research and partially a revision of an existing tool (Feingold, Calalupe, & Kallen, 2004). Likewise, the tool used in this study does not have established reliability and validity measures.

To compensate for these weaknesses, the faculty members at CVTC were asked to review the survey to evaluate for content validity. A few suggestions for minor changes in wording were made but no significant changes to content were suggested. Faculty members expressed both verbally and in writing that the items on the survey reflected major competencies required of the registered nurse and were definitely goals of HPS learning sessions. No pilot testing was performed.

Summary

This exploratory study aimed to determine associate degree nursing students' perceptions of learning using HPS technology. A group of 43 students were asked to complete a 20-item survey to complete the evaluation. All the students were in the final semester of the nursing program and will have had three separate experiences in the HPS lab. Scores for each of the items were added and a mean determined. Results were evaluated to answer the first two research questions. The final two research questions were answered by comparing survey results with demographic data. Results from the study were used to evaluate the current use of the HPS at the technical college and to develop a plan for further use of this technology.

Chapter IV: Results

Introduction

The purpose of this study was to determine associate degree nursing students' perceptions of learning using a human patient simulator. The results of the study are reported in this chapter. Descriptive statistics, t-tests and analysis of variance were utilized to analyze the data and answer the research questions.

Description of the Respondents

The demographic characteristics of the sample of associate degree nursing students included collection of data on age, gender, previous educational experience, and previous nursing experience. This data was collected through a four-question additional sheet attached to the HPS survey. The demographics are discussed first followed by each individual research question.

Age. Thirty-seven students completed the survey. Seven students did not complete the demographic data portion of the survey (18% of the total). Of those that answered these questions, 11 students fell into the 18-25 age group (30 %) and 11 were in the 26-30 age group (30%). Eight percent (8%) (3) were in the 31-35 age group. There was one respondent for each of the 36-40, 41-45, and over 50 age groups (3%). The 46-50 age group had two respondents (5%).

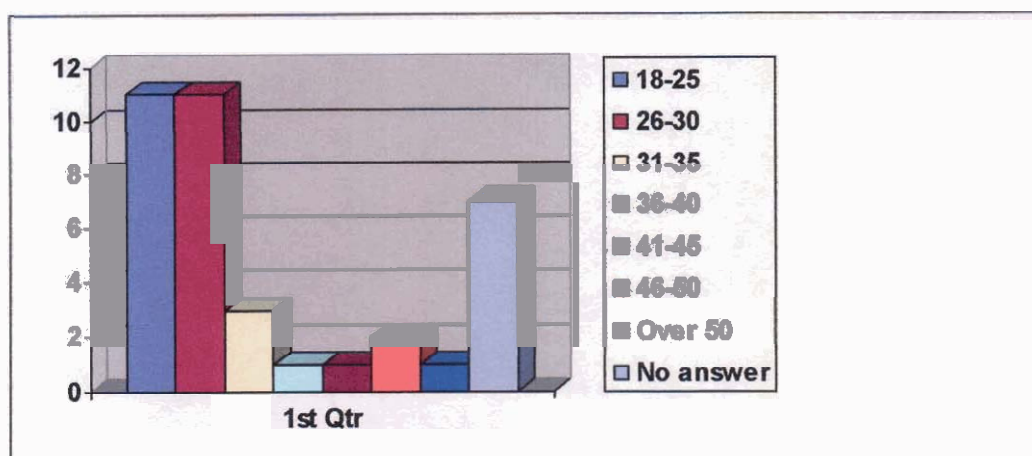


Figure 1. Distribution of Age

Table 2

Age Distribution

Age Group	Number of Responses (n=37)	Percentage
18-25	11	30%
26-30	11	30%
31-35	3	8%
36-40	1	3%
41-45	1	3%
46-50	2	3%
Over 50	1	5%
No response	7	19%
Total	37	100%

Gender. There were both male and female students in the class. As noted above, seven students did not complete this section. Those that did answer are representative of the average gender of working nurses, with 90% of the students female and 10% of the students males. (Of the total, 73% were female, 8% were male, and 19% did not respond.) In 2000, the number of male nurses was estimated at 5.4% (Spratley, Johnson,

Sochalski, Fritz, & Spencer, 2000). Over the past few years, the number of male students per class at the college has ranged from one to five.

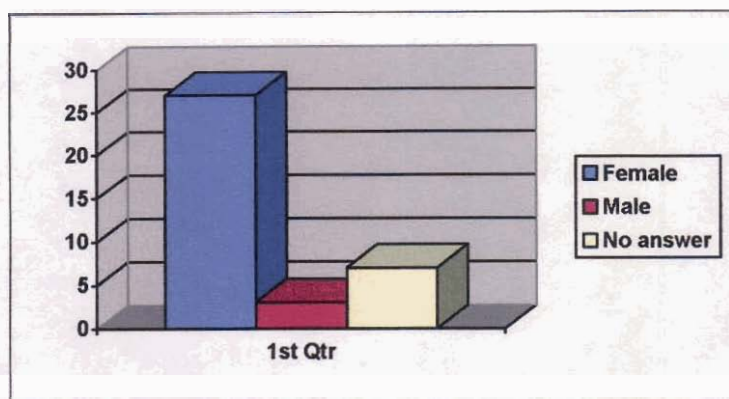


Figure 2. Distribution of Gender

Table 3

Gender Distribution

Gender	Number	Percentage
Female	27	73%
Male	3	8%
No answer	7	19%
Total	37	100%

Previous Educational Experience. Another factor that may have affected the students' perception of satisfaction with HPS experiences could have been previous educational experience. Fourteen of the responding 37 students (37%) had high school education only. Ten students (27%) had received a previous technical degree. Six students (17%) had previous baccalaureate degrees. No responding students in the sample had a graduate degree.

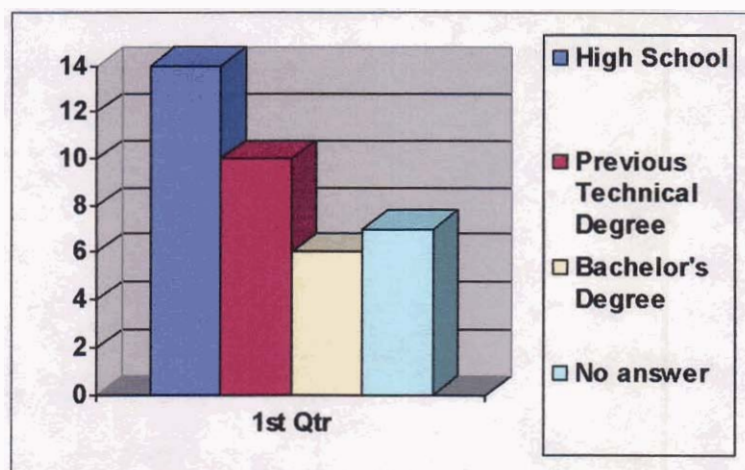


Figure 3. Previous Educational Experience of Participants

Table 4

Distribution of Previous Educational Experience

Previous Educational Experience	Number of Students	Percentage
High school	14	37%
Previous technical degree	10	27%
Previous bachelor's degree	6	17%
Previous graduate degree	0	0
No response	7	19%
Total	37	100%

Previous Nursing Experience Another factor that may have influenced the pattern of response was previous nursing experience. The results of the demographic data showed that only one student reported no previous nursing experience. All students are required to have taken a nursing assistant course prior to beginning the associate degree nursing program but this student probably meant he/she had not been employed in nursing in the past. Twenty respondents had previously been certified nursing assistants.

Four students reported working as medical assistants (MA), emergency medical technicians (EMT), or paramedics prior to their nursing education. One student was a licensed practical nurse (LPN). Other reported health care related experience included nurse technician (1), student nurse intern (2), surgical technician (1), and emergency technician (1). One student reported a past work experience as a phlebotomist, lab assistant, and transcriptionist. A few of the students reported more than one previous health care occupation

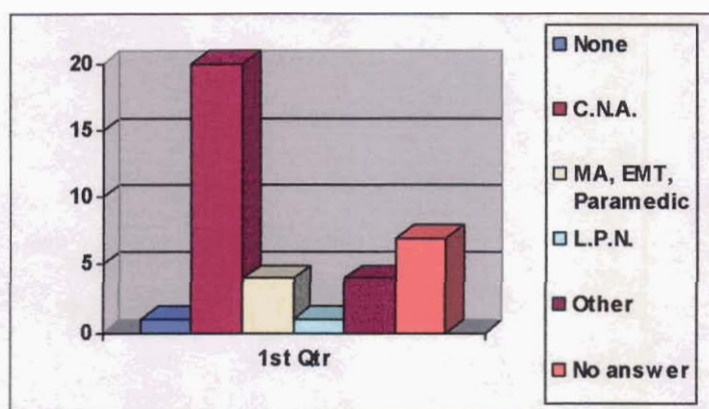


Figure 4. Previous Nursing Experience of Respondents

Table 5

Distribution of Previous Nursing Experience

Previous Nursing Experience	Number of Students	Percentage
None	1	3%
Certified Nursing Assistant	20	53%
Medical Assistant, EMT, Paramedic	4	11%
L.P.N.	1	3%
Other	4	11%
No answer	7	19%
Total	37	100%

Data Analysis

Research Question 1. What is the level of associate degree nursing students' overall satisfaction with clinical learning using a human patient simulator? Five items were asked to determine the students' overall level of satisfaction (items 5, 12, 17, 20, and 21). The first item to deal with this research question, item 5, stated "I was adequately prepared for HPS experiences." This item received a mean rating of 3.84. Also focused on this question was "The pace of the simulation reflected the flow of an actual clinical setting." This statement had a mean score of 3.53, the lowest in the survey but still just above the median score of 3.00. "The time offered in the HPS lab was adequate received a mean score of 3.61, also one of the lower scores. This was the only item to receive a rating by any participant of "strongly disagree." Item 20, "I am satisfied with the HPS experiences," received a mean score of 4.14. The final survey question, item 21 which stated "Overall, the experience of working with Stan enhanced my learning," received a mean score of 4.28. The final two items really focus on the exact research question asked and were rated quite highly. Table 6 summarizes these results.

Table 6

Research Question 1: Frequencies and Mean Scores of Student Responses

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation
5. I believe I was adequately prepared for the HPS experiences.	0	2	7	23	5	3.84	.727
12. The pace of the simulation reflected the flow of an actual clinical setting.	0	1	9	21	5	3.83	.878
17. I am satisfied with the HPS experiences.	0	1	12	19	4	4.14	.683
20. The time offered in the HPS lab was adequate.	1	7	2	21	5	3.61	1.050
21. Overall, the experiences of working with the simulator enhanced my learning.	0	1	3	22	10	4.28	.566

Research Question 2. Do associate degree nursing students believe that working in the HPS laboratory offers them realistic clinical experiences? Five items on the survey answered this research question. Table 7 outlines the students mean responses to the five items that really focused on answering this research question. Item 1, "The simulator is a realistic tool for learning patient assessment," received a mean score of 4.16. The next item, item 2 ("The scenarios used with the simulator recreates real-life situations") had a mean of 4.19. Item 6, "The HPS lab resembles an actual health care setting," received a mean score of 3.97. The mean score for item 7, "The simulator scenarios were realistic," was 4.16. The last item measuring this research question was item 12, "The pace of simulation reflects the flow of an clinical setting," and it received a mean score of 3.53. Overall, students agreed that the simulation laboratory provided them with realistic clinical experiences.

Table 7

Research Question 2: Frequencies and Mean Scores of Student Responses

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation
1. The simulator is a realistic tool for learning patient assessment.	0	3	2	27	5	4.16	.501
2. The scenarios used with the simulator recreate real-life situations.	0	0	4	22	11	4.19	.616
6. The HPS lab resembles an actual health care setting.	0	1	5	25	6	3.97	.645
7. The simulator scenarios were realistic.	0	0	2	27	8	4.16	.501
12. The pace of simulation reflects the flow of an actual clinical setting.	0	5	11	16	4	3.53	.697

Research Question 3. Do associate degree nursing students believe HPS experiences improve their confidence and motivation? Next, students were asked if they believed the HPS experiences improved their confidence and motivation. Three items examined this aspect of the HPS learning environment (See Table 8). Two items rating increased confidence related to working in the simulation lab and were rated with means of 3.81 and 3.69. Motivation to learn created by the simulator experiences, item 18, was related highly, however (4.22).

Table 8

Research Question 3: Frequencies and Mean Scores of Student Responses

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation
10. The HPS experience increased my confidence about going into the real clinical setting.	0	2	8	22	5	3.81	.739
14. The HPS lab experiences gave me confidence in my technical skills.	0	4	7	21	4	3.69	.822
18. Working with the simulator motivated me to learn.	0	0	6	16	14	4.22	.722

Research Question 4. Do associate degree nursing students believe that working in the HPS laboratory offers them real world clinical experiences in regard to assessment, clinical decision-making, implementation and technical skill performance, and prioritization? This research question was multivariate. Table 9 lists the results for this research question. The students agreed that the simulation experiences allowed them to gain essential nursing skills of patient assessment, clinical decision-making, implementation and technical skill performance, and prioritization. The highest rated item

in the study was "The scenarios develop critical thinking and decision-making" with mean score of 4.43.

Satisfaction with assessment experience was rated with items 1 and 19. Item 1, "The simulator is a realistic tool for learning patient assessment," received a mean score of 4.16. "Working with the simulator assisted me in gathering patient data," item 19, received a mean score of 3.72.

Perceptions of students related to experience with clinical decision-making was evaluated by looking at the results of two items. Item 4, "The scenarios develop critical thinking and decision-making," received the high mean score of 4.43. The mean score of item 9, "The clinical decision making skills taught in the HPS lab are valuable," was also high at 4.32.

Implementation and technical skill performance was evaluated with five items (3, 11, 13, 16, and 18). Results showed item 3, "The simulator experience improved my technical skills," received a mean score of 3.92. Item 11, "My interaction with the simulator improved my clinical competence," had a mean score of 3.83. A mean score of 4.03 was found for items 13 ("The simulator allowed me to put theory into practice") and 16 ("The simulator helped me to manage clinical emergencies effectively"). Item 18, "The HPS lab experiences gave me confidence in my technical skills," received a mean score of 3.69.

Prioritization skills are very important to nursing practice as nurses have to be able to manage the care of a group of patients and determine which of the patients' needs require immediate attention. Three items, 8, 15, and 16, were related to this important nursing responsibility. Item 8, "The prioritization skills taught by using the simulator are

valuable,” received a mean score of 4.32. “The simulator experiences helped me to determine priority aspects of nursing care” item 15 received a mean score of 4.22. Item 16, “The simulator helped me to manage clinical emergencies effectively,” scored a mean of 4.03.

Table 9

Research Question 4: Frequencies and Mean Scores of Student Responses

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation
A. Assessment							
1. The simulator is a realistic tool for learning patient assessment	0	0	2	27	8	4.16	.501
19. Working with the simulator assisted me in gathering patient data.	0	1	12	19	4	3.72	.701
B. Clinical decision-Making							
4. The scenarios develop critical thinking and decision-making	0	1	0	18	18	4.43	.647
9. The clinical decision-making skills taught in the HPS lab are valuable	0	1	0	22	14	4.32	.626
C. Implementation and technical skill performance							
3. The simulator experience improved my technical skills.	0	3	2	27	5	3.92	.722
11. My interaction with the simulator improved my clinical competence	0	1	9	21	5	3.83	.697
13. The simulator allowed me to put theory into practice.	0	1	3	26	6	4.03	.609
16. The simulator helped me to manage clinical emergencies effectively	0	1	4	24	7	4.03	.654
18. The HPS lab experiences gave me confidence in my technical skills.	0	4	7	21	4	3.69	.822
D. Prioritization							
8. The prioritization skills taught in the course are	0	2	0	19	16	4.32	.747

valuable.							
15. The simulator experiences helped me to determine priority aspects of nursing care.	0	0	5	18	13	4.22	.681
16. The simulator helped me to manage clinical emergencies effectively.	0	1	4	24	7	4.03	.654

Research Question 5. Is there a difference in student perception of satisfaction based on prior experiences with other simulators? The specific type of data needed for this research questions was inadvertently left off the questionnaire and only data related to prior educational experience was collected. This research question cannot be fully answered. All students had used low-fidelity simulators in previous and current education. With this high-fidelity simulator being the only one in the technical college's district, most students had probably had no previous experience with such a simulator. However, this cannot be accurately determined.

Data related to previous educational experience was collected. Seven students did not complete the demographic data, 14 had high school degrees, 10 students had previous technical school education, and 6 had bachelor's degrees. No students had degrees beyond the bachelor degree (See the discussion below).

Research Question 6. Is there a difference in perception of satisfaction based on age, gender, prior work or educational experience? The final research questions addressed possible differences between students' perceptions of HPS learning and demographic variables. Research question 6 compared student perceptions of satisfaction and age, gender, prior health care work experience and previous educational experience.

A. Age

Perceptions of satisfaction and age were evaluated using a one-way analysis of variance with the Student-Newman-Keuls multiple range test. Three levels of age were used in the analysis: 18-25 years ($n = 11$), 26-30 ($n = 11$), and 31 and older ($n = 8$). Although two items were close to significance at the $p < 0.05$ level, none of the items were found significantly different based on age. This data is presented in Table 10.

Table 10

Analysis of Variance Results for Perception of Satisfaction and Age Group

Item		Sum of Squares	df	Mean Square	F	Sig.
1. Simulator is realistic tool for learning	Between groups	.027	2	.014	.042	.959
	Within groups	8.773	27	.325		
	Total	8.800	29			
2. Scenarios with simulator recreate real-Life	Between groups	.618	2	.309	.685	.513
	Within groups	12.182	27	.451		
	Total	12.800	29			
3. Simulator improved technical skills	Between groups	.216	2	.108	.211	.811
	Within groups	13.784	27	.511		
	Total	14.000	29			
4. Scenarios develop critical/decision Making	Between groups	.512	2	.256	.534	.592
	Within groups	12.955	27	.480		
	Total	13.467	29			
5. Adequate preparation for HPS experiences	Between groups	.734	2	.376	.621	.545
	Within groups	11.966	27	.591		
	Total	12.700	29			
6. HPS lab resembles actual health care Setting	Between groups	.734	2	.367	.828	.448
	Within groups	11.966	27	.443		
	Total	12.700	29			
7. Simulator scenarios realistic	Between groups	.348	2	.174	.602	.555
	Within groups	7.818	27	.290		
	Total	8.167	29			
8. Prioritization skills valuable	Between groups	.516	2	.258	.392	.680
	Within groups	17.784	27	.659		
	Total	18.300	29			
9. Clinical decision-making skill valuable.	Between groups	1.212	2	.606	1.429	.257
	Within groups	11.455	27	.424		
	Total	12.667	29			
10. HPS experience increased confidence		.216	2	.108	.298	.745
	Within groups	9.784	27	.362		
	Total	10.000	29			
11. Simulator improved confidence	Between groups	.348	2	.174	.346	.711
	Within groups	13.100	26	.504		
	Total	13.448	28			
12. Pace reflects flow of clinical setting	Between groups	.031	2	.016	.020	.980
	Within groups	20.520	26	.789		

	Total	20.552	28			
13. Simulator allowed me to put theory into practice	Between groups	.262	2	.131	.294	.748
	Within groups	11.600	26	.446		
	Total	11.862	28			
14. Working with sim motivated me to learn.	Between groups	.022	2	.011	.017	.983
	Within groups	16.736	26	.064		
	Total	16.759	28			
15. HPS helps me to determine priority aspects of nursing care	Between groups	.722	2	.833	2.215	.129
	Within groups	14.036	26	.376		
	Total	14.759	28			
16. Helped me manage clinical Emergencies	Between groups	1.666	2	.833	2.215	.129
	Within groups	9.782	26	.376		
	Total	11.448	28			
17. Time offered was adequate	Between groups	5.057	2	2.528	2.658	.089
	Within groups	24.736	26	.951		
	Total	29.793	28			
18. HPS gave me confidence in technical Skills	Between groups	.950	2	.475	.693	.509
	Within groups	17.809	26	.685		
	Total	18.759	28			
19. Assisted in gathering patient data	Between groups	.102	2	.051	.110	.897
	Within groups	12.036	26	.463		
	Total	12.138	28			
20. I am satisfied with HPS experiences	Between groups	.508	2	.254	.466	.633
	Within groups	14.182	26	.545		
	Total	14.690	28			
21. Overall, simulator improved learning	Between groups	.848	2	.424	1.232	.308
	Within groups	8.945	26	.344		
	Total	9.793	28			

B. Gender

Gender was found to be a significant factor for only item 8. "The prioritization skills taught by using the simulator are valuable" was significant at the $p < 0.05$ level (0.023, 2 df). Female students rated this item significantly higher than the male students. (See Table 11 for these results.).

C. Previous Educational Experience

The aspect of previous educational experience was discussed above. One way analysis of variance with a Student-Newman-Keuls multiple range test was used to evaluate the items by educational experience. Only two of the items were found significant at the $p < 0.05$ level. Item 20, "I am satisfied with the HPS experiences" ($p = 0.16$, 2.26 df) and item 21, "Overall, experience with the

simulator improved my learning" ($p = 0.46, 2.26 \text{ df}$) were significantly different between the groups. Those with technical and bachelor's degrees rated the satisfaction slightly higher than those with only a high school diploma (See Table 12 for these results.).

Table 11

Difference Between Student Satisfaction and Gender

Item		F	Sig.	t	df	Sig. (2-tailed)	Mean Differ-ence	Std. Error Differ-ence	95% Confidence Interval of Difference: Lower	95% Confidence Interval of Difference: Upper
1. The simulator is realistic tool for learning	Equal Variances Assumed	1.783	.193	-.656	28	.517	-.22	.339	-.916	.471
	Equal Variances Not Assumed			-.380	2.115	.739	-.22	.586	-2.614	2.170
2. The scenarios with simulator recreate real-life	Equal Variances Assumed	.262	.612	-1.497	28	.146	-.59	.396	-1.404	.218
	Equal Variances Not Assumed			-1.663	2.611	.208	-.59	.356	-1.829	.644
3. The simulator improved technical skills	Equal Variances Assumed	.061	.807	-8.72	28	.390	-.37	.425	-1.240	.499
	Equal Variances			-1.029	2.714	.386	-.37	.360	-1.587	.847

[illegible]

are realistic	Equal Variances Not Assumed			.531	2.396	.641	.19	.349	-1.101	1.472
8. Prioritization skills valuable	Equal Variances Assumed	1.903	.179	-2.397	28	.023*	-1.07	.448	-1.992	-1.156
	Equal Variances Not Assumed			-1.580	2.163	.246	-1.07	.680	-3.798	1.649
9. Clinical decision-making skill valuable.	Equal Variances Not Assumed	31.165	.000	-3.162	28	.004	-1.11	.351	-1.831	-.391
	Equal Variances Not Assumed			-1.649	2.086	.236	-1.11	.674	-3.898	1.676
10. HPS experience increased confidence	Equal Variances Assumed	.104	.749	-1.038	28	.308	-.37	.357	-1.101	
	Equal Variances Not			-1.052	2.484	.384	-.37	.352	-1.635	

11. The simulator improved confidence	Assumed Equal Variances	2.869	.102	-1.421	27	.167	-.59	.415	-1.441	.723
	Equal Variances Not Assumed			-.870	2.138	.471	-.59	.678	-1.512	.794
12. Pace reflects flow of clinical setting	Assumed Equal Variances	.788	.383	-.681	27	.502	-.36	.527	-1.441	.723
	Equal Variances Not Assumed			-.955	3.210	.406	-.36	.376	-1.512	.794
13. The simulator allowed me to put theory into practice	Assumed Equal Variances	1.849	.185	-.190	27	.850	-.08	.404	-.906	.752
	Equal Variances Not Assumed			-.570	25.000	.574	-.08	-.135	-.355	.201
14. Working with simulator motivated me to	Assumed Equal Variances	.004	.949	-.482	27	.633	-.23	.478	-1.212	.751
	Equal Variances			-.387	2.278	.732	-.23	.597	-2.519	2.058

learn.	Not Assumed									
15. HPS helped me to determine priority aspects of nursing care	Equal Variances Assumed	2.426	.131	-1.383	27	.178	-.60	.436	-1.496	.291
	Equal Variances Not Assumed			-.887	2.157	.463	-.60	.679	-3.331	2.126
16. Helped manage clinical emergencies	Equal Variances Assumed	6.676	.016	-2.510	27	.018	-.90	.358	-1.631	-.164
	Equal Variances Not Assumed			-1.331	2.093	.310	-.90	.674	-3.679	1.884
17. Time offered was adequate	Equal Variances Assumed	.004	.949	-1.300	27	.205	-.81	.621	-2.083	.467
	Equal Variances Not Assumed			-1.322	2.507	.294	-.81	.611	-2.988	1.372
18. HPS gave me confidence in technical	Equal Variances Assumed	1.081	.308	-1.029	27	.313	-.51	.499	-1.536	.510
	Equal			-.750	2.218	.525	-.51	.684	-3.196	2.170

skills	Variances Not Assumed	Equal Variances Assumed	Equal Variances Not Assumed	Equal Variances Assumed	Equal Variances Not Assumed	Equal Variances Assumed	Equal Variances Not Assumed	Equal Variances Assumed	Equal Variances Not Assumed
19. Assisted in gathering patient data	.015	.903	-1.396	27	.174	-.55	.395	-1.361	.259
20. I am satisfied with HPS experiences	.066	.799	-1.108	27	.278	-.49	.440	-1.390	.415
21. Overall simulator improved learning	.180	.675	-1.980	27	.058	-.68	.343	-1.384	.025
	-1.936	2.458	.168		-.68	.351	-1.950		.591

*
 $p < 0.05$

Table 12

Analysis of Variance: HPS Satisfaction and Students' Previous Educational Experience

Item		Sum of Squares	df	Mean Square	F	Sig
1. Simulator is realistic tool for learning	Between groups	.638	2	.319	1.055	.362
	Within groups	8.162	27	.302		
	Total	8.800	29			
2. Scenarios with simulator recreate real-life	Between groups	.638	2	.319	.708	.501
	Within groups	12.162	27	.450		
	Total	12.800	29			
3. Simulator improved technical skills	Between groups	.638	2	.319	.645	.533
	Within groups	13.362	27	.495		
	Total	14.000	29			
4. Scenarios develop critical/decision making	Between groups	.876	2	.438	.939	.403
	Within groups	12.590	27	.466		
	Total	13.467	29			
5. Adequate preparation for HPS experiences	Between groups	2.838	2	1.419	2.764	.081
	Within groups	13.862	27	.513		
	Total	16.700	29			
6. HPS lab resembles actual health care setting	Between groups	1.752	2	.876	2.161	.135
	Within groups	10.948	27	.405		
	Total	12.700	29			
7. Simulator scenarios realistic	Between groups	.733	2	.367	1.332	.281
	Within groups	7.433	27	.275		
	Total	8.167	29			
8. Prioritization skills valuable	Between groups	.610	2	.105	.227	.798
	Within groups	17.690	27	.461		
	Total	18.300	29			
9. Clinical decision-making skill valuable.	Between groups	.210	2	.105	.227	.798
	Within groups	12.457	27	.461		
	Total	12.667	29			
10. HPS experience increased confidence	Between groups	.238	2	.119	.329	.722
	Within groups	9.762	27	.362		
	Total	10.000	29			
11. Simulator improved confidence	Between groups	.946	2	.473	.983	.388
	Within groups	12.503	26	.481		
	Total	13.448	28			
12. Pace reflects flow of clinical setting	Between groups	1.221	2	.610	.821	.451
	Within groups	19.331	26	.743		
	Total	20.552	28			
13. Simulator allowed me to put theory into practice	Between groups	.506	2	.253	.579	.568
	Within groups	11.356	26	.437		
	Total	11.862	28			
14. Working with sim motivated me to learn.	Between groups	2.602	2	1.301	.553	.582
	Within groups	12.156	26	.544		
	Total	16.759	28			
15. HPS helps me to determine priority aspects of nursing care	Between groups	.602	2	.546	1.371	.272
	Within groups	14.156	26	.398		
	Total	14.759	28			

16. Helped me manage clinical emergencies	Between groups	1.092	2	.546	1.371	.272
	Within groups	10.356	26	.398		
	Total	11.448	28			
17. Time offered was adequate	Between groups	.624	2	.312	.278	.759
	Within groups	29.169	26	1.122		
	Total	29.759	28			
18. HPS gave me confidence in technical skills	Between groups	1.795	2	.897	1.375	.271
	Within groups	16.856	26	.652		
	Total	12.138	28			
19. Assisted in gathering patient data	Between groups	.282	2	.141	.309	.737
	Within groups	11.856	26	.456		
	Total	12.138	28			
20. I am satisfied with HPS experiences	Between groups	4.020	2	2.010	4.899	.016*
	Within groups	10.669	26	.410		
	Total	14.690	28			
21. Overall, simulator improved learning	Between groups	2.060	2	1.030	3.463	.046*
	Within groups	7.733	26	.297		
	Total	9.793	28			

* $p < 0.05$

D. Work Experience in Health Care

Analysis of previous work experience in health care and satisfaction of student learning using HPS was the final area evaluated. Two levels of experience were used for the data analysis: those with no previous work experience, certified nursing assistant experience, or nurse technician/student nurse intern ($n = 22$) and those with a higher level of educational training (licensed practical nurse, paramedic, emergency medical technician and medical assistant) ($n = 7$). Independent group t-tests were used to compare this data. There were no significant differences found ($p < 0.05$).

Table 13

Analysis of Previous Work Experiences and Satisfaction with HPS Learning

Item	F	Sig.	t	df	Sig (2-tailed)	Mean Diff.	Std. Error Diff.	95% Conf. Interval-Lower	95% Conf. Interval-Upper
1. Simulator is realistic tool for learning	.419	.523	-1.214 -1.245	27 10.559	.235 .240	-.29 -.29	.241 .235	-.786 -.811	.202 .227
2. Scenarios with simulator recreate real-life	.183	.673	.283 .282	27 10.074	.779 .783	.08 .08	.298 .299	-.527 -.581	.696 .750
3. Simulator improved technical skills	.614	.440	-.607 -.856	27 21.966	.549 .401	-.19 -.19	.310 .220	-.825 -.645	.449 .268
4. Scenarios develop critical/decision making	1.043	.316	-1.187 -1.456	27 15.283	.246 .166	-.35 -.35	.295 .241	-.957 -.863	.256 .162
5. Adequate preparation for HPS experiences	.447	.509	-1.460 -1.867	27 16.959	.156 .079	-.47 -.47	.320 .250	-1.125 -.996	.189 .061
6. HPS lab resembles actual health care setting	.815	.375	-.460 -.513	27 12.350	.649 .617	-.14 -.14	.296 .266	-.744 -.713	.472 .441
7. Simulator scenarios realistic	1.054	.314	-1.473 -1.461	27 10.002	.152 .175	-.34 -.34	.229 .231	-.808 -.853	.133 .177
8. Prioritization skills valuable	.409	.528	-.575 -.734	27 16.920	.570 .473	-.20 -.20	.350 .274	-.920 -.780	.517 .377
9. Clinical decision-making skill valuable.	.767	.389	.111 .136	27 15.028	.912 .894	.03 .03	.292 .239	-.566 -.478	.631 .543
10. HPS experience increased confidence	.533	.472	.720 .653	27 8.826	.478 .530	.19 .19	.311 .273	-.831 -.778	.450 .397

11. Simulator improved confidence	1.648	.211	-.612 -.698	26 13.371	.546 .497	-.19 -.19	.311 .273	-.831 -.778	.450 .397
12. Pace reflects flow of clinical setting	.131	.720	.246 .266	26 11.875	.807 .795	.10 .10	.386 .358	-.699 -.686	.890 .876
13. Simulator allowed me to put theory into practice	.299	.589	-.324 -.319	26 10.053	.749 .757	-.10 -.10	.294 .299	-.700 -.761	.509 .570
14. Working with sim motivated me to learn.	.069	.794	-.988 -.976	26 10.115	.332 .352	-.33 -.33	.337 .341	-1.027 -1.093	.360 .426
15. HPS helps me to determine priority aspects of nursing care	3.387	.077	-.446 -.369	26 7.985	.659 .722	-.14 -.14	.320 .387	-.801 -1.035	.515 .750
16. Helped me manage clinical emergencies	.011	.916	-.664 -.795	26 14.954	.513 .439	-.19 -.19	.287 .240	-.780 -.701	.399 .320
17. Time offered was adequate	.166	.687	.000 .000	26 11.857	1.000 1.000	.00 .00	.467 .433	-.959 -.944	.959 .944
18. HPS gave me confidence in technical skills	4.161	.052	-1.209 -1.762	26 24.225	.237 .091	-.43 -.43	.354 .243	-1.157 -.930	.300 .073
19. Assisted in gathering patient data	1.453	.239	1.147 1.019	26 8.673	.262 .336	.33 .33	.291 .327	-.264 -.411	.931 1.078
20. I am satisfied with HPS experiences	.003	.953	-1.352 -1.627	26 15.118	.188 .124	-.43 -.43	.317 .263	-1.080 -.990	.223 .133

21. Overall, simulator improved learning	.019	.893	-.721 -.781	26 11.967	.477 .450	-.19 -.19	.264 .244	-.733 -.722	.352 .341
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Comments Section

An area was available on the survey for students to add comments about their feelings and perceptions about HPS use. Six students chose to write additional comments about their simulation experiences with "Stan," the HPS at CVTC. These comments were:

- "More time and exposure to 'Stan' would be beneficial."
- "I feel that the patient simulator is a good learning experience though at times is unrealistic. Real clinical experience is much better for given situations. Situations that we may not encounter in clinical, simulator is effective."
- "Do more!"
- "It would have been helpful if we would have known more about 'Stan' prior to beginning HPS. A lot of time was spent asking and being confused on what we could and could not do on 'Stan.' A prior education on 'Stan' would have been helpful prior to the first HPS experience."
- "Break down the situations—here is what is going on, use critical thinking to get onto the next phase."
- "It was a great learning experience. I would have liked groups to be smaller to get more 'hands on' time."

Summary

The data from 37 associate degree nursing students on their perceptions of satisfaction with learning using HPS technology has been analyzed. Both descriptive and inferential statistics were used. Data for all research questions were discussed. Written comments were also included.

Chapter V: Summary, Conclusions, and Recommendations

Introduction

This chapter begins with a summary of this descriptive study. Data was gathered using a 21- item survey and 37 associate degree nursing students at Chippewa Valley Technical College (CVTC) completed the survey. The results of the study are discussed and compared to previous studies reported in the literature to present any similarities in results that exist. Limitations of this study are addressed. Conclusions drawn by the researcher are explained and a discussion of recommendations for nursing education and research concludes the chapter.

Summary

The study examined associate degree student nurses' perceptions of satisfaction with learning using a high-fidelity human patient simulator. Since the early 1900's, health care education has included clinical practice in training programs. Today's nursing education includes classroom, skill laboratory, and clinical practicum experiences to provide them with a complete preparation for practice. Graduate nurses must be able to take over care of complex, acutely ill patients shortly after graduation. Nursing educators realize that a method for improving nursing students' learning experiences to better prepare them for the responsibilities of nursing practice would be very advantageous. One teaching method now being used in some schools is HPS technology.

Computer simulation is available in many disciplines and simulators of various degrees of fidelity have been used in professional training for many years. Many people learning to drive have used a driving simulator. Aviation relies heavily on this methodology to train pilots. Schools of engineering and the military often utilize

simulators. Teenagers can experience infant care responsibilities with an infant simulator Baby-Think-It-Over, one of the first simulators available for public education (Roberts & McCowan, 2004). High-fidelity human patient simulators (HPS) have been developed to provide health care students with the ability to practice patient care in a safe environment. The HPS is a computerized mannequin developed to respond as a person would to physical illness and pharmacologic agents.

The human patient simulator method was first used in medical training, particularly in anesthesiology. The earliest simulators allowed medical students to evaluate the heart. As technology advanced, so did simulator technology. They now are programmed to react to as a person would to a variety of injuries, illnesses and pharmacological therapies. Simulation is now being incorporated into nursing education. At this time, only limited schools of nursing have included HPS into their curricula.

Much of the research done to evaluate simulation has been with medical students. Although most of these studies have had small sample sizes, they have shown effectiveness of HPS as a teaching strategy and have shown that students have been satisfied with HPS use. Simulation in nursing education has been felt to be a valuable technique to teach complex care and decision-making skills (Van Ort & Putt, 1985, p. 123). Nursing research in this area is even more limited than in medicine, however. The nursing studies have been done with small samples. Like the medical studies, the nursing studies, however, have shown effectiveness and satisfaction with HPS use.

The HPS incorporated in this study is manufactured by Medical Education Technologies, Inc. (METI), of Sarasota, Florida. The simulator is a computerized mannequin that features the ability to breathe, have palpable pulses, heart and breath

sounds, pupils that react to light, and the ability to produce urine. The simulator is programmed to realistically respond to medications and other treatments. A child-size simulator is also available for pediatric simulations. The simulation experience is made to be as close to a real-life situation as possible.

A 21-item survey was developed by the researcher, partially based on a previous survey used by Feingold, Calaluce and Kallen (2004). Using a 5 point Likert-type scale, the survey evaluated students' perceptions of satisfaction with HPS use particularly in relation to important aspects of nursing like data collection, decision-making, technical skill development and prioritization. A "comments" area on the tool allowed participants to add any other information they felt was pertinent to their HPS experience.

Demographic data was also collected.

Students who were asked to complete the survey were all in their final semester at Chippewa Valley Technical College (CVTC). All had completed three courses in which HPS experiences were included. Thirty-seven of 43 associate degree nursing students in the final semester completed the survey. Thirty of the 37 also included demographic data.

The purpose of this study was to answer the following research questions which will be restated and findings discussed.

1. What is the level of associate degree nursing students' overall satisfaction with clinical learning using a human patient simulator? The student respondents were quite highly satisfied with learning using HPS technology. Results of the five items focusing on answering this research question showed mean scores between 3.53 and 4.28. The last two items on the survey ask students specifically about satisfaction with HPS use

and both had quite high mean scores. The items were "I am satisfied with the HPS experiences" (4.14) and "Overall the experiences of working with the simulator improved my learning" (4.28).

2. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them realistic clinical experiences? Five items on the survey answered this question. The mean scores of 3.53 to 4.19 indicate that students did feel the simulation laboratory provided them with realistic clinical experiences. Item 1, "The simulator is a realistic tool for learning patient assessment," received a mean score of 4.16 and item 2's mean score was 4.19 ("The scenarios used with the simulator recreates real-life situations"). The mean score for item 7, "The simulator scenarios were realistic," was 4.16. Item 12, "The pace of simulation reflects the flow of a clinical setting," received the lowest mean score of the items answering this research question with 3.53.
3. To what degree do associate degree nursing students believe HPS experiences improved their confidence and motivation? This research question was answered by three items, 10, 14, and 18. Item 10, "The HPS experience increased my confidence about going into the real-world clinical setting," received a mean score of 3.81. Item 14 was similar, "The HPS experiences gave me confidence in my technical skills," received a mean of 3.69. Item 18 was focused on if the HPS experience motivated the student to learn and received a high mean score of 4.22.

4. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them real-world clinical experiences in regard to:
- A. Assessment;
 - B. Clinical decision-making;
 - C. Implementation;
 - D. Technical skill performance;
 - E. Prioritization

A number of items on the survey addressed all of these important aspects of nursing practice. Perceptions related to assessment skills were evaluated by item number 1, "The simulator is a realistic tool for learning patient assessment," (mean score 4.16) and item 19, "Working with the simulator assisted me in gathering patient data" (mean score 3.72).

Development of critical thinking and decision-making skills were assessed with item 4 ("The scenarios develop critical thinking and decision making") (mean score 4.43) and item 9 ("The clinical decision-making skills taught in the HPS lab are valuable") (mean score 4.32). Both items received very high mean scores.

The next two items, perceptions of satisfaction with implementation and technical skill performance were evaluated with items 3, 13, 11, 16 and 18. Item 3, "The simulator experience improved my technical skills," received a mean score of 3.92. The next item, number 11 stated "My interaction with the simulator improved my clinical competence" and had a mean score of 3.83. "The simulator allowed me to put theory into practice," item 13 received a mean score of 4.03. Item 16 ("The simulator helped me to manage

clinical emergencies effectively”) also received a mean score of 4.03. Item 18, “The HPS lab experiences gave me confidence in my technical skills,” received a mean score of 3.69.

The next aspect of nursing practice evaluated by this research question was the development of prioritization skills. Survey items 8, 15, and 16 assessed the students’ perceptions of this area. Students rated item 8, “The prioritization skills taught by using the simulator are valuable,” highly with a mean score of 4.32. A mean score of 4.22 was determined for item 15, “The simulator experiences helped me to determine priority aspects of nursing care.” Item 16, “The simulator helped me to manage clinical emergencies effectively,” scored a relatively high mean of 4.03.

5. Is there a difference in student perception of satisfaction based on prior experience with other simulators?

Data was not specifically collected to answer this research question. Prior simulator experience was inadvertently omitted from the survey.

6. Is there a difference in perception of satisfaction based on:
 - A. Age
 - B. Gender of the student
 - C. Prior work and educational experience?

The final research question assessed for differences between students’ satisfaction with HPS learning and select demographic variables. No significant differences were found between satisfaction and age. One item of the 21 survey items was found significant for differences between satisfaction and gender. Item 8, “The prioritization

skills taught by using the simulator are valuable" was significant at the $p < 0.05$ level (0.023, 2 df) with female students rating this item significantly higher than male students.

In relation to previous educational experience and satisfaction with HPS use, two items were found significant. Those with previous technical degree and/or bachelor's degree rated the last two items significantly higher at the $p < 0.05$. Item 20, "I am satisfied with the HPS experiences" ($p = 0.16$, 2.26 df) and item 21, "Overall, experience with the simulator improved my learning" ($p = 0.46$, 2.26 df) were significantly different between the groups.

The last aspect analyzed was differences between student satisfaction and previous work experience. Based on self-reported data, students were placed into one of two levels of previous work experience. The two groups were those with no previous work experience, certified nursing assistant experience, or nurse technician/student nurse intern ($n = 22$) and those with a higher level of educational training (licensed practical nurse, paramedic, emergency medical technician and medical assistant) ($n = 7$). No significant differences were found between satisfaction and previous work experience. A variety of comments were elicited from the respondents. The written comments included feelings of satisfaction with HPS use, a concern about the time allowed to practice in the HPS lab, student group size, and a need for more orientation to the lab and the simulator.

Conclusions

Each research question is again restated and answered based on the results of the study.

1. What is the level of associate degree nursing students' overall satisfaction with clinical learning using a human patient simulator (HPS)?

This study found that the students in the last semester of the associate degree nursing program at CVTC were quite highly satisfied with learning using the human patient simulator. A majority of the students "agreed" or "strongly agreed" that they were satisfied with HPS experiences and that the simulator improved learning. Only one student (3%) disagreed with statements expressing satisfaction with the HPS experiences and the learning offered in this environment.

Generally, most aspects assessed were rated quite highly. The range of means was 4.43 to 3.53. Twelve of the 21 items were rated over 4.00. Even the written comments reflect that students would even like more HPS experience in the curriculum. This finding is similar to previous studies on satisfaction with HPS learning. Feingold, Calaluce, and Kallen (2004) found that both nursing students and instructors felt that simulator experience was an accurate test of clinical skills and would be transferable to real clinical practice. In their study, the item "The technical skills taught in this course are valuable" was rated highest. This study did not find the items on technical skills rated the highest but those related to technical skills did have means of 3.69-3.93 on the 1-5 Likert scale.

Other studies also found that learners appreciated HPS learning Gaba and DeAndrea (1989), Gordon (2000), Gordon, Wilkerson, et al (2001), and Graydon, Blum, Cooper, et al (2004), among others, found

that medical students found HPS learning highly effective. In a study of 70 nursing students, Jeffries, Rew and Cramer (2002) found that students who used interactive learning were significantly more satisfied with learning than students who did not have interactive learning included in their course. Underberg (2003) reports that evaluative data from a variety of health care students participating in HPS scenarios at the Penn State Milton S. Hershey Medical Center were very positive and received comments such as "very effective for learning." Similar comments were reported from participants in this study.

The item receiving the lowest rating in this study, "The pace of the simulation reflected the flow of an actual clinical setting," had a mean of 3.53 (s.d. .878). This finding may reflect that the adult learners participating in the study found this area to be the least realistic. Usually, HPS experiences have limited time necessitating that many events happen in a short time. In the clinical setting, the student may have six hours without as many events occurring. Also rated low was a similar item, "The time offered in the HPS lab was adequate" with a mean of 3.61 (sd .681).

2. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them realistic clinical experience?

The mean scores of survey items related to this question indicate that students did feel the simulation laboratory provided them with realistic clinical experiences. The mean scores ranged from 3.53 to 4.19

but three of the five items rating this section were actually among the highest rated items on the survey with two mean scores of 4.16 and one of 4.19. Although the HPS is a mannequin, when students actually see the chest rise and fall, the pupils react to light, a cardiac rhythm on the monitor, and hear the simulator speak (through a microphone from the control room), the simulator becomes much more realistic. One of the students did offer a written comment that the simulator was unrealistic "at times." However, the other 36 students (97%) did not make such a comment.

Students entering associate degree nursing programs vary in age but all are adult learners with specific needs. More and more, adults are realizing the necessity of life-long learning. As more adults return to learning settings, diversity of educational opportunities needs to be a goal and Cross (1981, p. 49) points out that all learners should be guaranteed access to learning opportunities relevant to their needs at any stage of life. Knowles (1984, p. 55-61) notes that adults need to understand why they are learning the content required by the educational program and to realize where their learning deficits are. He also notes that adults feel responsible for their learning and enter the learning environment with a great volume and wide variety of experience. Adult learners have a great need for experiential techniques—techniques that tap into the experiences of the learner (Knowles, 1984, p. 61). They are motivated to learn and learn more effectively when the learning is presented in the context of

application to real-life situations. Simulation learning can offer the experiential learning preferred by adult learners. Simulation techniques allow students to practice a variety of aspects of a situation in a quite realistic environment. This study supports this aspect of HPS learning.

Previous studies have also noted realism of HPS to be an advantage. Bond, Kostenbader and McCarthy (2001), for example, found that realism and the ability to see immediate and appropriate response to treatment were two of the most frequently identified positive responses in their study of pre-hospital and hospital-based personnel's acceptance of simulation training. Hotchkiss, et al (2002) and Jeffries (2005) both stress the need to as closely as possible approximate the HPS setting to reality.

3. To what degree do associate degree nursing students believe HPS experiences improved their confidence and motivation?

The student respondents agreed to a high degree that HPS learning improved their confidence and motivation. Particularly in relation to the simulator motivating students, the mean score was high at 4.22. The mean scores related to increased confidence received scores of 3.81 and 3.69, above the median.

With more practice will come more confidence and comfort with the practice of nursing. The students' responses indicated that they realized this concept and were satisfied with the HPS learning experiences. This improvement in confidence will serve to further motivate learners, as the data of this study supports. Takayasu, Gordon,

Farrell, Evans, Sullivan, and Pawlowski (2002) also found that motivation was one aspect of HPS use when they surveyed 74 students in emergency medicine and critical care and found that 9.5% of the students reported that HPS experience increased their motivation to learn. Cioffi, Pural, and Arundell (2005) in a study of 36 graduate students found that simulation experience increased students' reported confidence levels.

4. To what extent do associate degree nursing students believe that working in the human patient simulator laboratory offers them real-world experiences in regard to:
- A. assessment;
 - B. clinical decision-making;
 - C. implementation;
 - D. technical skill performance;
 - E. prioritization?

Student responses indicate that students feel the HPS lab offered real-world clinical experiences in relation to vital aspects of nursing practice: assessment, decision-making, implementation, technical skill performance, and prioritization. In the HPS lab, students care for the simulated patient, evaluate their performances, and repeat the scenario if desired. Similar repetitive practice is seldom a possibility in the actual clinical area.

A Chinese proverb states, "I hear, I forget; I see, I remember; I do, I understand." This saying can certainly be applied to HPS learning.

Learning theorists such as Bloom (1956) and Gardner (1983) recognized the psychomotor or kinesthetic component of learning. Many nursing students are kinesthetic learners, as are many learners in all disciplines. HPS experiences allow students to put theory into practice, requiring not only thought about how to apply concepts and skills but actual practice in an ever changing, challenging yet risk-free environment. Students in this study rated HPS learning as satisfying in relation to learning and developing competence in technical skills. Also rated highly was development of critical thinking, decision-making and prioritization skills, other aspects of nursing practice that certainly can be more effectively learned by hands-on practice. Similarly, Cioffi, et al (2005) have found that simulation experience improves students' abilities to collect data, decreased time to reach decisions in patient care, and increased reported confidence levels.

Awareness of student satisfaction with HPS technology is important to assess as society's health care needs drive changes in nursing education. The population is aging and the demand for nurses is growing. Schools of nursing are responding by increasing enrollments. Nursing faculty members are being faced with increasing numbers of students. Faculty-to-student ratios are increasing making it less possible for the instructor to directly supervise all of the students closely in a clinical setting. Staff nurses may be asked to assist in supervision. Unfortunately, in some areas, significant nursing staff shortages already exist and this

interferes with the ability to allow students in the clinical area for optimal periods of time. With both limited faculty and nursing staff time with students and limited supervision and guidance, students' clinical time may be limited. However, Casey, Fink, Krugman and Propst (2004) found in a survey of 270 graduate nurses, graduates did not feel comfortable, confident, or skilled for up to one year after graduation. This data suggests that a method to increase clinical practice is vital to nursing education.

Student nurses need to be well prepared to provide nursing care before they enter the real clinical setting so they can make the best use of the time available. As this study shows, HPS lab experiences are felt by students to be an effective way to provide learning. This type of preparation can be useful in the setting of limited faculty availability and limited access to appropriate clinical sites. HPS use may allow a quicker and more comfortable transition into practice for new nursing graduates. Clinical orientation programs and ongoing continuing education for health care professionals can also be enhanced by HPS use (Rauen, 2004; Stein & Deese, 2004).

No one would argue that the health care environment of the 21st century is one of scientific advancement and ever-changing technology. Unfortunately, it is also an environment of high public expectation and litigation. National safety goals have been established by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) with an error prevention focus to protect the consumers of health care (JCAHO,

2005). The JCAHO stresses that health care professionals must be competent in what they do and must take all necessary measures to avoid errors. Statements like, "I didn't know that could happen," and "I'll never do that again," should not be heard in the clinical area. HPS learning can offer students to practice in error prevention practices so that these types of statements aren't heard in the clinical area. In addition, HPS training could be incorporated into health care quality improvement practices (Stewart, 2003; Beyea & Kobokovich, 2004).

As Rauert (2001) points out, the most obvious advantage of simulation is that HPS learning presents no risk to patients. Errors can be made, corrected and discussed immediately without harm to a real patient (Medley & Horne, 2005). The HPS lab offers a safe environment in which to practice. Even life-threatening errors can be made in the HPS lab. Although committing error is not the usually a planned aspect of an HPS scenario, seeing the results of an error on the physiologically-responding simulator is a very powerful learning experience. Associate degree nursing students at CVTC felt that the HPS scenarios did create realistic situations and allowed them to learn emergency management skills. The instrument did not specifically ask about the student's reaction to error.

Other changes in the health care arena necessitate creative teaching strategies and tools such as HPS. As Medley and Horne (2005) point out, factors such as increased acuity of patients in all settings, especially hospital, make it difficult for early students with limited knowledge to

participate in patient care. The HPS environment would allow students at all levels to practice in a fast-paced, high-acuity environment. In addition, length of patient stay in health care facilities is generally shorter which can alter the resources available to students for practice.

Another factor influencing the access of students to the health care environment is the Health Insurance Portability and Accountability Act of 1996 (HIPAA). This law was passed to ensure portability of health care information and continuity of health insurance coverage, to prevent medical waste, fraud, and abuse, and to simplify administration of health insurance. The law also ensures privacy of personal health care information, both in written and electronic forms. The law has provisions for sanctions against health care professionals and agencies that fail to protect health care information. The privacy aspects of HIPAA took effect in April, 2003, and have led to increased rigidity in access to medical records and other health care information. Student nurses are monitored closely for compliance with privacy regulations, as they always have been, but now in some cases, are prevented from access to medical information, particularly electronic medical records. HPS experiences can include simulated medical records and documentation for students. If students are limited or prevented from access to medical records, the simulated experience will allow for the learning to still take place.

5. Is there a difference in student perception of satisfaction based on prior experience with other simulators?

This research question was not answered. The researcher failed to include a question on the survey that addressed this research question. Although few students probably had simulation experience and there would likely have been no significant difference found, this cannot be truly answered.

6. Is there a difference in perception of satisfaction based on:
 - A. age
 - B. gender of the student
 - C. prior work and educational experience?

Few significant differences were found between satisfaction with HPS learning and the demographic variables of age, gender, and previous work and educational experience. Age and previous health care work experience were not significantly different between demographic groups. Only one item was significantly different based on gender.

The last two items that focused on the simulator's ability to improve learning and the overall satisfaction with HPS experiences were rated significantly higher by those with more education. These respondents may realize the benefits of simulation based on previous training without such a learning tool. Although the sample size was small, these results support the benefit of HPS use with adult learners, particularly those returning for additional and/or advanced education. Also, the findings support use of HPS not only in associate degree programs but with those in undergraduate and graduate programs

Student Comments

Students expressed comments that highlighted both satisfaction with HPS use and limitations of this teaching strategy. A common theme of the comments was the need for more time with the simulator and more preparation or orientation early in HPS experience. The quick pace of learning and the limited time allowed in the HPS laboratory may make some students anxious and may be the cause of these types of comments. This conclusion was similarly noted by Hotchkiss, et al (2002). They found nurse anesthesia students videotaped during a 30 minute crisis scenario were quite anxious and attributed this to the simulator's quick changes in condition over a short period of time. Trained observers in the study noted the anxiety, also, but found that despite the anxiety, the scenarios were realistic and were valuable to the students' education.

HPS experiences certainly can be versatile and can allow a number of aspects of nursing can be individually or simultaneously practiced. The students responding in this study were satisfied with the many aspects of nursing education that are provided by HPS experiences. The study also indicates that students did not feel the technological aspect of HPS experiences interfered with their learning. Nurse educators must realize that Increasingly technology-oriented students will demand technology-driven tools to enhance learning.

Limitations

This study is not without limitations. These include:

1. The focus of the study was quite narrow and the sample size small. Only

nursing students in an associate degree nursing program enrolled at CVTC were included. Results certainly may not be generalizable to other two-year nursing programs or baccalaureate or masters' level nursing students who may also use HPS technology. The sample size was small with only 37 respondents. Six students in the course did not choose to respond. Unknown is whether these students did not wish to take the time to complete the survey on the particular day of data collection or if their choice indicated dislike of HPS learning.

The study attempted to compare satisfaction of HPS learning with various demographic aspects. The sizes of some demographic age groups and gender groups were quite small. This certainly limits the results of this portion of the study.

2. The data collection timing may also have been a limitation. The data was collected during class periods when the students in the final semester of the nursing program met for the classroom component of their learning. All students were present during these class periods. The survey was distributed to students following an exam. After the survey was distributed and explained, along with the informed consent form, seven students chose not to complete the survey. Their decision not to complete the survey may have been related to feelings related to the exam or may have been due to their desire to leave the setting as early as possible. Also, having the data collected following an exam may have altered the responses of some of the students.

3. The tool is used for the study had not been used before so determine reliability and validity have not been determined. To control for this, the tool was partially based on an existing tool by Feingold, Calaluce, and Kallen (2004). Recent graduates and professional nursing educators familiar with human patient simulation methodology did evaluate the tool for content validity and program outcomes for associate degree nursing programs.
4. Data was inadvertently not completely collected for the fourth research question related to satisfaction of HPS learning and previous experience with simulators. Although an assumption can be made that few of the participants had simulator experience but this cannot be proven by this study.
5. Limited access in the HPS lab may have affected the responses of the participants. As noted by the students' comments, more time would have been appreciated. The limited time in the lab may certainly have influenced the students' satisfaction and may have limited the study.
6. Faculty members using the HPS methods have had two years to implement the HPS components of the curriculum. The technician assists faculty in the operation of the simulator during their final experiences was new to the lab. These factors certainly may have affected the respondents' responses.

7. The time allotted for each simulation is two hours per session. Each of the last three clinical courses at CVTC includes one or two sessions. The time allowed for simulations may also be a limitation.
8. A variety of students attend the associated degree nursing program at CVTC. There is a large range in ages of the students, from 19-50. The students are from the Midwestern district in Wisconsin that is served by CVTC. Currently the student population is approximately 90% female. The primary ethnic group is Caucasian. These factors may certainly limit the study and decrease its generalizability.
9. The leading paragraph on the survey was meant to provide students with a brief explanation of the study. Evaluation of the survey by former graduates of the CVTC nursing program and by the nursing faculty at the college did not find the leading paragraph problematic. However, the statement could have altered the perceptions of the students and swayed their answers. The survey could be revised to either delete the opening paragraph with the quote from the HPS manufacturer or placing the statement within a survey item.

Recommendations

Based on the findings of this field study, the following recommendations are made:

1. The study needs to be replicated with a much larger sample size. This could be done by collecting data over time at one college. An alternative would be to collect data from associate degree nursing students from a

variety of associate degree programs. This may be difficult, however, as there are a limited number of associate degree programs with HPS technology at this time.

2. With larger sample sizes, differences between different demographic aspects could be better evaluated. This study attempted to compare differing groups but had low numbers of certain population groups.
3. Satisfaction with HPS learning should also be expanded to look at different levels of educational preparation for nursing, i.e. associate degree, bachelor's degree, and master's level. The degree of satisfaction could be compared between the various levels of education.
4. HPS research in nursing is still very new. In an educational milieu emphasizing evidence-based practice, further research is needed to evaluate the outcomes of traditional nursing educational strategies with the use of HPS technology. This study found that students are satisfied with HPS learning. Now the educational outcomes of this teaching strategy must be evaluated in nursing education. Controlled experimental studies with cohort groups of students with and without HPS experiences should be planned to further evaluate the effectiveness of this methodology.
5. HPS studies should also look at the transition of new graduates over the first year of their careers. Comparison could be made between graduates who had HPS experiences in their programs and those who did not to see if their levels of adjustment varied in the first year of practice. Evaluating student perceptions at one, six, and twelve months after graduation could

further determine the long-term benefit of HPS learning. The transition of graduates who received HPS training could be compared with those who did not receive this type of training.

6. HPS use may be a way to help nurses and other health care professionals prevent errors in the clinical setting. Error rates should be examined between recent graduates who were trained using HPS technology and those who were not to determine if this is truly the case. Little empirical data is available in this area and research of this type is vital in furthering error prevention strategies.
7. Research in simulation should also be expanded to include settings where practicing nurses are using HPS technology for continuing education. More health care agencies may want to incorporate simulation if research evidence proves it to be a valid and reliable method for providing training. Schools and agencies may be encouraged to form alliances to develop HPS labs.
8. Results of this study and further HPS research must be disseminated to health care educators. If further research continues to show positive outcomes of this type of teaching strategy, steps should be taken to expand access to HPS technology to more schools of nursing.
9. This study's certainly has implications for the nursing program at CVTC. Students responding to this study are quite highly satisfied with many aspects of HPS learning and are overall satisfied with the current HPS experiences. Chippewa Valley Technical College currently has a newly

remodeled HPS lab. The nursing instructors should feel safe in continuing the active learning activities currently in the curriculum and should pursue developing more HPS learning experiences.

Early nursing courses should be planned to include HPS learning. As students begin and continue to work in the HPS, their comfort level with the environment will increase. Jeffries (2005) points out that a detailed orientation to the lab environment and the simulator itself must be included. She stresses that the time spent in orientation will better allow students to concentrate on the objectives of the sessions without distraction.

Summary

This study has found that associated degree nursing students at CVTC are overall quite satisfied with learning using HPS technology. The research questions have been answered with students feeling that they were offered realistic learning opportunities that improved confidence and motivation in the HPS lab. Students felt that they were provided real-world clinical experiences in regard to assessment, clinical decision-making, implementation, technical skill performance, and prioritization. Conclusions were drawn and recommendations made based on the data. Nursing educators are encouraged to continue research in the use of the human patient simulator.

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Appendix A
Student Survey

Student Survey
Associate Degree Nursing Students' Perceptions of Clinical Experiences Using the
Human Patient Simulator (HPS)

The Human Patient Simulator has been part of your clinical learning at CVTC. The manufacturer claims that the HPS offers "hands-on experience" via "true-to-life scenarios that change to meet the needs of the instructor's goals" and allows "students to practice again and again, until the highest quality patient care becomes second nature" (Medical Education Technologies, Inc., 2004). Nursing Instructor Kathy Kuznar is interested in evaluating your perceptions of this teaching method and to know if you agree.

This survey contains items related to the important aspects of the nursing role. Please rate each item based on your HPS experiences using the following scale:

SA	Strongly agree
A	Agree
N	Neutral
D	Disagree
SD	Strongly disagree

- | | |
|--|-------------|
| 1. The simulator is a realistic tool for learning patient assessment. | SA A N D SD |
| 2. The scenarios used with the simulator recreate real-life situations | SA A N D SD |
| 3. The simulator experience improved my technical skills. | SA A N D SD |
| 4. The scenarios develop critical thinking and decision-making. | SA A N D SD |
| 5. I believe I was adequately prepared for the HPS experiences. | SA A N D SD |
| 6. The HPS lab resembles an actual health care setting. | SA A N D SD |
| 7. The simulator scenarios were realistic. | SA A N D SD |
| 8. The prioritization skills taught by using the simulator are valuable. | SA A N D SD |
| 9. The clinical decision making skills taught in the HPS lab are valuable. | SA A N D SD |
| 10. The HPS experience increased my confidence about going into the actual clinical setting. | SA A N D SD |
| 11. My interaction with the simulator improved my clinical competence. | SA A N D SD |
| 12. The pace of the simulation reflected the flow of an actual clinical setting. | SA A N D SD |
| 13. The simulator allowed me to put theory into practice. | SA A N D SD |
| 14. Working with the simulator motivated me to learn. | SA A N D SD |
| 15. The simulator experiences helped me to determine priority aspects of nursing care. | SA A N D SD |

(Continued on the back)

- | | |
|--|-------------|
| 16. The simulator helped me to manage clinical emergencies effectively. | SA A N D SD |
| 17. The time offered in the HPS lab was adequate | SA A N D SD |
| 18. The HPS lab experiences gave me confidence in my technical skills. | SA A N D SD |
| 19. Working with the simulator assisted me in gathering patient data. | SA A N D SD |
| 20. I am satisfied with the HPS experiences. | SA A N D SD |
| 21. Overall the experience of working with the simulator improved my learning. | SA A N D SD |

Comments:

Thank you for completing the HPS portion of the survey. Please complete that following informational items.

1. Age:
 - a. 18-25
 - b. 25-30
 - c. 30-35
 - d. 35-40
 - e. 40-45
 - f. 45-50
 - g. over 50
2. Gender
 - a. male
 - b. female
3. Previous educational experience
 - a. high school graduate or equivalent
 - b. previous technical degree
 - c. previous bachelor's degree
 - d. previous graduate degree
4. Previous nursing experience
 - a. No previous experience
 - b. Certified nursing assistant
 - c. Medical assistant, EMT, or paramedic
 - d. L.P.N.
 - e. Other: _____

Appendix B

Informed Consent

Consent to Participate in UW-Stout Approved Research

Title: Associate Degree Nursing Students' Perceptions of Learning Using a Human Patient Simulator

Investigator: Kathleen A. Kuznar
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Description:

Health care education includes both classroom didactic learning and training in the clinical area. Students in health care training programs, including nursing, must be able to safely provide care in the clinical area. In order to allow students to practice skills in a realistic manner prior to working with actual human subjects, computerized human patient simulators have been created. This new type of teaching strategy has been used heavily in medical training over the past decade but is rather new to nursing education. Little research has been done on the use of human patient simulation with nursing students.

This study will evaluate nursing students' perception of learning using a human patient simulator. A survey has been developed to gather the data on the students' perceptions. Your class, associate degree nursing students in the final semester at Chippewa Valley Technical College, are being asked to complete the survey. Descriptive statistics will be performed to evaluate the results of the survey.

Risks and Benefits:

There are no expected risks to you. Completion of the survey may take 15-20 minutes and this is the only cost to participants. The researcher will be available immediately after you have completed the survey, during office hours or by appointment if you would like to discuss the project.

Time Commitment:

As stated above, the survey will take no longer than 15-20 minutes.

Confidentiality:

Your name will not be included on any documents. We do not believe that you can be identified from any of this information.

Right to Withdraw:

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been submitted to the investigator.

Institutional Review Board Approval:

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

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Statement of Consent:

By completing the following survey, you agree to participate in the project entitled, "Associate Degree Nursing Students' Perceptions of Learning Using a Human Patient Simulator."