THE FUTURE OF SIMULATIONS IN ALLIED HEALTHCARE EDUCATION AND TRAINING: A MODIFIED DELPHI STUDY IDENTIFYING THEIR INSTRUCTIONAL AND TECHNICAL FEASIBILITY

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF EDUCATION

UNIVERSITY OF FLORIDA

2014

To Mom and Dad and all those who literally helped me survive 2013

ACKNOWLEDGMENTS

I would like to thank my family whose support has been invaluable. Without you I never would have made it this far. My sincere gratitude goes to my advisor Dr. Albert Ritzhaupt who was both supportive and encouraging through a very difficult time. My thanks also goes to my dissertation committee and the rest of faculty involved in the online program at UF, this journey was made possible because you believed in me. I would also like to thank all those at the START Center, Baptist Breast Center and Hospital. You believed that not only would I survive, I would succeed.

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LIST OF ABBREVIATIONS

ADEA	American Dental Education Association
ASAHP	Association of Schools of Allied Health Professions
CASE	Comprehensive Anesthesia Simulation Environment
CNA	Certified Nursing Assistants
CPR	Cardiopulmonary Resuscitation
DARPA	Defense Advanced Research Projects Agency: Established in 1958 to research and create cutting edge technologies for the military.
DoD	Department of Defense
EFI	Educational Framework Initiative
FMSTC	Federal Medical Simulation and Training Consortium
GAS	Gainesville Anesthesia Simulator
HPS	Human Patient Simulator: A device or technology that presents a simulated patient.
IOM	The Institute of Medicine
IPSE	Inter-Professional Simulation-Based Education
LPN	Licensed Practical Nurse: a generalist with one year of vocational training who works in various areas of health care
METC	Medical Education and Training Campus
METI	Medical Education Technologies, Inc.
OR	Operating Room
PII	Personally Identifiable Information
RN	Registered Nurse: provide and coordinate direct patient care in a variety of settings including hospitals, nursing homes, and in the home. Requires an Associate’s Degree.
TATRC	Telemedicine and Advanced Technology Research Center: this Department of Defense office supports medical research
VR	Virtual Reality

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Education

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May 2014

Chair: Albert Ritzhaupt
Major: Curriculum and Instruction

Healthcare educators have an important responsibility in educating and training students so they have the knowledge and skills necessary to successfully and competently work in today's healthcare fields. The demand for allied healthcare professionals continues to grow, and many programs are struggling to accommodate the increase in applicants and the decrease in state and federal funding. In today's challenging environment it is crucial to find a way to effectively teach in a cost effective manner without risking patient safety. To do this, institutions must strategically plan for the future of healthcare education and training by analyzing the literature, gathering strong empirical data, and surveying expert opinions.

Many experts who advocate for the use of simulation maintain that simulated training can successfully be used as a complement to didactic and clinical training by giving students the opportunity to demonstrate specific skills and confirm a high level of understanding before they begin working with patients. However, the use of simulations does have its critics and limitations. The effectiveness of simulation in allied healthcare

education is often diminished due to a lack of knowledge about how to use the equipment, how to set up the scenarios, and how evaluate the simulation.

This study used the modified Delphi method to explore the feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology in allied healthcare education. There were a total of 85 items separately rated for their technical and instructional feasibility. The finding revealed that there are still many unknowns when it comes to the use of simulation in allied healthcare education. No item was ranked at either end of the feasibility scale 1=as not at all feasible or 5=extremely feasible, meaning that while they are possible to pursue, none is completely ready to pursue at this current time. The outcome of this research point to a strong need for more research concerning the need for each of these items as well as continued research which answers how and when simulation as a teaching method is as good as or better than other models.

CHAPTER 1
INTRODUCTION

This project is concerned with exploring and identifying issues impacting the future of simulation in allied healthcare education and training. It seeks to consolidate and assess expert opinions about the feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology within allied healthcare education in order to help develop recommendations for strategic decision making. This work consists of an introduction, a literature review, methodology, results, and a conclusion. The purpose of Chapter 1 is to provide the background and an overview of this study. It establishes the need for a rigorous analysis concerning the future of simulation in allied healthcare education and introduces the methodology and context for this research.

Background

Allied Healthcare

Allied health professionals currently comprise an estimated 60% of America's healthcare workforce and can be defined as medical practitioners with some formal education and clinical training who are credentialed through a certification, registration, and/or licensing process (Fitzgerald, 2006). The allied healthcare field encompasses over 200 health careers and can be broken into two board categories: technicians (assistants) and therapists/technologists. Technicians are often trained to perform specific procedures and work under the supervision of a therapist/technologist who has the additional training needed to evaluate patients, diagnose conditions, and develop treatment plans (American Dental Education Association (ADEA), 2012). These individuals are responsible for a wide variety of tasks and are often directly responsible for patient care and safety.

Healthcare educators have an important responsibility in educating and training students so they have the knowledge and skills necessary to successfully and competently work in today's healthcare fields. As the demand for allied health professionals (e.g., dental hygienists, diagnostic sonographers, surgical technologists, physical therapists, radiographers, and respiratory therapists) continues to grow, many education programs are struggling to accommodate the increase in applicants and the decrease in state and federal funding (McLaughlin, Starobin, & Laanan, 2010). It is projected that the U.S. will face a shortage of allied health professionals which will range from 1.6 million to 2.5 million by 2020 (Fitzgerald, 2006), placing more pressure on schools to produce larger numbers of qualified healthcare professionals.

Today patient care has shifted from being largely hospital based to being predominantly outpatient, limiting student exposure to live patients, and the accompanying opportunities to acquire problem solving and clinical skills (Morgan, Cleave-Hogg, Desousa, & Lam-McCulloch, 2006). Due to time limitations, as well as legal, ethical, and cost issues, it has become a challenge to meet the clinical component of these educational programs, the traditional method for providing students hands on experience. In today's challenging healthcare environment, it is crucial to find a way to effectively teach in a cost effective manner without risking patient safety. To do this, institutions must strategically plan for the future of allied healthcare education and training by analyzing the literature, gathering strong empirical data, and surveying expert opinions.

A 2012 survey conducted by the Healthcare Association of New York State concluded that with the passing of the Affordable Care Act there is a high probability that more people will seek treatment in the near future, and therefore, the difficulty of recruiting qualified allied health professionals such as clinical lab technicians, medical coders, physical therapists, and occupational therapists is likely to worsen. Increases in the cost and demand of healthcare are likely to impact the role of the allied health professional requiring them to take on more responsibilities. The qualifications, and therefore, the training and education of an allied health professional will also need to expand (Lizarondo, Kumar, Hyde, & Skidmore, 2010). With over 200 different professions, each educational institution is unique in its programs and scope, and faculty shortages continue to impact the increasing number of rejected qualified applicants (Fitzgerald, 2006). The changing needs of the healthcare industry require educational institutions to find new cost-effective methods to educate more students.

Washington State's Allied Health Center of Excellence seeks to address some of these concerns through the formation of an allied healthcare core curriculum to help expand capacity through greater efficiency (2012); however, the program is new so its impact on the field is as yet unknown. It is important to note one of the essential ideas behind building a common core curriculum for allied healthcare education is that there are certain courses and skills that all allied health professionals need regardless of specialty: medical terminology, anatomy/physiology, first aid, and pharmacology to name a few. This builds on a 1999 report by the U.S. Department of Health and Human Services which noted: "Although the allied health professions represent a multitude of therapeutic, diagnostic, and preventive areas of health care, their practices and education have common elements, and they share a commonality of purpose and mutual concerns about the health care delivery system" (p. 1). Utilizing simulations within these core courses may help ensure the greatest impact on the largest number of students with the least amount of cost.

Medical Simulations

Healthcare simulations can seem like a blessing to healthcare educators, curriculum developers, and program directors as they try to develop new methods to teach more students more information with greater efficiency. Limited research shows that simulation can be beneficial in training diagnostic skills, communication skills, and team building, while allowing for the systematic collection of archival data, and the deliberate practice of responding to rare scenarios (Gaba, Howard, Fish, Smith, & Sowb, 2001; McLaughlin, et al., 2010; Okuda et al., 2009; Ziv et al., 2006). Research has successfully established outcome improvement for anesthesiologists who have used simulator training, but in surgical training, the research is insufficient to prove that simulator training can result in error reduction (Dawson, 2002). Simulation is often used in an effort to improve patient safety as it provides students an opportunity to learn without risking patients' lives or making patients feel uncomfortable by being used as live training subjects (Burgess, 2007; Okuda et al., 2009; Seropian, 2003). Many experts who advocate for the use of medical simulation maintain that simulated training can successfully be used as a complement to didactic and clinical training as students have the opportunity to demonstrate specific skills and confirm a high level of understanding before they begin working with patients (Dawson, 2002; Gaba, 2004b; Haluck et al., 2007; Okuda et al., 2009). However, the use of simulations in healthcare education does have its critics and limitations (Bradley & Postlethwaite, 2003b; Cantrell,

& Deloney, 2007; Chiniara et al., 2012; Colliver, 2002; Gibbs, Durning, & Van Der Vleuten, 2011), and the research concerning its impact and outcomes on allied healthcare education is scarce.

Healthcare simulations have been commonly used for more than twenty years, yet highly quality rigorous research concerning quality assessment, learning outcomes, patient outcomes, and skill transfer capabilities of simulations is limited (Holzinger, Kickmeier-Rust, Wassertheuer, & Hessinger, 2009; Kardong-Edgren, Adamson, & Fitzgerald, 2010; McGaghie, Issenberg, Petrusa, & Scalese, 2010; Okuda et al., 2009). Simulations allow for realistic, real-world training and skills assessment in a controlled, non-threatening environment, but these emerging technologies are in need of a framework to guide their development, a supporting taxonomy for instructional design, a formulation of best practices for implementation, and rigorous research designs for evaluating learning outcomes (Chiniara et al., 2012; Jeffries, 2006). The practice of using healthcare simulation for educational purposes is based largely on anecdotal feedback from informal user studies (Magee, 2003) and not upon validated methods. In a 2004 survey concerning human patient simulators (HPS) in nursing education, it was shown that community college programs used more hours in almost all courses than universities and simulation centers (Nehring & Lashley, 2004). Despite this, a literature search uncovers few research articles specifically addressing healthcare simulations in community and technical college settings for any degree of study. So is there a future for healthcare simulations in allied healthcare education and training, and if so, what does it look like?

Identification of Need

The Medical Education & Training Campus (METC) at Fort Sam Houston, Texas, provides for the initial and advanced education and training of enlisted medical personnel throughout the military. METC resulted from a Base Realignment and Closure (BRAC) initiative which in 2011 brought together students, faculty, and staff from various military locations including San Diego, CA; Portsmouth, VA; Great Lakes, IL; and Wichita Falls, TX. The majority of all initial medical education and training programs for enlisted personnel are now located at METC as single Service, consolidated (more than one Service component taking the same course), or collocated (same course but classes separated by Service). This training campus consists of over 50 medical programs, most of which fall into the allied healthcare category, with an estimated annual graduation rate of 21,000 Army (A), Navy (N), Air Force (AF), and Coast Guard (CG) enlisted personnel.

Simulations have been assessed for use in higher education for nursing education (Jeffries, 2006; Leigh & Hurst, 2008), surgical training (Dawson, 2002; Haluck et al., 2007; Hammoud et al., 2008), and veterinary training (Scalese & Issenberg, 2005), but at METC, many of the incoming students are recent high school graduates with only military basic training (boot camp) behind them. For most, the level of training they receive is comparable to associate degrees or medical certifications, not at the level of surgeons or registered nurses. Programs include Army healthcare specialist (combat medic), Air Force/Navy basic medical technician/corpsmen, dental assistant/specialist (A, N, AF), surgical technologist (A, N, AF), biomedical technician (A, N, AF), medical laboratory technician (A, N, AF), radiologic technologist (A, N, AF, CG), respiratory therapist (A, N), and behavioral health specialist (A, N, AF).

Depending on their program, students receive a few weeks or months of Phase One classroom education and lab training, followed by a Phase Two clinical internship. After graduating from METC, they are deployed or sent to field/specialized training with their specific Service component. At METC, it is imperative that the students become competent practitioners *because* of their training rather than despite of the highly compressed training (Morgan et al., 2006). Many of these students comprise the military's first responders, men and women who are the first on the scene at the point-of-injury in combat, accidents, and humanitarian missions. Others may be the only medical support readily available (e.g., on some Navy deployments, a corpsman may be the only medical personnel available).

Many of the programs at METC utilize simulations during Phase One; however, there currently is no centralized strategic plan concerning the future integration, sustainment, and implementation of healthcare simulations within and across curriculums. In my role as a Learning Systems Developer, I compiled a survey to assess modeling and simulations capabilities and needs. This was conducted in October 2011, shortly after METC was at full operating capability. The Academic Support division attempted to discover what medical models and simulations were currently being used, how they were being used, what support structure existed for these technologies, and what methods and technologies the programs would like to use, as well as to identify barriers to the adoption of these methods and technologies. The results indicated that only nine of the twenty programs who responded were using modeling and simulation on a regular basis. Nevertheless, all but one program indicated that they were interested in using such technologies. A Modeling &

Simulations (M & S) Working Group was subsequently formed and chaired by the Associate Dean of Academics to help design and support a strategic path forward. The shortage of academic literature verifying that simulation training has a long-term positive impact on learning outcomes and results in successful skills transfer to the clinical environment (Bradley, 2006; Cooper & Taqueti, 2008; Gaba, 2004b; Ziv et al., 2006) leaves some decision makers uncertain that increased use and curriculum integration is the most effective and cost efficient course of action. Therefore, this group has been working on a number of issues and concerns including how to develop a short- and long-term plan for the sustainment and growth of modeling and simulation at METC.

To fully integrate healthcare simulations successfully into the curriculum at METC, an assessment and reworking of hundreds of hours of curriculum may be required, along with intensive faculty training, and support from the Services, administration, and staff (Bradley, 2006; Moreno-Ger et al., 2010). At METC, the periods of instruction and curriculum are highly controlled, and significant changes to the curriculum, including the integration of medical simulation, requires approval from the Services before they can be implemented. Before any significant change can be requested, let alone implemented, it is necessary to ensure that the continued use and integration of medical simulation is the proper course of action and that it will result in improved learning outcomes, more effective use of classroom/lab time, and/or cost savings. Through this modified Delphi study I attempt to identify technical and instructional issues impacting the future of simulations in allied healthcare education and training by consolidating and assessing expert opinions in order to help build actionable recommendations and guidelines for strategic decision making.

Role of the researcher. As part of my work as a Learning Systems Developer, I assess and integrate emerging and innovative technologies for use in enlisted military medical education. In this role, I strive to ensure that students and educators have the most appropriate technologies and methodologies in order to participate in effective and engaging learning. It is my belief that the appropriate use of technology, including simulators, can engage and support adult learners and those who educate them. As a member of the Education Technology Department, I work to integrate student-centered technology into a military classroom setting which has a strong didactic tradition and a great emphasis on PowerPoint® presentations. Simulator technology and simulation methodology has the potential to give instructors another tool to use to enhance the social and collaborative aspect of learning, increase retention, and assist in the practice of skills which are transferrable to clinical and field settings.

It is my assertion that simulator technology and simulation methodology can enhance and support the learning experience at METC, but it is vital that these technologies and methods are based on relevant and sound research and validated practices. The Department of Defense (DoD) has begun several initiatives to decrease the use of live tissue through the increased use of simulation technology, but admit that it “cannot assume the risk to transition fully to human-based methods until simulation devices and measurable outcomes can be scientifically validated with training methods that achieve established combat casualty survival rates” (Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, 2013, p. 2). While simulation is not a new concept, it still lacks a solid educational methodology (O’Donnell & Goode, 2008) and standards for simulations, curricula, and simulation centers (Gaba, 2004b).

The exact future uses and effectiveness of healthcare simulation is in question, but few, including myself, question that it will play an ever expanding role in healthcare education and training (McGaghie et al., 2010; Rosen, 2008). It is my belief that simulation will be and should be integrated into the military medical curriculum, but the process should be grounded in research-based instructional practices. Today technology is often purchased at METC without fully understanding how it will be utilized, it is my goal to help ensure that simulation is carefully considered as curriculum is reviewed and technology is acquired to meet training needs.

Gaba (2004) notes that it may be too soon for research to prove long term benefits as the simulation studied needs to be applied consistently over long periods of time. "Yet most institutions in health care are cautious about committing themselves to long term implementation without a definitive evidence base to justify its application" (p. i7). Many healthcare educators and researchers argue that despite the lack of rigorous research supporting the use of simulations; it is likely that the future of healthcare education and training will include their widespread use (Okuda et al., 2009; Rosen, 2008). I maintain that simulation has the potential to increase instructional effectiveness, student engagement, and the transfer of skills, but only if it is carefully and appropriately integrated into the learning environment. But how do institutions such as METC prepare for the future use of simulations when there are still many questions concerning their current application? It is my goal to help find answers to this question through a detailed study of the literature and the gathering of expert opinions.

Research Question

The purpose of this study was to explore and assess the issues facing the future use of simulation in allied healthcare education by examining and correlating the views of a panel of experts pertaining to specific issues in implementing, integrating, utilizing, and assessing simulation methodology and simulator technology in allied healthcare programs (Ziglio, 1996). Specifically, the questions which guide this research are:

1. In the opinion of a panel of experts, what technical issues will impact the future use of simulators/simulation in allied healthcare education?
2. In the opinion of a panel of experts, what instructional issues will impact the future use of simulators/simulation in allied healthcare education?
3. What is the technical feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?
4. What is the instructional feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?

Technical issues are concerned not only with the simulation technology itself, but can include issues with peripherals such as network support, simulator maintenance, technical difficulties in running the simulators, and the design and development of new technologies. Instructional issues may include pedagogical issues such as the choosing of the most effective instructional method, policy issues such as accreditation requirements, curriculum issues such as assessment validation, and faculty issues such as training. It is important to not only identify and define technical and instructional issues which may impact the future of simulations in allied healthcare education, but to develop a consensus concerning whether or not issues can be dealt with successfully.

The purpose of this research was to develop a list of items (specific issues) to be addressed based not only on the strengths and weaknesses of the technology, but also on the strengths and weaknesses of the methodology. The research could not be simply theoretical, but actionable; “If it is not actionable, then it is strictly educational and less likely to affect decision making in real time” (Melnick et al., 2010, p. 318). By understanding the future opportunities and/or threats of each item, decision makers can make informed decisions concerning the possible success of a specific plan to adopt, integrate, and/or use simulation. It is proposed that by utilizing a panel of experts valid and actionable guidelines and recommendations can be developed that can help inform decision makers in their strategic planning initiatives.

As the tasks and skills needed vary greatly within healthcare education, it was decided to limit this study to healthcare education taught at a comparable skill and learning level to that taught at METC. It was established that this research would look only at allied healthcare programs (McLaughlin et al., 2010). For the purpose of this study, allied healthcare fields include only those listed by the Commission on Accreditation of Allied Health Education Programs (CAAHEP). While licensed practical nurse (LPN) programs are often taught at the institutions as allied healthcare programs, they are considered a separate field and are not included in this study (ADEA, 2012; Health Professions Network, 2010).

Overview of Methodology

The Delphi method is an "iterative process to collect and distill the anonymous judgments of experts using a series of data collection and analysis techniques interspersed with feedback" (Skulmoski, Hartman, & Krahn, 2007, p. 1) in order to improve understanding of a problem, solution, or prediction. This project utilized the modified Delphi method proposed by Custer, Scarcella, and Steward (1999) in that it began with a set of carefully selected items drawn from an extensive literature review concerning issues affecting the future of simulation in allied healthcare education. The items were then subjected to a three round Delphi to ascertain expert agreement concerning the items and the technical and instructional feasibility of addressing these issues. The Delphi method was applied in order to facilitate an anonymous exchange of ideas and opinions among a panel of experts concerning the items derived from the literature (Fleuren, Wiefferink, & Paulssen, 2004). By utilizing the Delphi method experts from a variety of geographic locations with varied backgrounds and professions could be utilized.

For this study, the term expert was defined as someone who has designed or developed a medical simulation lab for allied healthcare programs or has a minimum of three years' experience in any of the following roles within allied healthcare programs: operating simulations; assessing simulation-based competencies; using simulation as a teaching or assessment tool; developing new curriculum for the integration of simulation; or having published peer-reviewed research concerning simulations at the allied healthcare level (Holden & Wedman, 1993; Pollard & Pollard, 2004). Basic demographic information, including his/her background in simulation, years of experience, qualifications, and the reason for his/her interest in the study was collected from each potential participant (Keeney, Hasson, & McKenna, 2011) via a demographic survey hosted on SurveyMonkey® (Melnick et al., 2010; Schibler, 2008). Any individual not meeting the minimum standards was thanked for his/her time and received notice that he/she would not be invited to participate in the Delphi study.

Prior to the first round of the modified Delphi, the initial round one questionnaire was developed by drawing on a synthesized literature review (Custer et al., 1999; Hsu & Sandford, 2007; Stewart et al., 1999). The questionnaire and instructions for round one were then disseminated via email to the pre-selected Delphi panel (Holden & Wedman, 1993; Pollard & Pollard, 2004). All rounds were conducted so the responses were anonymous to the participants.

Qualitative analysis was used to synthesize and analyze the data as issues were modified or added based on the panel's feedback. Items were rated on a scale of one to five for their instructional feasibility and technical feasibility: 1= not at all feasible, 2= probably unfeasible, 3= feasible, 4= very feasible, 5= extremely feasible. Quantitative analysis was conducted on the items based on means (as a measure of central tendency), standard deviation (a measure of spread), and the interquartile range (IQR) to demonstrate the range of consensus within the panel (Wicklein, 1993). According to Linstone & Turoff (1975), the interquartile analysis is considered the best method for determining consensus because the spread shows a distribution of responses for a single item. Defined as the absolute value of the difference between the first and third quartiles of the data set, IQR was calculated with the formula IQR = Q3 - Q1. Following Bailie's (2011) example, the IQR first established the first and third quartiles using the formula Q1 = (n+1)/4 and Q3 = 3(n+1)/4. The IQR showed the level of agreement in responses by demonstrating if they are more varied (spread out) or tighter (more consensus) (Zeedick, 2010). This helps panel members understand their response in relation to the panel as a whole and limits the effects of outlier responses. The goal of the Delphi is to reach consensus among a group of experts, therefore the IQR is used to exclude extreme scores on either end (Kreber, 2002). The use of all these descriptive statistics allowed the panel to work towards consensus concerning the feasibility of each item as it pertained to the future use of simulation in allied healthcare education.

Significance of the Study

The significance of this study is that it fills an important gap in the literature as simulation is often unquestioningly accepted by healthcare educators even when they are uncertain how they should fully utilize the technology/methodology (Leigh & Hurst, 2008). Some literature concerning the future use of healthcare simulation in education and training exists (Bradley, 2008; Gaba, 2004b); however, like much of the research on healthcare simulations, the literature is limited and focused mainly on surgical and baccalaureate or master's level nursing applications. Allied healthcare areas such as first aid, dental assistance, pharmacy technician, emergency medical services, and nurse's aide are often associate degrees or certifications with skill sets and learning levels comparable to those taught at METC. While a few articles have been published regarding the use of simulation for allied healthcare and associate degree nursing students (Kuznar, 2007; Maas & Flood, 2011; McLaughlin et al., 2010), there is a distinct lack of literature concerning simulations in certificate and associate degree allied healthcare programs.

The Delphi method can be difficult to employ and some question its validity and reliability (Sackman, 1975; Rieger, 1986), but when used carefully and appropriately, it can explore critical issues, help predict the future, equip leadership with vital information to use in decision-making, or help improve the practice (Nworie, 2011). By determining the future issues facing the feasibility of medical simulation in allied healthcare education and training, this study provides valuable planning information for education and training facilities such as METC. The consensus of opinions of this panel of experts should be of interest to those charged with planning and implementing future educational programs for allied healthcare education and training.

Limitations and Delimitations

This study is constrained by certain limitations which are inherent within the modified Delphi method. These limitations include the fact that outlying views can be repressed by the nature of consensus building; therefore, some insightful or important information may be lost through the iterations. It is also important to note that the results are the collated opinions of a specific group; they may or may not be factual and the data may not be applicable to other medical education and training settings. Each member of the panel brings his/her own perspective and context as their input is based on personal experience, which may bias some of the input. The researcher's bias may also impact the interpretation of the data as individual panel input was consolidated and correlated for review. The final limitation using the Delphi method is related to the number of rounds and subsequent length of the survey instrument and study. The very nature of its length may have lead some experts choose not to participate or resulted in significant attrition rates. Only the responses included in all three rounds are included in the final results.

Delimitations are linked to the narrow scope of the project. These delimitations include the fact that participants were restricted to those who are currently planning, using, or are published in the field of simulation used in allied healthcare settings; a different demographic may have resulted in different responses. Other delimitations are related to the scope of the project as there was a limited amount of time to conduct the research and a limited number of participants, an expert pool of 20 experts. Because of this small pool the experts may not be fully representative of all allied healthcare programs or adequately address the unique needs of METC.

Definition of Terms

Allied health professionals. The Association of Schools of Allied Health Professions (ASAHP) (2012) states that: "Allied Health professionals are involved with the delivery of health or related services pertaining to the identification, evaluation and prevention of diseases and disorders; dietary and nutrition services; rehabilitation and health systems management, among others” (Allied Health Professionals section). Examples of occupations include athletic trainer, cytotechnologist, dental hygienists, dietitians, emergency medical technicians, medical technologists, medical laboratory technician, physical therapists, radiographers, respiratory therapists, surgical technologists, and ultrasound technologists. Associate degree nursing (LPN) programs are typically not considered allied healthcare programs, but certified nursing assistants (CNA) are (ADEA, 2012).

Delphi method. The Delphi method is a method for soliciting expert opinions about real-world knowledge (Hsu & Sandford, 2007). It often consists of a series of three rounds where experts’ input and analysis moves the group towards consensus. It is “an intuitive methodology for organizing and sharing “expert” forecasts about the future” (Weaver, 1971, p. 267).

Experts. Individuals who are leaders in the field of inquiry, who have firsthand experience, or are primary stakeholders related to the target issue or research effort (Hsu & Sandford, 2007). In this study, it was an individual who has had firsthand experience implementing, using, or researching medical simulation for allied healthcare education and training.

Healthcare simulator. Device or technology that presents a simulated patient, or an anatomic part of a simulated patient, that appropriately interacts and reacts to the actions taken by the simulation participant(s) (Gaba, 2004b). Healthcare simulation is often divided into four areas of practice: standardized patient, computer-based interactions, partial-task trainer, and high-fidelity simulators (Okuda et al., 2009).

Modified Delphi. The traditional Delphi begins with an open-ended questionnaire. In the modified model, the items are preselected based on synthesized reviews of the literature. "The primary advantages of this modification to the Delphi is that it (a) typically improves the initial round response rate, and (b) provides a solid grounding in previously developed work" (Custer et al., 1999, Abstract section, para. 6).

Simulation. A technique which reproduces, takes the place of, or amplifies real experiences, events, situations, or environments, which is a fully interactive, and often immersive, guided experience (Lee, Lee, Wong, Tsang & Li, 2010; Gaba, 2004b).

Simulator. A physical object, technology, or representation of a task, environment, or experience with which one or more targeted tasks are carried out (Cooper & Taqueti, 2008).

CHAPTER 2
LITERATURE REVIEW

This study explores and assesses the technical and instructional feasibility of successfully addressing the issues facing the future use of simulation in allied healthcare education. Chapter 2 reviews the literature and theoretical framework related to the current practice of simulation in healthcare education in general and then in allied healthcare specifically. Chapter 2 begins by reviewing the history, strengths and weaknesses, and possible future uses of simulation in healthcare education. It also identifies the gaps in the current literature and weaknesses in the current research. This literature review is the basis for the questionnaire given during the first round of this Delphi study. This review also briefly looks at the history, evolution, strengths, and weaknesses of the modified Delphi method. Specifics on how and why the Delphi method was used in this study are discussed in Chapter 3.

History of Simulation Use in Healthcare Education

Healthcare simulations have humble beginnings such as using an orange to practice injections; however, modern technologies and methodologies are a relatively recent addition to education. Today, simulations (the technique) and simulators (the technology) are used to train a wide variety of professions including surgeons, pilots, mechanics, soldiers, and scientists; but the modern use of simulations for educational purposes began in the aviation and aerospace industries and was then appropriated by other fields including healthcare education (Lynagh, Burton, & Sanson-Fisher, 2007). Anesthesiology was one of the first medical fields to rigorously research, integrate, and study the impact of the use of simulation for education and training purposes. In the 1980s anesthesiologists purposely studied how simulations were being used in military and aviation training as it pertained to team and individual performance during critical events. They used what they learned to develop a simulated environment for anesthesia administration (Hovancsek, 2007). According to Shaffer et al. (2001) medical and aviation fields have similar needs:

> “Expert domains” like aviation and medicine are characterized by unstructured problems, where a potentially unlimited number of features are related in unclear and complex ways. Theorists argue that skill development in such domains requires practical experience, rather than abstract “book learning.” Pilots and physicians must develop finely-tuned perceptual and motor skills, the ability to analyse (sic) complex situations quickly and accurately, based on limited information, and the ability to make sound decisions about how to proceed, based on their assessment of the tactical or clinical information. (p. 76-77)

Both the healthcare field and the aviation field have a low threshold for failure, high-costs for training, and strive to limit mistakes by ensuring skills are mastered before individuals apply them in real situations, but currently the aviation field has used simulation to a much greater extent than the healthcare education field (Ziv, Wolpe, Small, & Glick, 2003). After all, unlike an airplanes’ mechanics, which are man-made, the human body is in many ways still a place of great mystery.

Simulation based medical education can be traced as far back as 17th century France where birthing mannequins were used (McGaghie et al., 2010), but it is only recently that simulations have become a common part of healthcare education and training. Early simulators mimicked human anatomy and were often used to teach basic psychomotor skills (Lynagh et al., 2007). In 1960 Resusci®-Anne was developed as a simplistic mannequin and was widely used to train mouth to mouth resuscitation and cardiopulmonary resuscitation (CPR). This model was used until the mid-1990s when the Laedral Company began to develop a higher-fidelity mannequin. In the late 1960s, Sim One, often considered the first true computer controlled mannequin simulator, was developed to train anesthesiology residents in endotracheal intubation. This was a significant advancement in technology; however, it was little more than a proof-of-concept as only one was ever made (Cooper & Taqueti, 2008). In contrast, the Harvey® mannequin was developed in 1968 and was able to simulate 27 cardiac conditions and three different diseases. This technology has continuously been improved upon, both as the Harvey model and as numerous smaller cardiology patient simulators (Cooper & Taqueti, 2008). The Harvey model is still used today to help students develop and improve cardiac care skills.

The 1980s saw an expansion of medical-related simulator technology as both Stanford University and the University of Florida (UF) started development on high-fidelity simulators. The group at Stanford developed the comprehensive anesthesia simulation environment (CASE), which was commercialized as Medsim, and the UF group developed the Gainesville anesthesia simulator (GAS), which evolved into Medical Education Technologies, Inc. (METI) (Bradley, 2006) and is now CAE Healthcare. In the 1990s the military, which had been using simulation for training pilots and soldiers in combat scenarios, utilized internal organizations such as Defense Advanced Research Projects Agency (DARPA) and Telemedicine and Advanced Technology Research Center (TATRC), to develop medical simulators for use in training medical personnel (Kunkler, 2006). As the technology advanced the cost of simulation decreased, making it more accessible to more teaching institutions and more appealing to developers (Issenberg et al., 1999). Cooper and Taqueti (2008) note that over twenty types of skill training devices have been developed since the mid-1980s. Today medical simulators include the highly complex da Vinci® Skills Simulator, computer-based simulations such as those developed by Mad Scientist Software, and a variety of high-fidelity mannequins in a variety of ages, races, shapes, and sizes. Some of these mannequins can breathe, blink, and bleed, providing real-time feedback in order for students to develop new skills, practice existing ones, and be evaluated on their performance.

Terminology

As with any specialty there are numerous terms used to describe and explain simulators and simulations. Simulations can be described by technology type, methodology, functionality, or design, but even the word simulation can cause problems when a precise educational definition is sought for its implementation (Alinier, 2007). One of the terms that seems to have little consensus concerns the patient simulators, as the literature uses both mannequins and manikins. In this study the term mannequin is used based on the recommendation of the Society for Simulation in Healthcare (Gaba, 2006). The Society for Simulation in Healthcare also recommends not using the term human-patient simulator to refer to generic simulators representing human beings as the Human Patient Simulator® is a specific model produced by METI (Gaba, 2006). Therefore, this study uses the term patient simulator or mannequin simulator when referring to generic human-patient simulator models.

The term fidelity is typically defined as how accurate a reproduction is to the original (Lampotang, 2008), but in the world or healthcare simulation the level of fidelity is not always clear. The same technology can be thought of differently depending on the objective and task being simulated. Simulations are described along a low- to high-fidelity spectrum, which refers to the level of realism that a simulation presents (Feinstein & Cannon, 2002; Tuoriniemi & Schott-Baer, 2008). They range in variety, abilities, and platform and can be anything from scenario-based patient simulations (Jeffries, 2006) to highly realistic surgical trainers, or comprehensive multimedia curriculum (Issenberg et al., 1999). There are also many different kinds of fidelity, including educational, procedural, visual, physical, and functional (Lampotang, 2008) and some simulations may have high fidelity in one area and low fidelity in another. There is also great variety concerning the role feedback plays when it comes to deciding the level of fidelity. Typically, “an inherent feature of most advanced medical simulators is the ability to provide immediate feedback about clinical decision and quality of actions” (Lane, Slavin, & Ziv, 2001, p. 306), but this feedback mechanism is often not available in models with functional lower-fidelity. In this study the following definitions of fidelity were used.

Low-fidelity simulations are those which focus on teaching or practicing a single skill (Yaeger et al., 2004). Low-fidelity simulations can be bench models which assist with skills such as knot tying and dissection, simple mannequins such as Resusci®-Anne, or video box trainers which incorporate real surgical equipment and video monitors for practicing hand-eye coordination, camera operation, suturing, and cutting (Hammoud et al., 2008; Seropian, Brown, Gavilanes, & Driggers, 2004). On the other end of the spectrum are high-fidelity simulators that can utilize motion capture, augmented and virtual reality technology, and can respond both verbally and physiologically to interventions and omissions on the part of the student (Leigh & Hurst, 2008). On some models responses can be either automatic or given by the instructor depending on the educational need. High-fidelity patient simulation “minimizes the disconnect between preparatory exercise and actual incident by combining consistent lifelike clinical scenarios with real-time stressors" (Gillett et al., 2008, p. 1145) making its use a growing trend in disaster medicine. The term high-fidelity can be used to describe two types of fidelity, cosmetic (does it look real) and response (does it react in a realistic manner) (Seropian et al., 2004). Examples of high-fidelity patient simulators are the SimMan®, the METIman™, and Noelle® with Newborn Hal®.

In between the low- and high-fidelity simulators is a large array of partial task trainers and mannequins that help students perform specific psychomotor skills and sophisticated computer-based simulations aimed at teaching students to problem solve, perform a task, or make diagnostic observations (Hovancsek, 2007). Patient-care scenarios often use medium-fidelity full-body simulators, such as the VitalSim™ Anne, which simulates breath sounds, but does not simulate chest rises or eye movements (Hayden, 2010; Seropian et al., 2004). High-fidelity simulators are often more attractive to students (Hammoud et al., 2008), but are more expensive than the lower fidelity models and may not be optimal for teaching basic life support (BLS) skills such as those needed by many allied healthcare professionals.

This wide variety of technology can be both exciting and daunting when trying to choose the best technology or methodology to address the needs of the students, curriculum, and institution so it is important that institutions closely examine their requirements and their learning objectives before making a costly purchase. It has not been verified that more technology always equals a better learning outcome. Lampotang (2008) argues that high-fidelity simulations may actually overload the learner with too much information and details, detracting from its effectiveness and overshadowing the learning objective. Haptic technology (tactile feedback technology which gives a feeling of resistance) and virtual reality (VR) present virtual objects to learners in a way that is identical to their natural environment (Jones & Sheppard, 2007), but currently these technologies are expensive and not well studied for their effectiveness. While Seymour et al. (2002) argue that VR training significantly improved the operating room (OR) performance of residents, Seropian et al., (2004) maintain that when it comes to VR devices, there is no convincing evidence that skills developed with these devices translate to better clinical performance or results.

Types of Simulation

Mannequin-based patient simulators

The mannequins and partial-task trainers discussed in the previous section are probably the most well-known types of simulation for healthcare education and training. Much of the history and variety of mannequin-based simulators has already been discussed, but it is important to note that these simulators are only one option for educators. Mannequin simulators were developed to reproduce aspects of the human patient (Bradley, 2006) and are used in a variety of ways to teach and assess student skills. A mannequin-based simulator can vary widely in cost, fidelity, and function, but they all present “a large set of features and behaviors of a real patient’s physiology and pharmacology in a fully interactive way” (Gaba, 2004a, p. 7). This interactivity gives the educator options when designing scenarios to meet the learning objectives and skill level of the student. These simulators are often used in conjunction with clinical equipment and are placed in labs designed to replicate clinical settings (Gaba, 2004a), giving students an opportunity to practice skills in a real-world context.

Figure 1-1. Elizabeth Stewart, left, a nurse, and Jennifer Barreiro, a health technician, perform cardiopulmonary resuscitation on a mannequin during a mock code blue drill in the pain management clinic at Naval Medical Center San Diego, Calif., Oct. 13, 2010. Mannequins offer health care providers the opportunity to practice using simulated patients and sophisticated technology. (U.S. Navy photo by Mass Communication Specialist 1st Class Anastasia Puscian/Released)

Partial-task trainers

It is not always necessary in healthcare education to replicate the human body in its entirety. Surgeons, nurses, allied healthcare students, and practitioners often need to learn or practice specific skills which require the simulation of only a specific body part or the use of specific instruments. Task-trainers can be found to support a wide variety of objectives including abdominal ultrasounds, pelvic examinations, urinary catheterization, and central line placement. “The goal of a task trainer is to teach the specific steps associated with a particular procedure and allow repeated practice of desired skills in order to become competent” (Malekzadeh, Pfisterer, Wilson, Na, & Steehler, 2011, p. 532). The Life/form® Airway Management Trainer is a simulated head which allows students to practice intubation, ventilation, and suction techniques whereas the Gaumard® S402 Patient Training Arm is a replication of an arm which allows for the practice of intravenous, infusion, and blood collection techniques.

Figure 1-2. Sgt. Marlen Lopez examines the mouth of a mannequin head with a laryngoscope at an intubation class during the 2011 Warrior Exercise on Fort McCoy, Wis., Aug. 22, 2011. Lopez is from 7246th Installation Medical Support Unit, based out of Omaha, Neb. (U.S. Army photo by Spc. True Thao/Released)

Bench models are inexpensive and portable, allowing students to practice skills on a static model. Hammoud et al. (2008) lists several types of bench models: “knot tying trainers, tissue models for practicing dissection and suturing, abdominal opening and closure trainers, episiotomy repair trainer, anal sphincter repair trainer, and urethral sling procedure trainer” (p. 339). There is no automatic feedback mechanism with these models, an instructor directly observes and gives feedback on the student’s actions. Box trainers are only slightly more complex and are literally a box with slits to insert real surgical instruments. These models include a camera and video screens so the students can see what they are doing in a manner which replicates clinical practice.

“Box trainers are an excellent mechanism to train for eye-hand coordination, camera handling, suturing techniques, grasping mechanisms, point-to-point movement clip applying, and cutting” (Hammoud et al., 2008). These also require an instructor to directly observe in order to provide feedback.

The use of a partial-task trainer helps to control costs and there are even videos on YouTube demonstrating how to build your own laparoscopic box trainer. While some box trainers can cost between $215,000 and $285,000 depending on the quality of the surgical and video equipment used, some institutions, such as the University of Texas Southwestern Medical Center, have developed their own at a cost of $270 per graduating resident. In comparison, operating room time to train residents is estimated at around $48,000 per graduating resident (Scott et al., 2000). Task trainers allow students to concentrate on a single objective as they use and become familiar with the function and operation of real equipment and practice specific skills such as knot tying and suturing (Malekzadeh et al., 2011). An honest assessment of the requirements and learning outcomes will help institutions decide if and when to use a task-trainer as opposed to a full mannequin.

Box trainers have been shown to be effective in teaching and improving basic psychomotor skills that are transferable to real tasks (Clevin & Grantcharov, 2008; Katx, 2006; Munz, Kumar, Moorthy, Bann, & Darzi, 2004; Scott et al., 2000). There are limitations to these studies however, as they are often convenience studies conducted on residents. It is also unclear how long the effects of this training last, and therefore it is unclear how often a student or practitioner needs to use such mechanisms to keep proficient. It is also difficult to compare results from training on partial-task trainers to training which occurs in clinical situations as the simulations are controlled environments while there are numerous variables in operating room scenarios.

Actor patients

It is important to understand that the term healthcare simulation does not just refer to a physical task-trainer or mannequin simulator; they can also be case-studies and drills where students use personal and diagnostic skills to properly assess and treat actor patients who have been moulaged (made up with fake injuries). This technique is often used to teach triage and other mass casualty skills (Gillett et al., 2008). Actor-patients can play diverse roles in an effort to teach students how to deal with a variety of clinical situations such as giving a patient bad news or how to interact with family members after a death (Sinz, 2004). These actors are trained to role-play patients, giving students real experience and allowing instructors to assess their abilities to take patient histories, conduct physicals, and communicate with patients, families, and other medical personnel (Ziv et al., 2003). Simulated patients can be used in either summative or formative evaluation (Ladyshewsky, Baker, Jones, & Nelson, 2000) allowing students to both practice and be evaluated on their performance before interacting with real patients in a clinical situation.

Figure 1-3. U.S. Navy Lt. Graham Danyleyko acts as a triage officer and attaches triage tags to a Sailor with a simulated injury during a mass casualties drill in USS Abraham Lincoln's (CVN 72) hangar bay while under way in the Pacific Ocean Aug. 5, 2007. (U.S. Navy photo by Mass Communication Specialist Seaman Chantell J. Wilson/Released)

One of the most significant factors in the use of live patients for educational purposes is that the actors must be well trained in both their clinical and inter-personal interactions, but there is some evidence in the literature that when done effectively, these types of simulated scenarios have high validity and reliability (Ladyshwesky et al., 2000; Swanson & Stillman, 1990; Vleuten, & Swanson, 1990). Simulated patients may seem like a cost effective alternative to human-patient simulations, but besides the costs of the actors themselves, institutions must factor in the time and costs associated with the use and set-up of the facilities needed to run the simulation, developing the scenarios and instrumentation, and training the actors, staff, and faculty (Ladyshwesky et al., 2000). The time needed and the cost could range widely depending on the scale and objectives of the simulation.

Screen-based simulations

There are also a number of computer- or screen-based simulations that are used alone or in conjunction with mannequins. Screen-based simulations use the computer to graphically present a clinical scenario where the student selects diagnostic and therapeutic options (Hovancsek, 2007; Schwid, 2004). They can also be used to simulate processes such as the distribution and pharmacodynamics effects of anesthetic drugs (Kalkman, 2012). These simulations can be part of the classroom curriculum, or they can be run by the student on their own time in support of their didactic learning. Screen-based simulations can be used to train and assess clinical knowledge concerning a variety of decision making skills including: perioperative critical incident management; problem-based learning; physical diagnosis in cardiology; and acute cardiac life support (Ziv et al., 2003). Similar to the state of research concerning patient actors, the research concerning the effectiveness of screen-simulation shows some effectiveness (Schwid, Rooke, Ross & Sivarajan, 1999; Nyssen, Larbuisson, Janssens, Penderville & Mayne, 2002; Ziv et al., 2003), but is in the early stages of validation (Reznek, 2004). Screen-based simulations are relatively new as this technology required the advent of easily accessible personal computers (Lane et al., 2001); however, this method may have great potential as more individuals and technologies are going mobile through the use of smartphones and tablets.

Figure 1-4. A simulated dental head used to train dental technicians (DoD Visual ID Number 111209-N-ZZ999-014/released)

Summary

When it comes to simulation there is a wide variety of technologies and methodologies to choose from. Bradley (2006) argues that different types of simulation can be used in combination when the learning objective combines different types of skills such as technical (task-trainer) and interpersonal (actor patient). Girzadas et al. (2009) agree, noting that the "use of multiple simulation modalities, such as high-fidelity mannequins, standardized patients, and task trainers, may be able to more fully represent real clinical care" (p. 430). It is rare that one model or method would meet all of an institution's requirements, but deciding how to combine modalities can be difficult. It is important that decision makers understand the differences in types of fidelity, feedback mechanisms, outcome validation, and technical capabilities available in order to make an informed decision concerning what, when, where, why, and how to use a specific type of simulation.

Current Simulation Use

Students respond positively to the use of simulations and often identify an increase in learner confidence and motivation (Curtin & Dupuis, 2008; Jeffries, 2005; Kuznar, 2007; Shear, Greenberg, & Tokarczyk, 2013); and confidence is vital to the healthcare provider's ability to take proper action (Henrichs, Rule, Grady, & Ellis, 2002). Allied healthcare can be a high-risk profession, and confidence is an important trait; however, "high levels of self-efficacy will not create competent professionals without the development of requisite skills" (Kuznar, 2009, p. 10). Rodgers (2007) argues that learners are more confident in their abilities when the learning environment includes high-fidelity patient simulation, but also admits that the peer-reviewed literature on the subject is deficient. In their 2009 study Wenk et al. found that simulation-based medical education did not lead to significantly higher test scores, but it did lead to students overrating their clinical abilities and knowledge improvement. When it comes to healthcare education, a high level of self-efficacy does not automatically translate to a high level of knowledge or skill mastery. The ability to accurately self-assess is an important skill, and there has been some research that shows that simulation can be used to help students improve self-assessment skills (MacDonald, Williams, & Rogers, 2003; Sadosty et al., 2011) but it is unclear how this impacts their clinical abilities.

Skills labs and simulation centers have become widely used for programs such as orthopedics, anesthesiology, nursing, dentistry, and veterinary medicine, but the level of integration and validation varies widely from program to program and school to school. The literature makes it clear that to be effectively measured as a learning methodology, simulation based education must be tied to a clear objective that can be evaluated and not simply used because it appears to be engaging. Simulation should be evaluated concerning "its ability to impart knowledge (medical knowledge), the translation of knowledge into action (therapeutic intervention) and perhaps most powerfully, the action and its impact on patient outcome (success or failed treatment of disease)" (Shear et al., 2013, p. 160). In 1910 the Flexner Report to the Carnegie Foundation established that healthcare education should contain two components; a post-secondary-based scientific curriculum and a clinical practicum (Flexner, 1910). Since then medical educators have strived to find a balance between scientific knowledge and clinical practice. "The human patient simulation experience may prove to be a student and instructor-friendly method to achieve this balance, teaching theoretical concepts and allowing students to actively apply them to various simulated clinical situations" (Kuznar, 2009, p. 11). Some believe that when properly integrated into the curriculum simulation can help alleviate gaps between theory and practice (Morgan, Cleave-Hogg, Desousa, & Lam-Mcculloch, 2006). Both aspects are important to learn in order to effectively and efficiently practice in today's healthcare environment, but simulation needs to become a reliable and validated method to supplement limited clinical rounds before it can truly assist in achieving this balance.

Even when students are lucky enough to receive extensive time in a clinical setting, there is no guarantee that every student will receive an identical clinical experience, see a representative patient mix, and learn all the necessary skills (Lane et al., 2001; Reznek, 2004). The use of simulation allows students to experience uniform scenarios which cover a variety of issues giving students the opportunity to evaluate and practice skills they may never have an opportunity to practice in clinical settings. Clinical rotations, while an important part of the learning process, are problematic for developing communication, problem solving, and interpersonal skills (McLaughlin et al., 2010) as patient care and safety is the priority. The use of simulations helps to ensure students can practice and be evaluated on these skills without endangering lives or disrupting patient care.

Other factors affecting the increased use and interest in simulation in healthcare education include issues with teaching basic anatomy and physiology. Traditional dissection techniques are feeling the pressure from the decreasing availability of qualified anatomy instructors and the high cost and limited availability of cadavers. There is also some concern with the ethical considerations of using human bodies, the potential of cadavers to transmit infectious diseases, as well as the possible negative health effects of formaldehyde exposure (Anastakis et al., 1999; Gabard, Lowe, & Chang, 2012; McLachlan, Bligh, Bradley, & Searle, 2004). Many medical schools have also traditionally used live and dead animals to train certain procedures. Practicing on live animal tissue has numerous ethical implications as research now supports the idea that animals experience fear, stress, pain, and other emotions (Ferdowsian, 2011; Rollin, 2006). Live pigs have often been used in medical training as they display anatomical and physiological similarities to humans (Tanaka & Kobayashi, 2006), but no matter how close, animals have a different anatomy and they require special storage, feeding, and maintenance (Liu, Tendick, Cleary, & Kaufmann, 2003). Technology such as simulation has slowly started changing the practice of using live animals in medical education and experiments. One example is the “hemorrhagic shock labs where medical and veterinary students were forced to bleed animals out and watch the stages to death. Today such labs, once ubiquitous, have been replaced by films or computer simulations in most medical and veterinary schools" (Rollin, 2006, p. 299). Currently there is very little evidence-based research on the effects of students' learning concerning the use or non-use of cadavers and/or live tissue; however, in some cases the decision to use simulation instead is based on other considerations.

The healthcare educational field has been criticized for adopting and implementing innovations such as simulations without sound evidence for their efficacy (Bradley, 2006). Simulation is now firmly established in healthcare education (Kneebone et al., 2006), but an overload of products and concepts not supported by validation or institutional expertise has often lead to the purchase of simulation equipment without the institution understanding how, when, and why to use it (Seropian, 2003). Research still has not adequately answered if the use of medical simulation improves clinical skills when compared to standard training techniques or if skills learned via simulation are retained over time (Greenberg, 2004; Lynagh et al., 2007). The future of simulation in healthcare education may be determined by the answers to these questions and the ability of educators to successfully develop a standard for when and how to use it.

Evaluating Simulations

While there are some evaluation tools designed to assess student learning outcomes, detailed studies related to assessing the simulations themselves are limited. "The level and type of simulation will need to be adapted to the educational needs of the learner and the design and intended outcomes of the programme" (Bradley, 2006). There are many questions that need to be asked when assessing a simulation's ability to address the learner's education needs and intended program outcomes. Will a simulator provide better and more effective training than other methods? Why are certain simulations used to teach certain actions or skills? When is a high-fidelity simulator necessary and when will a low-fidelity simulator work? Can simulators be used for multiple purposes? What is the best way to assess new simulators for purchase? Finding answers to these and similar questions are crucial if a best practice for acquisition, assessment, integration, and application of healthcare simulations is to be established (McGaghie et al., 2010).

In the future, educators may find that while there are some limitations with the simulation technology itself, the challenge facing healthcare education may be keeping up with the pace of changing technology (Hamilton, 2005), but today many of the challenges come from a lack of understanding concerning instructionally-sound simulator technology and simulation methodology. The success of the simulators also depends on the developers of the technology, who do not necessarily have the same agenda as those who use them (Kneebone, 2003; Wilson, Shepherd, Kelly, & Pitzner, 2005). The design, development, integration, and use of simulation are often two separate enterprises. It is important that those using the technology communicate with developers to push for technologies that support their learning objectives.

Hammound et al. (2008) argue that the first step for evaluating any simulator-based training (SBT) is defining the simulator's capabilities. The second step is to define the relationship between the simulator and the simulation scenario. Kneebone (2005) goes further, stating that there are four criteria which should be considered when designing, implementing, evaluating, or purchasing simulators for procedural skills. The simulations should

1. allow for a safe environment for deliberate practice within a defined curriculum, ensuring that recently acquired skills are reinforced;
2. provide scaffolded support and access to experts, ensuring new learners have greater access to feedback and support than advanced learners;
3. accurately reflect real-world clinical experience, ensuring that learning supports actual practice;
4. afford a supportive, motivational, and learner-centered environment.

When strategically evaluating the use of medical simulation, Bonnel and Smith (2010) recommend taking into account the following questions. Will a simulated experience help the student achieve the learning goals? Are there other techniques that could be used which could help the students achieve those goals? Which of these techniques best fits the learning objective? (Or if they are equal which is the least expensive, simplest, and easiest to implement?) What support structure is in place for the simulator, including training, vendor support, and proper facilities? What options are there for presenting the material if the simulator is unavailable?

These are all important questions to ask and issues to consider, but the decision maker(s) are given little guidance on how to find answers to these questions. The answers and solutions will be unique and contextual based on the tasks to be taught, the level of learning being supported, and the outcome objectives as well as the financial and logistical constraints of the institution. Keeping all these issues in mind as institutions plan for the future is a difficult task, and one that is compounded by the limitations of simulations.

Limitations of Simulation

Many of the limitations of healthcare simulations are tied to the simulation type (Gaba, 2004b; Hammoud et al., 2008; Kunkler, 2006; Liu et al., 2003). However, some are inherent in the methodology. Simulations take time, money, and space, including storage space. Knowledgeable faculty and staff are required to develop scenarios, run the simulations, provide helpful feedback, and maintain the simulator and peripheral equipment (Moreno-Ger et al., 2010). It is also important to keep in mind that healthcare simulators currently cannot simulate all scenarios under all circumstances. "There is no substitute for the human body, which is, even without considering its mental and behavioural aspects, a system that can not be fully or effectively replicated by one or several simulators" (Kunkler, 2006, p.209). Human behavior is not a constant, nor is human physiology. "We cannot simulate what we do not know. Our knowledge about patients is incomplete, imperfect and inconsistent" (Lampotang, 2008, p.51). It is possible to simulate an average or an expected scenario, but it is also important to teach students how to think critically and problem solve so they are prepared to deal with the unexpected. Knowing when to seek help or ask questions can be as important as knowing how to perform a procedure.

Even the best run simulations cannot fully recreate the chaos, emotions, and ambiance of an emergency room, field hospital, or first responder situation (Guillaume, 2007). No matter how detailed or realistic a simulation is, it is still just a simulation; it can help a student learn and practice skills and gain confidence, but until those skills are put into practice it is unknown just how well a person will perform. Treating and caring for patients is a complex cognitive process no matter if the caregiver is a laparoscopic surgeon, a clinical nurse, or a physical therapist. Simulators are often used to develop and refine fine motor skills specifically needed for a procedure; however, "it is not possible to recreate every aspect of a procedure in a simulation. Determining what features are required for successful training in a simulator is thus as much a pedagogical question as a clinical and technical issue" (Shaffer et al., 2001, p. 76). Other concerns are with the lack of research and awareness concerning curriculum integration, embedded feedback, human-simulator interfaces, the seamless integration of simulation modalities, and data representation (Rosen, 2004). Educators have not developed pedagogical standards for how, why, or when to use which simulation versus more traditional training or assessment methods.

Fast, realistic mechanical modeling of soft tissues and organ properties is also a challenge for simulators (Liu et al., 2003). The elasticity, look, feel, and behavior when cut or bruised varies greatly by simulator, but no simulator can fully replicate human tissue and its reaction to medical and surgical instruments (Kerdoka et al., 2003). Real-time tissue and organ deformation is also limited to specific organs or simple structures such as arteries and ducts (Liu et al., 2003; Rosen, 2004). These limitations are why a few medical educational programs, including some military programs, still use live tissue (e.g., live pigs or goats).

Shaffer et al. (2001) also note that tactile skills are only a part of what healthcare students need to learn. They must also learn to make difficult and complex clinical decisions, which often involve medical, social, moral, and psychological factors. "While some decision-making ability can clearly be developed through interaction with a simulation curriculum, true clinical wisdom is developed only through interactions with experienced physicians as mentors" (p. 77). There are certain aspects of healthcare practice that are learned through experience as every patient, environment, procedure, and circumstance varies. While there are adult and infant simulators, there is currently no simulator designed specifically for geriatric patients, a growing population with illnesses that are often not curable (Bruhn & Philips, 1985). Moral and ethical dilemmas are also a part of healthcare that students need to learn about and practice managing. Simulated scenarios using standardized patients or ethical situations such as Kohlberg's famous Heinz's dilemma, can be used to help students identify, understand, and mentally prepare for these potential problems (Tysinger, Klonis, Sadler, & Wagner, 1997); however, "perhaps more than ever, in this coming era of high technology, people will need doctors they can trust; and the necessary qualities of humanity, compassion and professionalism can never be acquired from skill centres or the internet—only by example" (Hamilton, 2005). Mentoring is still an important aspect of healthcare education.

It is impractical to believe that a simulated scenario, no matter how realistic or immersive, can truly prepare students for the complexity of dealing with live patients and their families. The responsibility of patient care can only be understood when a caregiver is accountable for the life and health of another person (Jordan, 2003/1903). These are skills that come only from experience, practice, and repetition (Cantrell & Deloney, 2007). Personal interactions are required to care for the patient as a person as "technology cannot substitute for empathy, caring, and the therapeutic touch" (Bruhn & Philips, 1985, p. 294). These limitations should be kept in mind when deciding which educational objectives will be taught through simulation.

The Cost of Simulation

Cost can also be an issue for those seeking to integrate simulation into healthcare education. Moreno-Ger et al. (2010) report that simulations “developed in 2008 fell within the range between $20,000 and $100,000 (70.27%), with … an average cost per learner of $281.51” (p. 460). A single simulator mannequin can cost between $5,000 and $200,000 depending on the level of technology used, number of accessories, and realism achieved (Issenberg et al., 1999). Some institutions are deterred when the costs of simulator equipment maintenance, ancillary equipment such as drug carts, patient monitors, and defibrillators, facility space, maintenance for simulation labs, and salaries for support personnel is added to the budget (Adamson, 2010; Lee et al., 2010; Okuda et al., 2009; Schwid, 2004). For fiscal year 2009 a national survey of medical schools and teaching hospitals conducted by the Association of American Medical Colleges (AAMC) reported that for the majority of respondents, their annual operating budget for their simulation centers was under $500,000, but some reported budgets of over a million dollars (Passiment, Sacks, & Huang, 2011; Tuoriniemi & Schott-Baer, 2008). So how can institutions with limited resources justify the cost when research does not consistently show effectiveness or successful transfer of training to clinical environments (Cooper & Taqueti, 2008; Lynagh et al., 2007; Rodgers, 2007)? It is important to plan for the use of simulation in a way that will help increase the likelihood of successful integration and ensure responsible use of education dollars.

Some innovative programs have successfully introduced simulations to institutions with limited budgets (Curtin & Dupuis, 2008), but they required extensive planning, research, and a deep understanding of the program’s requirements. While these courses of action are recommended for any institution regardless of budget, few seem to have the expert knowledge or resources needed to accomplish this. McLaughlin et al. (2010) built a matrix for simulation integration and implementation at the community college level and breaks it down to five levels. The levels range from multiple simulations to no simulation, but demonstrate how institutions can implement a wide range of options based on the type of equipment, staff training, leadership buy-in, institutional mission, and infrastructure.

Planning for Simulation

According to Haluck et al. (2007) shopping for simulators is like shopping for any piece of electronic equipment; there is often a difference between what is desired and what is needed and affordable. With all that is involved in choosing, buying, using, and supporting simulations, it is crucial that educators also identify potential future issues associated with using simulations. In order to plan and prepare for the future it is important that institutions accurately understand how these potential issues can impact them. Haluck et al. (2007) observed that for most situations (and it is certainly true at a place as diverse as METC), one type of simulator will not provide all that is needed to address all training needs. Some combination of mannequin-based simulations, physical part-task trainer, and high-fidelity simulation will probably be needed, but there is little comparative data concerning simulator attributes (Bradley & Postlethwaite, 2003a), making decisions about current needs difficult and forecasting future needs nearly impossible. At the same time it is important to understand that just because a simulation is available it does not mean it is the best option (Lane et al., 2001). When assessing their future needs educational institutions should look at all options as simulation is not always the answer.

Planning for the future is essential to ensure that institutions are capable of producing fully competent healthcare practitioners given their numerous time and budgetary constraints. This planning can be biased if carried out by a small group of individuals who do not possess the knowledge and/or empirical data needed to formulate a plan capable of addressing the institution's most critical current and future issues and concerns (Wicklein, 1993). Therefore, it can be in the best interest of the institution to seek input from a wide range of experts from outside the institution. "Even with today's technologies there is an enormous amount that can be accomplished with simulation that is not being done because the institutional mechanisms for providing it are immature" (Gaba & Raemer, 2007, p. 1). There is more to using simulation than simply purchasing the technology; a holistic approach allows educators to assess curriculum, match technology with learning outcomes, and integrate different methodologies where most appropriate.

The effectiveness of simulation in healthcare education is often diminished due to a lack of knowledge about how to use the equipment, how to set up the scenarios, and how to evaluate the simulation. Jeffries (2006) notes, "too often the equipment is purchased either without a plan or faculty willing to implement the innovative teaching-learning practice" (p. 163). It is not known how underutilized simulation technology is in healthcare education (Adamson, 2010; Huang et al., 2012), but the research suggests that the barriers to full implementation and integration have led to thousands of dollars in misspent purchases.

Research Challenges

The limited number of methodologically sound, long-term studies with large sample sizes which demonstrate that simulation is more effective than traditional methods (Bradley, 2006; Bradley & Postlethwaite, 2003b) also makes deciding how and when to use simulations difficult. Garden (2008) lists six consistent flaws found in simulation-based research, including poor knowledge of the literature, lack of awareness of basic research design, poor attention to measurement properties, and no attention to statistical power. These flaws make the validity and applicability of the existing literature questionable. There is also a question of bias in much of the simulation research as a quick search of the literature finds that the research funding often comes from an academic simulation center where the research was at least partially funded by the academy (Wenk et al., 2009) or by simulation companies such as Laerdal Medical and METI.

There is little known concerning the conditions for the successful implementation of innovations in healthcare (Fleuren et al., 2004), and Rosen (2008) lists three reasons why there has been slow progress concerning the acceptance and innovation of healthcare simulations: skepticism; lack of communication; and the burden of proof. Bradley and Postlethwaite (2003b) add that much of the current simulation research relies on expert judgment of learners' performance and as such the data has issues with validity and reliability. "What's missing is validation of clinical learning: simulation will be ready when proponents can show that clinically useful learning results from simulation use" (Dawson, 2002, p. 16). This lack of empirical proof has not stopped many educational institutions from moving forward with simulation acquisition, but it has made successful integration difficult (Jeffries, 2006). Institutions often fail to effectively network with each other to share resources, best practices, analysis, or outcome data (Adamson, 2010). Bradley (2006) argues that some issues with small sample sizes and few class iterations could be addressed by using data from multiple sites, but currently many simulation initiatives are contained to educational and professional silos (Blackstock & Jull, 2007; Huang et al., 2012; Jeffries & Battin, 2012). Collaboration and the exchange of ideas will be imperative to the future of simulations in healthcare education (Rosen, 2008). These collaborations should cross not only institutional boundaries, but include input from clinicians, simulation developers, researchers, and educators.

While simulation has become more common in healthcare education and training, it still has a long way to go before reaching its full potential and unquestionable acceptance (Liu et al., 2003). Kuznar (2007) argues that adopting an advanced methodology without critically evaluating and determining its effectiveness could be considered negligent with regard to student learning. A few even hypothesize that this lack of evidence will make simulation obsolete in the future (Greenberg, 2004), but most agree that there is still great potential for simulation to positively impact healthcare education if the proper educational and methodological steps are collectively taken to develop both the technology and the methodology.

Simulation in Allied Health Education

This study assumes that clinical practice must be a significant component of the allied healthcare providers' education. The practice of healthcare is changing, and simulation allows allied health professionals to better prepare for this changing environment. The need to practice and prepare for a variety of common and rare situations is one of the basic arguments for using simulation in healthcare education (McLaughlin et al., 2010; Reznek, 2004); however, the National Council of State Boards of Nursing survey found that 96% of all associate degree simulation labs (N=523) use simulation to practice routine results, whereas only 61% practice rare patient scenarios. There is still a gap between what is theoretically possible with simulation and the practice of simulation.

Simulations and the Role of Patient Safety

In 1999 the Institute of Medicine (IOM) released *To Err Is Human* in an effort to make health care in America safer by shedding light on the number of preventable medical errors. The report stated that preventable hospital errors cause over one million injuries and the death of 44,000 to 98,000 people each year. *To Err Is Human* made public the concern that the decentralized and fragmented healthcare delivery system often gives little incentive for health care providers to improve safety and quality of care. "The IOM reframed medical error as a chronic threat to public health, as lethal as breast cancer, motor vehicle accidents, or AIDS" (Berwick, 2002, p. 81). The issue was taken up by the media and through it the public became more conscious of the issue. In 2006 a review of the patient safety literature revealed that it was extremely difficult to assess the impact of *To Err Is Human* as there was no comprehensive nationwide monitoring system for patient safety (Stelfox, Plaminsani, Scurlock, Orav, & Bates, 2006). Many of the problems noted in this report remain over a decade later, as 30% of healthcare workers in industrialized nations still fail to wash their hands and failures in teamwork and communication are recognized as causing more than 75% of medical errors and injuries (Gordon, Mendenhall & O'Connor, 2012). The public may be more aware of the problem, but the industry has yet to find a wide-spread viable means to address the problems impacting patient safety.

To Err Is Human (1999) was soon followed by *Crossing the Quality Chasm* (2001) which called for a complete redesign of the health care system in the U.S.

(Berwick, 2002). This report is broken down into six areas in need of improvement: safety; effectiveness; patient-centeredness; timeliness; efficiency; and equity. Perhaps the most far-reaching assertion this report makes is that these changes cannot be accomplished by changing the existing system; the system is the problem. “Health care has safety and quality problems because it relies on outmoded systems of work;” (p. 4) the system of care has to be redesigned from the ground up if the healthcare system is to provide safe high-quality care.

It is in the chapter concerning the preparation of the workforce that there is a pronounced place for simulation to be a part of this healthcare redesign. Many of the issues needing to be addressed are in areas that have been or are seeking to utilize simulation: team building; patient communication; identifying errors and hazards to care; and the use of decision support systems. *Crossing the Quality Chasm* (2001) calls for wide-ranging changes in the curriculum, and simulation should be seen as one tool that can be utilized to help improve healthcare education. The use of simulation in education and training may help make initial interactions with patients safer as experience can help decrease error rates (Schmidt, Goldhaber-Fiebert, Ho, & McDonald, 2013). The literature concerning the link between simulation practice and improved quality of delivered care is still sparse but it is beginning to show some positive relation (Shear et al., 2013).

Despite the sparse evidence, patient safety has become one of the most frequently cited reasons for using simulation as a teaching strategy (Gough, Hellaby, Jones, & MacKinnon, 2012; McLaughlin et al., 2010; Seropian et al., 2004; Shear et al., 2013; Tuoriniemi & Schott-Baer, 2008) as making a simulated mistake both decreases the risk to the patient and increases the student's practice time before they begin working with live patients. One of the IOM's recommendations was shorter work hours for residents. The intent was to improve training while limiting the harm to patients due to the traditionally long hours of residency. This resulted in many institutions looking at simulation for alternative ways to ensure residents experienced and practiced various scenarios. The recommendation that simulation and team training be used to improve patient care and patient safety helped increase funding for simulation research, improve simulation technologies, and increase the number of simulation centers to support the adoption of best practices and technologies (Nishisaki, Keren, & Nadkarni, 2007; Shear et al., 2013). Its overall impact on patient safety is still being assessed and work still needs to be done to ensure simulation can address the issues noted in both reports.

In the aviation field, simulation has been used not to just in conjunction with checklists and protocols to help increase safety, it has brought about a major cultural and behavioral shift, one still lacking in healthcare (Gordon et al., 2012). Despite the growing use of simulation there is little research which quantifiably ties its use to improved patient safety. Nishisaki et al. (2007) noted that there is no evidence that simulation improves patient outcomes as studies on this topic are difficult due to time, resources, large numbers of trainees needed, and the possibility of contamination.

The Changing Role of the Allied Healthcare Worker

The population in the United States is aging, presenting healthcare providers with an increasing patient load of individuals facing chronic and difficult illnesses (Lizarondo et al., 2010). Another growing trend is home health care services (Lipton, 2009; Mase & Wattenbarger, 1980), an area where allied healthcare workers are often the primary care giver. In this environment, "each allied health professional is ethically accountable for bringing a theoretically-sound and evidence-based approach to problem-solving in healthcare delivery" (Arena, Goldberg, Ingersoll, Larsen, & Shelledy, 2011, p. 161). Patients today tend to be active participants in their care as the Internet has made it easier for patients to research problems and potential solutions (Bradley & Postlethwaite, 2003a; Lizarondo et al., 2010; Masys, 2002). It is important that allied healthcare workers learn a wide variety of medical, technical, and social skills as well as the ability to think critically and act ethically in the best interest of their patients.

In order to curtail costs, many of the routine tasks previously handled by doctors are being allocated to allied healthcare workers or other medical support staff (Cooper, 2001; Lizarondo et al., 2010). Patient care in many cases has shifted from being largely based in a hospital to being predominantly outpatient, limiting student exposure to problem solving and clinical skills acquisition (Morgan et al., 2006). One method managed care is using to help mitigate costs is to put more emphasis on patient education and prevention (Robinson, 1993), where many allied healthcare workers interact with patients to help mitigate or prevent problems, rather than simply clinically treat them. A few innovative programs target patients at high risk for hospital readmission; "they received intensive, face-to-face consultations from allied health professionals following discharge; and allied health professionals worked in close collaboration with primary care physician" (Lipton, 2009, p. 1946). This role requires allied healthcare professionals to have both a wide understanding of health problems and treatments as well as strong interpersonal skills. Allied health professionals are an integral part of these multidisciplinary teams which "provide comprehensive education to high-risk patients and their families, patient self-management support, consultations with other health professionals, maintenance of close relationships with the patients' primary care physician, and intense, individualized follow-up with patient and family following discharge" (Lipton, 2009, p. 1946). This increase in responsibilities has led to an increasing need for skilled allied healthcare professionals and places new demands on community and technical colleges to find creative solutions for educating ever larger numbers of students under increasingly restrictive budgets (McLaughlin et al., 2010). These solutions must be cost-effective and produce successful learning outcomes to positively impact patient care.

The changing needs and practice of the industry is prompting changes in how practitioners are educated, but these changes are slow to be constructed, verified, and adapted. "A variety of studies of the adoption of proven innovations in health care confirm that there is unjustifiable slowness of change and incomplete implementation of best practices, even in the nation's best academic health centers" (Masys, 2002, p. 35). Addressing the issues of cost, acquisition, training, integration, and validation are essential if allied healthcare education is to produce qualified professionals ready to take on these new challenges.

The cost of simulators can be partially contained by carefully choosing the lowest fidelity model needed to meet the largest number of learning objectives. It may be cost-effective for novice trainees to utilize low-fidelity devices during the first stages of learning (Feinstein & Cannon, 2002). Some argue the low-fidelity models are effective for learning new skills (Bradley & Postlethwaite, 2003a; Wilson et al., 2005), while others argue that these low-fidelity simulations do not produce skills that will transfer to real life situations (Seropian et al., 2004; Tuoriniemi & Schott-Baer, 2008). So while there is no definitive answer as to the effectiveness of cheaper, low-fidelity models, institutions wishing to utilize simulation need to look at creative ways to get access to the technology they need.

The consortia model has been in effect between community colleges and four year institutions as it pertains to degree plans since the late 1960s (Hendee, 1971; Mase & Wattenbarger, 1980) and can be expanded to support simulation programs, thereby helping to divide responsibilities and costs (Jeffries & Battin, 2012; Sportsman et al., 2009). Another possible way to control costs is to utilize mobile simulation labs such as those used in Idaho, Florida, and Indiana. These labs give multiple sites access to simulation while sharing the cost for the equipment, space, and technical personnel.

Even if institutions find a way to distribute costs and responsibilities, the question remains, what are the hallmarks of a good simulation for allied healthcare education? Research by Grober et al. (2004) found that surgical skills training on low-fidelity simulators is as effective as training on high-fidelity model training for the acquisition of technical skills among novice surgeons, but it is unclear if this is applicable to other skills and tasks. Jeffries (2007) argues that the complexity of the simulation should be individually suited to the requirements of the learning objective as well as to the students' existing knowledge level. However, there is little research at any level that shows educators which teaching and learning process needs to be incorporated by the simulator (Jeffries, 2006) making it difficult to determine what the technical requirements are for the simulator.

In addition, when it comes to institutions with allied health programs, they often have several certificate or degree programs, (e.g., San Diego Mesa College offers Associate degrees or certificates in Animal Health Technology, Dental Assisting, Health Information Technology, Medical Assisting, Physical Therapist Assistant, and Radiologic Technology). Many of these programs require similar training in anatomy and life-saving techniques, but require different training when it comes to clinical application. That does not mean that the same simulation cannot sometimes be used to teach different clinical applications. In clinical settings multi-disciplined teams work together towards a common goal, and while each member of the team has their own tasks and skill sets, simulation can be used as an educational tool to build these teams.

Buelow et al. (2008) note that "researchers have identified lower mortality and morbidity rates, fewer hospitalizations, decreased costs and improved function by patients among significant health benefits of interdisciplinary teamwork" (p. e110). Teamwork, coordination, and collaboration are central parts of the allied healthcare worker's professional experience and it is important that they understand how to communicate and work with both patients and their fellow healthcare professionals. Buelow et al. (2008) conducted an inter-discipline live clinical case simulation at the University of South Dakota and found that many students had positive experiences, but that there were challenges to working in teams. Student comments noted that it was difficult to prioritize ideas; there was a tendency towards ethnocentric thinking; and individuals tended to focus on their own disciplines' diagnosis while ignoring the client's opinions, values, and emotions. A few studies conducted on inter-professional simulated activities found that student satisfaction and perception of learning were high

(Gough et al., 2012; Zhang Thompson, & Miller, 2011), but were inconclusive concerning learning outcomes. Those studies that do exist concerning inter-professional educational interventions often lack rigor in terms of design and the use of validated investigator-developed questionnaires (Zhang et al., 2011). Like other simulation methodologies the common conception is that inter-professional education is beneficial, but it needs a reliable methodology, educationally-sound curriculum integration, and rigorous research to support its use.

There are still many unanswered questions when it comes to the use of simulation in allied healthcare education. “The breadth of current simulator options presents educators with the challenge of deciding how to apply this technology to achieve the most effective simulation-based learning opportunities” (Hammoud et al., 2008, p. 340). The literature does little to shed light on how a simulator or simulation can be utilized across programs as there is a distinct lack of cross-disciplinary or even general medical practice research concerning the effectiveness of simulators (Lynagh et al., 2007). So while one simulator type may work for multiple programs with similar courses there is no roadmap to assist institutions in their decision making concerning acquisition or integration. “Rather, it is best to gradually and reflectively embark on a cautious and thoughtful integration of simulation. This should be done with an eye towards outcomes, best practices, and what is best for the students and the healthcare community being served” (McLaughlin et al., 2010, p. 472). This approach requires an inter-disciplinary team, which takes into account the student population, the learning objectives, institutional capabilities, and the clinical skills needing to be taught.

There is a limited amount of evidence-based research concerning allied health professions in general which leads to an absence of theoretical and scientific based research concerning evidence-based practice, optimal training methods, and program evaluation (Arena et al., 2011). Research concerning simulation use in allied healthcare education faces the same problem as other research areas in allied healthcare education: “the allied health professions have been theoretically-based, attempting to translate the experiences of clinicians and the science of other fields (medicine, basic science, education) into practice without discipline-specific evaluation” (Arena et al., 2011, p. 163). Limited research exists which studies simulation use in specific allied healthcare disciplines.

One study was found concerning endotracheal intubation (ETI) which showed that paramedic students trained to intubate on a human-patient simulator are as effective as students trained on human subjects (Hall et al., 2005). However, this study demonstrates many of the weaknesses found in simulation studies: while it was randomized, it was done at a single site; with a small sample (n=36), and outcomes were tested in a single setting.

There have been several studies concerning simulation and physiotherapy education (Blackstock & Jull, 2007; Ladyshwesky et al., 2000). Blackstock and Jull (2007) support the use of high-fidelity simulation in physiotherapy (physical therapy), but warn against its use “without developing complementary teaching materials, integrating simulation into the curriculum, or evaluating the outcomes of such an education medium appropriately” (p. 4). They also argue for the need to develop physiotherapy-specific simulation equipment. On the other hand, Ladyshewsky et al. (2000) studied the reliability and validity of simulated patients in physiotherapy education. They argue that simulated patient scenarios can result in high reliability and validity if the actors are properly trained, the checklist validated, and the simulated procedures specific. They also note that their study was limited and more research needs to be done concerning other disciplines and types of scenarios. Miles-Tapping, Dyck, Brunham, Simpson, and Barber (1990) note that in the field of physical therapy there is some frustration on the part of clinicians in that the available research rarely applies to practice.

In 2007, Jones and Sheppard attempted to review the literature concerning physiotherapy education and medium fidelity simulation, but due to the limited number of studies available they had to expand their search to other allied healthcare and medical fields. While 6% of the studies they found reported positive results in favor of using simulators as a training method, 28% found no difference between simulation and other methods. Perhaps the most important aspect of the analysis was that "those studies which found no difference between methods of training were scored at high quality on critical appraisal. Only five of the twelve studies with positive findings were appraised as high quality" (p. 2). As simulation use becomes wider spread in allied healthcare education more research should be conducted to assess its effectiveness.

Because little research has been done on allied healthcare education it is necessary to extrapolate data from some studies done on associate degree nursing programs. The issues and concerns of associate degree nursing programs and their use of simulations are a place to start when addressing potential issues for allied healthcare education and are arguably closer in type and scope than those issues faced in surgical or graduate level programs. A study conducted by the National Council of

State Boards of Nursing found that in 420 associate degree programs, the top barriers to increasing simulation use were: more faculty need to be trained in facilitating simulations (78%); and not enough staff to run the simulation controls and oversee the students (72%). Two other issues, more faculty need to be trained in writing scenarios and more faculty need to be trained in debriefing simulation, were at 57% (Hayden, 2010). These issues and concerns should be noted and addressed by allied health programs looking to integrate simulation into their curriculum.

While many medical schools have reported spending $500,000 or more over a 12 month period on simulation activities (Huang et al., 2012), community and technical colleges typically have smaller budgets. Adamson (2010) noted in her study of simulation use in associate degree nursing programs, schools only allocated between $2,000 and $5,000 annually for maintenance and training for an average of 1-7% of their initial investment. Among other things, she found that the lack of ongoing support meant that skills were lost over time, machines fell into disrepair, and scenarios where not updated to match changes in the curriculum. A long-term strategy which includes simulation support mechanisms should be in place before acquisition and integration.

The Role of Debriefing

The debriefing session should be the last step in the simulation activity as it reinforces the “positive aspects of the experience and encourages reflective learning, which allows the participant to link theory to practice and research, think critically, and discuss how to intervene professionally in very complex situations” (Jeffries, 2005, p. 101). The debriefing session follows a constructivist framework and implements the principles of adult learning theory, offering a safe space for self-assessment and interactive reflection. While feedback is a continuous process, the debriefing period occurs after the simulation session and “allows a constructive exchange of thoughts between the learner and facilitator, setting the stage for the learner to self-correct clinical or behavioral performance” (Siddall, 2008, p. 546). Through the reflective and interactive nature of the debriefing session the student has the opportunity to further reflect on the actions they took and the outcomes of those actions. They also have the opportunity to learn from the actions of others.

The debriefing session is facilitated by one or more instructors and is often supported by video of the simulation event. During the session the instructor honestly reviews individual and team performance in a non-threatening manner and creates an environment of trust (Fanning & Gaba, 2007). This does not mean that there is no constructive criticism; this session needs to be a time to accentuate, reinforce, correct, and when appropriate, challenge the student (Mort & Donahue, 2004). There is significant research that states that the debriefing session is an aspect of simulation use that is pedagogically vital (Bonnel & Smith, 2010; Childress, Jeffries & Dixon, 2007; Leigh & Hurst, 2008), and some of the literature maintains that the debrief is the most important part of the learning experience (Fanning & Gaba, 2007; Kalkman, 2012; Mort & Donahue, 2004). It is this period of guided reflection, correction, and analysis that supports the building of knowledge and skills through the simulation modality.

The debriefing session is a vital but often overlooked step in healthcare simulation due to the time, training, and cost involved in conducting a quality session. It is important that the debriefing session is conducted by clinically knowledgeable and flexible faculty with a working theoretical understanding of facilitated learning (Mort & Donahue, 2004; Siddall, 2008). This often requires instructors to add new responsibilities and learn new skills. It can also mean adding audio and video support staff and equipment. The cost to obtain and support high quality audio-video equipment and the staff to run and support these technologies is an often overlooked aspect of simulation (Bradley & Postlethwaite, 2003a). Despite the extra cost and effort involved in planning and delivering quality debriefing sessions it is a valuable tool which aids in the effectiveness of simulation use.

Summary

Many healthcare programs are investing in simulation but fail to adequately plan or allocate resources for educating personnel on how to effectively use the equipment (Adamson, 2010). Simulations are used in allied healthcare education to help students master complex tasks such as judging the patient's health status, monitoring care interventions, prioritizing and carrying out interventions efficiently, cooperating with other members of the staff, and managing complexity (Tuoriniemi, & Schott-Baer, 2008). Caring for patients is a collaborative practice especially as it pertains to disciplines such as geriatrics, rehabilitation, and primary care disciplines (Robinson, 1993) and simulation can be used to build effective teams. The few studies conducted on inter-professional simulated education (IPSE) found that student satisfaction and perception of learning were high (Gough et al., 2012; Zhang et al., 2011) but fail to prove that the skills learned successfully transfer to clinical settings or are retained over time. Gaba (2004b) eloquently summed up a possible way forward for healthcare simulations:

> The simulation community must educate the public and the implementing agencies on the vision of improved patient safety using the tool of simulation. The simulation community must also provide the core leadership in developing standards for simulators, curricula, and simulation centres. While we may never have unequivocal evidence of simulation's

> benefits equivalent to multiple randomised clinical trials, we should assemble the evidence where we can, and be forthright in our drive to move forward where possible without ironclad proof. (p. i9)

There are still many unanswered questions as pertaining to the use of simulation in allied healthcare education. It is recommended that educators, practitioners, and researchers work together to gather reliable and valid data that supports the use of simulation to supply community and technical colleges with best practices for the acquisition, integration, and support of simulation in allied healthcare education.

Theoretical Framework

There are several theories and methodologies that are used to support the use of simulation in allied healthcare education. Some studies suggest that simulation may be an effective teaching method because it employs four key facets of healthcare education: developing technical proficiency through practice of psychomotor skills and repetition; assistance of experts tailored to students' needs; situated learning within context; and incorporation of the affective (emotional) component of learning (Kneebone, 2005). Thus, simulations allow for a learning experience that involves the entire person. Mayer's multimedia learning theory (Mayer, 2001, 2005) states that learning is an active process, where mental representations of learning material are constructed and integrated into existing knowledge structures. This theory allows for a student-centered active learning approach consistent with healthcare simulation methodologies.

Other education principles that are discussed in relation to the use of healthcare simulation in education include Kolb's (1984) experiential learning theory, active learning, collaboration, diverse ways of learning (Jeffries, 2006), situated learning, reflective practice, activity theory (Bradley & Postlethwaite, 2003b), brain-based learning, social cognitive theory, and the novice to expert continuum (Rogers, 2007). This Delphi study relies mainly on constructivist and adult learning theories.

Constructivism

Constructivism holds that well designed instruction moves the teacher from a leader to a facilitator of personal meaning making (Jonassen, Davidson, Collins, Campbell, & Haag, 1995). This requires the learner to be an active participant in his/her own learning by interacting with the information, the environment, the teacher, and each other (Liu & Matthews, 2005). Instead of relying on didactic instruction where students repeat facts on a test, constructivist teachers "encourage students to think about what they already know about a topic, search for new information, and collaborate with others to solve realistic problems and derive new understanding" (Solomon & Schrum, 2007, p. 38). The constructivist perspective that learning "is determined by the complex interplay among learner's existing knowledge, the social context, and the problem to be solved" (Tam, 2000, p. 52) is well situated for the hands-on scenario-based training simulation can provide. Within the context of simulation the instructor creates a receptive atmosphere, providing constructive feedback during and/or after the scenario, and uses methods such as video feedback and debriefing sessions to assist with the learning process (Ziv et al., 2003). Simulations are not meant to take the place of qualified educators, but educators should utilize the technology and the methodology to support their teaching (Lampotang, 2008) when and where appropriate.

Rodgers (2007) notes that the constructivist idea of situated learning is especially relevant to the use of simulation in allied healthcare education:

> First, in simulation-based education, the knowledge or skills are presented in context as opposed to being presented in an environment that may not have a real-world implication. Second, simulation-based education

> emphasizes the function of debriefing after a simulation. This provides the opportunity to review the situation and examine what other contexts the knowledge and skills may be applied. Lastly, through the reflective process of debriefing, simulation-based education instills a critical thought process in the learner that better prepares the learner to transition the knowledge and skills into new situations. (p. 74)

In this context well-designed instruction should move the teacher from a class leader to a facilitator of personal meaning making. The learner actively participants in his/her own learning through simulation by interacting with the simulator, the teacher, and each other (Jonassen et al., 1995). The simulation is one tool that can be used to help students build applicable skills from theoretical concepts. "Interactive simulations support processes of actively developing mental representations of complex concepts" (Holzinger et al., 2009, p. 299); ideas central to constructivist theories. Learning is not an abstraction, but is tied directly into real-world situations where the learner applies his/her learning to solve a variety of problems.

The social constructivist perspective maintains that learning "is determined by the complex interplay among learner's existing knowledge, the social context, and the problem to be solved" (Tam, 2000, p. 52). It is the teacher's role to guide the instruction, moving the learner through a journey from novice to expert, a role supported by the proper integration and utilization of simulation. This social view of learning involves the whole person, treating learning as a process of constructing practice, meaning, and identity in relation to a community of practice (Barab, MaKinster & Scheckler, 2004). The ability of simulation to be used to build and support teamwork both as a learning modality and in practice supports the idea of social learning. This social constructivism (Vygosky, 1978) is not completely egalitarian; it is still the teacher’s role to guide the instruction, challenging the learner as he/she journeys from novice to expert.

This constructivist model can be applied to a variety of simulated scenarios, which include facilitated real-time feedback and after-action debriefing sessions. Rodgers (2007) recognizes that within the constructivist framework, “simulation offers the opportunity to push learners past their current knowledge level and see new areas where knowledge may be lacking” (p. v). Constructivism also supports the idea of a safe learning environment, an environment that allows students to take risks without the fear of failure or ridicule, and in the case of healthcare, without the fear of harming the patient (Bradley & Postlethwaite, 2003b). Safe-failure, or learning from one’s mistakes, is a central part of simulation education and one reason why the post-scenario debriefing sessions are such an important aspect.

Adult Learners

The theory, or practice, of adult learning is a concept built upon constructivist ideas of facilitated learning and emphasizing the self-directed nature of adult students. However, there is no specific age at which someone becomes an adult learner; it is more of a social and psychological state of being (Blondy, 2007). Knowles asserts that an individual is psychologically an adult when they reach a need for self-direction (Cavanagh, 1990) whereas Lindman characterized adulthood as a growing self-awareness (Brookfield, 1984). However, not all individuals become self-directed or self-aware in respect to their educational needs. In their study of university students, Delahaye, Limerick, and Hearn (1994) discovered that adult learners tend to utilize both pedagogical and andragogical principles dependent on context and learning goal. Within the context of this study, allied healthcare students can range from young adults directly out of high school to more mature adults looking for a career change. This wide demographic requires a teaching methodology that can support a diverse range of students. In this context it is important that instructors are not only subject matter experts (SMEs) with knowledge of the educational process, but that they also recognize the needs and expectations of their adult learners (Cavanagh, 1990).

The practice of andragogy, a learning strategy focused on adult learners, is rooted in the idea that learning is contextual and the teacher should facilitate a self-directed, project-centered learning process. In the United States the term andragogy is closely associated with the work of Malcolm Knowles; while the term dates back as far as the German educator Alexander Kapp in 1833, the concept remained ill-defined as researchers attempted to address the theoretical differences between accepted pedagogical practice and the needs of adult learners (Knowles, 1988). Knowles work leans heavily on John Dewey (1916) and Eduard Lindeman (1926) who remarked on the social nature and purpose of education (Brookfield, 1984; Rodgers, 2007). In 1970 Knowles wrote *The Modern Practice of Adult Education: Andragogy Versus Pedagogy* where he explained andragogy as the art and science of helping adults learn. In it he makes the argument that adult education is a separate area of study and practice from primary and secondary education. In this view of adult education, educators move from educating people (pedagogy) to helping them learn (Smith, 2002). Knowles (1988) later changed the subtitle to *From Pedagogy to Andragogy* to emphasize education as a continuing spectrum, not a dichotomy (Davenport & Davenport, 1985), as he noted that adults have a wide variety of needs, and sometimes those needs are best addressed through pedagogical approaches.

According to Knowles (1984) the learning environment should be collaborative, welcoming, and one of mutual respect and trust. Knowles emphasizes the self-directed nature of more mature students where learning can be directly applied to real-world situations. Andragogy places the teacher in the role of a facilitator who utilized a self-directed, project-centered learning process. The learning environment should be collaborative and welcoming where it is safe to fail, ask questions, and experiment. Hovancsek (2007) notes that a "simulation experience allows students to critically analyze their own actions (or failure to act), reflect on their own skill sets, and critique the clinical decisions of others" (p. 5). This is one way simulations are thought to be superior to clinical rotations; clinical settings are not designed for teaching and learning, but to deliver patient care and ensure patient safety. Supervisors are obligated to intervene before mistakes occur, so students typically do not have the opportunity to learn from their mistakes or have first-hand experience of negative outcomes (Reznek, 2004). This limitation of the learning experience is necessary in clinical settings, but learning through mistakes is a valuable teaching method supported by simulation.

Andragogy strives for a differential world-view where each learner's experience is unique and relevant (Davenport & Davenport, 1985). It holds that people become more self-directed as they mature; their motivation to learn is immediate and contextual. In healthcare, the concept of being self-directed is accompanied by the concept of self-assessment (Baxter & Norman, 2011; Sadosty et al., 2011), but as previously noted, many students and practitioners are inaccurate when it comes to self-assessment. It is important that educators allow self-directed learning to occur, but under conditions which can be accurately and honestly assessed.

Adults often expect to be active participants in their learning (Fanning & Gaba, 2007) and in the development of their learning environment as they typically have real-world experiences which they use as a resource for their learning. These experiences can influence their learning, and can include a preference to work in collaborative groups. Adult learners not only rely on their experiences to build new knowledge, but expect to integrate their learning with their daily lives on a concrete level through immediate application. "Experience is the adult learner's living textbook" (Lindeman, 1926, p. 37) which means that not only do adult students learn at their own pace, but that each student has his/her own experiences that they integrate into their learning process.

Healthcare simulations, consistent with constructivism and adult learning theory, allow students to actively participate in creating their own knowledge for immediate application (Bonnel & Smith, 2010). Both the constructivist and adult learning perspectives uphold that learning is social and contextual where each learner brings his/her own experience and prior knowledge to the process, but more research needs to be done in the areas of best practices and roles required by students to achieve optimal learning outcomes when using simulation (Jeffries, 2005). Student needs should be balanced with validated teaching methodologies and outcome assessments.

Limits of Theoretical Framework

The constructivist approach to learning is not without its limitations and it has been criticized as being inefficient and costly (Dick, 1992; Moore & Kearsley, 2005). It has also been argued that constructivism ignores that passive perception, memorization, and didactic lectures have demonstrated positive teaching effectiveness (Liu & Mathews, 2005) and should not be simply abandoned. In addition, Hardré and

Miller (2006) assert that motivation is not an assumable characteristic of adult learners; it is an individual and mutable trait. The amount, quality, and variety of interactions can also vary greatly between adult learners, as personal abilities and incentives impact the quality of interactions. Woods and Baker (2004) warn that high levels of learner-learner interaction can lead toward intellectually shallow dialogue and groupthink, indicating that a teacher or qualified peer facilitator is fundamental to ensuring that students engage in a deeper level of interaction. Questioning and reflective opposition should be fundamental; therefore, it is the role of the teacher/facilitator to ask for differing opinions and require a justification for individual conclusions.

While adult learning theory can be useful there is no unifying theory which describes the motivations and needs of every adult learner. Brookfield (1992) notes that for some theorists, the very idea of trying to develop a formal theory in “an area as complex and problematic is itself fruitless” (p. 92). Thus simulations are not seen as being a substitute for didactic or clinical methods of training, but another tool to support and facilitate student skill acquisition, comprehension, retention, and confidence.

Delphi Method

The term Delphi conjures up images of the Ancient Greek oracle renowned for her ability to foretell the future through the less then scientific method of inhaling sulfur fumes. Today the term Delphi is used to describe a “method for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses” (Delbecq, Van de Ven, & Gustafson, 1975). Predicting the future is difficult and inexact, and sometimes the best way to forecast an uncertain future is to use the experience of experts (Hall, 2009). By calling on their experience and knowledge a group of experts can work collaboratively to reflectively develop input and ideas at a level of accuracy and trustworthiness that could probably not be reached by an individual, no matter how learned or experienced.

Hanafin (2004) notes that as a research methodology the Delphi has taken a number of different paths and has been variously presented as a survey (Cohen, Harle, Woll, Despa & Munsell, 2004; Parker & Taylor, 1980), procedure (Meijer, Ihnenfeldt, Vermeulen, De Haan, & Van Limbeek, 2003; Rogers and Lopez, 2002), method (Crisp, Pelletier, Duffield, Adams, & Nagy, 1997; Linstone & Turoff, 1975; Weaver, 1971), and a technique (Broomfield & Humphries, 2001; Sharkey & Sharples, 2001; Snyder-Halpern, Thompson, & Schaffer, 2002). In this research, the definition of Delphi used is the one put forth by Lindstone and Turoff (1975): “a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem” (p. 3). The Delphi can be a qualitative or a quantitative study tool, but often it is conducted as a mixed-method analysis where the issues are identified with qualitative questions and then the results are quantified into actionable information (Hall, 2009). Analysis of the qualitative data requires a certain amount of inductive reasoning on the part of the researcher, as he/she interprets and derives meaning from the data. It is both an intellectual and conceptualizing process of transformation (Thorne, 2000). The Delphi method is an iterative process which requires a collaborative approach where all members work towards finding the best answers, even if they do not always agree on those answers.

The Delphi method was initially developed in the 1950s by the RAND Corporation as a method for forecasting future military events such as nuclear armament (Clayton, 1997; Dalkey & Helmer, 1963; Hall, 2009; Van Zolingen & Klassen, 2002), but over the years the Delphi has changed in application and scope as technology has helped streamline the data gathering process and more disciplines have adopted the method. There have been numerous modifications to the data collection process and the types of issues researched. Some of these will be explored in the next section.

Types of Delphi

Classical Delphi method

The classical Delphi is defined by four elements: anonymity, iteration, controlled feedback, and statistical group response (Dalkey, 1969a; Gracht, 2012; Landeta, 2005). Some researchers add a fifth element, stability in responses among those with expertise on a specific issue. These researchers argue that the strength of stability in responses between rounds is necessary to demonstrate consensus (Hanafin, 2004; Van Zolingen & Klaassen, 2003). In the classical Delphi the first round consists of open questions used to generate ideas around a specific problem or issue (Keeney et al., 2011). The panel participates by giving anonymous qualitative responses.

Anonymous and iterative group responses have been found to be slightly more accurate than face-to face groups (Dalkey, 1969b), and it is believed that the anonymity of the process helps guard from cooperation and coordination of the panelists (Rauch, 1979) thereby giving more reliable and original responses than would be gathered in a face-to-face meeting. Controlled feedback is handled through the communication of results during each subsequent round. Statistical group response “is a device to assure that the opinion of every member of the group is represented in the final response” (Dalkey, 1969b, p. 16). During rounds two and three the quantitative analysis of the group responses (usually given as the mean or median) is reported along with the panelist's individual response. This gives panelists whose responses lay outside the accepted mean an opportunity to give a reason for their score. Dalkey (1969b) noted that it is important that panelists receive not just the statistical feedback, but that the feedback includes the reasons supplied by any individual supporting their diverse answer. These counterarguments may not result in any changes to panelists' responses, but they may increase reflection.

Delphi studies are often done with slight modification in order to accommodate the needs of the situation (Murray & Hammons, 1995). These modifications include the electronic Delphi where email and/or electronic surveys are administered through sites such as SurveyMonkey® (Melnick et al., 2010). Technology has allowed for some variations, which do not inherently impact the design of the classical Delphi, but have impacted the method of communication and delivery of the questionnaires. These modified Delphi studies have become very popular and some are used for specific purposes.

Policy Delphi

The policy Delphi is not specifically concerned with building consensus or making decisions, but aims to use expert opinions to generate policy alternatives. In the classic Delphi a homogeneous group is often used, but the policy Delphi requires a heterogeneous response group in order to generate as many divergent ideas about the issues as possible (Brill, Bishop, & Walker, 2006; Van Zolingen & Klassen, 2003). Like the classic Delphi it also relies on iteration and controlled feedback; however, unlike the classic Delphi, it may actually seek to polarize group response and promote structured conflict in order to gather the greatest number of alternatives (Hanafin, 2004). Personal perspectives are crucial (Van Zolingen & Klaassen, 2003) as it is important to include controversial and minority opinions in order to stimulate exploration of all sides of an issue (Gracht, 2012). This structured approach often seeks conflict as the rounds are meant to gather information from a diverse group in order to define or clarify an issue.

In this type of Delphi the participants may be anonymous during early rounds, but then come together in a group setting to consider and discuss the alternative ideas (Van Zolingen & Klassen. 2002). Other times anonymity throughout the process is important as it makes it possible for members to safely propose extreme or unpopular views (Rauch, 1979). This Delphi method allows policy input to be gathered from individuals from within an organization or from a wide geographic area depending on the study's need and desired outcome.

Decision Delphi

The decision Delphi has been successfully applied to the social science arena and has become popular for researching issues concerning healthcare (Walker & Selfe, 1996). This process is similar to a traditional Delphi except the focus is not on building consensus but to prepare, assist, and make decisions (Rauch, 1979). The target panelists are principal decision makers as the purpose is to create a realistic roadmap in order to not simply predict the future, but to create the future. Through the iterative rounds feedback is used to brainstorm ideas and encourage panelists to delve deeper into their own statements by requiring supporting comments. Rauch (1979) notes that:

> For the practical application of such a decision Delphi it is not only important to include a large absolute number of participants (as in the case of the classical Delphi) or to touch all relevant areas (as in the case of the policy Delphi) but to include in the panel a high percentage of all the actual decision makers in the field under consideration. (p. 164)

The amount of influence the decision Delphi has is partially dependent on the field being discussed and the amount of interest decision makers have in the outcome. As the decision Delphi aims to influence and direct future decision those with the power and authority to make changes are not just the primary participants, but also the primary audience (Clayton, 1997). As such, some decision Delphi's use a quasi-anonymous approach, where the members of the panel are known to each other but the responses are anonymous (Van Zolingen & Klassen. 2002). This lends the study the authority needed to promote change while helping to assure open dialogue between the panelists.

Modified Delphi method

Modifications of the classical Delphi can take many forms. These include using interviews or focus groups for the first round (Cusick, McIntosh, & Santiago, 2004; Keeney et al., 2011) or conducting interviews after the rounds to clarify issues (Zunker, 2009). The classical Delphi uses three rounds, but some modified Delphi use only two rounds (Duffield, 1993) while others have used four in an effort to reach consensus on all items (Okoli & Pawlowski, 2004). While many Delphi studies are mixed method, others are strictly qualitative or quantitative in nature (Donohoe, Stellefson, & Tennant, 2012). Other modifications occur in cases where the framework is non-existent or unfamiliar; therefore, researchers chose to formulate the initial Delphi items themselves from an extensive literature review (Brill et al., 2003; Custer et al., 1999; Kreber, 2002; Steurer, 2011; Wicklein, 1993). Part of the strength of the Delphi is its flexibility as many of the aspects of the Delphi are capable of being modified to meet the specific needs of the study. There is no correct version of a Delphi study, only a best version for a particular Delphi study.

The traditional mail method is often abandoned in current Delphi studies as researchers choose to communicate solely through email or sometimes use a combination of email and follow-up calls to participants. Some recent studies have used online survey methods to collect questionnaire data (Brill et al., 2006; Cabaniss, 2001; Schmidt, 1995). Sometimes referred to as an electronic or an e-Delphi, these Delphi studies use Internet-based platforms, which can offer "unparalleled convenience, time and cost savings, and data management advantages" (Donohoe et al., 2012, p. 40). One of the primary reasons to utilize the Delphi method is that it is designed to use a panel of experts that are geographically dispersed; traditional mail methods could be slow, with no guarantee that the participant received the invite or the questionnaires. By utilizing email communication the time between soliciting participants and the rounds can be greatly shortened, which may increase the willingness and ability of panel members to participate.

Strengths of the Delphi Method

Unlike other methods for consensus building, such as the Nominal Group Technique (NGT), the Delphi method does not require face-to-face meetings. This means that the experts can be geographically dispersed and the ability to participate is not constrained by travel time and budgets. In committee meetings, strong personalities or ingrained hierarchies (Reid, 1988) can cause inhibitions or fear of reprisal leading to unequal participation or acquiescence to the status quo. These social and professional pressures are avoided by the anonymity of the Delphi method. In most professions, there is a hierarchy based on traits such as years in the profession, rank, professional degrees, or performance, and within that hierarchy those with higher status can manipulate or influence group decisions (Murphy et al., 1998), and in the healthcare field, concerns about status can lead people to devalue the important information of those with perceived lower status (Gordon, et al., 2012). Within the Delphi, all members are equal and are considered experts based on the criteria set out by the researcher. While the Delphi method often seeks consensus, group pressure to conform is avoided in that minority opinions are heard and weighed by the group (Clayton, 1997). Members of the panel can take their time to consider new ideas and weigh their own rankings based on the input of others without feeling embarrassed or pressured to change their minds and conform.

The flexibility of the Delphi method allows the researcher to contextually structure the data collection process and the design of the data collection tool. Each researcher decides what information is important, such as if the issues should be ranked, the level of consensus needed, how many rounds, and the number or experts needed. Donohoe et al. (2012) state that the Delphi method is both flexible and reflexive, allowing for a research design which can result in the collection of a rich and varied data set. “Flexibility and reflexivity also allows participants to scrupulously think through the problem between rounds so that the validity of the data and the outcomes are enhanced” (p. 40). By allowing both the panel members and the researcher time to think over and analyze the issues and items it is possible to receive deeper reflection than would occur under the constraints of a face-to-face meeting.

Weaknesses of the Delphi Method

The purpose of the Delphi method is to elicit expert opinion for a specific purpose. An opinion “is a belief that may or may not be backed up with evidence but which cannot be proved with any evidence that may exist” (Keeney et al., 2011, p. 9). The Delphi does not produce hard facts or unquestionable truths, but valid expert opinions and insight. “Neither the validity or the reliability of the Delphi method have been well evaluated” (Walker & Selfe, 1996) and there is debate as to the usefulness of the method. While there is extensive literature concerning the Delphi method, there are no set guidelines to follow and over 20 different variations are found in the literature. A quick search for Delphi will include terms such as real-time, online, modified, argument, technique, study, survey, and method (Keeney et al., 2011). This wide variety has led to confusion and a lack of conformity when it comes to the study design, analytical analysis, and reporting methods.

Committee meetings can happen in quick succession while it can be weeks between the Delphi rounds depending on the size of the panel, the number of items, and the amount of qualitative data gathered. Many of the weaknesses with the Delphi method can be avoided by paying strong attention to the planning, execution, and analysis of the process (Landeta, 2005; Walker & Selfe, 1996). The purpose and execution must be clearly stated and explained to the expert panel in order for the responses to reach a high level of validity. There are many aspects of the Delphi which remain unclear (Hasson & Keeney, 2011; Walker & Selfe, 1996), including proper sample size (Williams & Web, 1994), the degree of expertise required by the panel (Duffield, 1993; Sackman, 1975; Walker, 1994), and the method of analysis (Hanafin, 2004; Okoli & Pawlowski, 2004). In addition, there are no guidelines for acceptable response rates, but several researchers agree that a 70% return rate is acceptable (Keeney et al., 2011; Walker & Selfe, 2003), therefore the researcher should build in the possibility of less than 100% response rate into their decision of how many panel members to include.

There is no consensus as to the required size of the expert panel. Okoli and Pawlowski, (2004) recommended 10 to 18 members, Turoff (1970) recommended less than 15, and Murphy et al. (1998) argue that it “seems likely that below about six participants, reliability will decline quite rapidly, while above about 12, improvements in reliability will be subject to diminishing returns”(p. 37). Others have recommended groups as large as 50-100 (Rowe & Wright, 1999) or even greater (Bäck-Pettersson, Hermansson, Sernert, & Björkelund, 2008). The target panel size for this study is between 20 and 30 as there is no evidence from the research that larger groups increase the Delphi’s reliability or validity (Murphy et al., 1998) and groups larger than 30 are difficult to manage. Delbecq et al. (1975) argues that 30 is frequently used as an upper bound due to the fact that few new ideas have been demonstrated to be the result of groups larger than 30, whereas three or four people is probably too few, so between ten and twenty-five is a reasonable number of panelists. The group should be large enough to overcome the issue of attrition as some participants may drop out during the process due to time constraints or loss of interest (Sackman, 1975).

There is also no consensus concerning how the data is to be analyzed (Keeney et al., 2011). There is also some debate whether it is consensus or stability that is the goal of the Delphi (Dajani, Sincoff, & Talley, 1979; Gracht, 2012). Measures of central tendency tend to be analyzed in three ways: mode; median; and mean. Measures of dispersion are sometimes analyzed in conjunction with measures of central tendency. These measures are typically analyzed using range; standard deviation; interquartile range; and coefficient of variation. Several studies (Rogers & Lopez, 2002; West & Cannon, 1988) utilize both the mean and ±1.64 standard deviation as their consensus criterion, whereas Wicklein (2004) utilized mean, standard deviation, and interquartile range to analyze degree of consensus in order to rank the critical issues and problems identified. The Delphi process is often used to rank issues, at which point Kendall's *W* may be used to determine consensus as standard deviation does not apply to ordinal data. Several studies used Kendall's *W* in order to rank the importance of the issues (Brancheau & Wetherbe, 1987; Cougar, 1988), but it is not always necessary to rank responses in the Delphi.

Another area of contention is the threshold for consensus, which for most Delphi is related to the stopping criteria. In other words, the number of rounds is sometimes tied to a specific level of consensus on all or the majority of items. Boyce, Gowland, Russell, and Goldsmith (1993) set consensus at 66% while Keeney et al. (2011), and McKenna, Hasson, and Smith (2002) required a 70% consensus level for their research. Several studies set consensus even higher at 80% (Gabard et al., 2012; Raine, 2006). Determining the level of consensus needed is up to the individual researcher and partially dependent on the goal of the study. Whatever level is set by the researcher, much of the literature contends that this level should be determined prior to the start of the Delphi (Williams & Webb, 1994). This consensus can take two forms, the extent to which each panelist agrees with the issues (items) under consideration, and the extent to which panelists agree with each other (Jones & Hunter, 1995). The type of consensus being analyzed will impact the type of statistical analysis used.

The disadvantages of the Delphi method must be considered and addressed, but the disadvantages of the Delphi do not outweigh the fact that in many instances there is no other established method for gathering group opinions and building consensus across geographically distributed experts. In fact, it is in many cases that these same undefined characteristics make the Delphi method a flexible tool for a variety of purposes (Linstone & Turoff, 1975). The use of the Delphi method must be carefully considered by the researcher and decisions concerning the panel size, response rates, methods of analysis, consensus level, and stability should be made before panelists receive the first questionnaire.

Prior Studies

In the field of education, the Delphi has been used to identify competencies (Rogers & Lopez, 2002; West & Cannon, 1988), qualifications (Moercke & Eika, 2002; Van Zolingen & Klassen, 2002), critical issues and problems (Schibler, 2008; Wicklein, 1993), the role of technology (O'Neill, Scott, &, Conboy, 2011; Pollard & Pollard, 2004), define terminology (Kreber, 2002), and improve curriculum (Bell, Daly, & Chang, 2008; Blair & Uhl, 1993). According to Landeta (2005) the use of the Delphi method in educational research has increased over the last two decades and based on the number of research articles and dissertations being produced, it is expected that it will continue to be popular. Weaver (1971) alleged that:

> Although Delphi was originally intended as a forecasting tool, its more promising educational application seems to be in the following areas: a) a method for studying the process of thinking about the future, (b) a pedagogical tool or teaching tool which forces people to think about the future in a more complex way than they ordinarily would, and (c) a planning tool which may aid in probing priorities held by members and constituencies of an organization. (p. 270)

Educational Delphi studies have used classical, policy, decision, and modified versions.

Stillwell's 1999 dissertation research investigated critical issues facing higher education. This Delphi study was used to help determine future goal planning for university presidents. Using a modified three-round Delphi, Stillwell collected information from executive leaders of the International Association of University Presidents (IAUP) to develop 46 categories of issues focused primarily on society and students. Forty-two executive officers were approached for the study but only 18 completed the third round. Issues reaching consensus included global and local issues such as the need for increased access, funding, technology, and research.

Delphi studies are also popular in the field of medical research and healthcare education (Holey, Feeley, Dixon, & Whittaker, 2007). A Delphi study on the knowledge and skills required of allied healthcare graduates identified critical thinking and reasoning skills as highly important (Elder & Nick, 1997). Other studies in the field of healthcare have included the setting of research priorities (Annells, DeRoche, Koch, Lewin, & Lucke, 2005; Bäck-Pettersson et al., 2008; Bell et al., 2008; Bond & Bond, 1982; Daniels & Ascough, 1999; Lindeman, 1975; Misener, Watkins, & Ossege, 1994) and education priorities (Broomfield & Humphris, 2001; Cusick et al., 2004; Keyes, Wilson, & Becker, 1975; Moercke, & Eika, 2002). The researcher was unable to find a Delphi study specifically related to the future use of simulations in healthcare education at any level (nursing, surgical, or allied health).

Thompson, Repko, and Staggers (2003) used a Delphi study to help develop nursing competencies for peacetime and deployment preparation settings for Air Force Medical Surgical Nurses (46N3). Using a web-based questionnaire, 109 nurses participated in three rounds to achieve consensus on 83% of the items concerning the importance statements and 67% of the items concerning the practice statements. From this study the researchers were able to determine valid competencies to be considered for further development or research.

Burnett, Kumar, and Grimmer (2005) attempted to address the lack of research concerning evidence based practice in allied health professions through a Delphi survey seeking “expert opinion on the essential criteria for clinical appraisal, and whether a generic critical appraisal tool could be constructed for allied health use” (p. 1). Fifteen allied health professionals throughout Australia participated either through an electronic questionnaire or by phone interviews. Themes and criteria were identified, but there was no consensus concerning the feasibility of a generic critical appraisal tool.

The Delphi method is a flexible approach to research that can be used when it is important to use structured communication with a group of experts. This gathering of collective human intelligence (Linstone & Turoff, 1975) can assist researchers in finding answers or solutions which otherwise may be too complex to fully explore. The Delphi method has been utilized by numerous studies in order to research issues in both the education and healthcare fields, but it is important to keep in mind the limitations and weaknesses of the method in order to design a study with usable outcomes.

Summary

It is clear from the literature that there are still many questions when it comes to simulations in allied healthcare education and how best to assess and analyze their current and future use. The articles concerning both simulation and the Delphi method note the pitfalls related to the lack of rigorous design and research methodology. By conducting a thorough literature review this study seeks to avoid many of the problems noted in the current research and add to the body of knowledge concerning the technical and instructional feasibility of successfully addressing the issues facing the future use of simulations in allied healthcare education.

CHAPTER 3
METHODS AND PROCEDURES

This modified Delphi study explores the future of simulations in allied health education and training by consolidating expert opinions concerning the feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology. It seeks to find consensus concerning which items are feasible to pursue as solutions. Chapter 3 contains information concerning the methods and procedures used by the researcher in the course of this study. The methods presented in Chapter 3 were used to answer the following research questions:

1. In the opinion of a panel of experts, what technical issues will impact the future use of simulators/simulation in allied healthcare education?
2. In the opinion of a panel of experts, what instructional issues will impact the future use of simulators/simulation in allied healthcare education?
3. What is the technical feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?
4. What is the instructional feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?

This project utilized the modified Delphi method (Steurer, 2011) to work towards consensus concerning a list of items developed from a comprehensive literature review (Brill et al., 2003; Steurer, 2011; Wicklein, 1993). This literature review included scholarly articles covering topics such as the current use of healthcare simulations in education, specific examples of the use of simulation in allied healthcare, and the possible future of simulation in healthcare education. Each item was then rated by a panel of experts on its technical and instructional feasibility because, for most issues, both are necessary if the item is to be strategically pursued. The feasibility rating scale was based on one developed by Ziglio (1996), and a combination of qualitative and quantitative methods were used to analyze the expert input and the level of consensus on each item. The research protocol was submitted and approved by the Institution Review Board at the University of Florida (protocol #2013-U-0575).

The Modified Delphi Method

The Delphi method was developed in the 1950s by the RAND Corporation to research national security issues (Gracht, 2012; Zolingen & Klassen, 2003). It is a systematic procedure for soliciting and collating opinions from experts on a particular topic of study through the use of carefully designed rounds of questionnaires and structured feedback. Originally developed to “establish a chronology of scientific and technological events and to judge when the events might occur through the speculations of several experts” (Weaver, 1971, p. 267), it has more recently been used to help solve complex problems such as institutional planning (Uhl, 1983). The entire process is typically completed anonymously, and in this modified Delphi study done via email. Although each expert interacts with the researcher, all expert interactions are done through the questionnaire (Zolingen & Klaasen, 2003); thereby obtaining diverse expert opinion without the social pressure that can occur within a focus group. “The questions that a Delphi study investigates are those of high uncertainty and speculation” (Okoli & Pawlowscommunki, 2004, p. 19) and require thoughtful exploration through several iterations. The flexibility of the Delphi allows the method to be used in a variety of ways to answer many different types of research questions, but this flexibility also makes it confusing to develop a methodology best suited for each situation.

The first round of this study consisted of a questionnaire (Appendix F) built from carefully selected items concerning the use of simulations in allied healthcare education drawn from an extensive literature review. This grounded the project in the literature and gave the panel the opportunity to focus on existing items in the first round. The questionnaire was then subjected to a three round Delphi. The articles chosen for the literature review focused on several aspects of simulation in education and training. There is little research concerning the future of simulation in healthcare education or on the current use of simulation in allied healthcare education; therefore, it was necessary to research articles which discussed current simulation issues, theories, and practices among all levels of healthcare related education. Original search terms included allied healthcare education; future of medical simulation; community college healthcare education; simulation research; critiques of simulation in medical education; and validation of healthcare simulations. Subsequent searches were for specific studies referenced in the literature or for studies concerning specific issues noted in the literature. Searching for relevant information was completed remotely through the University of Florida's *George A. Smathers Library* by searching through five main databases, *Google Scholar, PubMed*, *MedlinePlus*, *Academic Search Premier (EBSCOHost)*, and *Science Direct (Elsevier)*. Data mining techniques were also employed by reviewing and utilizing the reference sections of crucial articles. Each article was reviewed for relevance and verified in *Ulrich's International Periodicals Directory* for academic/scholarly classification.

During round one, members of the expert panel rated the existing items and were also given the ability to add new items. The researcher then quantitatively analyzed the ratings and qualitatively assessed, clarified, and coded panelists' comments. There was one new item added to the questionnaire. During the second round individuals received the modified questionnaire with group ratings for existing items as well as new item (NTF and NIF) developed from experts' input. In the second and third rounds the questionnaire included individualized feedback, which compared individual expert ratings on each of the initial items with the panel scores (West & Cannon, 1988). Those whose ratings fell outside the established range of consensus were asked to reconsider their rating or give written justification for their scoring of the item outside the range of consensus. They were also asked to rate the new item added from round one. All three rounds were concerned with analyzing the level of consensus between the items (Fleuren et al., 2004).

Rationale for Using the Delphi Method

The purpose of using the Delphi method is to move towards group consensus through an iterative process of informed decision-making (Duffield, 1993). The future utilization of simulation in allied healthcare education is an issue of importance in the field, but currently lacks a rigorous research foundation upon which to make strategic decisions. Introducing a new idea, practice, or object to healthcare is widely considered a complex process (Fleuren et al., 2004), and there is a consistent gap between evidence and practice (Grol & Grimshaw, 2003) partially because there is often insufficient or contradictory information (Jones & Hunter, 1995). To make things more challenging, the decision-making process for academic institutions can be frustrating and hindered by divergences in opinion, strong allegiances, and varying vested interests (Uhl, 1983). Through the proper utilization of the Delphi method experts can collaboratively work to develop a way forward.

The Delphi method used for this study was based on the guidelines from Linstone and Turoff (1975). This research fits five of their seven criteria for choosing the Delphi method:

1. The problem does not lend itself to any precise analytical technique
2. Those contributing to the examination of the complex problem represent diverse backgrounds with respect to experience or expertise
3. It is not effective to interact face-to-face due to the number of experts involved
4. The time and cost involved to conduct face-to-face meetings is prohibitive
5. The heterogeneity of the expert panel is needed to assure validity of the results (each individual needs to give honest input without feeling pressured by the group)

Linstone and Turoff (1975) note that only one of these criteria needs to be present to make the Delphi an appropriate choice for the research method.

This project also utilized the modified Delphi method proposed by Custer, Scarcella, and Steward (1999) in that it began with a set of carefully selected items drawn from an extensive literature review concerning issues affecting the future of simulation in allied healthcare education. The items were then subjected to a three-round Delphi to ascertain expert agreement concerning the items and the technical and instructional feasibility of addressing these issues. The Delphi method was applied in order to facilitate an anonymous exchange of ideas and opinions among a panel of experts concerning the items derived from the literature (Fleuren et al., 2004). By utilizing the Delphi method, experts from a variety of geographic locations with varied backgrounds and professions could help explore an area of significance in the allied healthcare field that has lacked rigorous research.

Selection of the Expert Panel

According to Adler and Ziglio (1996) the panel members should meet four requirements: 1) knowledge and experience with the issues under investigation; 2) capacity and willingness to participate; 3) sufficient time to participate in the Delphi; and, 4) effective communication skills. The fact that experts willing to participate are often those that are most interested or even affected by the outcomes is a source of subject bias that should be acknowledged (Hasson, Keeney, & McKenna, 2000; Powell, 2003). For this study, the term expert is defined as someone who has run, designed, or developed a simulation lab for allied healthcare program(s) or has a minimum of three years' experience in any of the following roles within allied healthcare programs: operating simulations; assessing simulation-based competencies; using simulation as a teaching or assessment tool; developing new curriculum for the integration of simulation; or having published peer-reviewed research concerning simulations at the allied healthcare level (Holden & Wedman, 1993; Pollard & Pollard, 2004). While most researchers agree that the reliability of the Delphi lies heavily on the proper selection of experts (Duffield, 1993), Sumison (1998) argues that in reality what is important is to "recruit individuals who have knowledge of the topic and are willing to dedicate the time to this method of discussion" (p. 154). Recruiting the best minds in the field is only effective if they are willing to fully engage in all rounds of the process. Therefore, the definition of an expert is contextual to the research being done and it is the researcher's responsibility to defend their choice of experts.

The number of experts is also left up to the researcher as the numbers noted in the literature range anywhere from 12 to 1600 (Williams & Webb, 1994a). The number of experts is contingent on several factors including the topic being researched, the time and resources available to the researcher(s), and the breadth of expertise required (Grundy & Ghazi, 2009; Sumison, 1998). Whether the sample can be considered representative for statistical purposes is more a question of the quality of the expert panel than the number of experts on the panel (Powell, 2003). Based on the literature, it was determined that this research would be limited to a panel of no more than 30 experts.

The expert panel for this research effort consisted of individuals who were purposively sampled because they are uniquely qualified to know about the problem or issues being researched due to their immediate knowledge or experiences (Hall, 2009; Martino, 1972). The Delphi relies on a collective wisdom (Surowiecki, 2004), asserting that different voices are essential to the discussion. Certain demographic information concerning the background and area of expertise of the participants is included in the results section so potential users of the study can themselves determine the validity and relevance of the findings (Hall, 2009). Information concerning school demographics is also included. Some Delphi studies use randomized samples when various types of expertise are sought (Clayton, 1997), but this was not deemed to be appropriate for this research; however, some snowball sampling did occur as those experts initially contacted by the researcher were given the opportunity to nominate other panel members.

The panel of experts was selected through the use of four methods: sending email invitations to participate to allied healthcare programs with known simulation centers or labs across the United States; through postings on national list servers and message boards for relevant organizations such as the Society for Simulation in Healthcare (SSH) and the Center for Medical Simulation; utilizing the professional connections of METC faculty and staff; and soliciting authors published in the field. Many times experts in academic related Delphi studies are chosen based on the literature review (Okoli & Pawlowski, 2004), but due to the lack of literature concerning simulation use in allied healthcare education it was not possible to find enough experts just from the literature review. It was vitally important to find a panel that would be motivated to complete the three rounds of the Delphi by inviting members who were interested and engaged in the topic and the research findings. All individuals who participated and qualified in the demographic survey were asked to participate as it was expected that there would be some attrition and it was hoped to have over 20 panelists complete all three rounds.

The Delphi panel is a heterogeneous group as it is comprised of members who are experts on a particular topic but come from different social/professional stratifications, e.g., clinicians, teaching faculty, scholars, and administrators (Clayton, 1997). These "heterogeneous groups can greatly increase the complexity and difficulty of collecting data, reaching consensus, conducting analysis, and verifying results" (Skulmoski, 2007, p. 10), but it was deemed important to have a heterogeneous group as they all play essential roles in allied healthcare education. The initial group consisted of 23 members, a number which gave enough data to analyze without being so large that data gathering and analysis is excessively time consuming and consensus is difficult to reach (Murphy et al., 1998; Okoli & Pawlowski, 2004). This is a slightly larger group than Clayton's (1997) suggested number of 5-10 panel members for a heterogeneous population, but it was decided that a larger group would give more diverse input.

Purposive and snowball sampling was done to gather the panel of experts. Introductory letters were emailed to nearly 40 potential panel members throughout the United States as there was no guarantee as to how many potential panelists would meet the criteria and be willing to participate (Appendix A) (Schmidt, 1995). Due to the fact that the spring semester had ended, many of these introductory letters received an out of office response. Several others replied that they would not be able to participate but one forwarded the information to a colleague and two gave suggestions on other individuals to contact. A message requesting help with dissertation research was also posted on the Society for Simulation in Healthcare (SSH) listserv and several simulation and allied healthcare related groups on LinkedIn®. Those potential participants showing interest were sent the introductory letter and were asked to complete the demographics survey. Several contacted the researcher for more information. Participant fatigue is a challenge in Delphi studies, and it is important that the researcher kept the panelists interested and engaged throughout the process in order to ensure a 70% response rate across all rounds (Sumison, 1998). Therefore all responses were replied to and participants were kept up to date on any changes in the timeline.

The initial contact letter to the potential panelists, found in Appendix A, gave certain details about the study including the criteria for the expert panel, procedures, an estimate of the time expected to complete each round, and the purpose of the study (Hasson et al., 2000). The letter of inquiry asking for Delphi participation was sent to allied healthcare programs with simulation labs or simulation centers and it was requested that the individual participating in the Delphi study be someone who has designed, developed, or supported a medical simulation lab for an allied healthcare program(s) or worked for a minimum of three years in any of the following roles: operating healthcare simulations, assessing simulation-based competencies, using simulation as a teaching or assessment tool, developing new curriculum for the integration of simulation, or having published peer-reviewed research concerning simulations for teaching and training at the allied healthcare level (Holden & Wedman, 1993, Pollard & Pollard, 2004). Contained in the initial solicitation was a link to a SurveyMonkey® site which took the potential participant to a demographics questionnaire (Appendix D).

The informed consent information (Appendix C) was contained at the front of the demographic questionnaire, thereby the participants gave consent to participate by completing the survey. This questionnaire was used to determine basic demographic and background information including gender, age, education, current position and use of medical simulation, years of experience with simulations, amount and type of training with simulations, and the reason for their interest in the study (Keeney, Hasson, & McKenna, 2011). While gender and age information was gathered in the initial qualification survey for descriptive reasons, these were not used to determine qualification for participation. Panel members were also asked to include their preferred method of contact, either mail or email. Any individual not meeting the minimum standards received notice (Appendix B) that they would not be included in the Delphi panel and were thanked for their time.

There were 26 individuals who responded to the demographic survey. One individual did not complete the survey and did not leave valid contact information, and therefore was not eligible for the study. Two others did not meet the minimum requirements concerning years of experience. These individuals were thanked for their time and interest, leaving the total number of participants for round one at 23. Nearly

45% of the participants were 40-49 years of age with 24% being 60 or older, 16% being 30-39, and 16% being 50-59. They were split almost evenly by gender with 48% being male and 52% being female. Over 60% of the participants had graduate degrees and the majority had between six and ten years of experience supporting, using, researching, and/or evaluating simulator technologies and or simulation modalities in allied healthcare education. There was a big gap in time spent using or working with simulator/simulation with nearly 46% answering one to ten hours and just over 29% answering 21 or more hours. Most (84%) responded that they had received simulation-specific training. The majority of respondents were from the United States with one from Australia and two from the United Kingdom. A more complete breakdown of the demographics survey results can be found in Appendix E.

Instrument Development for Round One

There currently is a lack of a clear strategy when it comes to planning for the future of simulation in allied healthcare education. It is also apparent from the literature that no consensus exists regarding the most important issues facing the use of simulation in allied healthcare education and training. The initial questionnaire was developed by the researcher after an extensive literature review in order to ground the project in the research and give it greater focus (Brill et al., 2006; Tough, 2009). Over 85 different articles were reviewed from across medical fields including allied healthcare, nursing, surgical, and anesthesiology. Most articles were concerned with the use of simulation in education in general, but a few dealt specifically with continuing education and the retention of skills. Fewer than a dozen dealt solely or in part with the use of simulation in allied healthcare education. There were 84 items developed for the initial questionnaire with each to be rated on instructional and technical feasibility, making 168 separate items to score.

Validation of Questionnaire

The act of developing a clear and unambiguous questionnaire is difficult and time consuming, requiring the author to think of multiple ways in which the items can be (mis)interpreted and answered. Designing a clear and unambiguous questionnaire can assist in the collection of data by increasing survey response and helping ensure the data collected is the data wanted (Drennan, 2003). One method utilized by researchers to validate a questionnaire is cognitive interviews. There are two types of cognitive interviews used by researchers to provide feedback on research instruments in order to identify and correct issues before the instrument is delivered to the target audience. These two methods, think-aloud and verbal probing, assist the researcher in using cognitive theory to understand how respondents may perceive and interpret questions (Drennan, 2003). Beatty and Willis (2007) define cognitive interviewing as the "administration of draft survey questions while collecting additional verbal information about the survey responses, which is used to evaluate the quality of the response or to help determine whether the question is generating the information that its author intends" (p. 287). For this current research it was determined the think-aloud protocol would provide the necessary feedback to improve the researcher-developed questionnaire and was chosen partially due to the length of the survey (Dietrich & Ehrlenspiel, 2010). These think-aloud sessions are a type of cognitive interview which allows the researcher to determine if the participant's reply and thought process answers the question as intended.

Think-aloud sessions are standardized, where each participant completes an identical task of verbalizing out loud while answering the questionnaire (Beatty & Willis, 2007; Priede & Farrall, 2010). The researcher is mainly a passive observer. In contrast, verbal probing relies on the interviewer taking on a more active role, guiding the participant through the questionnaire while asking specific questions concerning the cognitive process (Willis, Royston, & Bercini, 1991). Some encouragement or requests for clarification by the researcher are acceptable during a think-aloud, but the researcher does not take as active a role as in the verbal probing cognitive interviewing technique.

During cognitive interviewing, it is possible that the very act of knowing they are being listened to and analyzed may change the amount of time and attention a participant gives to answering a question (Willis, 2005) which may change the way a participant responds. This may lead to some impact on the usefulness of the think-aloud method and it is up to the interviewer to decide how to interpret the responses. The responses may not always be useful as they may show that problems exist, without providing any insight as to what the problems are or how they may be fixed (Beatty & Willis, 2007; Priede & Farrall, 2010). The difficulty for the interviewer is knowing how and when to seek more information. According to Drennan (2003) issues that are discovered often deal with lexical misunderstandings (e.g., what is often?), scope (e.g., is there any overlap between allied healthcare education and nursing education), temporal problems (e.g., fiscal vs. calendar year), and logic problems (e.g., too many conjunctions/issues in a single item). During the think-aloud the respondents are encouraged to talk through their thought processes as they read and answer the items.

"After the interview, the researcher uses the transcript to examine the respondent's understanding of the question and the information that they drew upon when answering. The researcher can then redesign the questionnaire to remove as many potential sources of problems as possible" (Priede & Farrall, 2010, p. 272). The questionnaire is then reworked by "rewording, deleting, replacing, or simply changing the order of some items" (Dietrich & Ehrlenspiel, 2010, p. 54) in order to address issues that were expressed during the think-aloud session.

In order to validate and help ensure the questionnaire used in this study was clear and concise, a think-aloud session was conducted with three of the researcher's coworkers with differing backgrounds in education and medical simulation during off duty hours. Some participants found the process difficult as they were asked to verbalize their thoughts as they filled out the questionnaire, and there were times it was necessary to remind participants to speak out-loud. Sessions were conducted with the participants and notes were recorded. By listening to the participants as they worked through the questionnaire the researcher pinpointed some of these areas of confusion and reworked the items for greater clarity.

Questionnaire Distribution

This Delphi study used email to communicate with panel members and an online survey application (SurveyMonkey®) to collect data for the demographic survey. Due to the complexity of individualizing surveys during rounds two and three it was decided not to use SurveyMonkey® to distribute the questionnaires, but to use email to distribute the instructions and Adobe form questionnaires to the chosen panel for all three rounds. During rounds two and three each panelist received not just the group feedback and quantified group responses, but their own previous response to each item thus making each survey instrument unique. An Adobe form was developed and attached to an individualized email whose body included the instructions for each round, thereby allowing easy export into Microsoft Excel for analysis (Appendixes F-H). Because the research from which to draw upon was sparse, participants were requested to add other items during round one as they deemed appropriate. No cut off was given for number of items (Schmidt, 1997). Only two new items were requested, and after being coded it was determined only one matched the intent of the study and was included for round two. During round two participants were given the opportunity to verify or challenge the new item (Schmidt, 1997). The additional item only went through two rounds of the Delphi study but this was sufficient to reach a high level of consensus (Uhl, 1983).

Data Collection

A three round Delphi was used to collect qualitative and quantitative data from a panel of predetermined experts. An explanation of the purpose of the study as well as instructions and a timeline accompanied each round. The final results were disseminated to the panel members who completed all three rounds. In order to protect anonymity, all participants were given a random participant identification number. This number was used to track individual responses as well as any justifications for outlier responses.

The Delphi is an iterative process, requiring several phases to be completed before the data collection takes place. Sumison (1998) lists seven distinct steps found in most Delphi studies:

1. Identification of the primary aim
2. Contacting possible panel participants
3. Round one
4. Tabulating and quantifying round one results
5. Round two (includes tabulation)

6. Round three (includes tabulation)
7. Publication

Table 3-1 uses these steps to form the initial data collection timeline for this research.

Table 3-1. Data collection and analysis timeline

Task	Duration
Identification of the primary aim, create initial questionnaire items and Internet-based survey	7 days
Contact possible panel participants and send out demographic survey. Review criteria and respond to potential panelists	7 days
Round one, panelists respond to first round	10 days
Tabulating and quantifying round one results	17 days
Round two (includes tabulation)	14 days
Round three (includes tabulation)	14 days
Final analysis and recording of findings	21 days

Round 1. Round one consisted of emailing the panelists a fillable Adobe form containing the list of initial items developed by the researcher based on the literature review and presented by theme (e.g., research, curriculum, faculty and staff issues). The experts then reviewed the list and rated the items on a 5-point Likert scale (1= not at all feasible, 2= probably unfeasible, 3= feasible, 4= very feasible, 5= extremely feasible) for both their instructional and technical feasibility. It was decided to include a not applicable (NA) response because the items were taken from broad a range of literature and not all items may be relevant to all allied healthcare fields. The purpose was to identify issues, but also to find consensus on those items that are feasible to pursue.

Each theme included a space where panelists could add items (Rogers & Lopez, 2002) or modify existing ones (West & Cannon, 1988). The researcher reviewed the input and coded them as new item, edit to existing item, or general comments. Only one panelist suggested new items during round one, resulting in one new issue being added for round two. Several panelists had comments concerning the existing items which resulted in those items being edited for clarity. These were noted as edited for round two in the item number column and displayed strikeouts for deleted words and bold for additional words. These documents, which were unique for each panelist as they included not the only group data, but individual responses to round one, were then made into fillable Adobe forms for round two.

The day before the first questionnaire was due back to the researcher only 11 responses had been received. A reminder letter was sent in hopes of increasing the response rate. Several responded that they needed more time and the timeline was extended. This resulted in 19 panelists (83%) responding to round one.

Panelist ratings were analyzed for means, standard deviation, and range of consensus using IQR by importing the form information into Microsoft Excel. Consensus had been set at an IQR score of less than 1.2 (Alexander, 2008), where a high IQR score indicated a wide variance of opinion. Those items which were within the range of consensus were marked as such with an asterisk (*) on the round two questionnaire. This process was repeated for the next two rounds as the panel worked towards building a consensus (Custer et al., 1999). There were a number of items where some respondents answered NA. The percentage of NA responses as well as any given reasons for giving the NA response was also on the round two questionnaire.

Round 2. The panelists who responded to round one were sent their personalized and updated questionnaire for round two. There were 17 returned questionnaires for round two (74% response rate). During this round the experts were provided with both their individual ranking and the analysis of the group rankings

(Appendix G). During rounds two and three, the panelists had three options: 1) maintain their previous position regardless if it fell within the acceptable range; 2) attempt to sway others by voting strongly against the group rating; or 3) change their position based on group ratings (Walker & Selfe, 1996). This allowed the panelists an opportunity to think deeper about their response based on group responses and feedback.

All items were included for the round regardless if consensus had been reached, helping to control bias in the results (Grundy & Ghazi, 2009). While some Delphi studies remove items which reach consensus, it was decided to keep all items as "dropout may occur if minority opinions are not explored and therefore the resultant consensus may not be representative of all the experts" (Greatorex & Dexter, 2000, p. 1022). The Delphi is designed to elicit and explore minority opinions; therefore, all items were considered for all three rounds. Panelists were asked to rate the new item developed from the expert feedback in round one as well as reconsider their ranking of the round one items based on the analyzed results. All comments from round one were included but some were edited for clarity. Panelists were asked to give written justification for any rankings outside the range of consensus. Rankings for round two were done on the same 5-point Likert scale (1= not at all feasible to 5= extremely feasible) and included the NA option. All items were analyzed for means, standard deviation, and IQR. Round two was not expected to reach consensus on all items (Hsu & Sandford, 2007), but those within the range were marked as such with an asterisk on the third round questionnaire. Only the responses from round two were included in the analysis.

Round 3. Round three was sent to the 17 panel members who responded to round two and 16 returned the questionnaire (70% response rate). It was constructed of all items developed from the extensive literature review, the panelists' individual responses from round two, the analyzed group responses for each item, and summaries of justifications for rankings outside the range of consensus as well as any NA responses. Panel members were again asked to re-rate their outlier responses in light of the overall group response (Keeney, Hasson, & McKenna, 2011) or justify their continued rating outside the norm. Round three responses were then analyzed for means, standard deviation, and range of consensus. It was not necessary that panel members reached full consensus on all items (Keeney et al., 2011; Hsu & Sandford, 2007; Steurer, 2011) as these demonstrate areas in need of further review and research.

Data Analysis

During round one qualitative data was gathered in the form of new items and feedback on existing items. New items had to be analyzed and considered for inclusion in the next round. Memos were added to each new item in order to find themes. By asking if the coded themes were relevant to the research study, the researcher came up with one new item which was included in round two. There were 14 comments concerning the existing items. These were coded to see if there was confusion on an existing item which required editing the item for clarification or if the feedback on the item dealt with why the panelists chose to score the item in a particular way. Ten comments were included and five items were edited for round two. It should be noted, the lack of independent raters during this step may have allowed for researcher bias to influence the second questionnaire (Jenkins & Smith, 1994).

Descriptive statistics were used to analyze the data collected through the Likert scale. The initial questionnaire was presented as a five-point Likert scale (1= not at all feasible to 5= extremely feasible) broken down by topic area but given in no particular order. During the rounds, items were analyzed for means (as a measure of central tendency), standard deviation (a measure of spread) (Greatorex & Dexter, 2000; Wicklein, 1993), and IQR (range of consensus) (Wicklein, 1993). Consensus was realized when an IQR score of less than 1.2 was achieved (Alexander, 2008). All items were analyzed for each round with the group results and individual responses presented to each panelist for rounds two and three.

Reporting the Data

As a method, the Delphi has questionable reliability and validity that can be partially addressed through rigorous design and honest reporting of the data. Whittemore, Chase, and Mandle (2001) note that all methods have limitations, biases, and threats to validity; therefore trying to create a perfect investigation is futile. The important thing is to determine what validity ideals are important to a particular study, to employ the best technique, and to honestly and critically present the entire process in detail. The reader can then decide, based on all relevant data, including the qualitative code, if the research is valid for their particular need. Hence, the validity and applicability of the results are partially contextual, for the reader must answer for themselves if the results are authentic and credible for the context of the research (Whittemore et al., 2001). Audit trails help to substantiate the rigor and trustworthiness of the research (Glass, 1997; Koch, 2006; Wolf, 2003), therefore all qualitative data is reported.

There is no standard method for reporting the findings of a Delphi study, but it is recommended that the findings of each round are reported (Hasson et al., 2000; Thorne, 2000). It is important to be honest about researcher bias and note if any decisions are based out of the literature or personal experience (Koch, 2006). “In order to tell good numbers from bad numbers, we need to understand not only what was learned, but also how the researchers collected their data. We need to see the instrument and key data” (Skulmoski et al., 2005, p. 12). All relevant information concerning this study is available in the Appendices. For reliability’s sake it is desirable for this study to be replicated with the same approach but with a different pool of experts (Dalkey, 1969). Those interested in the results of this Delphi study might have greater confidence in the results should a second group of experts produce similar results.

The purpose of this study was to explore and identify technical and instructional issues impacting the future of simulation in allied healthcare education and training. The modified Delphi method was utilized in order to facilitate the open distribution of ideas and input from a heterogeneous group that was geographically dispersed. Qualitative and quantitative methods were used to analyze expert input and level of consensus. Chapter 4 includes the results of this modified Delphi study following a logical progression of each Delphi round.

CHAPTER 4
RESULTS

Chapter 4 reports the results of the data obtained through the three rounds of this modified Delphi study. This section describes the results of the study as they relate to the questions:

1. In the opinion of a panel of experts, what technical issues will impact the future use of simulators/simulation in allied healthcare education?
2. In the opinion of a panel of experts, what instructional issues will impact the future use of simulators/simulation in allied healthcare education?
3. What is the technical feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?
4. What is the instructional feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?

It was the intent of this research to provide valid data to assist in the development of actionable guidelines and recommendations that can help decision makers in their strategic planning initiatives. Both qualitative and quantitative data was collected and analyzed during each round. Items were rated on a scale of one to five for their instructional feasibility and technical feasibility: 1=not at all feasible, 2=probably unfeasible, 3=feasible, 4=very feasible, 5=extremely feasible. For this study, feasibility is the likelihood of an item being accomplished or being dealt with successfully. Quantitative analysis was conducted on the items based on means (as a measure of central tendency), standard deviation (a measure of spread), and the interquartile range (IQR) to demonstrate the range of consensus within the panel (Wicklein, 1993). For the purpose of statistical analysis, item means and standard deviations were figured to the 100th decimal place, but when discussing where an item fit in the feasibility scale the mean was rounded to the nearest whole number. For instance, an item with a mean of

3.26 was rounded to 3 and is reported as feasible, while a 3.68 was rounded to a 4 and reported as being ranked as very feasible.

When analyzing the data it was important to decide what the numbers represented for the future practice of simulation in allied healthcare education and training. “When reporting statistical tests the reader must be informed of how to interpret the results and how to digest the findings in relation to the emphasis being placed upon them” (Hasson et al., 2000, p. 1013). In other words, what does it actually mean when an item has a mean ranking of 3=feasible, versus an item having a ranking of 4=very feasible. For example:

- Technical feasibility=1 is interpreted as cannot be implemented as the cost is prohibitive or the technology does not exist
- Instructional feasibility=2 is interpreted as cannot be implemented under current conditions or there is significant opposition to its implementation
- Technical feasibility=3 is interpreted as possible to implement but some challenges must first be addressed
- Instructional feasibility=4 is interpreted as there are some concerns about its implementation which can be easily addressed or has minor obstacles
- Technical feasibility=5 is interpreted as having no barriers to implementation, development, resources, and training are available and adequate

Those items with a feasibility score of a 1 or 2 are considered unfeasible at this time and should not be pursued until the technology, research, and/or methodology is more complete. The full rating scale can be seen in Appendix F.

There were 23 Individuals who completed the demographic survey and met the basic requirements for the expert panel. Each panelist was given a random number in order to ensure anonymity. This number was used on all correspondence including the questionnaires. Once the expert panel had been chosen, the panel members were sent the first round questionnaire, found in Appendix E, and were asked to:

1. Review all the issues listed in the questionnaire
2. Make any comments or suggestions, give feedback, or request clarification on any item in the spaces provided. If commenting on a current item, they were asked to note the item number before the comment
3. Add new items as deemed appropriate
4. Rate the technical (TF) and instructional feasibility (IF) of each item based on the included feasibility scale

The first round consisted of 84 statements each to be ranked on their technical and instructional feasibility based on a scale of 1-5: 1= not at all feasible, 2= probably unfeasible, 3= feasible, 4= very feasible, 5= extremely feasible. They also had the option of choosing NA. The items were given in no particular order but were grouped by theme (e.g., research, curriculum, faculty and staff issues). There was some loss of participants through the rounds, thereby introducing some level of inconsistency; however, 16 of the original 23 participants (70%) completed all three rounds.

Delphi Survey Round 1

This section presents the results from the first round of the Delphi study. Each item on the survey had two Likert scales, one for technical feasibility and one for instructional feasibility. An example of some issues at each level was sent with the instructions. A comment box was placed at the end of each section for feedback on existing items or for panelists to add new items. As the items had been predetermined from an extensive literature review and not by the panelists themselves, it was decided that panelists would have the option to choose NA for the items. These responses would then be analyzed against the panelists' background and area of expertise to see if there were any patterns based on specific allied healthcare field or level of experience. There were only two comments made in the first round concerning new items, one of which resulted in the inclusion of a new item for round two.

The level of consensus had been predetermined as having an IQR of less than 1.2 (Alexander, 2008). Listed in Table 4-1 are those items that reached consensus in the first round. It was not expected that the majority of items would reach consensus in round one. As instructional and technical feasibility were rated independently, some items reached consensus on one but not both standards. The full results of each round can be found in Appendix I.

Table 4-1. Questionnaire items which reached consensus in round one

Item		Technical Feasibility Mean	Technical Feasibility IQR	Instructional Feasibility Mean	Instructional Feasibility IQR
1	Need to set up a clear research agenda for simulations in allied healthcare education			3.56	1
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	3.74	1		
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	3.53	1	3.42	1
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	3.22	1	3.50	1
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	3.56	1	3.73	1
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	3.33	.75	3.44	1
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques			2.76	1

Table 4-1. Continued

Item		Technical Feasibility Mean	IQR	Instructional Feasibility Mean	IQR
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants			3.63	1
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	3.39	1		
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)			2.58	1
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	3.33	1	3.28	1
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	3.50	1	3.83	1
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	3.47	1	3.78	1
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare			3.53	1
21	Need for faculty agreement on purpose and methodology for debriefing sessions			3.67	1
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	3.67	1		
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	3.60	1	2.44	1
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	3.56	1		

Table 4-1. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	Instructional Feasibility Mean	Instructional Feasibility IQR
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	3.61	1	3.61	1
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	3.59	1	3.42	1
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	3.25	1	3.32	1
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	3.07	0.5	2.88	1
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	3.42	1		
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas			3.28	1
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	3.32	1	3.11	1
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)			3.28	1
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	3.53	1		
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	2.71	1	2.41	1
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	2.82	1	2.50	1
42	Institutions should network with other institution to optimize simulation research	3.42	1	3.35	1

Table 4-1. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	Instructional Feasibility Mean	Instructional Feasibility IQR
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	3.42	1	3.39	1
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	2.74	1		
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)			3.74	1
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	3.42	1	3.39	1
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	2.68	1	2.83	1
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	2.84	1	2.78	1
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	3.56	1	3.72	1
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	3.26	1	3.47	1
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	3.06	0.75	3.06	1
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	3.53	1	3.37	1
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives			3.33	1
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs			3.24	1

Table 4-1. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	Instructional Feasibility Mean	Instructional Feasibility IQR
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	3.47	1	3.58	1
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	3.33	1	3.32	1
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education			3.53	1
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	3.31	1	3.61	1
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	3.74	1	3.47	1
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	3.72	1	3.68	1
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	3.74	1	3.84	0
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	3.68	1	3.68	1
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	3.53	1	3.53	1
66	Need to create standardized certification opportunities for those teaching with simulation	3.58	1	2.89	.75
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	2.89	1	2.89	1
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	3.56	1	3.32	1

Table 4-1. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	Instructional Feasibility Mean	Instructional Feasibility IQR
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	3.24	1	3.21	1
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)			3.06	.75
73	Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	3.06	1	3.13	1
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	3.17	1	3.16	1
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	3.06	.75	2.94	1.75
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	3.47	1	3.53	1
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	3.24	0	2.82	1
80	Need to address the fact that there is a lack of appropriate support equipment such as cameras, crash carts, catheters supplied by the institution	3.18	1		
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	2.81	1	2.82	1
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	3.05	0	3.06	0

Table 4-1. Continued

Item		Technical Feasibility Mean	IQR	Instructional Feasibility Mean	IQR
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	2.94	1		
84	Need to educate stakeholders better so they have an understanding of when simulation may be an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load			3.12	0

Most consensus items fell in the mid-range of the feasibility scale with the lowest mean score being 24IF "Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs" at 2.44 (± 1.43). Students not being fully prepared for higher education classes in the healthcare fields may be an issue facing many institutions (Allied Health Center of Excellence, 2012), but this was seen as a general education issue, not a simulation issue. The highest rated was 62IF "Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them" at 3.84 (± 0.83). Simulation literature is clear that feedback is essential to successful simulation-based learning, and while not all simulation programs fully utilize this process there exists research and guidelines concerning what works (Fanning & Gaba, 2007; Mort & Donahue, 2004).

The standard deviation for consensus items ranged from 0.78 to 1.57 with an average of 1.21, meaning there was some variation in responses. Five items (62IF, 78TF, 82IF and TF, 84IF) reached absolute consensus (IQR=0). The only item that reached absolute consensus on both technical (3.05 ± 0.78) and instructional feasibility

(3.06 ± 1.19) was "Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness." This is consistent with the literature which states that the use of simulation to enhance or replace clinical rotations is one of the major initiatives in allied healthcare education and training (Bradley & Postlethwaite, 2003b). The average rounded mean for most items (n=147) was 3, which is consistent with the literature which states that simulation will continue to be used but that implementation will be challenging (McGaghie et al., 2010; McLaughlin et al.; 2010; Rosen, 2008).

There were 58 items that did not reach consensus during the first round, and those items covered the entire range from research to resources. The areas of disagreement highlighted the complexity of the issue and set the stage for deeper analysis by the panelists for their rankings in round two. It was hoped that the results of round one would lead to more insight into the panelists' rankings through the inclusion of the justifications or supporting comments in the round two questionnaire.

There were 109 items in round one with NA responses; 37 items had NA on both technical and instructional feasibility, giving a total of 163 NA responses. Reasoning for those responses were provided during round two when given. It was decided, due to the fact that items had been drawn from diverse literature and not from panelist input, that if an item reached consensus (70%) on an NA response during round two, the item would be removed for round three.

Panelists did comment on some items and these were coded for theme. Table 4-2 displays all the input statements from round one that were coded as an issue or concern, including those explaining an NA response.

Table 4-2. Round one, emerging areas of concern by topic area

Theme	Count	Item #	Associated Statement(s)
Limitations of technology	1	30	Technology is not always adequate for replacing clinical experience (P1428, 30)
Need versus feasibility	1	General, resource items	Many things are feasible to study, but are not needed, with comparatively few the opposite; there should be a distinction made between NEED and FEASIBILITY (P1438, resources)
Barriers to collaboration	1	General, collabor-ation items	There may be different models available in the US compared to experience in the UK. While there is interest in collaboration, it can be very difficult across sectors (P1373, collaboration)
Currency of technology	2	12TF, 12IF	Assuming we are optimizing the mix using current technology (P1428, 12TF & IF)
NA-not needed	5	10TF, 10IF, 50TF, 50IF, 52 TF, 52IF, 54TF, 54IF, 55TF, 55IF	Not needed. The same metrics should be used to evaluate educational outcomes for any method or technique, with many examples are well established in the literature (P1438, 10TF & IF) Likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health (P1438, 50TF & IF, 52 TF & IF, 54TF & IF, 55TF & IF)
NA-not an issue specific to simulation	10	27TF, 27IF, 29TF, 29IF, 30TF, 30IF, 33TF, 33IF, 35TF, 35IF	Not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general (P1438, 27TF & IF, 29 TF & IF, 30 TF & IF, 33 TF & IF, 35 TF & IF)

The panelist input was, in several cases, used to make clarifying edits to existing items (i.e., 12, 30, 79, 80, and 84). The edits to the round two questionnaire can be seen in Appendix G. There were only five panelists (1367, 1373, 1399, 1428, and 1438) who made comments in round one. Panelist 1438, a Program Director of Cardiovascular Sonography, made the most with four comments. These comments were used to explain an NA response and after reviewing these comments it was decided that if the number of NA responses increased to 70% in subsequent rounds the item would be removed. The comments also highlighted areas that were seen as too broad in scope, too contextual, or general education issues as opposed to simulation issues.

Delphi Survey Round 2

This section presents those items which reached consensus in the second round. As expected, the number of consensus items did increase during this round. The level of consensus had been predetermined as having an IQR of less than 1.2 (Alexander, 2008). Listed in Table 4-3 are those items that reached consensus in the second round with their mean, IQR, and the change in the IQR from round one to help demonstrate the variation in consensus between rounds. Because instructional and technical feasibility were rated independently, some items reached consensus on one but not both feasibility standards. The full results of each round can be found in Appendix I.

There were 17 responses to the second round. Those items that were edited due to panelist input in round one have the word edit under their number and changes are marked with bold for additions or strikeouts for deletions. Results were analyzed only for those who responded to round two.

Table 4-3. Questionnaire items which reached consensus in round two

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
1	Need to set up a clear research agenda for simulations in allied healthcare education	3.65	1	-0.75	3.5	1	0.00
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	3.88	1	0.00			

Table 4-3. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	3.71	1	-0.50	3.79	1	-0.75
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	3.79	1	-0.50	3.74	1	-1.00
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	3.59	1	0.00	3.41	1	0.00
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	3.29	1	0.00	3.53	1	0.00
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	3.59	1	0.00	3.65	1	0.00
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	3.29	1	0.25	3.29	1	0.00
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	3.35	1	-0.50	3.18	1	-0.75
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	3.31	.25	-1.25	2.88	0	-1.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
New	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	3.41	1	NA	3.28	1	NA
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants				3.71	1	0.00
12 edit	Need to develop guidelines concerning the best mix of **current** clinical and simulation-based training for optimal learning outcomes	3.55	1	-1.00	3.68	1	-0.50
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	3.29	1	0.00	2.81	1	-1.00
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)				2.68	1	0.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	3.24	1	0.00	3.29	1	0.00
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	3.47	1	0.00	3.76	1	0.00
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	3.41	1	0.00	3.71	1	0.00
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	4.24	1	-0.75	4.18	1	-0.50
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	3.53	1	-0.75	3.44	1	0.00
21	Need for faculty agreement on purpose and methodology for debriefing sessions	3.86	1	-0.75	3.59	1	0.00
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	3.75	1	0.00	3.62	1	-0.50
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	3.19	.25	-1.75	3.12	0	-1.50
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	2.46	1	0.00	2.27	1	0.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	3.65	1	0.00	3.38	1	-1.00
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	3.71	1	0.00	3.50	1	0.00
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	3.13	1	-1.00	3.19	.25	-1.50
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	3.81	1	0.00	3.41	1	0.00
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	2.85	1	-0.25	2.94	.25	-1.25
30 edit	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience **when it has been proven to be a sufficient substitute**	3.07	1	-1.00			
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	3.38	1	0.00	3.24	0	-1.00

Table 4-3. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	3.66	1	-0.75	3.38	.25	-1.75
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	3.21	.75	0.25	2.75	.88	-0.13
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	3.65	1	0.00			
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	3.56	1	-1.00	3.31	1	0.00
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	3.37	1	0.00	3.18	0	-1.00
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)				3.13	1	0.00
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	3.56	1	0.00	3.62	1	-1.00
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	2.63	1	0.00	2.33	.5	-0.50

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	2.75	1	0.00	2.56	1	0.00
42	Institutions should network with other institution to optimize simulation research	3.41	1	0.00	3.31	1	0.00
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	3.59	1	0.00	3.31	1	0.00
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	3.58	1	-0.75			
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	2.71	1	0.00	2.72	1	-0.75
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	3.46	1	-0.50	3.29	0	-1.00
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	3.32	1	0.00	3.34	1	0.00
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	2.59	1	0.00	2.75	1	0.00

Table 4-3. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	2.79	.5	-0.50	2.84	.13	-0.88
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	3.61	1	0.00	3.73	1	0.00
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	3.21	1	0.00	3.44	1	0.00
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	2.88	0	-0.75	3.00	0	-1.00
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	3.41	1	0.00	3.29	1	0.00
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives				3.31	1	0.00
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	2.88	.25	-1.75	3.00	.50	-0.50
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	3.53	1	0.00	3.53	1	0.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	3.47	1	0.00	3.41	1	0.00
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	3.50	1	-0.25	3.57	1	0.00
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	3.47	1	0.00	3.62	1	0.00
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	3.75	1	0.00	3.53	1	0.00
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	3.81	1	0.00	3.65	1	0.00
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	3.71	1	0.00	3.82	0	0.00
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	3.71	1	0.00	3.74	1	0.00
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop				3.24	1	-0.50

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	3.52	1	0.00	3.38	1	0.00
66	Need to create standardized certification opportunities for those teaching with simulation	3.53	1	0.00	3.59	1	0.00
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	2.94	0	-0.75	2.88	0	-1.00
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	3.70	1	0.00	3.44	1	0.00
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	3.34	.63	-0.38	3.32	1	0.00
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	2.85	0	-2.00	2.93	1	-1.00
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	2.71	1	-1.25	2.63	1	-2.00
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	2.94	.25	-1.75	3.00	0	-0.75
73	Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	3.07	.50	-0.50	3.07	.75	-0.25
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	3.14	.06	-0.94	3.18	0	-1.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	3.06	0	-0.75	2.91	.13	-1.63
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	3.59	1	0.00	3.65	1	0.00
77	Need to show return on investment to decrease pressure to reduce high cost programs	2.96	0	-2.00	3.21	0	-2.00
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	3.20	0	0.00	2.76	1	0.00
79 edit	Need to address how to best equip and support facilities to properly run the appropriate scenarios ~~Need to address the fact that facilities are inadequate to properly run the scenarios~~	3.18	0	-2.00	2.94	.25	-1.75
80 edit	Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution ~~Need to address the fact that there is a lack of appropriate support equipment such as cameras, crash carts, catheters supplied by the institution~~	3.12	0	-1.00	2.81	1	-1.00
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	2.81	1	0.00	2.70	1	0.00

Table 4-3. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	3.24	0	0.00	3.06	0	0.00
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	2.73	1	0.00	2.93	.75	-0.50
84 edit	Need to **find ways to** educate stakeholders better so they have an understanding **if and when** simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	3.26	1	-1.00	3.19	.25	0.25

Most consensus items had no change (0.00) or only moderate change (≤1.00) in their IQR, but five items had significant changes (2.00):

- 70TF "Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges"
- 71 IF "Need to address the fact that low salaries make retention of a qualified workforce difficult"
- 77 TF and IF "Need to show return on investment to decrease pressure to reduce high cost programs"
- 79 TF "Need to address how to best equip and support facilities to properly run the appropriate scenarios"

None of these items had comments in round one that specifically addressed why the item was given a specific rank, although there was one general comment concerning resource items (77 and 79). Item 79 had been edited for clarity in the round two questionnaire, but for the most part panelists decided to modify their ranking based solely on the statistical data from round one.

Item 8TF “Need for defensible research to identify methods and technologies that work best for specific learning outcomes” had a positive change, going from an IQR of 0.75 to 1, meaning there was more variance in the ratings in round two, but it remained within the range of consensus. Item 84IF “Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load” changed from absolute consensus (IQR=0) to an IQR of 0.25, although the mean remained relatively stable going from 3.12 (± 1.32) to 3.19 (± 1.17). These adjustments in scores can be explained in part by the lower return rate in round two; however, when developing the round three questionnaire modifications were made to the previous response column for all but one panelist, demonstrating that panelists did reexamine their round one scores and in some cases modified their choices.

Standard deviation ranged from a low of 0.53 on 74IF “Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own” to 1.50 on 33TF “Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training” and 73IF “Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation.” The average standard deviation was 0.98, meaning there was nearly an entire point ± on the responses for most items; however the average spread between items was less for round two than it was in round one, demonstrating more consistency in responses between panel members.

There were 105 total NA responses on 52 items, 27 of which had NAs for both technical and instructional feasibility. Sixteen items had two NA responses and five had three NA responses. Reasoning for those responses were provided during round three when available. Seven participants had at least one NA response: 1387, 1399, 1419, 1428, 1438, 1453, and 1471. All of these individuals are over the age of 40, five have a BA or graduate degree, six hold at least one relevant certification, and six had at least six years of experience in the field. All these panelists reported having simulation specific training and are currently working with simulation. Three of the participants voting NA had similar positions, answering simulation coordinator or patient simulation lab coordinator. Demographically, while all the participants with an NA response had extensive experience, there was no discernable pattern to their having voted NA.

Similarly, there was little commonality between the two participants with the largest number of comments. There were a total of 187 comments for round two, significantly more than in round one, with eight participants giving no comments. Participants 1419 and 1453 made the majority of the comments, 37(20%) and 110(58%) respectively. Participant 1419 has over seven years of experience in simulation and currently lectures in radiation therapy. Participant 1453 has over 11 years of experience in simulation and currently works as a simulation coordinator. It appears that experience has a greater impact on the way a participant answered than their specific field or context, although the small sample size makes comparisons across participants difficult to validate.

Only five items had no comments: 49, 54, 63, 76, and 83. Comments were given not only for NA responses or for ratings outside the range of consensus; they often gave insight into a panelist's experience and background. Not all comments are listed in Table 4-4, only those themes coded more than once as being a concern, or coded as a justification for ranking outside the mean. The same item is sometimes listed twice due to the fact that more than one panelist made a comment on an item that was coded with the same theme. Some comments have been edited to include only the relevant text, but were not edited for grammar or spelling. A full list of comments can be seen in the questionnaire for round three in Appendix H.

Table 4-4. Round two, emerging areas of concern by topic area

Theme	Count	Item #	Example Associated Statement(s)
Justification	1	1TF	Changed from a 5 to a 4 to account for the lack of resources currently available (P1367, 1TF)
Lack of consensus	2	1TF, 26IF	Many of these items are feasible If you could ever get consensus of a group of educator to agree within a few years. (P1414, 1TF)
Complex issue	2	45TF, 80TF	Depending on the technological means, complexity can be the challenge (P1453, 80TF)
Curriculum challenges	2	28IF, 45IF	Some modifications to curriculums may be required to determine if objectives can be met with simulation (P1453, 28IF)
Questionable item	2	73TF, 73 IF	not sure this is fact (P1419, 73TF & IF)
Time consuming/ constraints	5	2TF, 4TF, 4IF, 59TF, 59IF	This is also time consuming but has been implemented in some programs (P1453, 4TF & IF) Resources require time to develop (P1419, 59TF & IF)
Cost	6	15TF, 45TF, 58TF, 67IF, 70IF, 78IF	curriculum content would require high fidelity trainers and not all institutions can fund such equipment (P1423, 15TF) This is a budgetary concern and obstacle (P1453, 70IF)

Table 4-4. Continued

Theme	Count	Item #	Example Associated Statement(s)
Not important/ needed	8	52TF, 52IF, 55TF, 55IF, 68TF, 68IF, 70TF, 70IF	Unnecessary - over kill (P1419, 68TF & IF)
Faculty limitations	8	11IF, 29TF, 29IF, 32IF, 36IF, 58TF, 62IF, 73TF	Instructional feasibility would be very instructor dependent but is seemingly not difficult to implement (P1453, 11IF) Important as not all teachers can get the best out of simulation (P1387, 29IF)
More development/ R&D	14	4TF, 4IF, 18TF, 18IF, 37IF, 39IF, 47TF, 48TF, 65IF, 72IF, 77TF, 81TF, 81IF, 82TF	More research and development needed (P1453, 37IF) Some R & D may be required (P1453, 47TF)
Context specific/ contextual	16	3TF, 8TF, 8IF, 12TF, 14TF, 14IF, 15TF, 15IF, 17TF, 17IF, 20IF, 24IF, 36TF, 36IF, 69IF, 82TF	This would be very student specific (P1453, 8TF & IF) I don't know how this would be possible with so many different disciplines and contexts (P1419, 12TF) This is program specific and faculty may not understand how to write scenarios. (P1453, 69IF)
Difficult to accomplish/ study	16	4TF, 5TF, 5IF, 6TF, 7TF, 7IF, 9TF, 10TF, 17TF, 18TF, 37TF, 37IF, 50TF, 51IF, 77TF, 77IF	I think it is difficult to isolate the impact of discrete variables (P1373, 6TF) I feel this is too big and could be to the detriment discreet disciplines (P1419, 37TF, 37IF) Not sure how this could be assessed (P1419, 561TF)

Table 4-4. Continued

Theme	Count	Item #	Example Associated Statement(s)
Politics	29	10IF, 16IF, 23IF, 31IF, 35IF, 37IF, 38IF, 39IF, 40IF, 41IF, 42TF, 43IF, 44IF, 46IF, 58IF, 61IF, 64IF, 66TF, 66TF, 66IF, 67IF, 68IF, 71IF, 74IF, 75IF, 77IF, 78IF, 80IF, 82IF	I foresee politics as the greatest hurdle here (P1453, 10IF) Institutional autonomy can be a challenge here. perhaps regional or national organisations could step (P1373, 66TF) Politics ....ohh yea. Lots of politics in this one (P1453, 71IF)

One comment on item 73, “not sure this is fact” (P1419, 73TF & IF), resulted in the only edit for the round three questionnaire. There were eight comments stating that the item was not needed and these were associated with items that had at least one NA response. Those concerns that were coded most often included cost, faculty and contextual constraints, needing more research and development, too difficult to accomplish, and political constraints.

Delphi Survey Round 3

This section presents the results of the third and final round. There were 16 responses to this round. Items having reaching an IQR of less than 1.2 (Alexander, 2008) were considered to have reached consensus. Listed in Table 4-5 are those items that reached consensus in the third round with their mean, IQR, and the change in the IQR from round two. As instructional and technical feasibility were rated independently, some items reached consensus on one but not both standards. Results were analyzed only for those who responded to round three. The full results for each round can be found in Appendix I.

Table 4-5. Questionnaire items which reached consensus in round three

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
1	Need to set up a clear research agenda for simulations in allied healthcare education	3.53	1	0.00	3.53	1	0.00
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	3.75	1	0.00	4.13	1	-1.00
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	3.58	1	0.00	3.63	1	0.00
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	3.50	1	0.00	3.50	1	0.00
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	3.44	1	0.00	3.38	1	0.00
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	3.19	.25	-0.75	3.44	1	0.00
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	3.50	1	0.00	3.50	1	0.00
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	3.13	0	-1.00	3.25	1	0.00
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	3.19	.25	-0.75	3.19	.25	-0.75

Table 4-5. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	3.27	0	-0.25	2.73	.5	0.50
New	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	3.30	1	0.00	3.17	0.75	-0.25
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	3.65	1	-1.00	3.63	1	0.00
12	Need to develop guidelines concerning the best mix of current clinical and simulation-based training for optimal learning outcomes	3.39	1	0.00	3.53	1	0.00
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	4.00	.5	-1.50	3.88	1	-1.00
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	3.31	1	0.00	2.67	1	0.00

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	2.88	.25	-1.75	2.59	1	0.00
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	3.25	.25	-0.75	3.25	.25	-0.75
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	3.31	1	0.00	3.63	1	0.00
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	3.25	1	0.00	3.56	1	0.00
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	4.25	1	0.00	4.19	.25	-0.75
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	3.43	1	0.00	3.34	1	0.00
21	Need for faculty agreement on purpose and methodology for debriefing sessions	3.79	1	0.00	3.49	1	0.00
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	3.60	1	0.00	3.41	1	0.00
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	2.93	0	-0.25	2.94	0	0.00

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	2.35	.5	-0.50	2.29	0	-1.00
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	3.44	1	0.00	3.20	1	0.00
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	3.50	1	0.00	3.37	.75	-0.25
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	3.07	0	-1.00	3.07	0	-0.25
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	3.67	1	0.00	3.31	1	0.00
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	2.63	1	0.00	2.73	1	0.75
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute	2.86	.75	-0.25			

Table 4-5. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	3.14	0	-1.00	3.06	0	0.00
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	3.53	1	0.00	3.27	.06	-0.19
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	3.07	0	-0.75	2.61	1	0.13
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	3.56	1	0.00	3.31	1	-1.00
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	3.50	1	0.00	3.20	1	0.00
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	3.27	.06	-0.94	3.06	0	0.00
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	3.07	.50	-0.75	3.07	.50	-0.50
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	3.50	1	0.00	3.47	1	0.00

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	3.13	0	-1.25	3.00	0	-1.25
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	2.43	1	0.00	2.27	0	-0.50
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	2.47	1	0.00	2.33	1	0.00
42	Institutions should network with other institution to optimize simulation research	3.31	1	0.00	3.20	0	-1.00
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	3.56	1	0.00	3.40	.5	-0.50
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	3.35	1	0.00			
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	2.46	1	0.00	2.57	1	0.00
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	3.36	1	0.00	3.19	0	0.00

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	3.34	.63	-0.38	3.36	.70	-0.30
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	2.55	1	0.00	2.59	1	0.00
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	2.66	1	0.50	2.70	.75	0.63
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	3.58	1	0.00	3.58	1	0.00
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	3.09	.63	-0.38	3.34	.63	-0.38
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	2.73	.50	0.50	3.00	0	0.00
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	3.44	1	0.00	3.30	.85	-0.15
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	3.05	.38	-1.63	3.27	.50	-0.50

Table 4-5. Continued

Item		Technical Feasibility Mean	Technical Feasibility IQR	IQR Change	Instructional Feasibility Mean	Instructional Feasibility IQR	IQR Change
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	2.73	1	0.75	3.00	0	-0.50
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	3.37	1	0.00	3.44	1	0.00
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	3.31	1	0.00	3.38	1	0.00
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	3.39	.88	-0.13	3.46	1	0.00
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	3.38	.25	-0.75	3.53	1	0.00
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	3.55	1	0.00	3.31	1	0.00
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	3.67	1	0.00	3.50	1	0.00
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	3.69	1	0.00	3.81	.25	0.25

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	3.69	1	0.00	3.72	.63	-0.38
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	3.36	1	-0.25	3.38	1	0.00
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	3.43	1	0.00	3.28	1	0.00
66	Need to create standardized certification opportunities for those teaching with simulation	3.44	1	0.00	3.50	1	0.00
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	2.73	.50	.50	2.69	1	1.00
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	3.61	1	0.00	3.33	1	0.00
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	3.37	.75	0.13	3.34	1	0.00
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	2.77	1	1.00	2.73	1	0.00
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	2.60	1	0.00	2.50	1	0.00

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	2.80	1	0.75	2.93	0	0.00
73 edit	Need to address the fact that there **can be a** lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	3.25	.25	-0.25	3.27	.50	-0.25
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	3.15	0	-0.06	3.06	0	0.00
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	3.13	0	0.00	2.84	.13	0.00
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	3.50	1	0.00	3.63	1	0.00
77	Need to show return on investment to decrease pressure to reduce high cost programs	2.81	.25	0.25	3.06	0	0.00
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	3.00	0	0.00	2.60	1	0.00
79	Need to address how to best equip and support facilities to properly run the appropriate scenarios	3.06	0	0.00	2.73	.50	0.25

Table 4-5. Continued

Item		Technical Feasibility Mean	IQR	IQR Change	Instructional Feasibility Mean	IQR	IQR Change
80	Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution	3.05	0	0.00	2.73	1	0.00
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	2.81	1	0.00	2.70	1	0.00
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	3.13	0	0.00	2.93	0	0.00
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	2.57	1	0.0	2.69	1	0.25
84	Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	3.16	.63	-0.38	3.07	0	-0.25

Consensus items had no change (0.00) or only moderate change (≤1.00). Only two items, 30IF “Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute” and 44IF “Need for institutions using or thinking of using simulation to develop a shared database or portal for resources,” did not reach consensus even though their IQR decreased between round 2 and round 3 (-0.50 and -0.38 respectively). Broad issues such as accreditation were problematic for several panel members as it was questionable if the return would be worth not just the time and money, but the frustration of trying to form consensus across disciplines and institutions. Sharing resources is a recommendation in some of the literature concerning simulation implementation (Adamson, 2010; Jansen, Johnson, Larson, Berry, & Brenner, 2009), but was seen by many of the panelists as too challenging. Item 39TF and IF "Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education" moved from no consensus (IQR=1.25) to absolute consensus (IQR=0). This item touches on political concerns, but the consortium model is becoming more accepted as a means to develop successful simulation centers (Jeffries & Battin, 2012; Mase & Wattenbarger, 1980; Sportsman et al., 2009). The mean scores of 39TF=3.13 and 39IF=3.00 reveal the panelists' concerns about difficulties in finding commonalities between educational institutions and other health science institutions while acknowledging the practical need to collaborate to share expenses and resources.

Some Delphi studies remove items that have reached consensus and ask the panel to only rank the non-consensus items in later rounds. It was decided that for this study all items would be present in all three rounds to give voice to divergent scores as well as to allow panelists to change their mind due to previous comments or further reflection. The following 14 items displayed a higher IQR in round three, but remained within the acceptable range of consensus:

- 10IF (2.73 ± .81) "Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques"

- 33IF (2.61 ± 1.13) “Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training”
- 49TF (2.66 ± .47) and IF (3.36 ± 1.03) “Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal”
- 52TF (2.73 ± .96) “Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums”
- 62IF (3.81 ± .54) “Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them”
- 67TF (2.73 ± .81)& IF (2.69 ± .48) “Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students”
- 69TF (3.37 ± 1.03) “Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios”
- 70TF (2.77 ± 1.34) “Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges”
- 72TF (2.80 ± .96) “Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)”
- 77TF (2.81 ± .54) “Need to show return on investment to decrease pressure to reduce high cost programs”
- 79IF (2.73 ± .81) “Need to address how to best equip and support facilities to properly run the appropriate scenarios”
- 83IF (2.69 ± 1.22) “Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space”

These items covered the entire range of issues and the change in their scoring demonstrates the convoluted nature of the problems and possible solutions as well as the ability of the Delphi to engage panel members in reflective thinking.

The number of NA responses went down in round three from 105 to 91. Twenty-two items (10, 27, 29, 30, 33. 35, 37, 39, 40, 41, 44, 50, 52, 54, 55, 58, 68, 70, 71, 72, 78, and 83) had at least one NA response for both TF and IF. There were 14 items that had two NA responses. Two items, 70TF "Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges" and 83IF "Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space," had three NA responses. These were seen as issue that did not impact simulation, but were more cultural or political in nature. Item 83 had two NA responses on TF and three on IF demonstrating that instructional and technical feasibility are not always interconnected. The same participants from round two with NA responses gave at least one NA response for round three: 1387, 1419, 1428, 1438, 1453, and 1471. Participant 1399, who had several NA responses in round two, did not return a questionnaire for round three. It must be noted that participant 1399 had 10 NA responses in round two, so it is probable that at least some of the difference between rounds comes from the lack of response from this participant.

The average standard deviation was 0.83, meaning that the data points tended to be closer to the mean than on previous rounds. Standard deviation ranged from a low of 0.25 on 31IF (3.06±.25) "Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum" to 1.40 on 58TF (3.39±1.40) "Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education." It is worth noting that both of these items are concerned with the lack of a clear research based simulation methodology. IPSE was seen by many panelists as an important model for the future and this is supported by the literature (Gough et al., 2012; Hendee, 1971; Sportsman et al., 2009; Zhang et al., 2011).

The findings of round three show that the majority of items (n=121) had a rounded mean score of 3, placing them in the feasible range. There were 42 items that scored in the very feasible range, meaning that these items had manageable obstacles. Surprisingly, 10 of these items were concerned with research issues, which then leads to the question, why is there so little research concerning simulation in allied healthcare education? Seven items fell in the probably unfeasible range: 24TF, 24IF, 40TF, 40IF, 41TF, 41IF, 45TF. Consistently, items with the lowest mean score or with multiple NA responses tended to deal with collaboration issues or areas where consensus between different institutions, disciplines, or accrediting agencies would be needed. There were no items with an averaged mean score on either end of the spectrum (1=not at all feasible or 5=extremely feasible). While no item was rated as being not at all feasible, the panelists' scores demonstrate that all items have at least some barriers to their implementation. Future research may seek to use a panel of experts to rank these items in order of priority as time and resources are limited. Discovering if an item is technically and instructionally feasible is only the first step; the item should also be needed before resources are spent pursuing it.

There were fewer comments in round three (n=107) than in round two (n=187), and they were more evenly distributed among the eight participants: P1419=32, P1373=21, P1428=17, P1471=13, P1387=9, P1388=7, P1414=5, P1367=3. Participant 1453, who had 58% of the comments in round two, did not leave any comments for round three. Results from round two showed that the small sample size makes comparisons across participants difficult and ineffectual when trying to tie input to experience or field of practice. There were 12 instances in round three where a participant noted agreement with a comment from round two. This helped validate the Delphi method in that participants took note of the input of others and on occasion found it useful or persuasive. Not all comments are listed in Table 4-6, only those coded more than once as being a concern, or coded as a justification for a ranking outside the mean. The same item is sometimes listed twice due to the fact that more than one panelist made a comment on an item that was coded with the same theme. The same themes were used from round two when appropriate. Some comments have been edited to include only the relevant text, but they were not edited for grammar or spelling.

Table 4-6. Round three, emerging areas of concern by topic area

Theme	Count	Item #	Example Associated Statement(s)
Student specific	3	8TF, 8TF, 8IF	preferred learning styles of different students should be taken into account (P1387, 8TF)
Faculty limitations	3	2IF, 11TF, 59IF	… but each faculty member has a different level of teaching perception which influences the validated matrix's use (P1414, 11TF)
More development/ R&D	4	10TF, 17TF, 18TF, 37IF	Agree with Round 2 Comment “More research and development needed” (P1419, 37IF)
Context specific/ contextual	4	5TF, 5IF, 12TF, 15TF	Agree with Round 2 Comment “ ... varies from state to state thus making a standardized consensus problematic (more research or development on that would be needed)” (P1419, 15TF)
Difficult to accomplish/ study	5	17TF, 18TF, 37TF, 37IF, 75TF	chicken and egg situation that needs organisational good will to address. (P1373, 75TF)
Justification	7	1TF, 11IF, 13TF, 23TF, 35TF, 64TF, 64IF	There is no lack of technology that is preventing this from being completed. (P1428, 35TF) This is based on our experience [Score 5] (P1419, 64TF & IF)
Cost	11	2IF, 6IF, 14TF, 15TF, 33TF, 45TF, 45TF, 70IF, 78IF, 84TF, 84IF	Not sure organizations are willing to finance this level of assessment. (P1414, 2IF) cost is the challenge for many rural schools (P1471, 45TF)
Not relevant/ needed	12	4TF, 15IF, 24TF, 24IF, 33TF, 33IF, 52TF, 52IF, 55TF, 55IF, 68TF, 68IF,	Does it really matter as we can't/don't validate that traditional non-simulation trg is retained over time either (P1414, 4TF) Not sure this is a "need". Might be nice to have but not needed. (P1367, 15IF)
Politics	14	23TF, 37IF, 37TF, 37IF, 39TF, 39TF, 39IF, 40IF, 41IF, 44IF, 44IF, 46TF, 56TF, 56IF	politically challenging, feasible IF stakeholders value creation of consistent benchmarks (P1471, 23TF) This is a political question, not a technological one (P1428, 39TF) Lack of political consensus will influence choices (P1388, 41IF)

Justifications were often given based on the panelist's personal experience and sometimes included a statement that their score may be valid only in that limited context. Panelists noted that some of these issues were not technical or instructional issues, but political or financial in nature. The ability of simulation-based education to support different learning styles was introduced in round three and has been noted in some of the literature (Fountain & Alfred, 2009; Jansen et al., 2009). Due to the fact that there was no survey instrument to display comments from round three, all round three comments can be found at the end of Appendix I.

Summary of Findings

Chapter 4 reported the findings of this three round modified Delphi study as it pertained to the questions:

1. In the opinion of a panel of experts, what technical issues will impact the future use of simulators/simulation in allied healthcare education?
2. In the opinion of a panel of experts, what instructional issues will impact the future use of simulators/simulation in allied healthcare education?
3. What is the technical feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?
4. What is the instructional feasibility of each issue impacting the future use of simulators/simulation in allied healthcare education?

This study began with 168 items to rate (84 issues scored on both technical and instructional feasibility) and the panel added only one item throughout the study, making a total of 170 items rated. The panel reached consensus on all but two issues, scoring all items between probably unfeasible and very feasible. No item was rejected as being not at all feasible. The 91 NA responses display the Delphi's ability to reach consensus while allowing for minority opinions. These minority opinions often noted that other issues, such as costs or politics, had greater impact on the item being feasible or unfeasible than either technology or instructional issues. No item was removed due to a consensus opinion of it not being needed/applicable. There was no item that ranked extremely feasible, meaning that out of 170 items, none is currently rated as being completely ready to be implemented.

Healthcare simulation is not a new concept, but it still lacks a solid educational methodology (O'Donnell & Goode, 2008) and standards for simulations, curricula, and simulation centers (Gaba, 2004b). There are still many questions concerning its effectiveness and long term impact in skills training, but even with all the unknowns, institutions, including military institutions, continue to explore and expand their use of simulation (McGaghie et al., 2010; Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, 2013; Rosen, 2008). The results of this study support the idea that simulation will continue to be integrated into allied healthcare curriculum at ever increasing rates, but to be fully utilized the implementation process should be thoughtful, contextual, and grounded in research-based instructional practices. This is not always feasible when there is little rigorous research to rely on for decision-making. Chapter 5 uses the results of this study to make some recommendations for strategic decision makers concerning the implementation and use of simulation in allied healthcare education and training.

CHAPTER 5
DISCUSSION, RECOMMENDATIONS, AND FUTURE WORK

This Delphi study explored and identified issues impacting the future of simulation in allied healthcare education and training through the consolidation and assessment of expert opinions about the technical and instructional feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology. Chapter 5 discusses the major findings broken down by issue type (research, curriculum, collaboration, tools and simulator technology, faculty and staff, and resources) then looks at recommendations for decision-makers as well as lessons learned from this Delphi study. Finally, this chapter discusses the implications for future research. The discussion is concerned with only the results from the third and final Delphi round.

Healthcare educators have an important responsibility educating and training students so they have the knowledge and skills necessary to successfully and competently work in today's healthcare fields, both civilian and military. There is a growing amount of simulation literature which supports the idea that simulated practice may improve the quality of delivered care (Schmidt et al., 2013; Shear et al., 2013), but many questions still exist as to how, when, and where to best utilize simulation in allied healthcare education. This study provides some insight and recommendations which can be used to base future decisions and research.

Discussion

This Delphi study used an extensive literature review to develop 84 items to be rated by a panel of experts for their technical and instruction feasibility. The articles chosen for the literature review focused on several aspects of simulation in education and training; however, less than a dozen dealt solely or in part with the use of simulation in allied healthcare education. This gap makes strategic decision making difficult as "increasingly, decision makers and stake-holders must see evidence that the use of such a methodology leads to desired and demonstrable learning outcomes" (Issenberg, Ringsted, Østergaard, & Dieckmann, 2011, p. 155). There is little research concerning the future of simulation in allied healthcare education or on the current use of simulation in allied healthcare education; therefore, it was necessary to research articles which discussed simulation issues, theories, and practices among all levels of healthcare related education and extrapolate. This meant that some of the items were viewed as not needed or appropriate by some of the panelists. Other items were seen as not appropriate to this study as they were not issues of technical or instructional feasibility.

The iterative nature of the Delphi made it possible for panel members to anonymously review, comment on items, and modify or maintain their initial ratings. This allowed panel members to take a broad view of the items as each member brought a different background and experiences to the process. The results of this study demonstrate that it is possible to find consensus among a wide range of allied healthcare educators and practitioners, but that there remain differences and concerns pertaining to the methodology, theory, and practice of simulation-based education. The major findings of this study are discussed below.

Research Issues

There were ten original items listed under the theme of research issues. The only item added after round one was a research issue interested in "andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios." Only two research items reached absolute consensus (IQR=0): 8TF (3.13 ± 0.72) “Need for defensible research to identify methods and technologies that work best for specific learning outcomes” and 10TF (3.27 ± 1.12) “Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques received.” While 10TF reached absolute consensus it also had one of the largest standard deviations, meaning there were minority scores ranging from two to five for this item. Item 10 also demonstrated that the relationship between technical and instructional feasibility was not always strong as 10IF received the lowest mean score (2.73 ± 0.81) in this area. Only one research item, 2IF “There is a need to research the impact of simulated learning as it impacts real-world skills application,” received a score in the very feasible range (4.13 ± 0.72). Research in this area has been noted as a gap in the literature (Holzinger, Kickmeier-Rust, Wassertheuer, & Hessinger, 2009; Kardong-Edgren, Adamson, & Fitzgerald, 2010; McGaghie, Issenberg, Petrusa, & Scalese, 2010; Okuda et al., 2009) but, as some panelists noted, conducting it would be time consuming and costly. It is recommended that the time and money be invested as understanding simulation’s impact on real-world skills is important to recognizing how and when it should be implemented in education and training environments. Items 10TF and 10IF were also the only research items which received a score of NA. Comments on item 10IF included that politics would be the greatest hurdle and is not really an instructional or technical feasibility issue.

The comments seen most often under research issues were related to the high level of difficulty due to the amount of data needed or number of variables present. When dealing with healthcare education it is difficult to pinpoint a single variable or track a large number of students over time (Bradley, 2006; Bradley & Postlethwaite, 2003b; Garden, 2008). Panelists' comments point out that some of the weaknesses in the literature are due to the fact that rigorous research requires extensive resources, time, money, and the ability to account for outside factors which may impact results. In allied healthcare education it can be difficult to remove those outside factors without negatively affecting student learning and/or patient outcomes. While research may be difficult, it is still needed to validate the practice of simulation-based education. Practitioners, educators, and researchers should collaborate to develop robust research designs which can be used to validate current practice and positively influence future implementation.

Curriculum Issues

Curriculum issues accounted for items 11-36 of the questionnaire. All curriculum items reached consensus, but only nine reached absolute consensus:

- 23TF (2.93 ± 0.86) and IF (2.94 ± 0.57) "Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation"
- 24IF (2.29 ± 1.15) "Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs"
- 27TF (3.07 ± 1.30) and IF (3.07 ± 0.89) "Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions"
- 31TF (3.14 ± 1.13) and IF (3.06 ± 0.25) "Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum"

- 33TF (3.07 ± 1.25) “Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training”
- 36IF (3.06 ± 0.44) “Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation”

These items received mean scores that ranged from probably unfeasible to just above feasible, but had standard deviations that ranged from 0.44 to 1.30. Curriculum items had some of the widest range of responses. Those panelists giving the highest mean scores, 1387 (average score 3.65) and1428 (average score 4.25), had slightly different backgrounds: a managing director for an organization who trains with simulation and researches simulation issues and a simulation coordinator, respectively. Both had more than 11 years of experience. Those giving the lowest average mean scores 1380 (2.92) and 1414 (2.85) were a simulation related business owner/simulation coordinator and director of a surgical simulation center. Both responded as having six to ten years of experience. From the demographic data it does not appear that either years of experience or current job explain the wide variance in responses.

There were 12 items (20TF, 22TF, 23TF, 24IF, 25IF, 26IF, 27IF, 28TF, 29IF, 30IF, and 35TF and IF) that had one NA response. Seven items (24TF, 27TF, 29TF, 30TF, 31TF, 33TF and IF) had two NA responses. Three curriculum items had some of the highest feasibility scores of the entire study: Item 13TF (4.00 ± 0.73) “Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies,” 19TF (4.25 ± 0.58), and 19IF (4.19 ± 0.54) “Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation.” The ratings reveal that it is very feasible to develop clear guidelines and objectives using current technology and teaching methodologies. Some simulation companies and groups such as the National League of Nursing have lesson plans and strategies (Jeffries, 2007; Kumar & Sherwood, 2007) which can be used as a starting point for developing guidelines and objectives for allied healthcare education.

Alternatively, there were 11 curriculum items which had some of the lowest scores of the study:

- 14IF (2.67 ± 0.60) "Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)"
- 15TF (2.88 ± 0.81) and IF (2.59 ± 0.61) "Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)"
- 23TF (2.93 ± 0.86) and IF (2.94 ± 0.57) "Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation"
- 24TF (2.35 ± 1.27) and IF (2.29 ± 1.15) "Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs"
- 29TF (2.63 ± 1.13) and IF (2.73 ± 0.89) "Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher"
- 30TF (2.86 ± 1.15) "Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute"
- 33IF (2.61 ± 1.13) "Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training"

Item 30IF (3.07 ± 1.09) was one of two items in the entire study that did not reach consensus (IQR=1.50). This seems to mirror the literature which is split on whether simulation is an adequate replacement for clinical experience (Bradley & Postlethwaite, 2003b; Cantrell, & Deloney, 2007; Chiniara et al., 2012; Colliver, 2002; Dawson, 2002; Gaba, 2004b; Gibbs, Durning, & Van Der Vleuten, 2011; Haluck et al., 2007; Okuda et al., 2009). This is a very important issue which will impact the future use of simulation in allied healthcare education and training so further research in this area is vital. It is also important to understand when and if simulation can be used to replace clinical experience from a patient safety perspective (Nishisaki et al., 2007). It should not be used as a replacement for clinical time if the outcomes include greater risk to patients.

Comments concerning the curriculum items noted that many of the issues listed were not simulation issues so much as educational issues. The differences in allied healthcare disciplines and even state regulations concerning accreditation and licensing were also noted as barriers to consensus building. Developing benchmarks, core curriculum, and objectives were seen as worthwhile pursuits, but difficult to achieve due to practical differences and political issues between individual instructors, administrators, and accrediting bodies. Curriculum issues are often contextual and developing solutions to these problems will probably be done within disciplines even though IPSE is becoming more valued (Gough et al., 2012). Finding individualized solutions may also be more cost effective and politically palatable. These targeted solutions may lead to more far-reaching solutions over time if these solutions are shared with the wider community.

An approach to using simulation in allied healthcare education which takes into account the entirety of the learning process has a better chance of influencing positive student outcomes than one which looks at simulation as a discrete variable. Just adding simulation to the curriculum does not improve learning; it is one tool that can be used in combination with other teaching strategies when appropriate (Chiniara et al., 2012; Gaba, 2004; Jeffries, 2006). Simulation should be assessed and implemented as part of the instructional design process, integrating it into the curriculum if and when appropriate.

Collaboration Issues

Closely related to curriculum issues, collaboration issues consisted of items 37-45. Collaboration appeared to be a concept that is seen as valuable, but difficult to attain. All but four collaboration issues (38IF, 42TF, 43TF, 45TF) had one NA response. Most NA responses came from two panelists, 1453 and 1387, a simulation coordinator and a managing director for an organization who trains with simulation and researches simulation issues. Both have over 11 years of simulation experience. Neither participant left comments supporting their reason for the NA responses. Participant 1453 did not leave any comments on their round three questionnaire; however, they had the same responses in round two, and left numerous comments stating that politics would be the biggest obstacle to many collaboration issues. In round three several other participants agreed that politics, including an institutional aversion to sharing resources, would play a big role in the feasibility of collaboration issues.

Four collaboration items reached absolute consensus:

- 39TIF (3.13 ± 1.06) and IF (3.00 ± 0.98) "Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education"
- 40IF (2.27 ± 0.81) "Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation"
- 42IF (3.20 ± 1.03) "Institutions should network with other institutions to optimize simulation research"

Item 40IF had the lowest mean score of any item in this Delphi study as this would require a wide assortment of stakeholders to come to a consensus concerning accreditation and oversight. The average mean score in this group was 2.97, with the highest mean score being for 43TF (3.56 ± 0.81) “Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios.” IPSE was one area that panelists noted was already being explored and implemented and this trend is also noted in the literature (Gough et al., 2012; Hendee, 1971; Sportsman et al., 2009). One collaboration item, 44IF (2.95 ± 1.07) “Need for institutions using or thinking of using simulation to develop a shared database or portal for resources,” did not reach consensus. This was viewed by some as too large a task with little return on investment. The Federal Medical Simulation and Training Consortium (FMSTC) Educational Framework Initiative (EFI) (Educational Framework Initiative, Office of Naval Research, 2014) is currently working on a simulation database for the DoD and other federal agencies, but it is not currently known what impact this will have on the field or if it will be shared outside the DoD community.

Most panelists agreed that pursuing collaboration issues could be beneficial for the field, but worried about the practicality of institutions with varying budgets, programs, and regulations working together. It is important that collaboration between institutions, programs, educational and clinical sites, as well as between simulation developers and educators is pursued if simulation is to positively impact student and patient outcomes (Adamson, 2010; Jansen et al., 2009). This may require a change in the culture of healthcare education, but economic factors may help drive solutions that were once politically unattainable.

Tools and Simulator Technology Issues

Items 46-55 were concerned with the tools and simulator technology available for use in allied healthcare education. The average mean for these items was 3.09, meaning most were scored in the feasible range. Item 53TF (3.44 ± 0.73) “Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives” had the highest mean score.

Nine items had one NA response:

- 47IF (3.36 ± 1.03) “Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound”
- 48IF (2.59 ± 1.09) “Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology”
- 49IF (2.70 ± 0.81) “Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal”
- 50IF (3.58 ± 1.20) and TF (3.58 ± 1.20) “Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex”
- 52TF (2.73 ± 0.96) “Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums”
- 54IF (3.05 ± 1.01) and TF (3.27 ± 0.93) “Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives”
- 55TF (2.73 ± 1.03) “Need to develop guidelines concerning the level of realism needed for human tissue and organs”

Two items, 52IF (3.00 ± 1.31) and 55IF (3.00 ± 1.26), had two NA responses. Two panelists, 1438, a program director with over three years of experience, and 1453, a simulation coordinator with over 11 years of experience, accounted for all NA responses in this topic area.

Comments on these items showed that some panelists felt that realism, or a high level of fidelity, is unnecessary for simulation activities to be successful. It was also noted that it is not necessary to have simulation technology specifically for allied healthcare education, only that it is necessary to have simulation that is used in such a way that it meets the needs of allied healthcare education (Bruhn & Philips, 1985). Overall there were few comments in this section with most of the concerns being on the proper use of the technology as opposed to the technology itself. Several noted that more development is needed to fully address feedback and cost issues, but remarked that the relationship between users and developers is complex and not always driven by the needs of discreet fields. A needs analysis should be done by any program or institution looking at implementing simulation to help assess if the appropriate technology exists to address its specific instructional needs. Unfortunately, without more research concerning issues of fidelity, skills assessment, feedback, and student outcomes it may prove difficult to accurately gauge the appropriateness of the technology for specific tasks and learning outcomes.

Faculty and Staff Issues

Items 56-76 were concerned with faculty and staff issues. There were nine items having a mean score of < 3.00, but the average mean for faculty and staff items was 3.28, placing many of these items in the feasible range. The lowest scoring were often related to budgetary concerns:

- 67TF (2.73 ± 0.81) & IF (2.69 ± 0.48) “Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students”
- 70TF (2.77 ± 1.34) and IF (2.73 ± 1.03) “Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges”
- 71TF (2.60 ± 0.96) and IF (2.50 ± 0.94) “Need to address the fact that low salaries make retention of a qualified workforce difficult”
- 72TF (2.80 ± 0.96) and IF (2.93 ± 0.93) “Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)”

- 75IF (2.84 ± 0.51) “Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused”

All but 75IF had at least one NA and 70TF received three NAs as this was not seen as a priority. There were 13 items that had one NA response (56TF, 61TF, 64TF, 67TF, 68IF, 69TF, 70IF, 71TF and IF, 72TF and IF, 73IF, and 74TF). Items 58TF and IF “Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education” and 68TF “Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation“ had two NA responses. Item 70TF was the only item with three NA responses as budgetary concerns were viewed as a bigger problem than an aging workforce. There were six panelists who responded NA at least once in this section, giving it the largest percentage of NAs of any topic area.

Comments for faculty and staff issues addressed concerns such as the need for more research and development, better education for faculty and administration concerning simulation capabilities, political issues, and budgetary concerns. Some comments noted that more collaboration in sharing best practices and resources could help alleviate some of the time and money constraints associated with developing simulation programs, but as rankings and comments in previous topic areas demonstrated, collaboration is not always feasible. Several panelists noted that their institution had successfully dealt with these challenges but recognized they could still be problematic for other institutions (e.g., 56IF “This is not an issue in my department but may be an issue for others” P1453). Sharing these experiences and lessons learned can help make the future implementation of simulation easier and more effective.

Technology innovations will probably continue to outpace advances in methodology (Greenberg, 2004), but as some panelists noted, integrating simulation into the curriculum helps alleviate some instructional issues as well as addresses some concerns about faculty and staff training and support (Adamson, 2010; Jansen et al., 2009). Successfully addressing faculty and staff issues can be politically challenging and resource dependent, but educating and training faculty and staff in simulator technology and simulation methodology is recommended as an essential piece for any successful simulation implementation.

Resource Issues

The last and smallest topic group was resource issues, items 77-84. This section had some of the lowest scores, having a mean average of 2.88, meaning that most scored in the range between probably unfeasible and feasible. Only seven items had a mean ≥ 3.0, and none rounded up to the very feasible level:

- 77IF (3.06 ± 0.57) “Need to show return on investment to decrease pressure to reduce high cost programs”
- 78TF (3.00 ± 1.09) “Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive”
- 79TF (3.06 ± 0.68) “Need to address how to best equip and support facilities to properly run the appropriate scenarios”
- 80TF (3.05 ± 0.55) “Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution”
- 82TF (3.13 ± 0.50) “Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness
- 84TF (3.15 ± 0.81) and IF (3.07 ± 1.09) “Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load”

The most common comments were concerned about political obstacles, cost, and the need for more development. Some issues such as budgetary constraints were viewed as difficult to find solutions for and not directly tied to the use or abandonment of simulation. Some panelists noted that solutions will probably be local and contextual (e.g., grants or donations). Several panelists commented that 84IF and TF could be very useful to research but cautioned that the different stakeholders should be viewed as independent variables (e.g., administrators, governance boards, and the public).

Three panelists (1387, 1438, and 1453) all had NA responses on at least two items in this section. Items 78IF “Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive” and 83TF “Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space” both had two NA responses while 83TF had three NA responses. These were viewed as budgetary and political concerns as opposed to technical or instructional issues.

Limited resources are not a simulation specific issue, but the success of a simulation program is often dependent on having found solutions to the issues noted in this section. “Initial faculty resistance, the complexity of the undertaking, and the administrative and financial costs can overwhelm the resources of a single institution” (Jeffries & Battin, 2012, p. 5). The more information an institution has concerning what works and what does not work the better they can manage their costs and resources. Ignoring the complexity and inter-related nature of simulation technology may cause some institutions to inadequately prepare for acquiring and maintaining support equipment and personnel. This lack of appropriate resources can lead to improper or discontinued use of expensive simulation equipment. It is recommended that institutions looking to implement simulation take a broad view and factor in all elements, including the time needed to develop, run, and debrief scenarios, into their decision making process.

Recommendations

This Delphi study, along with the supporting literature, provides insight into the future of simulation in allied healthcare education and training. This study shows that there are weaknesses in all the areas reviewed (research, curriculum, collaboration, tools and technology, faculty and staff, and resources) due to the complexity of a successful learning environment. The results from this study, including the literature review and panelists' comments, support the following recommendations. These recommendations are broken into two parts: considerations for specific stakeholders and general recommendations for institutions.

Stakeholder Considerations

Administrators. Administrators need to understand the scope of what the institution is trying to accomplish and plan small steps to reach this goal. There are many aspects that need to be considered before any technology is purchased. The resources, faculty, staff, and facilities issues need to be addressed and will vary based on simulation type and method. For instance, integrating a few case-study simulations into a course may not require dedicated staff, new technology, or additional space, but a simulation lab to for IPSE may require all three. Faculty and staff need to be involved in the decision making process in order to make them vested partners. Identify individual faculty and staff members who are interested or have previously used simulation and recruit them as simulation champions. The faculty and staff need to understand how it will affect them what the expectations are. There should be a single point of contact throughout the institution for questions, concerns, and implementation issues. Administrators should research the possibility of a consortium model and other collaboration options including renting out simulation labs to the wider community. To garner community support plan community outreach including tours and press releases.

Researchers. Researchers need to explore the possibilities of collaboration with other researchers at different institutions. This can help with larger sample sizes and improve the ability to look at outcomes across groups. Research needs to be valid and have results that can impact the practice. Before starting any new research, conduct an extensive literature review to understand weaknesses in the existing literature and understand gaps in the research. Talk with educators and simulation developers to understand what their needs are and what issues are most important to address.

Faculty and Staff. Simulation should be part of the faculty development experience. There are national organizations (e.g., Society for Simulation in Healthcare) and users groups (e.g., SimGHOSTS) that can help support training. Research courses offered for simulation professionals and review scenarios available through organizations such as the National League for Nursing. It is important to understand how and where simulation will be integrated into the curriculum, but not everything needs to be done at once. If simulation is new take integration in measured steps, look at the gaps and areas where students are struggling and choose one or two specific objectives to address with simulation. Low-fidelity task trainers or case-studies may be sufficient as an initial step. Plan how simulation will be used, e.g., as part of classroom instruction, skills lab, formative assessment, or in support of clinical time. The use of simulation should be in support of student learning and align with the learning objectives.

Students. Potential students reviewing programs should review the use of simulation. Some questions to ask include: how is it used (e.g., skills training or assessment), is there a set amount of simulation time required, what is the ratio of simulation to clinical time? Each student will need to decide what type of simulation use they are looking for, but it should be part of the process when deciding which institution and program is the best fit.

General Recommendations

General recommendations reiterate some of the suggestions noted above, but look at the process of integrating and using simulation from a broader institutional standpoint. It is important for institutions to take a holistic approach as many of these recommendations are interconnected, such as collaborating to gain insights on requirements.

Modular approach. The future implementation of simulation in allied healthcare education and training should be a modular approach allowing for flexibility and contextual customization. Allied healthcare is diverse and evolving; a single solution will not work in all situations and may be quickly outdated. It is recommended that institutions do not get tied to a specific technology that cannot be adapted due to changing needs or new methodologies (Bradley & Postlethwaite, 2003a; Girzadas et al., 2009). When researching appropriate simulator technology it is recommended that institutions take an approach which includes consideration of cross-utilization for a wide variety of programs within the institution and/or the wider community. Shared resources across programs can help alleviate many of the implementation barriers and increase educator awareness including how to use simulation in courses and programs not traditionally associated with simulation-based learning (Jansen et al., 2009).

A modular approach requires an honest assessment of the requirements. For example, if six programs need to learn BLS, is there a way to set up a single lab and schedule classes to rotate through? What is the lowest fidelity/lowest cost simulator that will work for the task? Or is there a slightly more expensive simulator that will work for BLS and airway management allowing it to be used for multiple objectives? Starting with easy to use technology aimed at supporting specific tasks allows faculty and staff to get used to the technology and increase their confidence with its integration.

Planning. It is recommended that institutions understand and plan for student to simulation ratios. Students not actively engaged in the simulation will still need to actively participate in learning, e.g., watching previously recorded content, autonomously studying and critiquing the actions of the participants, or independently using another technology. Additionally, different types of simulation or different teaching modalities can be used in combination when the learning objective combines different types of skills (Bradley, 2006; Lane et al., 2001), thereby giving the students opportunities for self-directed or project-based learning. Computer simulations can be self-directed and used as a teaching or study method. Whatever methodology or technology is used, the simulation curriculum should include valid, reproducible, and standardized learning experiences so all students receive the same experience.

Students can be active observers during a simulation and record actions for written or verbal evaluation. If rotating students through a simulation lab, an instructor or other proctor will need to be available to work with students outside the lab. This time can be utilized as an independent study, an instructor can run a small group session, or students could view previously recorded simulation sessions.

The number of students per simulator may vary some based on the task and technology, but for most allied healthcare education it is recommended to have 2-4 students per simulator. However, in some instances, such as for team communication, it is more important to mirror real-world experience and have the same number and types of roles as will be in a clinical setting. The number of students can be increased for basic courses through the use of audio/visual feeds for large groups. Students can view the instructor actions through technology to learn basic ideas; however they cannot practice skills in large group settings.

Requirements gathering. Objective strategic planning concerning the future use of simulation in allied healthcare education and training should be made by individuals with broad knowledge of the factors that influence its success (e.g., research, politics, cost, manpower) (Wicklein, 1993). It is recommended that institutions collect data from simulation companies, educators, administrators, support staff, and practitioners concerning the current state of simulation technology and then validate against the institution’s specific requirements (Haluck et al., 2007; McLaughlin et al., 2010; Rosen, 2004; Shaffer et al., 2001). Research and development is currently being conducted, and the technology is continually evolving while the literature does not always keep pace; therefore it is necessary to look beyond the literature and communicate with current practitioners and developers to make informed decisions.

If an institution is new to simulation they should consider hiring someone with experience to assist in requirements gathering. This individual should speak with all stakeholders and plan short- and long-term strategies and goals. They may need to begin the process with educating the stakeholders on simulation methodology and simulator technology, openly discussing the opportunities and concerns. It is difficult to gather requirements when individuals do not understand the possibilities. Classroom spaces may need to be reconfigured to accommodate simulation. Some task-trainers and lower fidelity simulators can be stored and moved in and out of classrooms as needed, but they will still need storage space, maintenance, and knowledgeable people to run them.

Collaboration. The optimal use of simulator types and simulation modalities is not currently known (Hammoud et al., 2008; Jeffries, 2006). Designing and conducting research which includes learner characteristics, skills retention, and scenario complexity is vital to understanding how to appropriately design and utilize simulation programs (McLaughlin et al., 2010). It is recommended that institutions and clinical sites collaborate on research to ensure studies have a large and robust sample size as well as the ability to track long-range outcomes. Utilize conferences, user's groups, and message boards to engage with other researchers concerning opportunities.

It is also recommended that institutions share resources including curricula and scenarios in order to improve consistency, decrease development time, build shared knowledge, and increase ongoing communication concerning what works and what has been problematic. A strong foundation for simulation-based education can be built on shared knowledge (Adamson, 2010; Curtin & Dupuis, 2008). Simulation takes time and money to learn, implement, and support. Sharing experiences, successes, and challenges may improve future efforts to integrate simulation into the curricula. In situations where funds, facilities, and staff are limited, institutions should look at the feasibility of collaborating on a mobile simulation lab. The costs are then shared, new facilities are not needed, and specialized staff is available for multiple locations.

Human factors. The human role is an often overlooked aspect of simulation, but understanding the educational theories and technological capabilities supporting simulation and its practice is fundamental to building a successful learning environment. It is recommended that institutions take into account and prioritize the investment in initial and ongoing education of all stakeholders in order to help the technology meet its full potential (Bonnel and Smith, 2010). Knowing how to run the simulator is not the same as understanding scenario development, debriefing techniques, learning theories which support simulation, and evaluating student outcomes. It is recommended that institutions consider innovative solutions including sharing specialized faculty, involving faculty or students from other departments for actor patients, hiring graduate students as support staff, and opening simulation labs to outside users for a fee (Jansen et al., 2009; Ladyshwesky et al., 2000), to lessen the impact of new simulation.

It is necessary to ensure long-term use and integration of simulation through the investment of training and education of the faculty and staff. All aspects need to be addressed, from curriculum integration to the debrief. A working group can help facilitate the exchange of ideas and help ensure a shared workload. Conferences and training courses are available through processional organizations such as the Society for Simulation in Healthcare, user groups for specific simulators such as Laerdal, and courses through institutions already utilizing simulation including the University of California Irvine and the University of Washington. Webinars are also available through organizations such as the Institute for Medical Simulation, these can help train multiple staff and faculty without having to pay travel costs.

Curricula integration. It is recommended that programs integrating new simulation rework their curricula and not just add in simulation to existing lesson plans. Issues such as feedback, type of tasks to be taught, desired learning outcomes, proper placement of ISPE, appropriate time on task, and faculty preparation need to be addressed before the technology is even purchased (Morgan et al., 2006; Rosen, 2004). Time and effort spent on integrating simulation into the curriculum before implementation can ease faculty concerns, ensure proper technology is adopted, and positively influence outcomes.

Starting with one or two tasks that students are struggling with may help decrease the burden of curriculum integration. Analyze the gaps through observation of student performance, instructor feedback, clinical site input, and assessment outcomes. Is there a skill clinical sites say is missing or is there a task students do not feel confident performing? Begin assessing the use of simulation to address these needs, then work to integrate its use in a way that can be measured. Once there is enough data to understand if and how simulation is impacting outcomes it can be integrated into the curriculum in more areas.

Institutional structure. It is recommended that an institution has a single point of contact for simulation in order to help ensure communication with all stakeholders and promote the integration of ideas, needs, methods, and resources (Jeffries & Battin, 2012; Mase & Wattenbarger, 1980; Sportsman et al., 2009). This individual should be involved in simulation acquisition, scheduling, curriculum design, and budget planning.

A Director of Simulation Operations or a Simulation Coordinator with a healthcare and education background can help provide oversight and execution of the simulation program or center. A single point of contact can help facilitate the development of curricula and training materials across programs. They work to coordinate with administrators, deans, department chairs, faculty, staff, and the community helping to ensure proper planning. This individual will assist with requirement validation and procurement to facilitate cross-utilization and proper use of funds. This individual is not responsible for the day to day set up and application of simulation, but oversees and helps to ensure simulation technicians are properly trained and supported. They work to strategically plan and facilitate the growth of the simulation program and help ensure the effectiveness of the program to limit redundancies and assist with garnering faculty support and adoption.

Summary

Many solutions will be contextual as each situation is different. “The level and type of simulation will need to be adapted to the educational needs of the learner and the design and intended outcomes of the programme” (Bradley, 2006, p. 260). This does not mean that results from research in other fields is not useful, only that its applicability may be limited. It is simply not practical for each allied healthcare field to conduct its own research, and for the majority of initial skills training, team building, and communication training it is not necessary; therefore, it is important that institutions utilizing and implementing simulation have open communication with each other.

Mistakes and successes should be shared so the knowledge base can be improved and expanded.

There is consensus that simulation is an appropriate tool for allied healthcare education and training, but that it has not reached its full potential. Those seeking to implement simulation should take an unbiased look at the healthcare education system in its entirety before making decisions concerning the appropriateness of simulation for their specific needs. Objective guidelines concerning valid and appropriate simulation use can be developed if it is looked at as part of the system and not an independent variable.

Future Work

The Delphi process allows for areas of disagreement and therefore highlights opportunities for further research. There is a need for more research concerning the use and effectiveness of simulation in healthcare education in general, and the use and effectiveness of simulation in allied healthcare education in particular. Nearly every aspect of the practice and methodology requires more research; however, there are some areas where research may be the most beneficial. The future of simulation in allied healthcare education and training may partially rest in the ability of the simulation community to perform rigorous research which answers how and when simulation as a teaching method is as good as or better than other models, including clinical rotations. The aviation industry has shown that simulation training can positively impact team building, error handling, and performance, but these lessons have not seamlessly transferred to the healthcare field (Sexton, Thomas, & Helmreich, 2000). Taking another look at the success of simulation-based education in aviation over the past decade may help to pinpoint some of the areas that can be most improved upon, such as patient safety.

The practice of simulation in allied healthcare education is complex, and there are many inter-connected issues that still need to be addressed concerning the technical and instructional feasibility of simulator technology and simulation methodology in allied healthcare education. Those items with the highest mean feasibility score (2IF “There is a need to research the impact of simulated learning as it impacts real-world skills application, 13TF “Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies,” and 19TF and IF “Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation”) are the easiest to address. However, this does not mean that they are the most important issues needing to be addressed; as several panelists noted, there is a difference between need and feasibility. Future research should seek to use a panel of experts to rank these items in order of priority as resources to pursue and implement solutions are limited.

In several places panelists noted that simulation issues were learner dependent, thereby compelling the question, what impact do learner characteristics such as previous knowledge, learner motivation, and social skills have on skills acquisition (Issenberg et al., 2011)? It is not known at this time if these characteristics have any impact on student success or skills retention.

Instructional and technical feasibility are not the only feasibility issues that need to be explored. Political and financial pressures are just two of the noted areas of concern which greatly impact the future of simulation in allied healthcare education and training. One of the best ways to address political concerns and help alleviate financial ones is to recommend evidence-based information and solutions. With the level of research available today institutions cannot make well-informed decisions identifying critical elements for healthcare education (Issenberg et al., 2011). It is vital to conduct research which helps educators design programs which effectively meet institutional needs and demonstrate objective outcomes. Currently even recognizing and agreeing to outcomes measurement is a source of contention. Research needs to be conducted in allied healthcare education which can demonstrate that simulation use results in highly effective clinical practice. In order to accomplish many of the research needs, research collaborations should cross not only institutional boundaries, but include input from clinicians, simulation developers, researchers, and educators. Small sample sizes have limited the validity of current research, by addressing issues of collaboration larger student populations and long-term outcomes could be assessed (Adamson, 2010).

This study attempted to find differences in panelist responses due to background or years of experience, but the sample size was too small to form any conclusions. To see if there are differences between allied healthcare fields, research would need to be conducted using separate groups of experts from different allied healthcare fields. This may answer some questions about the validity of the responses and their applicability to specific fields or institutions.

Lessons Learned

The Delphi “is a flexible approach, that is used commonly within the health and social sciences, yet little guidance exists to help researchers undertake this method of data collection” (Hasson et al., 2000, p. 1008). The fact that need, importance, and applicability of the items was not researched is a weakness of this study, but including these in a single study would have been burdensome for the panelists and may have resulted in lower response rates. The results of this Delphi study lead to more questions that still need to be explored. Reviewing and analyzing participants' comments exposed underlying assumptions or experiences leading to differing judgments (Hasson et al., 2000). Further communication with panel members may have resulted in richer data concerning these areas of concern and difference.

A more traditional Delphi study may have delivered very different results as the panel members would have developed the items based on their own knowledge and experience. I wanted to ground the project in the literature and give the panel the opportunity to focus on existing items in the first round, therefore this traditional first step was skipped. The panel was encouraged to add new items but the fact that there were already 84 items to score for technical and instructional feasibility possibly discourage people from providing suggestions for new items. This approach may have biased the responses or limited the available options (Hasson et al., 2000). When the literature is poor and assumptions have to be made concerning relevancy, having the panel develop the items would probably yield different and fewer items more closely tied to their individual practice. The ability to then utilize the results for individual practice may have been clearer. A smaller more manageable number of items may have positively influenced the amount of time panelists spent considering each item and increased retention. In this case, follow on work using a Delphi study to rank or score for need is suggested as those results may better align with strategic decision making.

When deciding on the type of Delphi and the methods of analysis the researcher is left to delve through existing studies, trying to align their research with an existing study design. The flexibility of the Delphi is both its strength and weakness as it allows for a research design that is contextual, but then leaves questions concerning the usefulness of the data gathered.

Conclusion

As this study shows, there is still research that needs to be done to address the issues pertaining to the use of simulation in allied healthcare education and training. This work was very successful in finding consensus among a panel of experts on the 170 technical and instructional items in the study. Even though there was consensus on all but two items, there were also strong minority opinions on many items. This divergence of opinion indicates a strong need for further research, including gauging the need to pursue each item.

It is important to not only identify and define technical and instructional issues which may impact the future of simulations in allied healthcare education, but to develop a consensus concerning whether or not issues can be dealt with successfully. "An improved understanding of conceptual issues and evidence of their effectiveness will ultimately guide the development, use, and funding of simulation" (Issenberg et al., 2011, p. 163). This study makes a contribution to the field of allied healthcare education and training in that it sheds light on current areas of strength and weakness in order to better address these issues for future practice. This study showed that a panel of experts can help inform decision makers in their strategic planning initiatives by analyzing the technical and instructional feasibility of issues impacting the field.

The Delphi method was used in this study as it allowed for an iterative process to collect and distill anonymous judgments of experts in order to improve understanding of the problem and feasible solutions (Skulmoski et al., 2007). This project utilized the modified Delphi method proposed by Custer, Scarcella, and Steward (1999) in that it began with a set of carefully selected items drawn from an extensive literature review concerning issues affecting the future of simulation in allied healthcare education and training. The items were then subjected to a three round Delphi to ascertain expert agreement concerning the items and the technical and instructional feasibility of addressing these issues. The Delphi method was applied in order to facilitate an anonymous exchange of ideas and opinions among a panel of experts concerning the items derived from the literature (Fleuren, Wiefferink, & Paulssen, 2004). By utilizing the Delphi method experts from a variety of geographic locations with varied backgrounds and professions were able to participate.

There is a distinct research need in allied healthcare and training. This work was able to shed some light on the strengths and weakness in the current use of simulation in allied healthcare education and training, and the results can help to create a roadmap concerning steps that can be taken to strengthen the field. Simulation implementation and utilization is complicated and the solutions may be as complex as the educational system in which it functions (Issenberg et al., 2011). Each individual or institution should view the results of this study and contextually decide which areas are of the most important to their future use of simulation. The need for highly skilled allied healthcare professionals will not be going away any time soon, so there is a need for the field to find research-based methods for adapting and adopting simulation. Improved understanding can lead to improved implementation, and that can lead to improved results for practitioners and patients.

APPENDIX A
INVITATION TO PARTICIPATE

Dear ,

I am writing today to invite you to participate in an exciting endeavor that I believe will have a positive impact in the field of allied healthcare education. I am asking you to become a member of an expert panel of approximately 25 to 30 persons with varied backgrounds in the field of simulation in allied healthcare education. For this study the term simulation includes all modalities including mannequin simulators, task-trainers, actor-patients, or screen-based simulations. The term expert is defined as someone who has designed, developed, or supported a simulation lab for allied healthcare program(s) or has a minimum of three years' experience in any of the following roles within allied healthcare programs: operating simulations; assessing simulation-based competencies; using simulation as a teaching or assessment tool; developing new curriculum for the integration of simulation; or having published peer-reviewed research concerning simulations at the allied healthcare level. This work is being undertaken as a part of my doctoral dissertation at the University of Florida.

This study will use the modified Delphi method to explore the feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology in allied healthcare education. Over the course of three rounds, it seeks to consolidate and assess expert opinions in order to help develop guidelines and recommendations for strategic decision making.

The first round will consist of rating the technical and instructional feasibility of items developed from an intensive literature review. During this round you will also have to opportunity to add new items or comment on existing items. During rounds two and three you will be able to view the panel's responses as well as your own and decide to keep your initial rating or modify your ratings based on the panel's input. As a member of the panel you will remain anonymous to all other panel members. All survey interactions are conducted through email and each panel member will be identified by a random number. This number will be used on all correspondence including the questionnaires.

The value of this study will be determined by the quality of its participants. Without the input of the most qualified individuals in the field of simulation use in allied healthcare education the results of this endeavor will not be optimal. Your willingness to commit to this endeavor is critical to its success. Each member of the panel who complete the three rounds will receive a copy of the findings. I believe that the results of this study will be of use to you and others in the field of allied healthcare education.

The approximate timetable for this study, subject to some adjustment to accommodate panel member's schedules, is:

Table A-1. Study timeline

Task	Date
Demographic questionnaire completed	June 23rd, 2013
Round One Questionnaire distributed to panel	June 24th, 2013
Round One Questionnaire returned to the researcher	July 7th, 2013
Round Two Questionnaire distributed to panel	July 21st, 2013
Round Two Questionnaire returned to the researcher	August 4th, 2013
Round Three Questionnaire distributed to panel	August 17th, 2013
Round Three Questionnaire returned to the researcher	August 25th, 2013

I would be grateful if you would consent to becoming a member of the expert panel by completing the demographic survey. Please go to http://www.surveymonkey.com.... to access the demographic survey. You will notice the informed consent information at the begging of the survey, by completing the demographic survey you will have given your consent to participate in this research. If you would prefer to receive hardcopies of all questionnaires please email me with your complete mailing address and I will send you hardcopies and a self-addressed stamped envelope. Following the completion of the demographic survey you will be sent the first round questionnaire or you will be notified that you did not meet the qualification requirements.

Thank you for giving this project your consideration. I hope that you will find this study of interest to your professional and/or academic work and will consent to participate. I would be happy to hear from you at jokkenney@ufl.edu or at 210-347-6200 if you have any questions concerning this project or if you wish to nominate someone else for this work. Please forward this invitation to others who you feel would be interested and qualified for this study.

Sincerely,

Johanna Kenney

APPENDIX B
REJECTION LETTER

Dear ,

I am writing to thank you for taking an interest this study concerning the future of simulation in allied healthcare education and for taking the time to fill out the demographics survey. While I was impressed with your background and experience, due to the very specific needs of this Delphi study it was decided that other individuals were better fits for the panel. Thank you again for your time,

Sincerely,

Johanna Kenney

APPENDIX C
INFORMED CONSENT

Informed Consent
Protocol Title: The Future of Simulations in Allied Healthcare Education and Training: A Modified Delphi Study Identifying Their Instructional and Technical Feasibility

Please read this consent document carefully before you decide to participate in this study and complete the demographic survey.

Purpose of the research study:

The purpose of this study is to consolidate and assess expert opinions about the feasibility of successfully addressing the critical issues facing the future use of simulator technology and simulation methodology in Allied Healthcare Education in order to help develop guidelines and recommendations for strategic decision making.

What you will be asked to do in the study:

Members of the expert panel will be asked to participate in a three round Delphi study. This process includes filling out an initial demographic questionnaire and then rate items and, if necessary add new items and provide qualitative feedback.

Time required:

This will vary some based on the amount of input and feedback given. The demographic survey should take more approximately 10-15 minutes. The initial round may take 2 to 4 hours to complete. The second and third rounds should take approximately 1-2 hours to complete. All together the panel participants will probably spend 4 to 7 hours completing the surveys over the course of 3 months.

Risks and Benefits:

We do not anticipate any direct risk or benefit from participating in this project.

Compensation:

There is no compensation for participating in this research.

Confidentiality:

Your identity will be kept confidential to the extent provided by law. Your information will be assigned a code number. The list connecting your name to this number will be kept off site in the researcher's home office. This code will be used to communicate to all panel members during the Delphi study. When the study is completed and the data have been analyzed, the list will be destroyed. Your name will not be used in any report.

Voluntary participation:

Your participation in this study is completely voluntary. There is no penalty for not participating.

Right to withdraw from the study:

You have the right to withdraw from the study at any time without consequence.

Whom to contact if you have questions about the study:

Johanna Kenney, Graduate Student, School of Teaching & Learning, phone: 210-347-6200, e-mail: jokkenney@ufl.edu

Dr Albert Ritzhaupt, Assistant Professor, Educator Technology, phone: 352-273-4180, e-mail: artizhaupt@coe.ufl.edu

Whom to contact about your rights as a research participant in the study:

IRB02 Office, Box 112250, University of Florida, Gainesville, FL 32611-2250; phone 392-0433.

Agreement:

By beginning the survey, you acknowledge that you have read this consent form and agree to participate in this research.

APPENDIX D
DEMOGRAPHICS SURVEY

PERSONAL CHARACTERISTICS
Name (For tracking purposes only, you will receive a participant number for use during the Delphi study) ______________________________
Preferred contact method ______________________________

Age group
__ *20-30*
__ *31-40*
__ *41-50*
__ *51-60*
__ *61 years or older*

Highest Level of Education
__ *High School graduate*
__ *Some College*
__ *Associates Degree*
__ *College Degree*
__ *Graduate Degree*

Please list any relevant certifications
____

Years of experience supporting, using, researching, and/or evaluating simulator technologies and or simulation modalities in allied healthcare education.
__ *0-2*
__ *3-5*
__ *6-10*
__ *11 or greater*

Current position

Title ____
Years in current position ____________

Have you previously held a simulation related position(s) at a community or technical college?
__ *Yes*
__ *No*

If yes
Title____
Years in position ____________

Title____

Years in position ____________

How many hours per week spent using or working with simulators/simulation?
__ *1-10*
__ *11-15*
__ *16-20*
__ *21 or more*

Type of simulator(s)/simulation used

Please list any simulation related publications

Other relevant information

Reason for interest in the study

INSTITUTIONAL CHARACTERISTICS

__ *I am not currently associated with a technical or community college*

Institution Name ______________________

Student Enrollment

Total Student Enrollment _____________

Total Degree Seeking Enrollment _____________

Total Non-Degree Seeking/Other Enrollment _____________

Allied Health Programs Offered

____
____
____
____
____
____

Carnegie Classification
If you are unsure of your classification please go to
http://classifications.carnegiefoundation.org/lookup_listings/institution.php *and look up your institution*

__ Public Rural-serving Small
__ Public Rural-serving Medium
__ Public Rural-serving Large
__ Public Suburban-serving Single Campus
__ Public Suburban-serving Multicampus
__ Public Urban-serving Single Campus
__ Public Urban-serving Multicampus
__ Public Special Use
__ Private Not-for-profit
__ Private For-profit
__ Public 2-year colleges under 4-year universities
__ Public 4-year Primarily Associate's
__ Private Not-for-profit 4-year Primarily Associate's
__ Private For-profit 4-year Primarily Associate's

Programs Currently Utilizing Human Patent Simulations

____
____
____

Programs Currently Utilizing Patient-Actor Simulations

____
____
____

Programs Currently Utilizing Screen-Based Simulations

____
____
____

Thank you for taking the time to complete this survey. I will contact you by May 24th with information concerning the first round of the Delphi survey.

APPENDIX E
DEMOGRAPHICS SURVEY RESULTS

Results for most of the demographic survey questions are shown in this section. Any question which included personally identifiable information (PII) including publications and place of work, has been removed. No edits were done for grammar, spelling, or consistency (e.g., PhD versus Ph.D.).

Table E-1. What is your preferred contact method?

Answer Options	Response Percent	Response Count
email	96.0	24
hard copies	4.0	1
Please specify email or physical address		17
Answered question		25
Skipped question		0

Table E-2. Age group

Answer Options	Response Percent	Response Count
20-29	0.0	0
30-39	16.0	4
40-49	44.0	11
50-59	16.0	4
60 or older	24.0	6
Answered question		25
Skipped question		0

Table E-3. Gender

Answer Options	Response Percent	Response Count
Male	48.0	12
Female	52.0	13
Answered question		25
Skipped question		0

Table E-4. What is the highest level of education you have completed?

Answer Options		Response Percent	Response Count
High school		0.0	0
Some college		4.0	1
Associates degree		12.0	3
Baccalaureate degree		20.0	5
Some graduate school		0.0	0
Graduate degree		64.0	16
Other (please specify)*		4	
	Answered question		25
	Skipped question		0

* PhD in process; Commercial pilot training; doctoral studies in progress; Chiropractic degree also

Table E-5. Degree(s) earned

Response Text		Response Count
	Answered question	25
	Skipped question	0
Integrated Marketing and Communications		
BSN, MSN		
Master of Health Science		
BS Biochemistry		
AA EMS Management		
Bachelor of Applied Science (Physiotherapy), Master of Physiotherapy, Doctor of Philosophy		
MSN		
MS in Family Nursing, Nurse Education		
BS. BHSc, MS		
PhD in Education-Training and Performance Improvement		
BSN, MA		
BS in Physical Therapy, MHS, DHS		
Ph.D, D.C.		
Bachalor of Science in Liberal Studies		
BS, MS Aeronautics and Astronautics		
B.S., M.Ed		
MSN, BSN, Diploma School of Nursing		
PhD MEd BA DASE Cert Ed		
Business, Accounting		
Associate in Applied Science - Allied Health Sciences, Bachelor of Science in Health Sciences		
B.A.		
AS Science		
AAS, BA, MAT, PhD		
Master Degree in Aeronautical Science (MAS)		

Table E-6. Please list any relevant certifications

Response Text		Response Count
	Answered question	17
	Skipped question	8
Certified TeamSTEPPS Master Trainer, Certified Laerdal Educator, Certified Anesthesia Technologist		
ANCC Certification - Nursing Professional Development		
ACLS/PALS/PEPP/BLS/AMLS/EMPACT/PHTLS/TC3 Instructor; NAEMT Level II Instructor		
IBM Certified Developer in six areas of expertise. Registered Vascular Technologist (RVT)		
Airline Pilot Licence, Fellow of the Royal Aeronautical Society, Crew Resource Management Instructor, Airline Type Rating Examiner		
Certified Healthcare Simulation Educator, Certified Perioperative Registered Nurse		
Certified Nurse Educator		
Licensed Practitioner with HeartMath, Certified health education specialist (CHES)		
National Registry Paramedic, Oregon Paramedic		
RPTA, NREMT-P		
CNE, CCRN Alumni		
FAcadMEd		
Certificate of Achievement in Clinical Simulation		
EMT-P		
Paramedic		
Paramedic license, ACLS instructor, Private Pilot, Instrument rating and Floatplane rating		

Table E-7. Years of experience supporting, using, researching, and/or evaluating simulator technologies and or simulation modalities in allied healthcare education

Answer Options		Response Percent	Response Count
0-2		8.0	2
3-5		16.0	4
6-10		48.0	12
11 or greater		28.0	7
	Answered question		25
	Skipped question		0

Table E-8. Have you had any simulation specific training?

Answer Options		Response Percent	Response Count
Yes		84.0	21
No		16.0	4
If yes, please specify*			21
	Answered question		25
	Skipped question		0

* I was a trained simulation specialist at WISER for 5 years, and I am now a simulation educator.

Currently enrolled in Postgraduate Certificate Program - Healthcare Simulation. Have completed 3 of 4 courses.

On line modules http://www.nhet-sim.edu.au/

manufacturer courses on equipment use, programming, repair, etc.

40 hour course through the U.S Army.

Through Laerdal and Gaumard plus some courses taken on my own

Conferences, reading of journals, peer education, education by product makers.

IML basic user trainig for the HeratWorks 3D echocardiography simulator.

Approved Synthetic Flight Instructor Course

Comprehensive Workshop in Debriefing at CMS-Cambridge

LAERDAL SUN User Conferences, Drexel University Simulation Certificate Course 8/2010

Laeredol Simulation mannequins

Instructor status with the American Heart Association, American Red Cross, American Safety and Health Institute and the Emergency Care and Safety Institute. I have also initiated immediate feedback systems with our CPR manikens and begun a unit using Second Life for age-related health changes for students this semester.

Several trainings through Laerdal, Several trainings through the Oregon Simulation Alliance

While I have never had any simulation specific "training", I have been a leader in developing simulation methods for over 40 years in multiple industries. With respect to healthcare: founder and director of a very large multidiscipline simulation center in a hospital, residency, community environment.

conferences and on site trainings

3 hour onsite training session provided by METI

Hands on in the United States Air Force, Attended the CAE Healthcare Human Patient Simulator Conference (HPSN 2011, 2012).

Completed all factory training with CAE (METI) and am fluent with physiological modeling user interface.

Training on Laerdal and CAE simulators

Various local courses from other medical disciplines (nursing and medical school faculty) and simulation equipment manufactures. Also training through grad school on simulations use in the aviation field.

Table E-9. What is the job title for your current position?

Response Text		Response Count
	Answered question	25
	Skipped question	0
Simulation Educator		
Chief Nurse		
Lecturer and Stream coordinator Radiation therapy		
Simulation Coordinator		
Training Specialist U.S. Army		
Senior Lecturer		
Simulation Coordinator		
Innovative Practice Center Coordinator		
Program Director		
Managing Director of (redacted)		
Director		
Currently not employed due to disability		
Assistant Professor		
Assistant Professor in Health Education		
Program Chair, Instructor		
Director		
Director		
Professor		
freelance consultant in continuing medical education		
Owner (redacted), Simulation Coordinator		
Patient Simulation Laboratory Coordinator		
Simulation Technician		
Simulation Coordinator		
Dean of Health Occupations/Director of Simulation		
Program Director and Department Chair		

Table E-10. About how long have you been in your current position?

Answer Options	Response Average	Response Count
Years	6.32	
Months	5.45	
	answered question	25
	skipped question	0

Table E-11. Have you previously held a simulation related position(s) at a community or technical college?

Answer Options		Response Percent	Response Count
Yes		24.0	6
No		76.0	19
	Answered question		25
	Skipped question		0

Table E-12. What is the job title for your current position?

Response Text		Response Count
	Answered question	6
	Skipped question	19
Associate Dean, Academic Support		
Adjunct Faculty San Antonio College		
Adjunct Faculty EMT		
Simulation Technician		
Adjunct Faculty- EMS		
Instructor and Assistant Professor		

Table E-13. Time in this position

Answer Options		Response Average	Response Count
Years		3.50	
Months		3.50	
	Answered question		6
	Skipped question		19

Table E-14. Other relevant previous experience

Response Text		Response Count
	Answered question	17
	Skipped question	8
2 years Chief Nurse -- education and training fell under chief nurse; low fidelity simulation used		
animal emergency medicine technician (ICU care, assist in surgeries and procedures, phlebotomy, run lab tests, prep and administer meds, check in out and triage, etc)		
I have worked in staff development since 1998. Also have some academic teaching experience.		
FAculty in nursing education, facilitated simulations with students, wrote simulations		
Developed and implemented computer-based simulations for educational purposes over a 15-year period while employed in IT/consulting roles		
Simulator trainer (redacted) Airways 1998 - 2005		
Past Certified EMT		
(redacted) Firefighter		
ADLS, BDLS Instructor		
TNCC		
20 yrs Army Nurse Corp		
Chiropractic training included the use of cadavers (3 year program)		
Instructor for 20+ years ACLS, PALS, PHTLS, PEPP		
Paramedic instructor last 14+ years		
Professor and Program Director at another four year college		
Sr. Clinical Education Specialist with Patient Simulator Manufacturer		
Adjunct faculty at (redacted) Community College 2004-2006 (Time of initial simulation development		
15 years university teaching and research; lead educator for (redacted) (UK) 1996 to present; ATLS educator		
Simulation Consultant, (redacted) Author		
Was a Nationallly Certified EMT, license is expired currently.		
Certified AHA CPR BLS Healthcare & Heartsaver Instructor, actively teaching yearly.		
A/V technician		
Simulation and WMD tech for (redacted) Health Systems emergency Department		
Also work ~36 hours per month as a paramedic to try and stay current in the field...		

Table E-15. On average, how many hours per week do you spend using or working with simulators/simulation?

Answer Options	Response Average	Response Count
1-10	45.8	11
11-15	16.7	4
16-20	8.3	2
21 or more	29.2	7
Other (please specify)*	45.8	3
Answered question		6
Skipped question		19

* I was a trained simulation specialist at WISER for 5 years, and I am now a simulation educator.

currently not working directly with simulation

It varies, some weeks lots, others none.

40 hours per week in simulation training (7 years)

Table E-16. Type(s) of simulator(s)/simulation used

Response Text	Response Count
Answered question	24
Skipped question	1
Laerdal Sim Essential, Meti Man, Noelle, Sim Mom, Sim Junior, Laerdal Sim Man 3G, Laerdal Sim Man, Laerdal ALS Man, Laerdal Sim Baby, Laerdal Sim NewBBLS Torso, Other Partial Task Trainers	
hard task trainer, low-fidelity; high fidelity (3G SimMan)	
virtual reality software, authentic clinical environments, manequins	
various adult peds infant manikins from METI, Laerdal and Gaumard, CAE VR endoscopy, simple and complex task trainers (including Harvey and LSAT), and more	
Laerdal Sim-Man/Sim-Baby	
I have had interests and participation in projects which use online simulation and patient examples.	
Sim-Man and megacode Kelly more than others. Haven't started actively using our other models yet. Also some medium fidelity and low fidelity as well as SPs and task trainers.	
High fidelity, medium fidelity, low fidelity task trainers. Laerdol, Guamard productts	
IML HeartWorks 3D echocardiography simulator	
Clinical - human mannequin	
SimMan 3G, Noelle, SimBaby, Nursing Kid, Neonate, Chest tube insertation	
LP, Rectal exam, IV starts, Sim IV, Harvey, Haptic Lap Mentor, Haptic Endoscopy, Difficult Airway Torso, Arterial Sticks, Suturing and Knot Tying, Vascular Suturing, Blood draws	
Patient actor simulations, Mannequin simulators with computer software	
Manikins, second life	
Live, task, low fidelity, high fidelity	
All Types	
All types of medical simulators: Hi-fidelity full body, task trainers, VR, Standardized patients, hybrids (we were the pioneers of surgical hybrids around 2007)	
METI Standard Man, METE pediatric HPS, A lower fidelity Laerdal simulator"	
Laerdal	
Laerdal, METI, Guamard	
We have 10 high-fidelity simulators. Eight are CAE Healthcare manikins and Four are Gaumard manikins.	
High fidelity: Laerdal SimMan, Sim Junior, Sim NewB, Sim Baby PTT: IV arms, intubating heads, LP backs, foley, TEE/TTE. We do lab based and in situ simulations	
Task trainers or static simulators, Computer based software simulation, Dynamic full body simulators	
CAE Istan, MetiMan; Laredal SimMan, SimMan 3G, SimBaby, Gaumard Noelle	
High-fidelity field based simulation for both paramedic students and currently active field providers. Have used or currently using a wide range of equipment (mostly laerdal), paid actors and volunteers.	

Table E-17. Please list any simulation related publications

Response Text		Response Count
	Answered question	12
	Skipped question	13

Note: publications not listed due to PII

Table E-18. Other relevant information

Response Text		Response Count
	Answered question	7
	Skipped question	18
Developed a "Basic Use of Sim Man 3G" course at the (redacted)		
Graduate capstone project was in simulation-happy to share if it would be helpful		
Member of the Hospital Emergency Response Team Society for Simulation in Healthcare • Journal Reviewer 2012-Present • Board of Director 2010-2011 • Secretary 2009-2010 • Chair, Membership & Bylaws Committee 2006-2008 • Nominations Committee 2006-2008 • Accreditation Committee • Technology & Standards Committee • Conference Abstract Reviewer (250) (2007-present) • Star-Wars Finals Judge (2010) (redacted). (redacted) Presented at the Society for Simulation in Healthcare Conference, Orlando, FL. (redacted). (redacted). Presented at the Society for Simulation in Healthcare Conference, Orlando, FL. (redacted). Panel presentation at Society for Simulation in Healthcare Conference, Orlando, FL. (redacted). Presented at the first Bio-skills conference, Orlando, FL. (redacted). (redacted). Presented at the Congressional Caucus National Training and Simulation Association, Virginia Beach, VA (redacted). (redacted). Presented at the Society for Simulation in Healthcare Conference, Orlando, FL (redacted). (redacted) Presented at the Capital Medical Center, Olympia, WA (redacted). (redacted) Presented at the Capital Medical Center, Olympia, WA (redacted) (2004). Masters in Nursing Commencement Speech. Presented at (redacted). (2005-2008). Various Tour Presentations to DOD VIPs. Presented at (redacted) (1985-2005). Various briefings to Soldiers and Higher Command. Presented during 20 years as U.S. Army Nurse officer.		
Using bio-communication technology from the Institute of HeartMath and the EVOX from the Zyto corporation for the past 6 years		
Helped set up simulation centers at other locations. Designed simulation centers for groups in foreign countries. Acted as a resource to train people setting up centers in other locations, both national and international. Have participated in many national surveys of this type.		
Owner of (redacted), Simulation Specialist Dacum panel member		
N/A		

Table E-19. Reason for interest in the study

Response Text		Response Count
	Answered question	21
	Skipped question	4
More information to share with the simulation community.		
Simulation is used throughout the (redacted) enlisted medical training. Simulation is often taught OJT with no formal training program for military instructors. This is minimal published research in the effectiveness/best use of simulation in allied health care.		
Passionate about simulation		
to advance the field		
To gather and provide information which would benefit sim-man use in the helath care educational setting		
My interest in research is growing and I would like to take part in more studies		
I'm all about the simulation		
To provide assitance in the project, and curious as to the findings as well		

Table E-20. I am currently associated with a technical or community college

Answer Options		Response Percent	Response Count
Yes		37.5	9
No		62.5	15
	Answered question		24
	Skipped question		1

Table E-21. Institution Name

Response Text		Response Count
	Answered question	9
	Skipped question	16

Note: Institution name redacted due to PII

Table E-22. Allied health programs offered (please include name and type, e.g., associate degree, continuing education, certificate)

Response Text		Response Count
	Answered question	9
	Skipped question	16
Continuing Education		
Physiotherapy Occupational Therapy Human Movement Health Science Podiatry Medical Raditions Occupational Therapy		
Pre-physical therapy, BS Pre-occupational therapy, BS Community Health, BS Biotechnology minor as part of a BS degree		
Paramedic Associate of Applied Science also Fire Science and Nursing		
AS Programs Nuclear medicine radiography sonography respiratory care dental hygiene dental assistant interdisciplinary studies medical assisting clinical lab science physical therapy occupation therapy Nursing Surgical Technology Certificate programs CNA PCT Massage Therapy EMT Paramedic Phlebotomy Sterile Processing Community		
Nursing AD Respiratory Therapy AD Physical Therapy Assistant AD Occupational Therapy Assistant AD Laboratory Tech AD Medical OffIce Assistant AD Surgical Technology AD Health Information Technology AD		
ADN - Associate Degree Nursing PN - Practical Nursing Surgical Technician - Certificate Medical Assistant - Certificate Massage Therapy - Certificate Medical Record Coding - Certificate Pharmacy Technician - Certificate		
We offer two Nursing degrees and 17 other Allied Health degrees, diploma and certificates.		
Within my department we offer: EMT certificaiton AAS in Paramedicine BS in EMS Management (starting in Fall 2013) Other departments within my university offer degrees in Respiratory therapy (BS), Nursing (RN and BSN through transfer), Clinical Lab Science (BS), Medical Imagining (BS).		

Table E-23. Carnegie Classification If you are unsure of your classification please go to http://classifications.carnegiefoundation.org/lookup_listings/institution.php and look up your institution

Answer Options	Response Average	Response Count
Public Rural-serving Small	0.0	0
Public Rural-serving Medium	22.2	2
Public Rural-serving Large	11.1	1
Public Suburban-serving Single Campus	0.0	0
Public Suburban-serving Multicampus	22.2	2
Public Urban-serving Single Campus	11.1	1
Public Urban-serving Multicampus	22.2	2
Public Special Use	0.0	0
Private Not-for-profit	0.0	0
Private For-profit	0.0	0
Public 2-year colleges under 4-year universities	11.1	1
Public 4-year Primarily Associate's	0.0	0
Private Not-for-profit 4-year Primarily Associate's	0.0	0
Private For-profit 4-year Primarily Associate's	0.0	0
	Answered question	6
	Skipped question	19

Table E-24. Programs currently utilizing human patient simulators

Response Text		Response Count
	Answered question	9
	Skipped question	16
EMT-Basic and Paramedic programs		
I know of one program - Physiotherapy		
Nursing Exercise Physiology Corporate Fitness Athletic Training Biology Physical Education Psychology Sociology Health Studies Pre-med		
Paramedic, Fire, Nursing		
All of the above listed		
Nursing Respiratory Therapy Medical Assistant		
Associate Degree Nursing and Practical Nursing Departments		
Nursing, Paramedic, EMT, Respiratory Therapy, Pharmacy Technician, OTA, PTA		
EMT, Paramedic, Nursing (presumably). Not sure about who else uses them as I'm not involved in their departments.		

Table E-25. Programs currently utilizing patient-actor simulation

Response Text		Response Count
	Answered question	9
	Skipped question	16
EMT-Basic and Paramedic programs		
I know of one program - Physiotherapy		
Unknown		
none		
Nursing PCT Respiratory Care		
Unknown		
Associate Degree Nursing		
Nursing, Paramedic, EMT, Respiratory Therapy, Pharmacy Technician, OTA, PTA		
EMT, Paramedic, Nursing (presumably). Not sure about who else uses them as I'm not involved in their departments.		

Table E-26. Programs currently utilizing screen-based simulation

Response Text		Response Count
	Answered question	9
	Skipped question	16
EMT-Basic and Paramedic programs		
I know of one program - Medical Raditions		
Same as 23 [Pre-physical therapy, BS Pre-occupational therapy, BS Community Health, BS Biotechnology minor as part of a BS degree]		
none		
Only our one day medical encounters, currently building this area		
Unknown		
N/A		
Phlebotomy		
not in our department and unknown use in the university.		

APPENDIX F
ROUND ONE QUESTIONNAIRE

Dear Panelist,

Thank you for agreeing to participate in this modified Delphi study exploring the instructional and technical feasibility of successfully addressing the issues facing the future use of simulator technology and simulation methodology in allied healthcare education and training. Attached to this email you will find the first round Delphi questionnaire with your unique participant ID. This questionnaire was built after an extensive literature review, but you may add new items or give feedback on the existing items during this round. Your input will be of great value in creating guidelines and recommendations based on the feasibility of successfully addressing the critical issues facing the use of simulator technology and simulation methodology within allied healthcare education. Also attached is the contact information I currently have for you. If you would like to add any information or correct this information please do so and return with the completed questionnaire by July 7th.

Technical issues are concerned not only with the simulation technology itself, but can include issues with peripherals such network support, simulator maintenance, technical difficulties in running the simulators, and the design and development of new technologies. Instructional issues may include pedagogical issues such as the choosing of the most effective instructional method, policy issues such as accreditation requirements, curriculum issues such as assessment validation, and faculty issues such as training. The purpose of this research is to develop items based not only the strengths and weakness of the technology, but also on the strength and weaknesses of the methodology. It is important to not only identify and define technical and instructional issues which may impact the future of simulations in allied healthcare education, but to develop a consensus concerning if these issues can be dealt with successfully.

The Delphi method is used to work towards group consensus concerning the list of items on the questionnaire. Development of the items began with a literature review concerning the current use of healthcare simulations in education, specific examples of the use of simulation in allied healthcare, and the possible future of healthcare simulations in healthcare education. Each item is to be rated on its technical and instructional feasibility as both are necessary if the item is to be strategically pursued. Keep in mind the question “Is it feasible to pursue solutions to these issues?”

You are requested to do the following:

1. Review all the issues listed in the questionnaire.
2. Make any comments or suggestions, give feedback, or request clarification on any item in the spaces provided. If commenting on a current item please note the item number before the comment.
3. Add new items as you deem appropriate.
4. Rate the technical (TF) and instructional feasibility (IF) of each item based on the included scale (more details in PDF).
5. Return your response by July 7th, 2013.

Thank you for your prompt attention. Should you have any questions or concerns please feel free to contact me by email at jokkenney@ufl.edu or at 210-347-6200.

Rating Scale for Technical Feasibility[1]

1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very Feasible, 5= Extremely Feasible

This is not intended to be an all-encompassing list, but an example of some issues at each level.

1. Not at all feasible
    - Cannot be implemented
    - Basic research and development of technology or methodology is needed
    - Current technologies do not exist
    - Cost of technology is excessive
2. Probably unfeasible
    - Implementation not possible under current conditions
    - Major research and development are needed before implementation
    - Cost of technology and other resources would require additional funding
    - Complexity of technology makes implementation difficult
3. Feasible
    - Possible implementation
    - Some research and development is still needed
    - Cost of technology and other resources is manageable
    - Complexity of technology makes implementation challenging
4. Very feasible
    - Some indication that implementation is possible
    - Small amount of research and development still needed (research and/or development is in process)
    - Cost of technology and other resources can be covered
    - Complexity of technology is manageable with training
5. Extremely feasible
    - Can be implemented
    - Current research and development is adequate
    - Necessary resources are available
    - Training is available and adequate

[1] Adapted from Ziglio, E. (1996). The Delphi method and its contribution to decision-making. In M. Adler and E. Ziglio (Eds.), *Gazing into the oracle: The Delphi method and its application to social policy and public health*, (3-33) London, England: Jessica Kingley Publishers.

Rating Scale for Instructional Feasibility[2]

1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very Feasible, 5= Extremely Feasible

This is not intended to be an all-encompassing list, but an example of some issues at each level.

1. Not at all feasible
   - Cannot be implemented
   - Faculty unwilling to support changes
   - No possibility of being acceptable for certification of skills
   - Curriculum would need a major re-write to support simulation
   - Politically unacceptable
2. Probably unfeasible
   - Implementation not possible under current conditions
   - Majority of faculty opposes changes
   - Low possibility of being acceptable for certification of skills
   - Extensive modifications are needed to curriculum
   - Political obstacles
3. Feasible
   - Possible implementation
   - Some research and development are still needed
   - Some possibility of being acceptable for certification of skills
   - Moderate modifications are needed to curriculum
   - Some political obstacles
4. Very feasible
   - Some instructional obstacles
   - Faculty concerns can be addressed
   - Possibility of being acceptable for certification of skills
   - Some modification is needed to curriculum
   - Minor political obstacles
5. Extremely feasible
   - No major instructional obstacles
   - Will be acceptable to faculty
   - Will be approved by accrediting/certification boards for certification of skills
   - Can be easily integrated into existing curriculum
   - No significant political obstacles

[2] Adapted from Ziglio, E. (1996). The Delphi method and its contribution to decision-making. In M. Adler and E. Ziglio (Eds.), *Gazing into the oracle: The Delphi method and its application to social policy and public health*, (3-33) London, England: Jessica Kingley Publishers.

Round 1 Questionnaire.
Rate and technical feasibility (TF) and instructional feasibility (IF) on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Item No.	***Issue Statement (in no particular order)***		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
	Research issues		
1	Need to set up a clear research agenda for simulations in allied healthcare education	TF	
		IF	
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	TF	
		IF	
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	TF	
		IF	
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	TF	
		IF	
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	TF	
		IF	
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	TF	
		IF	
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	TF	
		IF	
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	TF	
		IF	

Item No.	***Issue Statement (in no particular order)***		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	TF	
		IF	
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	TF	
		IF	
	Additional items or comments on existing research items (For comments on existing items, please state the item number)		
	Curriculum issues		
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	TF	
		IF	
12	Need to develop guidelines concerning the best mix of clinical and simulation-based training for optimal learning outcomes	TF	
		IF	
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	TF	
		IF	
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	TF	
		IF	
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	TF	
		IF	

Item No.	***Issue Statement (in no particular order)***		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	TF	
		IF	
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	TF	
		IF	
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	TF	
		IF	
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	TF	
		IF	
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	TF	
		IF	
21	Need for faculty agreement on purpose and methodology for debriefing sessions	TF	
		IF	
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	TF	
		IF	
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	TF	
		IF	
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	TF	
		IF	

Item No.	***Issue Statement (in no particular order)***		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	TF	
		IF	
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	TF	
		IF	
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	TF	
		IF	
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	TF	
		IF	
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	TF	
		IF	
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience	TF	
		IF	
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	TF	
		IF	
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	TF	
		IF	
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	TF	
		IF	

Item No.	Issue Statement (in no particular order)		1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	TF	
		IF	
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	TF	
		IF	
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	TF	
		IF	
	Additional items or comments on existing curriculum items (For comments on existing items, please state the item number)		
	Collaboration issues		
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	TF	
		IF	
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	TF	
		IF	
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	TF	
		IF	
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	TF	
		IF	

Item No.	*Issue Statement (in no particular order)*		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	TF	
		IF	
42	Institutions should network with other institution to optimize simulation research	TF	
		IF	
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	TF	
		IF	
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	TF	
		IF	
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	TF	
		IF	
	Additional items or comments on existing collaboration items (For comments on existing items, please state the item number)		
	Tools and simulator technology issues		
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	TF	
		IF	
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	TF	
		IF	

Item No.	***Issue Statement (in no particular order)***		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	TF	
		IF	
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	TF	
		IF	
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	TF	
		IF	
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	TF	
		IF	
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	TF	
		IF	
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	TF	
		IF	
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	TF	
		IF	
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	TF	
		IF	

Item No.	*Issue Statement (in no particular order)*		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
	Additional items or comments on existing technology items (For comments on existing items, please state the item number)		
	Faculty and staff issues		
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	TF	
		IF	
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	TF	
		IF	
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	TF	
		IF	
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	TF	
		IF	
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	TF	
		IF	
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	TF	
		IF	
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	TF	
		IF	

Item No.	Issue Statement (in no particular order)		1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	TF	
		IF	
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	TF	
		IF	
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	TF	
		IF	
66	Need to create standardized certification opportunities for those teaching with simulation	TF	
		IF	
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	TF	
		IF	
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	TF	
		IF	
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	TF	
		IF	
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	TF	
		IF	
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	TF	
		IF	

Item No.	Issue Statement (in no particular order)		1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	TF	
		IF	
73	Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	TF	
		IF	
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	TF	
		IF	
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	TF	
		IF	
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	TF	
		IF	
	Additional items or comments on existing faculty and staff items (For comments on existing items, please state the item number)		
	Resources		
77	Need to show return on investment for high cost simulation programs	TF	
		IF	
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	TF	
		IF	

Item No.	*Issue Statement (in no particular order)*		**1. Not at all Feasible, 2. Probably unfeasible 3. Feasible, 4. Very feasible, 5. Extremely feasible, NA**
79	Need to address the fact that facilities are inadequate to properly run the scenarios	TF	
		IF	
80	Need to address the fact that there is a lack of appropriate support equipment such as cameras, crash carts, catheters supplied by the institution	TF	
		IF	
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	TF	
		IF	
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	TF	
		IF	
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	TF	
		IF	
84	Need to educate stakeholders better so they have an understanding of when simulation may be an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	TF	
		IF	
	Additional items or comments on existing resource items (For comments on existing items, please state the item number)		

APPENDIX G
ROUND TWO QUESTIONNAIRE

Dear Panelist #,

Thank you for your participation and input on Round One of this modified Delphi study exploring the instructional and technical feasibility of successfully addressing the issues facing the future use of simulator technology and simulation methodology in allied healthcare education and training. As some of you noted, this research is only looking at one small part of a complex issue as feasibility and need is not always the same thing and this study will not be able to address every issue. Your participation is greatly appreciated and I anticipate even more interesting insights in this round. Attached to this email you will find the second round Delphi questionnaire. You can use Adobe Acrobat or Adobe Reader to fill in this form. If you are using a MAC you may experience problems if you use MAC Preview.

Attached is the questionnaire for Round Two of the study. Your comments and feedback as well as one new item have been compiled and added to the questionnaire. Some of the comments have been edited for clarity and consistency. A few items were edited based on panel feedback for clarity; these are noted as edited in the item number and consist of strikeouts for deletion of words and bold for additional words. Items listed with an interquartile range (IQR) of less than 1.2 are noted with an asterisk (*) and have statistically reached consensus; however, you still have an opportunity to modify your rating. There were a number of items where some respondents answered NA. Reasoning for those responses are provided when given. If an item reaches consensus on an NA response (70%) the item will be removed for Round Three.

For this round you are requested to do the following:

1. Review all the issues listed in the questionnaire.

2. Review the group responses to Round One items. The mean, standard deviation, and IQR are given along with the number of NA responses.

3. Review your Round One response against the group mean. Any comments given during Round One are included. Decide if you wish to re-rank the item or leave your Round One ranking. Check the box under **No change to response** if you wish to keep your rating from Round One. If you wish to change, type in a number 1-5 or NA in the **Rank** column. **Note**: Those listed with an asterisk next to the IQR number have reached consensus, but you may still change your rating.

4. Rate the technical (TF) and instructional (IF) feasibility of the new item based on the included scale by typing the number 1-5 or NA in the **Rank** column.

5. If your ranking is outside of group mean, please explain your reasoning in the last column. You may also add any additional feedback you may think helpful to your fellow panelists. Your input from this round could impact the way other panelists respond, so please be clear and concise.

6. Please return your response by August 4th. Clicking on the Submit button on the first page will send it directly back to me.

Thank you for your prompt attention. Should you have any questions or concerns please feel free to contact me by email at jokkenney@ufl.edu or call me at 210-347-6200.

Johanna Kenney

Round 2 Questionnaire.
Rate technical feasibility (TF) and instructional feasibility (IF) on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
Research issues							
1	Need to set up a clear research agenda for simulations in allied healthcare education	Mean: 3.72 SD: 1.26 IQR: 1.75 %NA 5.26%	5	TF			
		Mean: 3.56 SD: 1.26 IQR: 1* %NA 5.26%	5	IF			
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	Mean: 3.74 SD: 0.87 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.94 SD: 1.28 IQR: 2 %NA 5.26%	5	IF			
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	Mean: 3.63 SD: 1.16 IQR: 1.5 %NA 0.00%	5	TF			
		Mean: 3.67 SD: 1.39 IQR: 1.75 %NA 5.26%	5	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	Mean: 3.84 SD: 0.90 IQR: 1.5 %NA 0.00%	5	TF			
		Mean: 3.83 SD: 1.34 IQR: 2 %NA 5.26%	5	IF			
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	Mean: 3.53 SD: 1.02 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.42 SD: 0.84 IQR: 1* %NA 0.00%	4	IF			
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	Mean: 3.22 SD: 1.03 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.50 SD: 1.00 IQR: 1* %NA 5.26%	3	IF			
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	Mean: 3.56 SD: 1.12 IQR: 1* %NA 5.26%	5	TF			
		Mean: 3.72 SD: 1.12 IQR: 1* %NA 5.26%	5	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	Mean: 3.33 SD: 1.07 IQR: 0.75* %NA 5.26%	5	TF			
		Mean: 3.44 SD: 1.24 IQR: 1* %NA 5.26%	5	IF			
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	Mean: 3.37 SD: 1.12 IQR: 1.5 %NA 0.00%	3	TF			
		Mean: 3.28 SD: 1.24 IQR: 1.75 %NA 5.26%	3	IF			
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	Mean: 3.11 SD: 1.31 IQR: 1.5 %NA 5.26%	5	TF			
		Mean: 2.76 SD: 1.26 IQR: 1* %NA 10.53%	3	IF			
Comments on Item 10: Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques" is not needed. The same metrics should be used to evaluate educational outcomes for any method or technique, with many examples are well established in the literature.							
New	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	Added	New	TF			
		Added	New	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
Curriculum issues							
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	Mean: 3.72 SD: 1.58 IQR: 2.75 %NA 5.26%	5	TF			
		Mean: 3.63 SD: 1.07 IQR: 1* %NA 0.00%	3	IF			
12 - edited	Need to develop guidelines concerning the best mix of **current** clinical and simulation-based training for optimal learning outcomes	Mean: 3.67 SD: 1.39 IQR: 2 %NA 5.26%	3	TF			
		Mean: 3.74 SD: 0.93 IQR: 1.5 %NA 0.00%	3	IF			
Comments on Item 12: assuming we are optimizing the mix using current technology							
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	Mean: 4.00 SD: 1.32 IQR: 2 %NA 5.26%	3	TF			
		Mean: 3.84 SD: 0.96 IQR: 2 %NA 0.00%	3	IF			
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	Mean: 3.39 SD: 1.23 IQR: 1* %NA 5.26%	4	TF			
		Mean: 2.89 SD: 1.05 IQR: 2 %NA 0.00%	2	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	Mean: 3.17 SD: 1.45 IQR: 2 %NA 5.26%	5	TF			
		Mean: 2.58 SD: 1.22 IQR: 1* %NA 0.00%	1	IF			
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	Mean: 3.33 SD: 1.38 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.28 SD: 1.24 IQR: 1* %NA 5.26%	3	IF			
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	Mean: 3.50 SD: 1.34 IQR: 1* %NA 5.26%	2	TF			
		Mean: 3.83 SD: 1.21 IQR: 1* %NA 5.26%	2	IF			
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	Mean: 3.47 SD: 0.96 IQR: 1* %NA 0.00%	2	TF			
		Mean: 3.78 SD: 1.22 IQR: 1* %NA 5.26%	2	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	Mean: 4.11 SD: 1.33 IQR: 1.75 %NA 5.26%	5	TF			
		Mean: 4.11 SD: 0.94 IQR: 1.5 %NA 0.00%	5	IF			
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	Mean: 3.50 SD: 1.34 IQR: 1.75 %NA 5.26%	4	TF			
		Mean: 3.53 SD: 0.96 IQR: 1* %NA 0.00%	2	IF			
21	Need for faculty agreement on purpose and methodology for debriefing sessions	Mean: 3.83 SD: 1.30 IQR: 1.75 %NA 5.26%	5	TF			
		Mean: 3.67 SD: 1.22 IQR: 1* %NA 5.26%	3	IF			
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	Mean: 3.67 SD: 1.35 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.68 SD: 1.06 IQR: 1.5 %NA 0.00%	3	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	Mean: 3.12 SD: 1.51 IQR: 2 %NA 10.53%	2	TF			
		Mean: 3.16 SD: 0.96 IQR: 1.5 %NA 0.00%	2	IF			
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	Mean: 2.60 SD: 1.51 IQR: 1* %NA 21.05%	NA	TF			
		Mean: 2.44 SD: 1.43 IQR: 1* %NA 15.79%	NA	IF			
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	Mean: 3.56 SD: 1.26 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.29 SD: 1.43 IQR: 2 %NA 10.53%	3	IF			
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	Mean: 3.61 SD: 1.22 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.61 SD: 1.22 IQR: 1* %NA 5.26%	3	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	Mean: 3.13 SD: 1.61 IQR: 2 %NA 15.79%	3	TF			
		Mean: 3.17 SD: 1.33 IQR: 1.75 %NA 5.26%	3	IF			
Comments on Item 27: not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general							
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	Mean: 3.59 SD: 1.47 IQR: 1* %NA 10.53%	4	TF			
		Mean: 3.42 SD: 0.84 IQR: 1* %NA 0.00%	2	IF			
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	Mean: 2.81 SD: 1.42 IQR: 1.25 %NA 15.79%	2	TF			
		Mean: 3.11 SD: 1.31 IQR: 1.5 %NA 5.26%	2	IF			
Comments on Item 29: not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general							

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
30 edited	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience **when it has been proven to be a sufficient substitute**	Mean: 3.06 SD: 1.54 IQR: 2 %NA 15.79%	3	TF			
		Mean: 3.12 SD: 1.44 IQR: 2 %NA 10.53%	4	IF			
Comments on Item 30: - technology is not always adequate for replacing clinical experience; not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general							
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	Mean: 3.25 SD: 1.48 IQR: 1* %NA 10.53%	3	TF			
		Mean: 3.32 SD: 0.95 IQR: 1* %NA 0.00%	3	IF			
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	Mean: 3.72 SD: 1.39 IQR: 1.75 %NA 5.26%	5	TF			
		Mean: 3.44 SD: 1.48 IQR: 2 %NA 5.26%	5	IF			
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	Mean: 3.07 SD: 1.57 IQR: 0.5* %NA 21.05%	3	TF			
		Mean: 2.88 SD: 1.57 IQR: 1* %NA 15.79%	2	IF			
Comments on Item 33: not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general							

Issue No.	*Issue Statement (in no particular order)*	*Round 1 Group Response*	*Your Round 1 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	Mean: 3.42 SD: 1.07 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.37 SD: 1.26 IQR: 2 %NA 0.00%	3	IF			
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	Mean: 3.24 SD: 1.56 IQR: 2 %NA 10.53%	4	TF			
		Mean: 3.28 SD: 1.29 IQR: 1* %NA 5.26%	3	IF			
Comments on Item 29: not needed, redundant, or not specifically applicable or attributable to the use of simulations in healthcare education specifically, but exist as educational issues in general							
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	Mean: 3.32 SD: 1.06 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.11 SD: 0.94 IQR: 1* %NA 0.00%	3	IF			
Collaboration issues							
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	Mean: 3.17 SD: 1.41 IQR: 1.75 %NA 5.26%	4	TF			
		Mean: 3.28 SD: 1.52 IQR: 1* %NA 5.26%	4	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	Mean: 3.53 SD: 1.57 IQR: 1* %NA 10.53%	5	TF			
		Mean: 3.74 SD: 1.15 IQR: 2 %NA 0.00%	5	IF			
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	Mean: 3.00 SD: 1.34 IQR: 2 %NA 5.26%	2	TF			
		Mean: 3.06 SD: 1.41 IQR: 2 %NA 5.26%	2	IF			
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	Mean: 2.71 SD: 1.43 IQR: 1* %NA 10.53%	2	TF			
		Mean: 2.41 SD: 1.21 IQR: 1* %NA 10.53%	2	IF			
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	Mean: 2.82 SD: 1.43 IQR: 1* %NA 10.53%	3	TF			
		Mean: 2.50 SD: 1.12 IQR: 1* %NA 5.26%	3	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
42	Institutions should network with other institution to optimize simulation research	Mean: 3.42 SD: 1.02 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.35 SD: 1.49 IQR: 1* %NA 10.53%	5	IF			
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	Mean: 3.42 SD: 1.17 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.39 SD: 1.36 IQR: 1* %NA 5.26%	5	IF			
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	Mean: 3.56 SD: 1.46 IQR: 1.75 %NA 5.26%	4	TF			
		Mean: 3.28 SD: 1.45 IQR: 2 %NA 5.26%	4	IF			
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	Mean: 2.74 SD: 1.15 IQR: 1* %NA 0.00%	3	TF			
		Mean: 2.89 SD: 1.28 IQR: 1.75 %NA 5.26%	3	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
Tools and simulator technology issues							
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	Mean: 3.74 SD: 0.93 IQR: 1.5 %NA 0.00%	4	TF			
		Mean: 3.37 SD: 0.90 IQR: 1* %NA 0.00%	4	IF			
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	Mean: 3.42 SD: 0.84 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.39 SD: 1.18 IQR: 1* %NA 5.26%	5	IF			
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	Mean: 2.68 SD: 1.06 IQR: 1* %NA 0.00%	5	TF			
		Mean: 2.83 SD: 1.25 IQR: 1* %NA 5.26%	5	IF			
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	Mean: 2.84 SD: 1.12 IQR: 1 %NA 0.00%	3	TF			
		Mean: 2.78 SD: 1.21 IQR: 1* %NA 5.26%	3	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	Mean: 3.56 SD: 1.38 IQR: 1* %NA 5.26%	5	TF			
		Mean: 3.72 SD: 1.26 IQR: 1* %NA 5.26%	5	IF			
Comments Item 50: likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health							
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	Mean: 3.26 SD: 1.05 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.47 SD: 0.90 IQR: 1* %NA 0.00%	5	IF			
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	Mean: 3.06 SD: 1.29 IQR: 0.75* %NA 5.26%	3	TF			
		Mean: 3.06 SD: 1.45 IQR: 1* %NA 10.53%	3	IF			
Comments Item 52: likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health							
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	Mean: 3.53 SD: 0.96 IQR: 1* %NA 0.00%	2	TF			
		Mean: 3.37 SD: 1.01 IQR: 1* %NA 0.00%	2	IF			

Issue No.	*Issue Statement (in no particular order)*	*Round 1 Group Response*	*Your Round 1 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	Mean: 3.17 SD: 1.25 IQR: 1.75 %NA 5.26%	3	TF			
		Mean: 3.33 SD: 1.17 IQR: 1* %NA 5.26%	3	IF			
Comments Item 54: likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health							
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	Mean: 3.00 SD: 1.34 IQR: 2 %NA 5.26%	3	TF			
		Mean: 3.24 SD: 1.49 IQR: 1* %NA 10.53%	3	IF			
Comments Item 54: Likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health							
Faculty and staff issues							
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	Mean: 3.47 SD: 1.56 IQR: 1* %NA 10.53%	4	TF			
		Mean: 3.58 SD: 1.02 IQR: 1* %NA 0.00%	4	IF			
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	Mean: 3.33 SD: 1.21 IQR: 1* %NA 5.26%	4	TF			
		Mean: 3.32 SD: 0.89 IQR: 1* %NA 0.00%	4	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	Mean: 3.50 SD: 1.68 IQR: 1.25 %NA 15.79%	5	TF			
		Mean: 3.53 SD: 1.46 IQR: 1* %NA 10.53%	5	IF			
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	Mean: 3.31 SD: 1.62 IQR: 1* %NA 10.53%	5	TF			
		Mean: 3.61 SD: 1.39 IQR: 1* %NA 0.00%	5	IF			
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	Mean: 3.74 SD: 0.87 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.47 SD: 0.84 IQR: 1* %NA 0.00%	2	IF			
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	Mean: 3.72 SD: 1.22 IQR: 1* %NA 5.26%	5	TF			
		Mean: 3.68 SD: 0.95 IQR: 1* %NA 0.00%	3	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	Mean: 3.74 SD: 0.87 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.84 SD: 0.83 IQR: 0* %NA 0.00%	5	IF			
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	Mean: 3.68 SD: 0.89 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.68 SD: 0.95 IQR: 1* %NA 0.00%	4	IF			
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	Mean: 3.24 SD: 1.49 IQR: 2 %NA 10.53%	3	TF			
		Mean: 3.16 SD: 1.07 IQR: 1.5 %NA 0.00%	3	IF			
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	Mean: 3.53 SD: 0.90 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.42 SD: 0.90 IQR: 1* %NA 0.00%	3	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
66	Need to create standardized certification opportunities for those teaching with simulation	Mean: 3.58 SD: 0.90 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.58 SD: 0.96 IQR: 1* %NA 0.00%	4	IF			
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	Mean: 2.89 SD: 1.10 IQR: 0.75* %NA 5.26%	3	TF			
		Mean: 2.89 SD: 0.94 IQR: 1* %NA 0.00%	3	IF			
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	Mean: 3.56 SD: 1.26 IQR: 1* %NA 5.26%	4	TF			
		Mean: 3.32 SD: 1.00 IQR: 1* %NA 0.00%	4	IF			
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	Mean: 3.24 SD: 1.41 IQR: 1* %NA 10.53%	5	TF			
		Mean: 3.21 SD: 1.03 IQR: 1* %NA 0.00%	5	IF			

Issue No.	Issue Statement (in no particular order)	Round 1 Group Response	Your Round 1 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	Mean: 3.06 SD: 1.54 IQR: 2 %NA 15.79%	4	TF			
		Mean: 3.11 SD: 1.35 IQR: 2 %NA 5.26%	4	IF			
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	Mean: 2.75 SD: 1.60 IQR: 2.25 %NA 15.79%	4	TF			
		Mean: 2.41 SD: 1.38 IQR: 3 %NA 10.53%	4	IF			
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	Mean: 3.06 SD: 1.15 IQR: 2 %NA 5.26%	4	TF			
		Mean: 3.06 SD: 0.99 IQR: 0.75* %NA 5.26%	4	IF			
73	Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	Mean: 3.06 SD: 1.41 IQR: 1* %NA 10.53%	5	TF			
		Mean: 3.13 SD: 1.54 IQR: 1* %NA 15.79%	5	IF			

Issue No.	*Issue Statement (in no particular order)*	*Round 1 Group Response*	*Your Round 1 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	Mean: 3.17 SD: 1.20 IQR: 1* %NA 5.26%	4	TF			
		Mean: 3.16 SD: 0.69 IQR: 1* %NA 0.00%	4	IF			
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	Mean: 3.06 SD: 1.15 IQR: 0.75* %NA 5.26%	3	TF			
		Mean: 2.94 SD: 1.03 IQR: 1.75 %NA 5.26%	3	IF			
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	Mean: 3.47 SD: 0.84 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.53 SD: 0.77 IQR: 1* %NA 0.00%	4	IF			
Resources							
77	Need to show return on investment to decrease pressure to reduce high cost programs	Mean: 3.11 SD: 0.99 IQR: 2 %NA 0.00%	2	TF			
		Mean: 3.11 SD: 0.99 IQR: 2 %NA 0.00%	2	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 1 Group Response***	***Your Round 1 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	Mean: 3.24 SD: 1.37 IQR: 0* %NA 5.26%	3	TF			
		Mean: 2.82 SD: 1.35 IQR: 1* %NA 10.53%	3	IF			
79 edited	~~Need to address the fact that facilities are inadequate to properly run the scenarios~~ Need to address how to best equip and support facilities to properly run the appropriate scenarios	Mean: 3.06 SD: 1.29 IQR: 2 %NA 5.26%	5	TF			
		Mean: 2.94 SD: 1.47 IQR: 2 %NA 15.79%	3	IF			
80	~~Need to address the fact that there is a lack of appropriate support equipment such as cameras, crash carts, catheters supplied by the institution~~ Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution	Mean: 3.18 SD: 1.34 IQR: 1* %NA 10.53%	4	TF			
		Mean: 2.81 SD: 1.38 IQR: 2 %NA 15.79%	4	IF			
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	Mean: 2.82 SD: 1.17 IQR: 1* %NA 5.26%	3	TF			
		Mean: 2.71 SD: 1.12 IQR: 1* %NA 10.53%	3	IF			

Issue No.	*Issue Statement (in no particular order)*	*Round 1 Group Response*	*Your Round 1 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	Mean: 3.05 SD: 0.78 IQR: 0* %NA 0.00%	4	TF			
		Mean: 3.06 SD: 1.19 IQR: 0* %NA 5.26%	2	IF			
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	Mean: 2.94 SD: 1.26 IQR: 1* %NA 5.26%	3	TF			
		Mean: 3.00 SD: 1.39 IQR: 1.25 %NA 15.79%	3	IF			
84 edited	Need to **find ways to** educate stakeholders better so they have an understanding **if and when** simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	Mean: 3.25 SD: 1.59 IQR: 2 %NA 5.26%	3	TF			
		Mean: 3.12 SD: 1.32 IQR: 0* %NA 5.26%	3	IF			
Comments on resource items: There should be a distinction made between NEED and FEASIBILITY. Many things are feasible to study, but are not needed, with comparatively few the opposite. Many of the items above are also very specific to site/institution, or so wide-reaching that one wonders who exactly would be doing the research; a consortium of users? Manufacturers of simulations? Both?							

APPENDIX H
ROUND THREE QUESTIONNAIRE

Dear Panelist #,

Welcome to the third and final round of this modified Delphi study exploring the instructional and technical feasibility of successfully addressing the issues facing the future use of simulator technology and simulation methodology in allied healthcare education and training. Thank you for your participation and input on the first two rounds. All but a dozen items have reached consensus, however, all but five items include comments from Round Two. Based on some input I considered adding a ranking concerning whether or not the implementation of each item was feasible. After much debate I decided that I could not do justice to that issue within the scope of this research; that needs to be researched on its own as that issue, as well as need and political feasibility, are extremely important to discuss and deserve more time and effort than can be given for this particular study.

Attached to this email you will find the third round Delphi questionnaire. You can use Adobe Acrobat or Adobe Reader to fill in this form. If you are using a MAC you may experience problems if you use MAC Preview. Your comments and ratings have been compiled and added to the questionnaire. Some of the comments have been edited for clarity and consistency. One item was edited based on feedback for clarity; this is noted as edited in the item number and consists of bold text for additional words. Items listed with an interquartile range (IQR) of less than 1.2 are noted with an asterisk (*) and have statistically reached consensus; however, you may still modify your rating. There were a number of items where some panelists answered NA. Reasoning for those responses are provided when given. If an item reaches consensus on an NA response (70%) the item will be removed for the final analysis.

For this round you are requested to do the following:

1. Review all the issues listed in the questionnaire.

2. Review the group responses to Round Two items. The mean, standard deviation, and IQR are given along with the number of NA responses.

3. Review your Round Two response against the group mean. Comments given during Round Two are included. Decide if you wish to re-rank the item or leave your Round Two ranking. Check the box under **No change to response** if you wish to keep your rating from Round Two. If you wish to change, type in a number 1-5 or NA in the **Rank** column. **Note**: Those listed with an asterisk next to the IQR number have reached consensus, but you may still change your rating.

4. If your ranking is outside of group mean, please explain your reasoning in the last column. You may still add additional feedback; this will be included in the final analysis.

5. Please return your response by August 31st. Clicking on the Submit button on the first page will send it directly back to me or you may just send it as an email attachment.

Thank you for your prompt attention. I will return a copy of the final analysis to you as soon as it is available. Should you have any questions or concerns please feel free to contact me by email at jokkenney@ufl.edu or call me at 210-347-6200.

Johanna Kenney

Round 3 Questionnaire.
Instructional feasibility (IF) and technical feasibility (TF) rated on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Issue No.	*Issue Statement (in no particular order)*	*Round 2 Group Response*	*Your Round 2 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
Research issues							
1	Need to set up a clear research agenda for simulations in allied healthcare education	Mean: 3.65 SD: 0.79 IQR: 1* %NA 0.00%	5	TF			
		Mean: 3.59 SD: 0.80 IQR: 1* %NA 0.00%	4	IF			
1TF: Changed from a 5 to a 4 to account for the lack of resources currently available to support quantitative research in this area. Many of these items are feasible If you could ever get consensus of a group of educator to agree within a few years. My experience has been that you get more than two to three people together to work on a project, the project can be difficult to complete in a timely manner. "Simulation should not be an ""add-on"" nor a side effect of any program. Most graduate and some under-grad programs have established research methods. To include simulation to the research agenda would require a folk to actually sit and talk about it however, simulation is still somewhat new and not many understand effective implementation of the many platforms of simulation to research. Implementation has already occurred in some research programs, development might need tweaking to suit the type of research. Cost as less prohibitive than in previous years. Simulation technology is very manageable with minimal training. **1IF:** Instruction obstacles would result from lack of simulation technologies which would probably cover the major faculty concern other than cost. Many credentialing bodies have accepted simulation as capable of providing a high level of fidelity in certification of skills. Curriculum modification would be to incorporate the simulation. Political obstacles can easily be overcome.							
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	Mean: 3.88 SD: 0.70 IQR: 1* %NA 0.00%	4	TF			
		Mean: 4.03 SD: 0.84 IQR: 2 %NA 0.00%	5	IF			
2TF: This may be time consuming but to determine if simulation has impacted the learner could simply require reassessment of skills. **2IF:** From an instructional standpoint there should not be much difference then the technical feasibility.							

Issue No.	***Issue Statement (in no particular order)***	***Round 2 Group Response***	***Your Round 2 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	Mean: 3.71 SD: 0.85 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.79 SD: 0.81 IQR: 1* %NA 5.56%	5	IF			
3TF: This would be very much dependent on the specific procedure. Traditional methods in the past have used live models (starting IV on each other vs a simulator). Simulation technology is continuing to evolve requiring a little R & D **3IF:** Many skills assessments have been certified through simulation thus making the instructional feasibility higher.							
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	Mean: 3.79 SD: 0.88 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.74 SD: 0.83 IQR: 1* %NA 5.56%	4	IF			
4TF: It seems it would be difficult to do a controlled study proving Retaining skills learned and tested on a simulator should not be confused with the validity of the skill. **4IF & TF:** This is also time consuming but has been implemented in some programs. Some R & D could be needed depending on the skill being assessed.							
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	Mean: 3.59 SD: 1.00 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.41 SD: 0.87 IQR: 1* %NA 0.00%	4	IF			
5TF: I have undertaken a longitudinal study and apart from some impatience and the risk of anticipating outcomes, there are real benefits in gaining perception over time **5TF & IF:** This variable is mostly dependent on time and context as well as technological hurdles (how can you assess a procedure if the test subject moves or completes the program) Not sure that it is useful for long range studies as practice and conceivably simulation practices may changeevolve over time - more useful to get current data							

Issue No.	*Issue Statement (in no particular order)*	*Round 2 Group Response*	*Your Round 2 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	Mean: 3.29 SD: 0.77 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.53 SD: 0.72 IQR: 1* %NA 0.00%	4	IF			
6TF: I think it is difficult to isolate the impact of discrete variables **6TF & IF:** A simple metric or rubric would be needed during follow up to assess confidence.							
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	Mean: 3.59 SD: 0.71 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.65 SD: 0.70 IQR: 1* %NA 0.00%	4	IF			
7TF & IF: Technologically how would one asses impact from simulation? Complexity of technology could make this challenging							
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	Mean: 3.29 SD: 0.69 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.29 SD: 0.92 IQR: 1* %NA 0.00%	4	IF			
8TF & IF: This would be very student specific							

Issue No.	Issue Statement (in no particular order)	Round 2 Group Response	Your Round 2 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	Mean: 3.35 SD: 0.86 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.18 SD: 0.88 IQR: 1* %NA 0.00%	4	IF			
9TF: I think it is difficult to isolate the impact of discrete variables **9IF:** I think this would be beneficial data to gain More simulation technology research could be required							
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	Mean: 3.31 SD: 1.11 IQR: .25* %NA 5.56%	3	TF			
		Mean: 2.88 SD: 0.85 IQR: 0* %NA 5.56%	3	IF			
10TF: I don't know how much technology would play a part in comparing debriefing techniques It would be difficult to create Comment related to the Item 10 comment from round 1 ("Item 10 above is not needed. The same metrics should be used to evaluate educational outcomes for any method or technique, with many examples are well established in the literature."). My understanding of this survey effort is for the panel to rate the implementation feasibility (T or I) of the items you provide on the survey, not to provide our opinions on if the survey items are needed or would be valuable in the industry. **10IF:** I foresee politics as the greatest hurdle here.							
N1 (Added from Round 1)	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	Mean: 3.41 SD: 0.95 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.28 SD: 0.77 IQR: 1* %NA 0.00%	3	IF			
NEWTF: There are a number of variables introduced here							

Issue No.	Issue Statement (in no particular order)	Round 2 Group Response	Your Round 2 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
Curriculum issues							
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	Mean: 3.73 SD: 1.15 IQR: 2 %NA 0.00%	4	TF			
		Mean: 3.71 SD: 0.92 IQR: 1* %NA 0.00%	4	IF			
11TF: Development of a matrix for validation could be implemented currently in some programs. **11IF:** Institution often designates one facilitator for session, based on availability and not skill level experience. Instructional feasibility would be very instructor dependent but is seemingly not difficult to implement.							
12	Need to develop guidelines concerning the best mix of current clinical and simulation-based training for optimal learning outcomes	Mean: 3.55 SD: 1.27 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.68 SD: 0.85 IQR: 1* %NA 0.00%	4	IF			
12TF: Guideline development would not require much in terms of technology - it would mostly require faculty discussion I don't know how this would be possible with so many different disciplines and contexts **12IF:** To study outcome results of clinical vs. simulation training requires follow up with clinical participants (usually something IRB approved) thus should not incur major instructional obstacles, accepted by faculty (its IRB approved if it's institutional research) thus negating political obstacles.							
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	Mean: 4.06 SD: 0.90 IQR: 2 %NA 0.00%	5	TF			
		Mean: 3.94 SD: 0.90 IQR: 2 %NA 0.00%	4	IF			
13TF & IF: Guidelines would be based on current simulation technology (you wouldn't prepare guidelines based on technology yet to be available)							

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14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	Mean: 3.29 SD: 0.77 IQR: 1* %NA 0.00%	4	TF			
		Mean: 2.81 SD: 0.81 IQR: 1* %NA 0.00%	3	IF			
14TF & IF: This is very institution resource dependent. Some programs have more resources to commit to simulation curriculum content then others. Some courses may not require simulation as the platform to include in the curriculum.							
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	Mean: 3.12 SD: 1.17 IQR: 2 %NA 0.00%	4	TF			
		Mean: 2.68 SD: 0.92 IQR: 1* %NA 0.00%	3	IF			
15TF & IF: This varies from state to state. For example, Respiratory Therapist training, scope of practice, etc. ... varies from state to state thus making a standardized consensus problematic (more research or development on that would be needed)							
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	Mean: 3.24 SD: 0.90 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.29 SD: 0.77 IQR: 1* %NA 0.00%	4	IF			
16TF: Studies in this have been conducted with more being done, however this can be started at the individual institution level. Some simulation methods have already been validated to serve in place of some clinical experiences (if students come up a little short on procedures, accrediting bodies with allow simulated procedures to substitute, i.e., a student needs 3 central lines to complete the requirement and have already completed their last clinical commitment could use simulated central line training to be checked off) **16IF:** Some political obstacles could be incurred depending on the discipline. More development may be needed							

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17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	Mean: 3.47 SD: 1.01 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.76 SD: 0.83 IQR: 1* %NA 0.00%	4	IF			
17TF: Again - not sure this is technically feasible - huge amount of data required **17IF:** There may be two stages to this process: during design phase (where are the potential challenges - knowledge, expertise; and during practice - is a scenario difficult to bring to a successful closure **17TF & IF:** Development of this variable is in progress and dependent on each individual program. We begin our students gently with basics (task trainers) gradually increasing to complex simulated scenarios just prior to graduation.							
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	Mean: 3.41 SD: 1.00 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.71 SD: 0.85 IQR: 1* %NA 0.00%	4	IF			
18TF: Again - not sure this is technically feasible - huge amount of data required **18IF:** There may be two stages to this process: during design phase (where are the potential challenges - knowledge, expertise; and during practice - is a scenario difficult to bring to a successful closure **18TF & IF:** Scenario development is technology driven. We can't simulate certain things if the tech does not exist thus, complexity is based on technology at hand.							
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	Mean: 4.24 SD: 0.75 IQR: 1* %NA 0.00%	5	TF			
		Mean: 4.18 SD: 0.73 IQR: 1* %NA 0.00%	4	IF			
19TF & IF: As part of any lab a clearly defined outcome should be established prior to use of simulation. "At the end of this lab the learner should......"							

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20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	Mean: 3.53 SD: 1.21 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.44 SD: 0.93 IQR: 1* %NA 0.00%	4	IF			
20TF: Framework development would not have any technological issue that I can think of **20IF:** Such a development would could have faculty issue in determining which would be the best framework, it would be curriculum specific requiring potential modification.							
21	Need for faculty agreement on purpose and methodology for debriefing sessions	Mean: 3.86 SD: 0.86 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.59 SD: 0.80 IQR: 1* %NA 0.00%	3	IF			
21TF: Debriefing methodology at its core requires an audio and video recording that can be played back. Such technology exists in multiple forms and on multiple platforms **21IF:** This could possibly be implemented depending on faculty agreement.							
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	Mean: 3.75 SD: 1.23 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.62 SD: 0.93 IQR: 1* %NA 0.00%	3	IF			
22IF: Most people do not know what simulators are much less understand their limitations							

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23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	Mean: 3.19 SD: 1.17 IQR: 0.25* %NA 5.56%	4	TF			
		Mean: 3.12 SD: 0.93 IQR: 0* %NA 0.00%	3	IF			
23IF: There may be some instructional obstacles from an instructional standpoint resulting from politics							
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	Mean: 2.46 SD: 1.28 IQR: 1* %NA 11.11%	NA	TF			
		Mean: 2.27 SD: 1.22 IQR: 1* %NA 5.56%	NA	IF			
24TF & IF: Not sure this is relevant **24IF:** This is highly dependent on school budgets that have (as of late) been cut so deep simulation equipment and proper instructional with said simulators is prohibitive							
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	Mean: 3.65 SD: 0.79 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.38 SD: 1.13 IQR: 1* %NA 5.56%	3	IF			
25TF: Each simulator manufacturer has a bank of purchasable pre-programmed scenarios available. Current technology would determine is objectives are met or able to be met. I would be little inclined towards off the shelf purchases of scenarios. Bespoke ones should meet objectives as part of design process **25IF:** This is more of a technology driven question							

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26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	Mean: 3.71 SD: 0.77 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.50 SD: 1.16 IQR: 1* %NA 5.56%	4	IF			
26TF: I would be little inclined towards off the shelf purchases of scenarios. Bespoke ones should meet objectives as part of design process **26IF:** I cannot see faculty arriving at an agreement on this matter. **26TF & IF:** Each simulator manufacturer has a bank of purchasable pre-programmed scenarios available. Current technology would determine is objectives are met or able to be met.							
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	Mean: 3.13 SD: 1.39 IQR: 1* %NA 11.11%	4	TF			
		Mean: 3.19 SD: 1.06 IQR: 0.25* %NA 5.56%	3	IF			
27TF: Feedback has a lot of challenges and not knowing what you don't know offers a particular challenge to effective feedback							
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	Mean: 3.81 SD: 1.18 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.41 SD: 0.80 IQR: 1* %NA 0.00%	4	IF			
28IF: Some modifications to curriculums may be required to determine if objectives can be met with simulation							

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29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	Mean: 2.85 SD: 1.28 IQR: 1* %NA 11.11%	4	TF			
		Mean: 2.94 SD: 1.03 IQR: 0.25* %NA 5.56%	3	IF			
29TF: I think this is about teacher assessment - vital. **29IF:** Important as not all teachers can get the best out of simulation							
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute	Mean: 3.07 SD: 1.31 IQR: 1* %NA 11.11%	2	TF			
		Mean: 3.13 SD: 1.20 IQR: 2 %NA 5.56%	2	IF			
30IF: As time and simulation technology improve, more accrediting bodies will accept simulated experiences for certifications and licensing. Some currently do.							
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	Mean: 3.38 SD: 1.13 IQR: 1* %NA 5.56%	3	TF			
		Mean: 3.24 SD: 0.75 IQR: 0* %NA 0.00%	3	IF			
31IF: May encounter some political obstacles.							

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32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	Mean: 3.66 SD: 1.12 IQR: 1* %NA 5.56%	3	TF			
		Mean: 3.38 SD: 1.19 IQR: 0.25* %NA 5.56%	3	IF			
32TF: Current technology exists and if delivered in a high fidelity context can be easily incorporated into a program curriculum. **32IF:** Current limitations are faculty agreement and involvement. Some programs do not have the faculty resources to adequately incorporate simulation and it ends up being a stand alone thing.							
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	Mean: 3.21 SD: 1.50 IQR: 0.75* %NA 16.67%	4	TF			
		Mean: 2.75 SD: 1.35 IQR: 0.86* %NA 16.67%	NA	IF			
33TF & IF: Not sure this is relevant							
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	Mean: 3.65 SD: 0.86 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.29 SD: 1.05 IQR: 2 %NA 0.00%	4	IF			
34TF & IF: This seems like a great outcome							

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35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	Mean: 3.56 SD: 1.22 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.31 SD: 1.11 IQR: 1* %NA 5.56%	3	IF			
35TF: We currently incorporate this in our crisis management training. **35IF:** Depending on the school and program, could encounter some political difficulties.							
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	Mean: 3.37 SD: 0.78 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.18 SD: 0.73 IQR: 0* %NA 0.00%	3	IF			
36TF & IF: This is program specific and may require more development **36IF:** Not sure what this might look like: there are some learning outcomes that an experienced educator can look at and think this modality will work better than that one. It is based on intuition and experience and cannot be reduced to a checklist.							
Collaboration issues							
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	Mean: 3.13 SD: 1.30 IQR: 1.25 %NA 5.56%	4	TF			
		Mean: 3.13 SD: 1.20 IQR: 1* %NA 5.56%	NA	IF			
37TF &IF: I feel this is too big and could be to the detriment discreet disciplines **37IF:** More research and development needed. Some political obstacles.							

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38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	Mean: 3.56 SD: 1.27 IQR: 1* %NA 5.56%	3	TF			
		Mean: 3.62 SD: 0.99 IQR: 1* %NA 0.00%	3	IF			
38IF: I foresee big political obstacles							
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	Mean: 3.19 SD: 1.22 IQR: 1.25 %NA 5.56%	3	TF			
		Mean: 3.25 SD: 1.30 IQR: 1.25 %NA 5.56%	NA	IF			
39TF: Some R & D still needed. Over time simulation costs will decline as technology becomes commonplace **39IF:** Some political obstacles							
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	Mean: 2.63 SD: 1.21 IQR: 1* %NA 11.11%	3	TF			
		Mean: 2.33 SD: 0.97 IQR: 0.5* %NA 11.11%	NA	IF			
40IF: Big political obstacles							
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	Mean: 2.75 SD: 1.00 IQR: 1* %NA 5.56%	3	TF			
		Mean: 2.56 SD: 0.94 IQR: 1* %NA 5.56%	NA	IF			
41IF: Lots of political issues							

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42	Institutions should network with other institution to optimize simulation research	Mean: 3.41 SD: 0.87 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.31 SD: 1.17 IQR: 1* %NA 5.56%	NA	IF			
42TF: Some political issues **42IF:** Technology can be shared via distance in some cases							
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	Mean: 3.59 SD: 0.87 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.31 SD: 1.17 IQR: 1* %NA 5.56%	NA	IF			
43TF: We have been working in some collaborative areas with other disciplines within the institution. **43IF: A**s always, politics **43TF & IF:** IP education is the way of the future so simulation fits nicely							
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	Mean: 3.58 SD: 1.27 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.20 SD: 1.28 IQR: 2 %NA 5.56%	NA	IF			
44IF: This can be a big task. I am more enthusiastic about portable models of good practice, rather than portable examples Politics - many institutions would not be as open to sharing as others							

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45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	Mean: 2.71 SD: 0.69 IQR: 1* %NA 0.00%	3	TF			
		Mean: 2.72 SD: 0.93 IQR: 1* %NA 5.56%	NA	IF			
45TF: Technology could be a small issue in terms of cost and complexity **45IF:** Some curriculum modification may be needed							
Tools and simulator technology issues							
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	Mean: 3.46 SD: 0.71 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.29 SD: 0.77 IQR: 0* %NA 0.00%	3	IF			
46TF: Issues considered would be influenced by available technology **46IF:** Politics							
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	Mean: 3.32 SD: 0.68 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.34 SD: 1.06 IQR: 1* %NA 5.56%	3	IF			
47TF: Some R & D may be required							

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48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	Mean: 2.59 SD: 0.87 IQR: 1* %NA 0.00%	3	TF			
		Mean: 2.75 SD: 1.28 IQR: 1* %NA 5.56%	3	IF			
48TF: More R & D needed							
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	Mean: 2.79 SD: 0.81 IQR: 0.5* %NA 0.00%	3	TF			
		Mean: 2.84 SD: 1.04 IQR: 0.13* %NA 5.56%	3	IF			
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	Mean: 3.61 SD: 1.37 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.73 SD: 1.23 IQR: 1* %NA 5.56%	4	IF			
50TF: I don’t think that technology is the potentially overwhelming variable here, given that it is there to replicate patient response. Accordingly, complexity arises from clinical issues and student’s' level of knowledge and skill Not sure how this could be assessed							

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51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	Mean: 3.21 SD: 1.02 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.44 SD: 0.86 IQR: 1* %NA 0.00%	3	IF			
51TF: I don't think that technology is the potentially overwhelming variable here, given that it is there to replicate patient response. Accordingly, complexity arises from clinical issues and student's' level of knowledge and skill Not sure how this could be assessed							
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	Mean: 2.88 SD: 1.16 IQR: 0* %NA 5.56%	4	TF			
		Mean: 3.00 SD: 1.46 IQR: 0* %NA 11.11%	4	IF			
52TF & IF: Agree with comment "likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health"							
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	Mean: 3.41 SD: 0.94 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.29 SD: 0.94 IQR: 1* %NA 0.00%	3	IF			
53TF & IF: Each simulation session should always be at the highest level of fidelity. If you are using a IV task trainer, the learner should be encouraged to go through every step (PPE, Aseptic technique etc...) they would normally go through. If they are learning epidural placement, the learner should be in sterile PPE as if they are in the live clinical environment.							

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54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	Mean: 3.05 SD: 1.10 IQR: 2 %NA 5.56%	4	TF			
		Mean: 3.31 SD: 0.99 IQR: 1* %NA 5.56%	4	IF			
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	Mean: 2.88 SD: 1.05 IQR: 0.25* %NA 5.56%	4	TF			
		Mean: 3.00 SD: 1.27 IQR: 0.5* %NA 11.11%	4	IF			
55TF & IF: Unnecessary							
Faculty and staff issues							
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	Mean: 3.53 SD: 1.26 IQR: 1* %NA 5.56%	4	TF			
		Mean: 3.53 SD: 0.87 IQR: 1* %NA 0.00%	3	IF			
56TF: This can be a challenge and needs to address underlying structural features of inter-professional behavior. **56IF:** This is not an issue in my department but may be an issue for others. As the sole coordinator all simulation activities funnel through me for all campuses (our main one and 3 distance sites that require per the COA an commensurate experience as the main campus students receive)							

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57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	Mean: 3.47 SD: 0.80 IQR: 1* %NA 5.56%	3	TF			
		Mean: 3.41 SD: 0.71 IQR: 1* %NA 0.00%	3	IF			
57TF & IF: Technology advances have eased faculty concerns and as ours is integrated into the curriculum, faculty participation is not lacking at all							
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	Mean: 3.50 SD: 1.48 IQR: 1* %NA 11.11%	3	TF			
		Mean: 3.57 SD: 1.41 IQR: 1* %NA 11.11%	NA	IF			
58TF: Most unsupported simulation is budget driven or stems from lack of simulator familiarity with technology. **58IF**: Politics							
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	Mean: 3.47 SD: 0.87 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.62 SD: 0.93 IQR: 1* %NA 0.00%	3	IF			
59TF: Limitation here would be on the level of technology and such activities can be delegated to the tech coordinator **59IF:** Primary here is the faculty communication of their objective and the tech to prepare the session to the faculty needs. Once complex scenarios are written, they can be saved. **59TF & IF:** Resources require time to develop							

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60	Need to address the fact that faculty development needs to include the proper use of simulator technology	Mean: 3.75 SD: 0.75 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.53 SD: 0.80 IQR: 1* %NA 0.00%	3	IF			
60IF: Many of the older faculty members still use the see one, do one, teach one model							
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	Mean: 3.81 SD: 1.18 IQR: 1* %NA 5.56%	3	TF			
		Mean: 3.65 SD: 0.70 IQR: 1* %NA 0.00%	3	IF			
61IF: Politics							
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	Mean: 3.71 SD: 0.77 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.82 SD: 0.73 IQR: 0* %NA 0.00%	4	IF			
62IF: Simulation debriefing is considered terrifying by most participants. The faculty would need some minimal training on softer debriefing methods.							
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	Mean: 3.71 SD: 0.69 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.74 SD: 0.56 IQR: 1* %NA 0.00%	4	IF			

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64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	Mean: 3.21 SD: 1.23 IQR: 1.25 %NA 5.56%	3	TF			
		Mean: 3.24 SD: 0.90 IQR: 1* %NA 0.00%	3	IF			
64TF & IF: Strongly agree - need assistance **64IF:** Shared educational resources (curricula, scenarios) would cut down on development time. Politics							
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	Mean: 3.52 SD: 0.79 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.38 SD: 0.70 IQR: 1* %NA 0.00%	3	IF			
65TF: In UK this is a resource issue- availability of courses, who pays etc. **65IF:** More development is required							
66	Need to create standardized certification opportunities for those teaching with simulation	Mean: 3.53 SD: 0.72 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.59 SD: 0.71 IQR: 1* %NA 0.00%	3	IF			
66TF: Institutional autonomy can be a challenge here. perhaps regional or national organisations could step in – e.g. ASPiH in UK **66TF &IF:** Politics							

Issue No.	*Issue Statement (in no particular order)*	*Round 2 Group Response*	*Your Round 2 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	Mean: 2.94 SD: 0.97 IQR: 0* %NA 5.56%	3	TF			
		Mean: 2.88 SD: 0.70 IQR: 0* %NA 0.00%	3	IF			
67IF: Politics and budgets can be the main obstacles							
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	Mean: 3.70 SD: 1.39 IQR: 1* %NA 11.11%	4	TF			
		Mean: 3.44 SD: 1.03 IQR: 1* %NA 5.56%	3	IF			
68TF & IF: Unnecessary - over kill **68IF:** Politics							
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	Mean: 3.34 SD: 1.00 IQR: 0.63* %NA 5.56%	3	TF			
		Mean: 3.32 SD: 0.68 IQR: 1* %NA 0.00%	3	IF			
69IF: This is program specific and faculty may not understand how to write scenarios.							

Issue No.	*Issue Statement (in no particular order)*	*Round 2 Group Response*	*Your Round 2 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	Mean: 2.85 SD: 1.42 IQR: 0* %NA 16.67%	3	TF			
		Mean: 2.93 SD: 1.28 IQR: 1* %NA 5.56%	3	IF			
70TF & IF: Don't see this as a priority **70TF:** Decrease in college student pool also noted; less population in this age group upcoming in the next few years **70IF:** This is a budgetary concern and obstacle							
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	Mean: 2.71 SD: 1.30 IQR: 1* %NA 11.11%	3	TF			
		Mean: 2.63 SD: 1.16 IQR: 1* %NA 5.56%	NA	IF			
71TF: With a less-qualified technical staff, the technology will need to be much more intuitive, reliable and versatile. **71IF:** Politics....ohh yea. Lots of politics in this one =)							
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	Mean: 2.94 SD: 0.97 IQR: 0.25* %NA 5.56%	3	TF			
		Mean: 3.00 SD: 0.95 IQR: 0* %NA 5.56%	NA	IF			
72TF: With a less-qualified technical staff, the technology will need to be much more intuitive, reliable and versatile. **72IF:** more research is needed as well as some development							

Issue No.	Issue Statement (in no particular order)	Round 2 Group Response	Your Round 2 Response	No change to response		Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA	If no change and outside of group mean, please explain. You may also add any feedback to new items here.
73 edited	Need to address the fact that there **can be a** lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	Mean: 3.07 SD: 1.36 IQR: 0.50* %NA 11.11%	3	TF			
		Mean: 3.07 SD: 1.50 IQR: 0.75* %NA 16.67%	NA	IF			
73TF: Lack of knowledge from simulation technologies requires administration and faculty become more aware of simulation capabilities. **73IF:** See 73 TF. We know at face value, simulation works however more research may be needed to validate							
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	Mean: 3.14 SD: 0.90 IQR: 0.06* %NA 5.56%	3	TF			
		Mean: 3.18 SD: 0.53 IQR: 0* %NA 0.00%	3	IF			
74IF: Political obstacles							
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	Mean: 3.06 SD: 0.93 IQR: 0* %NA 5.56%	3	TF			
		Mean: 2.91 SD: 0.90 IQR: 0.13* %NA 5.56%	3	IF			
75IF: Political obstacles							
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	Mean: 3.59 SD: 0.62 IQR: 1* %NA 0.00%	4	TF			
		Mean: 3.65 SD: 0.61 IQR: 1* %NA 0.00%	4	IF			

Issue No.	***Issue Statement (in no particular order)***	***Round 2 Group Response***	***Your Round 2 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
Resources							
77	Need to show return on investment to decrease pressure to reduce high cost programs	Mean: 2.96 SD: 0.76 IQR: 0* %NA 0.00%	3	TF			
		Mean: 3.12 SD: 0.78 IQR: 0* %NA 0.00%	3	IF			
77TF: Could require more technological development My response (2) may be based on ignorance of possible value for money assessments **77TF &IF:** Proving that simulation improves clinical performance has been next to impossible, beyond reducing central line infections with standardized training **77IF:** Political obstacle							
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	Mean: 3.20 SD: 1.29 IQR: 0* %NA 5.56%	3	TF			
		Mean: 2.76 SD: 1.17 IQR: 1* %NA 11.11%	NA	IF			
78IF: Political obstacles, budget concerns							
79	Need to address how to best equip and support facilities to properly run the appropriate scenarios	Mean: 3.18 SD: 0.81 IQR: 0* %NA 0.00%	3	TF			
		Mean: 2.94 SD: 1.03 IQR: 0.25* %NA 5.56%	NA	IF			
79TF: Cost is manageable however alternative methods can be utilized...i.e., donations Models can vary to meet local resources, rather than impose external equipment levels							

Issue No.	***Issue Statement (in no particular order)***	***Round 2 Group Response***	***Your Round 2 Response***	***No change to response***		***Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA***	***If no change and outside of group mean, please explain. You may also add any feedback to new items here.***
80	Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution	Mean: 3.12 SD: 0.60 IQR: 0* %NA 0.00%	3	TF			
		Mean: 2.81 SD: 0.93 IQR: 1* %NA 5.56%	NA	IF			
80TF: Depending on the technological means, complexity can be the challenge **80IF:** Political obstacles arise from determining what is actually needed vs. wanted							
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	Mean: 2.81 SD: 0.93 IQR: 1* %NA 5.56%	3	TF			
		Mean: 2.70 SD: 1.11 IQR: 1* %NA 11.11%	NA	IF			
81TF & IF: Simulation technicians should have, as part of their knowledge base, the basics on simulation maintenance and repair. More development is needed							
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	Mean: 3.24 SD: 0.66 IQR: 0* %NA 0.00%	3	TF			
		Mean: 3.06 SD: 0.99 IQR: 0* %NA 5.56%	NA	IF			
82TF: Not sure that there is a fixed best mix: this depends of availability of resources, staffing levels etc. More development needed **82IF:** Some political obstacles							

Issue No.	*Issue Statement (in no particular order)*	*Round 2 Group Response*	*Your Round 2 Response*	*No change to response*		*Rank 1= Not at all feasible, 2= Somewhat feasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible or NA*	*If no change and outside of group mean, please explain. You may also add any feedback to new items here.*
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	Mean: 2.73 SD: 1.23 IQR: 1* %NA 11.11%	3	TF			
		Mean: 2.93 SD: 1.37 IQR: 0.75* %NA 16.67%	NA	IF			
84	Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	Mean: 3.26 SD: 1.03 IQR: 1* %NA 0.00%	3	TF			
		Mean: 3.19 SD: 1.17 IQR: 0.25* %NA 5.56%	NA	IF			
84TF: I have a problem with the notion of all stakeholders having the same rights and responsibilities and the same claims to having these met. This is something useful to research **84IF:** Could make a significant impact							

APPENDIX I
SURVEY RESULTS

Round 1 Results

Rating technical feasibility (TF) and instructional feasibility (IF) on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
Research issues				
1	Need to set up a clear research agenda for simulations in allied healthcare education	TF	Mean: SD: IQR: %NA	3.72 1.26 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.56 1.26 1* 5.26%
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	TF	Mean: SD: IQR: %NA	3.74 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.94 1.28 2 5.26%
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	TF	Mean: SD: IQR: %NA	3.63 1.16 1.5 0.00%
		IF	Mean: SD: IQR: %NA	3.67 1.39 1.75 5.26%
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	TF	Mean: SD: IQR: %NA	3.84 0.90 1.5 0.00%
		IF	Mean: SD: IQR: %NA	3.83 1.34 2 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	TF	Mean: SD: IQR: %NA	3.53 1.02 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.42 0.84 1* 0.00%
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	TF	Mean: SD: IQR: %NA	3.22 1.03 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.50 1.00 1* 5.26%
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	TF	Mean: SD: IQR: %NA	3.56 1.12 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.72 1.12 1* 5.26%
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	TF	Mean: SD: IQR: %NA	3.33 1.07 0.75* 5.26%
		IF	Mean: SD: IQR: %NA	3.44 1.24 1* 5.26%
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	TF	Mean: SD: IQR: %NA	3.37 1.12 1.5 0.00%
		IF	Mean: SD: IQR: %NA	3.28 1.24 1.75 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	TF	Mean: 3.11 SD: 1.31 IQR: 1.5 %NA 5.26%
		IF	Mean: 2.76 SD: 1.26 IQR: 1* %NA 10.53%
Curriculum issues			
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	TF	Mean: 3.72 SD: 1.58 IQR: 2.75 %NA 5.26%
		IF	Mean: 3.63 SD: 1.07 IQR: 1* %NA 0.00%
12	Need to develop guidelines concerning the best mix of clinical and simulation-based training for optimal learning outcomes	TF	Mean: 3.67 SD: 1.39 IQR: 2 %NA 5.26%
		IF	Mean: 3.74 SD: 0.93 IQR: 1.5 %NA 0.00%
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	TF	Mean: 4.00 SD: 1.32 IQR: 2 %NA 5.26%
		IF	Mean: 3.84 SD: 0.96 IQR: 2 %NA 0.00%
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	TF	Mean: 3.39 SD: 1.23 IQR: 1* %NA 5.26%
		IF	Mean: 2.89 SD: 1.05 IQR: 2 %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response	
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	TF	Mean: SD: IQR: %NA	3.17 1.45 2 5.26%
		IF	Mean: SD: IQR: %NA	2.58 1.22 1* 0.00%
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	TF	Mean: SD: IQR: %NA	3.33 1.38 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.28 1.24 1* 5.26%
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	TF	Mean: SD: IQR: %NA	3.50 1.34 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.83 1.21 1* 5.26%
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	TF	Mean: SD: IQR: %NA	3.47 0.96 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.78 1.22 1* 5.26%
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	TF	Mean: SD: IQR: %NA	4.11 1.33 1.75 5.26%
		IF	Mean: SD: IQR: %NA	4.11 0.94 1.5 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response	
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	TF	Mean: SD: IQR: %NA	3.50 1.34 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.53 0.96 1* 0.00%
21	Need for faculty agreement on purpose and methodology for debriefing sessions	TF	Mean: SD: IQR: %NA	3.83 1.30 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.67 1.22 1* 5.26%
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	TF	Mean: SD: IQR: %NA	3.67 1.35 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.68 1.06 1.5 0.00%
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	TF	Mean: SD: IQR: %NA	3.12 1.51 2 10.53%
		IF	Mean: SD: IQR: %NA	3.16 0.96 1.5 0.00%
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	TF	Mean: SD: IQR: %NA	2.60 1.51 1* 21.05%
		IF	Mean: SD: IQR: %NA	2.44 1.43 1* 15.79%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	TF	Mean: 3.56 SD: 1.26 IQR: 1* %NA 5.26%
		IF	Mean: 3.29 SD: 1.43 IQR: 2 %NA 10.53%
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	TF	Mean: 3.61 SD: 1.22 IQR: 1* %NA 5.26%
		IF	Mean: 3.61 SD: 1.22 IQR: 1* %NA 5.26%
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	TF	Mean: 3.13 SD: 1.61 IQR: 2 %NA 15.79%
		IF	Mean: 3.17 SD: 1.33 IQR: 1.75 %NA 5.26%
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	TF	Mean: 3.59 SD: 1.47 IQR: 1* %NA 10.53%
		IF	Mean: 3.42 SD: 0.84 IQR: 1* %NA 0.00%
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	TF	Mean: 2.81 SD: 1.42 IQR: 1.25 %NA 15.79%
		IF	Mean: 3.11 SD: 1.31 IQR: 1.5 %NA 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience	TF	Mean: 3.06 SD: 1.54 IQR: 2 %NA 15.79%
		IF	Mean: 3.12 SD: 1.44 IQR: 2 %NA 10.53%
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	TF	Mean: 3.25 SD: 1.48 IQR: 1* %NA 10.53%
		IF	Mean: 3.32 SD: 0.95 IQR: 1* %NA 0.00%
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	TF	Mean: 3.72 SD: 1.39 IQR: 1.75 %NA 5.26%
		IF	Mean: 3.44 SD: 1.48 IQR: 2 %NA 5.26%
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	TF	Mean: 3.07 SD: 1.57 IQR: 0.5* %NA 21.05%
		IF	Mean: 2.88 SD: 1.57 IQR: 1* %NA 15.79%
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	TF	Mean: 3.42 SD: 1.07 IQR: 1* %NA 0.00%
		IF	Mean: 3.37 SD: 1.26 IQR: 2 %NA 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 1 Group Response*	
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	TF	Mean: SD: IQR: %NA	3.24 1.56 2 10.53%
		IF	Mean: SD: IQR: %NA	3.28 1.29 1* 5.26%
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	TF	Mean: SD: IQR: %NA	3.32 1.06 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.11 0.94 1* 0.00%
Collaboration issues				
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	TF	Mean: SD: IQR: %NA	3.17 1.41 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.28 1.52 1* 5.26%
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	TF	Mean: SD: IQR: %NA	3.53 1.57 1* 10.53%
		IF	Mean: SD: IQR: %NA	3.74 1.15 2 0.00%
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	TF	Mean: SD: IQR: %NA	3.00 1.34 2 5.26%
		IF	Mean: SD: IQR: %NA	3.06 1.41 2 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	TF	Mean: SD: IQR: %NA	2.71 1.43 1* 10.53%
		IF	Mean: SD: IQR: %NA	2.41 1.21 1* 10.53%
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	TF	Mean: SD: IQR: %NA	2.82 1.43 1* 10.53%
		IF	Mean: SD: IQR: %NA	2.50 1.12 1* 5.26%
42	Institutions should network with other institution to optimize simulation research	TF	Mean: SD: IQR: %NA	3.42 1.02 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.35 1.49 1* 10.53%
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	TF	Mean: SD: IQR: %NA	3.42 1.17 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.39 1.36 1* 5.26%
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	TF	Mean: SD: IQR: %NA	3.56 1.46 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.28 1.45 2 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	TF	Mean: SD: IQR: %NA	2.74 1.15 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.89 1.28 1.75 5.26%
Tools and simulator technology issues				
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	TF	Mean: SD: IQR: %NA	3.74 0.93 1.5 0.00%
		IF	Mean: SD: IQR: %NA	3.37 0.90 1* 0.00%
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	TF	Mean: SD: IQR: %NA	3.42 0.84 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.39 1.18 1* 5.26%
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	TF	Mean: SD: IQR: %NA	2.68 1.06 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.83 1.25 1* 5.26%
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	TF	Mean: SD: IQR: %NA	2.84 1.12 1 0.00%
		IF	Mean: SD: IQR: %NA	2.78 1.21 1* 5.26%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	TF	Mean: SD: IQR: %NA	3.56 1.38 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.72 1.26 1* 5.26%
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	TF	Mean: SD: IQR: %NA	3.26 1.05 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.47 0.90 1* 0.00%
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	TF	Mean: SD: IQR: %NA	3.06 1.29 0.75* 5.26%
		IF	Mean: SD: IQR: %NA	3.06 1.45 1* 10.53%
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	TF	Mean: SD: IQR: %NA	3.53 0.96 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.37 1.01 1* 0.00%
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	TF	Mean: SD: IQR: %NA	3.17 1.25 1.75 5.26%
		IF	Mean: SD: IQR: %NA	3.33 1.17 1* 5.26%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	TF	Mean: 3.00 SD: 1.34 IQR: 2 %NA 5.26%
		IF	Mean: 3.24 SD: 1.49 IQR: 1* %NA 10.53%
Faculty and staff issues			
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	TF	Mean: 3.47 SD: 1.56 IQR: 1* %NA 10.53%
		IF	Mean: 3.58 SD: 1.02 IQR: 1* %NA 0.00%
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	TF	Mean: 3.33 SD: 1.21 IQR: 1* %NA 5.26%
		IF	Mean: 3.32 SD: 0.89 IQR: 1* %NA 0.00%
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	TF	Mean: 3.50 SD: 1.68 IQR: 1.25 %NA 15.79%
		IF	Mean: 3.53 SD: 1.46 IQR: 1* %NA 10.53%
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	TF	Mean: 3.31 SD: 1.62 IQR: 1* %NA 10.53%
		IF	Mean: 3.61 SD: 1.39 IQR: 1* %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response	
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	TF	Mean: SD: IQR: %NA	3.74 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.47 0.84 1* 0.00%
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	TF	Mean: SD: IQR: %NA	3.72 1.22 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.68 0.95 1* 0.00%
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	TF	Mean: SD: IQR: %NA	3.74 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.84 0.83 0* 0.00%
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	TF	Mean: SD: IQR: %NA	3.68 0.89 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.68 0.95 1* 0.00%
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	TF	Mean: SD: IQR: %NA	3.24 1.49 2 10.53%
		IF	Mean: SD: IQR: %NA	3.16 1.07 1.5 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response	
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	TF	Mean: SD: IQR: %NA	3.53 0.90 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.42 0.90 1* 0.00%
66	Need to create standardized certification opportunities for those teaching with simulation	TF	Mean: SD: IQR: %NA	3.58 0.90 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.58 0.96 1* 0.00%
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	TF	Mean: SD: IQR: %NA	2.89 1.10 0.75* 5.26%
		IF	Mean: SD: IQR: %NA	2.89 0.94 1* 0.00%
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	TF	Mean: SD: IQR: %NA	3.56 1.26 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.32 1.00 1* 0.00%
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	TF	Mean: SD: IQR: %NA	3.24 1.41 1* 10.53%
		IF	Mean: SD: IQR: %NA	3.21 1.03 1* 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 1 Group Response	
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	TF	Mean: SD: IQR: %NA	3.06 1.54 2 15.79%
		IF	Mean: SD: IQR: %NA	3.11 1.35 2 5.26%
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	TF	Mean: SD: IQR: %NA	2.75 1.60 2.25 15.79%
		IF	Mean: SD: IQR: %NA	2.41 1.38 3 10.53%
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	TF	Mean: SD: IQR: %NA	3.06 1.15 2 5.26%
		IF	Mean: SD: IQR: %NA	3.06 0.99 0.75* 5.26%
73	Need to address the fact that there is a lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	TF	Mean: SD: IQR: %NA	3.06 1.41 1* 10.53%
		IF	Mean: SD: IQR: %NA	3.13 1.54 1* 15.79%
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	TF	Mean: SD: IQR: %NA	3.17 1.20 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.16 0.69 1* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	TF	Mean: SD: IQR: %NA	3.06 1.15 0.75* 5.26%
		IF	Mean: SD: IQR: %NA	2.94 1.03 1.75 5.26%
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	TF	Mean: SD: IQR: %NA	3.47 0.84 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.53 0.77 1* 0.00%
Resources				
77	Need to show return on investment to decrease pressure to reduce high cost programs	TF	Mean: SD: IQR: %NA	3.11 0.99 2 0.00%
		IF	Mean: SD: IQR: %NA	3.11 0.99 2 0.00%
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	TF	Mean: SD: IQR: %NA	3.24 1.37 0* 5.26%
		IF	Mean: SD: IQR: %NA	2.82 1.35 1* 10.53%
79	Need to address the fact that facilities are inadequate to properly run the scenarios	TF	Mean: SD: IQR: %NA	3.06 1.29 2 5.26%
		IF	Mean: SD: IQR: %NA	2.94 1.47 2 15.79%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 1 Group Response***	
80	Need to address the fact that there is a lack of appropriate support equipment such as cameras, crash carts, catheters supplied by the institution	TF	Mean: SD: IQR: %NA	3.18 1.34 1* 10.53%
		IF	Mean: SD: IQR: %NA	2.81 1.38 2 15.79%
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	TF	Mean: SD: IQR: %NA	2.82 1.17 1* 5.26%
		IF	Mean: SD: IQR: %NA	2.71 1.12 1* 10.53%
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	TF	Mean: SD: IQR: %NA	3.05 0.78 0* 0.00%
		IF	Mean: SD: IQR: %NA	3.06 1.19 0* 5.26%
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	TF	Mean: SD: IQR: %NA	2.94 1.26 1* 5.26%
		IF	Mean: SD: IQR: %NA	3.00 1.39 1.25 15.79%
84	Need to educate stakeholders better so they have an understanding of when simulation may be an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	TF	Mean: SD: IQR: %NA	3.25 1.59 2 5.26%
		IF	Mean: SD: IQR: %NA	3.12 1.32 0* 5.26%

Round 2 Results

Rating technical feasibility (TF) and instructional feasibility (IF) on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
Research issues				
1	Need to set up a clear research agenda for simulations in allied healthcare education	TF	Mean: SD: IQR: %NA	3.65 0.79 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.59 0.80 1* 0.00%
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	TF	Mean: SD: IQR: %NA	3.88 0.70 1* 0.00%
		IF	Mean: SD: IQR: %NA	4.03 0.84 2 0.00%
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	TF	Mean: SD: IQR: %NA	3.71 0.85 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.79 0.81 1* 5.56%
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	TF	Mean: SD: IQR: %NA	3.79 0.88 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.74 0.83 1* 5.56%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	TF	Mean: SD: IQR: %NA	3.59 1.00 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.41 0.87 1* 0.00%
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	TF	Mean: SD: IQR: %NA	3.29 0.77 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.53 0.72 1* 0.00%
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	TF	Mean: SD: IQR: %NA	3.59 0.71 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.65 0.70 1* 0.00%
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	TF	Mean: SD: IQR: %NA	3.29 0.69 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.29 0.92 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*	
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	TF	Mean: SD: IQR: %NA	3.35 0.86 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.18 0.88 1* 0.00%
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	TF	Mean: SD: IQR: %NA	3.31 1.11 .25* 5.56%
		IF	Mean: SD: IQR: %NA	2.88 0.85 0* 5.56%
N1 (Added from Round 1)	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	TF	Mean: SD: IQR: %NA	3.41 0.95 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.28 0.77 1* 0.00%
Curriculum issues				
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	TF	Mean: SD: IQR: %NA	3.73 1.15 2 0.00%
		IF	Mean: SD: IQR: %NA	3.71 0.92 1* 0.00%
12	Need to develop guidelines concerning the best mix of current clinical and simulation-based training for optimal learning outcomes	TF	Mean: SD: IQR: %NA	3.55 1.27 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.68 0.85 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*	
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	TF	Mean: SD: IQR: %NA	4.06 0.90 2 0.00%
		IF	Mean: SD: IQR: %NA	3.94 0.90 2 0.00%
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	TF	Mean: SD: IQR: %NA	3.29 0.77 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.81 0.81 1* 0.00%
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	TF	Mean: SD: IQR: %NA	3.12 1.17 2 0.00%
		IF	Mean: SD: IQR: %NA	2.68 0.92 1* 0.00%
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	TF	Mean: SD: IQR: %NA	3.24 0.90 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.29 0.77 1* 0.00%
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	TF	Mean: SD: IQR: %NA	3.47 1.01 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.76 0.83 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	TF	Mean: 3.41 SD: 1.00 IQR: 1* %NA 0.00%
		IF	Mean: 3.71 SD: 0.85 IQR: 1* %NA 0.00%
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	TF	Mean: 4.24 SD: 0.75 IQR: 1* %NA 0.00%
		IF	Mean: 4.18 SD: 0.73 IQR: 1* %NA 0.00%
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	TF	Mean: 3.53 SD: 1.21 IQR: 1* %NA 5.56%
		IF	Mean: 3.44 SD: 0.93 IQR: 1* %NA 0.00%
21	Need for faculty agreement on purpose and methodology for debriefing sessions	TF	Mean: 3.86 SD: 0.86 IQR: 1* %NA 0.00%
		IF	Mean: 3.59 SD: 0.80 IQR: 1* %NA 0.00%
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	TF	Mean: 3.75 SD: 1.23 IQR: 1* %NA 5.56%
		IF	Mean: 3.62 SD: 0.93 IQR: 1* %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 2 Group Response
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	TF	Mean: 3.19 SD: 1.17 IQR: 0.25* %NA 5.56%
		IF	Mean: 3.12 SD: 0.93 IQR: 0* %NA 0.00%
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	TF	Mean: 2.46 SD: 1.28 IQR: 1* %NA 11.11%
		IF	Mean: 2.27 SD: 1.22 IQR: 1* %NA 5.56%
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	TF	Mean: 3.65 SD: 0.79 IQR: 1* %NA 0.00%
		IF	Mean: 3.38 SD: 1.13 IQR: 1* %NA 5.56%
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	TF	Mean: 3.71 SD: 0.77 IQR: 1* %NA 0.00%
		IF	Mean: 3.50 SD: 1.16 IQR: 1* %NA 5.56%
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	TF	Mean: 3.13 SD: 1.39 IQR: 1* %NA 11.11%
		IF	Mean: 3.19 SD: 1.06 IQR: 0.25* %NA 5.56%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	TF	Mean: SD: IQR: %NA	3.81 1.18 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.41 0.80 1* 0.00%
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	TF	Mean: SD: IQR: %NA	2.85 1.28 1* 11.11%
		IF	Mean: SD: IQR: %NA	2.94 1.03 0.25* 5.56%
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute	TF	Mean: SD: IQR: %NA	3.07 1.31 1* 11.11%
		IF	Mean: SD: IQR: %NA	3.13 1.20 2 5.56%
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	TF	Mean: SD: IQR: %NA	3.38 1.13 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.24 0.75 0* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	TF	Mean: SD: IQR: %NA	3.66 1.12 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.38 1.19 0.25* 5.56%
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	TF	Mean: SD: IQR: %NA	3.21 1.50 0.75* 16.67%
		IF	Mean: SD: IQR: %NA	2.75 1.35 0.86* 16.67%
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	TF	Mean: SD: IQR: %NA	3.65 0.86 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.29 1.05 2 0.00%
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	TF	Mean: SD: IQR: %NA	3.56 1.22 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.31 1.11 1* 5.56%
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	TF	Mean: SD: IQR: %NA	3.37 0.78 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.18 0.73 0* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	TF	Mean: SD: IQR: %NA	3.13 1.30 1.25 5.56%
		IF	Mean: SD: IQR: %NA	3.13 1.20 1* 5.56%
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	TF	Mean: SD: IQR: %NA	3.56 1.27 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.62 0.99 1* 0.00%
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	TF	Mean: SD: IQR: %NA	3.19 1.22 1.25 5.56%
		IF	Mean: SD: IQR: %NA	3.25 1.30 1.25 5.56%
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	TF	Mean: SD: IQR: %NA	2.63 1.21 1* 11.11%
		IF	Mean: SD: IQR: %NA	2.33 0.97 0.5* 11.11%
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	TF	Mean: SD: IQR: %NA	2.75 1.00 1* 5.56%
		IF	Mean: SD: IQR: %NA	2.56 0.94 1* 5.56%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
42	Institutions should network with other institution to optimize simulation research	TF	Mean: SD: IQR: %NA	3.41 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.31 1.17 1* 5.56%
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	TF	Mean: SD: IQR: %NA	3.59 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.31 1.17 1* 5.56%
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	TF	Mean: SD: IQR: %NA	3.58 1.27 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.20 1.28 2 5.56%
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	TF	Mean: SD: IQR: %NA	2.71 0.69 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.72 0.93 1* 5.56%
Tools and simulator technology issues				
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	TF	Mean: SD: IQR: %NA	3.46 0.71 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.29 0.77 0* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	TF	Mean: SD: IQR: %NA	3.32 0.68 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.34 1.06 1* 5.56%
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	TF	Mean: SD: IQR: %NA	2.59 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.75 1.28 1* 5.56%
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	TF	Mean: SD: IQR: %NA	2.79 0.81 0.5* 0.00%
		IF	Mean: SD: IQR: %NA	2.84 1.04 0.13* 5.56%
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	TF	Mean: SD: IQR: %NA	3.61 1.37 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.73 1.23 1* 5.56%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	TF	Mean: SD: IQR: %NA	3.21 1.02 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.44 0.86 1* 0.00%
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	TF	Mean: SD: IQR: %NA	2.88 1.16 0* 5.56%
		IF	Mean: SD: IQR: %NA	3.00 1.46 0* 11.11%
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	TF	Mean: SD: IQR: %NA	3.41 0.94 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.29 0.94 1* 0.00%
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	TF	Mean: SD: IQR: %NA	3.05 1.10 2 5.56%
		IF	Mean: SD: IQR: %NA	3.31 0.99 1* 5.56%
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	TF	Mean: SD: IQR: %NA	2.88 1.05 0.25* 5.56%
		IF	Mean: SD: IQR: %NA	3.00 1.27 0.5* 11.11%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 2 Group Response	
Faculty and staff issues				
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	TF	Mean: SD: IQR: %NA	3.53 1.26 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.53 0.87 1* 0.00%
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	TF	Mean: SD: IQR: %NA	3.47 0.80 1* 5.56%
		IF	Mean: SD: IQR: %NA	3.41 0.71 1* 0.00%
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	TF	Mean: SD: IQR: %NA	3.50 1.48 1* 11.11%
		IF	Mean: SD: IQR: %NA	3.57 1.41 1* 11.11%
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	TF	Mean: SD: IQR: %NA	3.47 0.87 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.62 0.93 1* 0.00%
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	TF	Mean: SD: IQR: %NA	3.75 0.75 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.53 0.80 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	TF	Mean: 3.81 SD: 1.18 IQR: 1* %NA 5.56%
		IF	Mean: 3.65 SD: 0.70 IQR: 1* %NA 0.00%
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	TF	Mean: 3.71 SD: 0.77 IQR: 1* %NA 0.00%
		IF	Mean: 3.82 SD: 0.73 IQR: 0* %NA 0.00%
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	TF	Mean: 3.71 SD: 0.69 IQR: 1* %NA 0.00%
		IF	Mean: 3.74 SD: 0.56 IQR: 1* %NA 0.00%
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	TF	Mean: 3.21 SD: 1.23 IQR: 1.25 %NA 5.56%
		IF	Mean: 3.24 SD: 0.90 IQR: 1* %NA 0.00%
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	TF	Mean: 3.52 SD: 0.79 IQR: 1* %NA 0.00%
		IF	Mean: 3.38 SD: 0.70 IQR: 1* %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 2 Group Response	
66	Need to create standardized certification opportunities for those teaching with simulation	TF	Mean: SD: IQR: %NA	3.53 0.72 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.59 0.71 1* 0.00%
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	TF	Mean: SD: IQR: %NA	2.94 0.97 0* 5.56%
		IF	Mean: SD: IQR: %NA	2.88 0.70 0* 0.00%
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	TF	Mean: SD: IQR: %NA	3.70 1.39 1* 11.11%
		IF	Mean: SD: IQR: %NA	3.44 1.03 1* 5.56%
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	TF	Mean: SD: IQR: %NA	3.34 1.00 0.63* 5.56%
		IF	Mean: SD: IQR: %NA	3.32 0.68 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*	
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	TF	Mean: SD: IQR: %NA	2.85 1.42 0* 16.67%
		IF	Mean: SD: IQR: %NA	2.93 1.28 1* 5.56%
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	TF	Mean: SD: IQR: %NA	2.71 1.30 1* 11.11%
		IF	Mean: SD: IQR: %NA	2.63 1.16 1* 5.56%
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	TF	Mean: SD: IQR: %NA	2.94 0.97 0.25* 5.56%
		IF	Mean: SD: IQR: %NA	3.00 0.95 0* 5.56%
73 edited	Need to address the fact that there **can be a** lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	TF	Mean: SD: IQR: %NA	3.07 1.36 0.50* 11.11%
		IF	Mean: SD: IQR: %NA	3.07 1.50 0.75* 16.67%
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	TF	Mean: SD: IQR: %NA	3.14 0.90 0.06* 5.56%
		IF	Mean: SD: IQR: %NA	3.18 0.53 0* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 2 Group Response***	
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	TF	Mean: SD: IQR: %NA	3.06 0.93 0* 5.56%
		IF	Mean: SD: IQR: %NA	2.91 0.90 0.13* 5.56%
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	TF	Mean: SD: IQR: %NA	3.59 0.62 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.65 0.61 1* 0.00%
Resources				
77	Need to show return on investment to decrease pressure to reduce high cost programs	TF	Mean: SD: IQR: %NA	2.96 0.76 0* 0.00%
		IF	Mean: SD: IQR: %NA	3.12 0.78 0* 0.00%
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	TF	Mean: SD: IQR: %NA	3.20 1.29 0* 5.56%
		IF	Mean: SD: IQR: %NA	2.76 1.17 1* 11.11%
79	Need to address how to best equip and support facilities to properly run the appropriate scenarios	TF	Mean: SD: IQR: %NA	3.18 0.81 0* 0.00%
		IF	Mean: SD: IQR: %NA	2.94 1.03 0.25* 5.56%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 2 Group Response*
80	Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution	TF	Mean: 3.12 SD: 0.60 IQR: 0* %NA 0.00%
		IF	Mean: 2.81 SD: 0.93 IQR: 1* %NA 5.56%
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	TF	Mean: 2.81 SD: 0.93 IQR: 1* %NA 5.56%
		IF	Mean: 2.70 SD: 1.11 IQR: 1* %NA 11.11%
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	TF	Mean: 3.24 SD: 0.66 IQR: 0* %NA 0.00%
		IF	Mean: 3.06 SD: 0.99 IQR: 0* %NA 5.56%
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	TF	Mean: 2.73 SD: 1.23 IQR: 1* %NA 11.11%
		IF	Mean: 2.93 SD: 1.37 IQR: 0.75* %NA 16.67%
84	Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	TF	Mean: 3.26 SD: 1.03 IQR: 1* %NA 0.00%
		IF	Mean: 3.19 SD: 1.17 IQR: 0.25* %NA 5.56%

Round 3 Results

Rating technical feasibility (TF) and instructional feasibility (IF) on a scale of 1 to 5: 1= Not at all feasible, 2= Probably unfeasible, 3= Feasible, 4= Very feasible, 5= Extremely feasible

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***	
Research issues				
1	Need to set up a clear research agenda for simulations in allied healthcare education	TF	Mean: SD: IQR: %NA	3.53 0.72 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.53 0.81 1* 0.00%
2	There is a need to research the impact of simulated learning as it impacts real-world skills application	TF	Mean: SD: IQR: %NA	3.75 0.77 1* 0.00%
		IF	Mean: SD: IQR: %NA	4.13 0.72 1* 0.00%
3	Research is needed which demonstrates that simulations are more effective than other teaching methods for learning specific procedural skills	TF	Mean: SD: IQR: %NA	3.58 0.83 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.63 0.72 1* 0.00%
4	Research is needed to demonstrate if skills acquired through simulation training are retained over time	TF	Mean: SD: IQR: %NA	3.50 0.82 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.50 0.73 1* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***	
5	Evaluation of simulation needs to be done contextually and over time through long-range studies	TF	Mean: SD: IQR: %NA	3.44 0.96 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.38 0.89 1* 0.00%
6	Need for verification or refutation of relationship between increased student confidence as a result of using simulation and actual clinical performance	TF	Mean: SD: IQR: %NA	3.19 0.75 .25* 0.00%
		IF	Mean: SD: IQR: %NA	3.44 0.73 1* 0.00%
7	Need valid research concerning the impact of simulation on student learning outcomes for allied healthcare skills	TF	Mean: SD: IQR: %NA	3.50 0.63 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.50 0.63 1* 0.00%
8	Need for defensible research to identify methods and technologies that work best for specific learning outcomes	TF	Mean: SD: IQR: %NA	3.13 0.72 0* 0.00%
		IF	Mean: SD: IQR: %NA	3.25 0.93 1* 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
9	Research needs to be completed to determine if computer-based simulations for skills assessment for certification procedures is as accurate as hands-on assessments	TF	Mean: SD: IQR: %NA	3.19 0.75 0.25* 0.00%
		IF	Mean: SD: IQR: %NA	3.06 0.68 0.25* 0.00%
10	Research needs to be completed to determine common metrics to compare simulation debriefing sessions to other educational methods and techniques	TF	Mean: SD: IQR: %NA	3.27 1.12 0* 5.88%
		IF	Mean: SD: IQR: %NA	2.73 0.81 0.5* 5.88%
N1 (Added from Round 1)	Conduct research to find best andragogical strategies concerning when to use simulation with large class sizes versus condensed but personalized simulation scenarios (when to use team based, individual scenario, student observation, etc.)	TF	Mean: SD: IQR: %NA	3.30 0.88 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.17 0.65 0.75* 0.00%
Curriculum issues				
11	Institutions need to develop a validated matrix which clearly defines the role(s) of the facilitator in the debriefing process based on issues including complexity of the scenarios, objectives, time available for session, and experience level of the participants	TF	Mean: SD: IQR: %NA	3.65 0.70 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.63 0.62 1* 0.00%
12	Need to develop guidelines concerning the best mix of current clinical and simulation-based training for optimal learning outcomes	TF	Mean: SD: IQR: %NA	3.39 1.10 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.53 0.62 1* 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response
13	Faculty and staff need guidelines concerning how simulation should be combined with other teaching strategies	TF	Mean: 4.00 SD: 0.73 IQR: 0.5* %NA 0.00%
		IF	Mean: 3.88 SD: 0.72 IQR: 1* %NA 0.00%
14	Need to find consensus concerning curriculum content for simulation across allied health disciplines within an institution (e.g., basic anatomy and physiology courses required by all disciplines)	TF	Mean: 3.31 SD: 0.48 IQR: 1* %NA 0.00%
		IF	Mean: 2.67 SD: 0.60 IQR: 1 %NA 0.00%
15	Need to find consensus concerning curriculum content for simulation within allied health disciplines across institutions (e.g., standard curriculum for all respiratory therapists)	TF	Mean: 2.88 SD: 0.81 IQR: 0.25* %NA 0.00%
		IF	Mean: 2.59 SD: 0.61 IQR: 1* %NA 0.00%
16	Need validated method of measurement to verify transferability of simulation performance to the clinical setting	TF	Mean: 3.25 SD: 0.45 IQR: 0.25* %NA 0.00%
		IF	Mean: 3.25 SD: 0.45 IQR: 0.25* %NA 0.00%
17	Need to develop guidelines which ensure students are not overwhelmed with scenarios that are too complex	TF	Mean: 3.31 SD: 0.95 IQR: 1* %NA 0.00%
		IF	Mean: 3.76 SD: 0.81 IQR: 1* %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
18	Need to develop guidelines which ensure faculty are not overwhelmed with scenarios that are too complex	TF	Mean: SD: IQR: %NA	3.25 0.93 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.56 0.81 1* 0.00%
19	Clear learning outcomes must be developed in a way that is easily communicated to and understood by students using simulation	TF	Mean: SD: IQR: %NA	4.25 0.58 1* 0.00%
		IF	Mean: SD: IQR: %NA	4.19 0.54 0.25* 0.00%
20	Develop a dedicated framework and supporting taxonomy for instructional design concerning simulation in healthcare	TF	Mean: SD: IQR: %NA	3.43 1.05 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.34 0.70 1* 0.00%
21	Need for faculty agreement on purpose and methodology for debriefing sessions	TF	Mean: SD: IQR: %NA	3.79 0.75 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.49 0.51 1* 0.00%
22	Need for all stakeholders to have an understanding of the limitations of what can be taught through simulation, (e.g., simulated patients cannot teach the responsibility of patient care)	TF	Mean: SD: IQR: %NA	3.60 1.09 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.41 0.61 1* 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
23	Need for all stakeholders to create measurable (objective) benchmarks for assessing a good clinician so it can be possible to assess student clinical success through the use of simulation	TF	Mean: SD: IQR: %NA	2.93 0.86 0* 5.88%
		IF	Mean: SD: IQR: %NA	2.94 0.57 0* 0.00%
24	Need to address the lack of a shared K-12 framework for healthcare curriculum which ensures students are prepared for and can easily enter state and local postsecondary education programs	TF	Mean: SD: IQR: %NA	2.35 1.27 0.5* 11.76%
		IF	Mean: SD: IQR: %NA	2.29 1.15 0* 5.88%
25	Need to verify if commercially available scenarios address tasks and objectives at the proper level for allied healthcare education	TF	Mean: SD: IQR: %NA	3.44 0.63 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.20 1.03 1* 5.88%
26	Need to verify if pre-written scenarios are appropriate for the average educational level of the allied healthcare student	TF	Mean: SD: IQR: %NA	3.50 0.63 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.37 1.03 0.75* 5.88%
27	Need to address the constructivist aspects of simulated learning where some actions taken within the simulation may seem logical to the learner based on their personal experience but not valued by the teacher and therefore not given appropriate time and attention during feedback/debriefing sessions	TF	Mean: SD: IQR: %NA	3.07 1.30 0* 11.76%
		IF	Mean: SD: IQR: %NA	3.07 0.89 0* 5.88%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***
28	Need to develop consensus concerning which learning objectives are appropriate for simulation enhanced education	TF	Mean: 3.67 SD: 1.15 IQR: 1* %NA 5.88%
		IF	Mean: 3.31 SD: 0.70 IQR: 1* %NA 0.00%
29	Need to develop validated methods to assess if positive outcomes were a result of an effective simulation or effective teacher	TF	Mean: 2.63 SD: 1.13 IQR: 1* %NA 11.76%
		IF	Mean: 2.73 SD: 0.89 IQR: 1* %NA 5.88%
30	Need to address the issues that accreditation, licensing, and certification do not always allow for required clinical experience to be substituted with simulated experience when it has been proven to be a sufficient substitute	TF	Mean: 3.07 SD: 1.09 IQR: 1.5 %NA 5.88%
		IF	Mean: 3.13 SD: 1.20 IQR: 2 %NA 5.56%
31	Need to develop a clear understanding of when to introduce simulation supported IPSE into the allied healthcare curriculum	TF	Mean: 3.14 SD: 1.13 IQR: 0* %NA 11.76%
		IF	Mean: 3.06 SD: 0.25 IQR: 0* %NA 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***	
32	Need to address the issue that simulators are often seen as stand-alone objects, not as a part of an integrated system	TF	Mean: SD: IQR: %NA	3.53 0.62 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.27 0.77 0.06 0.00%
33	Need to find ways to address institutional or accreditation pressures which can hamper the implementation of flexible methods of training	TF	Mean: SD: IQR: %NA	3.07 1.25 0* 11.76%
		IF	Mean: SD: IQR: %NA	2.61 1.13 1* 11.76%
34	Need to identify core curriculum across allied healthcare programs where the use of simulation could benefit the greatest number of students	TF	Mean: SD: IQR: %NA	3.56 0.73 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.31 0.79 1* 0.00%
35	Need to identify if and how simulation can be used to teach students to deal with moral and ethical dilemmas	TF	Mean: SD: IQR: %NA	3.50 1.18 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.20 1.03 1 5.88%
36	Need to establish a validated matrix concerning when to employ traditional teaching methods versus simulation	TF	Mean: SD: IQR: %NA	3.32 0.57 0.06* 0.00%
		IF	Mean: SD: IQR: %NA	3.06 0.44 0* 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
37	Institutions need to create a network of community-based, multi-sector, multi-disciplinary collaborations for the support of simulation in allied healthcare education (consortium model)	TF	Mean: SD: IQR: %NA	3.07 1.09 0.5* 5.88%
		IF	Mean: SD: IQR: %NA	3.07 1.09 0.5* 5.88%
38	Institutions need to give faculty the ability to network through observation of clinical simulation use in other programs/institutions	TF	Mean: SD: IQR: %NA	3.50 1.13 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.47 0.81 1* 0.00%
39	Educational institutions should find ways to collaborate with other health science institutions in the community to help pay for and support simulation-based education	TF	Mean: SD: IQR: %NA	3.13 1.06 0* 5.88%
		IF	Mean: SD: IQR: %NA	3.00 0.98 0* 5.88%
40	Need to address the disparate voluntary oversight of educational institutions in the form of accrediting bodies, societies, and collaborations make the adoption of simulation a patchwork of organizations providing de facto regulation	TF	Mean: SD: IQR: %NA	2.43 0.86 1* 5.88%
		IF	Mean: SD: IQR: %NA	2.27 0.81 0* 5.88%
41	Institutions should work to address the lack of a systematic or coordinated means to identify issues in simulation-based allied healthcare education	TF	Mean: SD: IQR: %NA	2.47 0.79 1* 5.88%
		IF	Mean: SD: IQR: %NA	2.33 0.75 1* 5.88%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
42	Institutions should network with other institution to optimize simulation research	TF	Mean: SD: IQR: %NA	3.31 0.70 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.20 1.03 0* 5.88%
43	Educational institutions should work to find ways to schedule inter-professional simulation-based education (IPSE) scenarios	TF	Mean: SD: IQR: %NA	3.56 0.81 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.40 1.11 0.5* 5.88%
44	Need for institutions using or thinking of using simulation to develop a shared database or portal for resources	TF	Mean: SD: IQR: %NA	3.35 1.02 1* 5.88%
		IF	Mean: SD: IQR: %NA	2.95 1.07 1.63 5.88%
45	Need to find a way to address the inequality which may exists between rural and urban schools due to their proximity to universities and medical centers when using the consortium model	TF	Mean: SD: IQR: %NA	2.71 0.69 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.57 0.88 1* 5.88%
Tools and simulator technology issues				
46	Need to find ways to ensure educational issues are considered during the early stages of simulator design (a framework)	TF	Mean: SD: IQR: %NA	3.36 0.48 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.19 0.40 0* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***	
47	Need to find ways to ensure simulators are designed with feedback features that are pedagogically sound	TF	Mean: SD: IQR: %NA	3.34 0.60 0.63* 0.00%
		IF	Mean: SD: IQR: %NA	3.36 1.03 0.70 5.88%
48	Develop ways to mitigate the cost of keeping up with the changing pace of the technology which may dissuade some institutions from attempting to implement new technology	TF	Mean: SD: IQR: %NA	2.55 0.81 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.59 1.09 1* 5.56%
49	Need to find a way to ensure that the design, development, integration, and use of simulator technology becomes an integrated enterprise with developers, clinicians, and educators working together towards the same goal	TF	Mean: SD: IQR: %NA	2.66 0.47 1* 0.00%
		IF	Mean: SD: IQR: %NA	2.70 0.81 0.75* 5.88%
50	Proper care needs to be taken to ensure students are not overwhelmed with technologies that are too complex	TF	Mean: SD: IQR: %NA	3.58 1.20 1.00 5.88%
		IF	Mean: SD: IQR: %NA	3.58 1.20 1.00 5.88%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***
51	Proper care needs to be taken to ensure faculty are not overwhelmed with technologies that are too complex	TF	Mean: 3.09 SD: 0.93 IQR: 0.63* %NA 0.00%
		IF	Mean: 3.34 SD: 0.79 IQR: 0.63* %NA 0.00%
52	Need to address the fact that there is a lack of simulation technology designed specifically for allied healthcare curriculums	TF	Mean: 2.73 SD: 0.96 IQR: 0.50* %NA 5.88%
		IF	Mean: 3.00 SD: 1.31 IQR: 0* %NA 11.76%
53	Need to develop clear guidelines concerning the needed level of fidelity of a simulation for teaching specific skills or learning objectives	TF	Mean: 3.44 SD: 0.73 IQR: 1* %NA 0.00%
		IF	Mean: 3.30 SD: 0.69 IQR: 0.85* %NA 0.00%
54	Need to develop guidelines concerning the appropriate type of human-simulator interface (e.g., visual, haptic, olfactory) to use based on learning levels and objectives	TF	Mean: 3.05 SD: 1.01 IQR: 0.38* %NA 5.88%
		IF	Mean: 3.27 SD: 0.93 IQR: 0.50* %NA 5.88%
55	Need to develop guidelines concerning the level of realism needed for human tissue and organs	TF	Mean: 2.73 SD: 1.03 IQR: 1* %NA 5.88%
		IF	Mean: 3.00 SD: 1.26 IQR: 0* %NA 11.76%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
Faculty and staff issues				
56	Need to find ways to ensure that educators, simulation technicians, and clinical faculty work together, they can have a tendency of not communicating and integrating ideas, needs, methods, and resources	TF	Mean: SD: IQR: %NA	3.37 1.09 1* 5.88%
		IF	Mean: SD: IQR: %NA	3.44 0.51 1* 0.00%
57	Need to address the fact that simulation is often viewed as an added burden by faculty members and is therefore not fully supported	TF	Mean: SD: IQR: %NA	3.31 0.48 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.38 0.50 1* 0.00%
58	Need to address the fact that simulation is not supported because there is a lack of strong theoretical and philosophical basis for its use in education	TF	Mean: SD: IQR: %NA	3.39 1.40 0.88* 11.76%
		IF	Mean: SD: IQR: %NA	3.46 1.32 1* 11.76%
59	Need to address the fact that faculty does not have the time to prepare complex simulation scenarios	TF	Mean: SD: IQR: %NA	3.38 0.72 0.25* 0.00%
		IF	Mean: SD: IQR: %NA	3.53 0.81 1* 0.00%
60	Need to address the fact that faculty development needs to include the proper use of simulator technology	TF	Mean: SD: IQR: %NA	3.55 0.62 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.31 0.60 1* 0.00%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***
61	Need to address the fact that faculty development needs to include an understanding of simulation methodology and the underlying learning theories that support the methodology	TF	Mean: 3.67 SD: 1.15 IQR: 1* %NA 5.88%
		IF	Mean: 3.50 SD: 0.52 IQR: 1* %NA 0.00%
62	Need to address the fact that faculty development should include the use of the debriefing sessions; why, when, and how to conduct them	TF	Mean: 3.69 SD: 0.70 IQR: 1* %NA 0.00%
		IF	Mean: 3.81 SD: 0.54 IQR: 0.25* %NA 0.00%
63	Need to address the fact that faculty development should include the integration of simulation into the curriculum which includes an understanding of the different modalities and technologies available	TF	Mean: 3.69 SD: 0.48 IQR: 1* %NA 0.00%
		IF	Mean: 3.72 SD: 0.45 IQR: 0.63* %NA 0.00%
64	Need to address the fact that often too much time is needed to develop simulation programs; faculty and staff do not have the time to properly develop	TF	Mean: 3.36 SD: 1.21 IQR: 1* %NA 5.88%
		IF	Mean: 3.38 SD: 0.81 IQR: 1* %NA 0.00%
65	Need to address how best to provide simulation specialists continuing education opportunities to keep abreast of changes in the field	TF	Mean: 3.43 SD: 0.721* IQR: 0.00% %NA
		IF	Mean: 3.28 SD: 0.58 IQR: 1* %NA 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 3 Group Response*	
66	Need to create standardized certification opportunities for those teaching with simulation	TF	Mean: SD: IQR: %NA	3.44 0.63 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.50 0.63 1* 0.00%
67	Need to address the fact that there is often not enough staff to run the simulation controls and oversee the students	TF	Mean: SD: IQR: %NA	2.73 0.81 0.50* 5.88%
		IF	Mean: SD: IQR: %NA	2.69 0.48 1* 0.00%
68	Need an acceptable continuing education curriculum for faculty and staff teaching with simulators/simulation	TF	Mean: SD: IQR: %NA	3.61 1.36 1* 11.76%
		IF	Mean: SD: IQR: %NA	3.33 0.96 1* 5.88%
69	Need to address the fact that faculty is not properly trained to write pedagogically sound scenarios	TF	Mean: SD: IQR: %NA	3.37 1.03 0.75* 5.88%
		IF	Mean: SD: IQR: %NA	3.34 0.70 1* 0.00%

Issue No.	*Issue Statement (in no particular order)*	*Feasibility*	*Round 3 Group Response*
70	Need to address the fact that an aging workforce will lead to critical faculty shortages in community and technical colleges	TF	Mean: 2.77 SD: 1.34 IQR: 1* %NA 17.65%
		IF	Mean: 2.73 SD: 1.03 IQR: 1* %NA 5.88%
71	Need to address the fact that low salaries make retention of a qualified workforce difficult	TF	Mean: 2.60 SD: 0.96 IQR: 1* %NA 5.88%
		IF	Mean: 2.50 SD: 0.94 IQR: 1* %NA 5.88%
72	Need to address the fact that a lack of time for orientation and mentoring of new workers mean new employees are not knowledgeable concerning the technology (knowledge loss)	TF	Mean: 2.80 SD: 0.96 IQR: 1* %NA 5.88%
		IF	Mean: 2.93 SD: 0.93 IQR: 0* %NA 5.88%
73 edited	Need to address the fact that there **can be a** lack of support from administration, faculty, and technical staff due to concerns about the validity of simulation	TF	Mean: 3.25 SD: 0.68 IQR: 0.25* %NA 0.00%
		IF	Mean: 3.27 SD: 1.06 IQR: 0.50* %NA 5.88%
74	Need to address the fact that individual faculty often have to take the initiative and be motivated to learn how to use the simulators on their own	TF	Mean: 3.15 SD: 0.86 IQR: 0* %NA 5.88%
		IF	Mean: 3.06 SD: 0.44 IQR: 0* %NA 0.00%

Issue No.	Issue Statement (in no particular order)	Feasibility	Round 3 Group Response	
75	Need to address the lack of time and resources to train incumbent faculty, meaning simulators that are purchased go unused or underused	TF	Mean: SD: IQR: %NA	3.13 0.50 0* 5.56%
		IF	Mean: SD: IQR: %NA	2.84 0.51 0.13* 0.00%
76	Need to develop guidelines for debriefing sessions which include when the debriefing session is required and what the most effective technique is to achieve a specific teaching method, and if the session should be a team or individual interaction	TF	Mean: SD: IQR: %NA	3.50 0.52 1* 0.00%
		IF	Mean: SD: IQR: %NA	3.63 0.50 1* 0.00%
Resources				
77	Need to show return on investment to decrease pressure to reduce high cost programs	TF	Mean: SD: IQR: %NA	2.81 0.54 0.25* 0.00%
		IF	Mean: SD: IQR: %NA	3.06 0.57 0* 0.00%
78	Need to address the fact that the cost associated with hiring dedicated experts for simulation programs is prohibitive	TF	Mean: SD: IQR: %NA	3.00 1.09 0.00 5.88%
		IF	Mean: SD: IQR: %NA	2.60 1.00 1.00 11.76%
79	Need to address how to best equip and support facilities to properly run the appropriate scenarios	TF	Mean: SD: IQR: %NA	3.06 0.68 0* 0.00%
		IF	Mean: SD: IQR: %NA	2.73 0.81 0.50 5.88%

Issue No.	***Issue Statement (in no particular order)***	***Feasibility***	***Round 3 Group Response***	
80	Need to understand the appropriate level of support equipment such as cameras, crash carts, catheters supplied by the institution	TF	Mean: SD: IQR: %NA	3.05 0.55 0* 0.00%
		IF	Mean: SD: IQR: %NA	2.73 0.89 1* 5.88%
81	Need to address the fact administrators do not fully fund ongoing maintenance and training in their annual budgets	TF	Mean: SD: IQR: %NA	2.81 0.66 1.00 0.00%
		IF	Mean: SD: IQR: %NA	2.70 0.96 1* 5.88%
82	Need to address the fact that it is not known what the best mix of clinical and simulation is in order to meet cost-effectiveness	TF	Mean: SD: IQR: %NA	3.13 0.50 0* 0.00%
		IF	Mean: SD: IQR: %NA	2.93 0.86 0* 5.88%
83	Need to find solutions to the fact that individual institutions are hampered in their expansion of simulation-based educational opportunities by a lack of resources including funding, available faculty, and space	TF	Mean: SD: IQR: %NA	2.57 1.06 1* 11.76%
		IF	Mean: SD: IQR: %NA	2.69 1.22 1* 17.65%
84	Need to find ways to educate stakeholders better so they have an understanding if and when simulation is an appropriate solution for dealing with institutional issues such as student learning, funding cutbacks, increased student load	TF	Mean: SD: IQR: %NA	3.16 0.81 0.63* 0.00%
		IF	Mean: SD: IQR: %NA	3.07 1.09 0* 5.88%

Table I-1. Comments from round 3

Item	Comments
1TF &IF	Regardless of challenges (which I recognize) this still is a priority. In UK, there are a number of bodies that are encouraging a degree of collaboration, if only in identifying a research agenda. (P 1373)
1TF	I don't see a real problem in the UK. I think it is very feasible here. (P 1387)
2IF	I think so long as the instructors properly understand the link between technical and non-technical skills it should be entirely practicable (P 1387)
4TF	surely the sustainability will erode over time whether using sim or not depending on opportunity to maintain recency in the skill? (P 1387) Does it really matter as we can't/don't validate that traditional non-simulation trg is retained over time either. (P 1414) The question deals only with research on skill retention, not with the validity of the skill or its transference to real patients, Retention has been studied thoroughly in other areas and should transfer to simulation fairly easily. (P 1428)
5TF	This is an essential ingredient and one which will be responsive to developments that bring theoretical and practical aspects of the curriculum closer together. (P 1373)
5TF &IF	Agree with Round 2 Comment "I have undertaken a longitudinal study and apart from some impatience and the risk of anticipating outcomes, there are real benefits in gaining perception over time" (P 1419)
6TF	Agree with Round 2 Comments "This variable is mostly dependent on time and context as well as technological hurdles (how can you assess a procedure IF the test subject moves or completes the program)" and "Not sure that it is useful for long range studies as practice and conceivably simulation practices may change/ evolve over time - more useful to get current data" (P 1419) I continue to have reservations about the design that would permit this but would like to see proposals. (P 1373) confidence is a function of the debrief skills of the instructor as well as success or otherwise. So long as the experience has been realistic it should be achievable (P 1387)
6IF	Not sure organizations are willing to finance this level of assessment. (P 1414)
8TF	preferred learning styles of different students should be taken into account (P 1387)
8TF &IF	I believe this is too student-dependent to be easily accomplished. (P 1428)
9TF	I continue to have reservations about the design that would permit this but would like to see proposals. Also not convinced that computer based simulations will have the same fidelity. (P 1373)
9IF	Learning value on the computer is worth looking into. (P 1414)

Table I-1 Continued

Item	Comments
10TF	video debriefing would be highly beneficial, not always available in other situations (P 1387)
	The technology needed to compare debriefing sessions to other educational methods is fairly well developed, unlike the actual debriefing content. (P 1428)
N1TF	The number of variables and time required makes this difficult (P 1471)
11TF	Is doable but each faculty member has a different level of teaching perception which influences the validated matrix's use. (P 1414)
	Developing a validated instructor-role matrix should be done with currently available technology, not by relying on possible future developments. (P 1428)
11IF	There is an increasing body of literature (and I think, the will) to develop a more robust debrief procedure and maybe my 5 is an aspiration rather than a reality. (P 1373)
12TF	Agree with Round 2 Comment “Guideline development would not require much in terms of technology - it would mostly require faculty discussion” and I don't know how this would be possible with so many different disciplines and contexts” (P 1419)
13TF	I have been a long term simulation trainer and see no problem here. I have run multiple train the trainer courses (P 1387)
13IF	Subject to reservations expressed below. (P 1373) [previous comment: Guidelines would be based on current simulation technology (you wouldn't prepare guidelines based on technology yet to be available)]
14TF	Perhaps developing less expensive, therefore more easily adopted, technologies would aid in reaching a consensus. (P 1428)
15TF	Agree with Round 2 Comment “This varies from state to state. For example, Respiratory Therapist training, scope of practice, etc. ... varies from state to state thus making a standardized consensus problematic (more research or development on that would be needed)” (P 1419)
	Perhaps developing less expensive, therefore more easily adopted, technologies would aid in reaching a consensus. (P 1428)
15IF	Not sure this is a "need". Might be nice to have but not needed. (P 1367)
17TF	Agree with Round 2 Comment “Again - not sure this is technically feasible - huge amount of data required” (P 1419)
	Having more choice among technologies available for a scenario would make it easier to fine-tune the complexity. (P 1428)
17IF	I think this is essential and should result from careful mapping of curriculum elements (theory and practice) (P 1373)
18TF	Having more choice among technologies available for a scenario would make it easier to fine-tune the complexity. (P 1428)
18IF	I think this is essential and should result from careful mapping of curriculum elements (theory and practice) (P 1373)

Table I-1 Continued

Item	Comments
19TF	can not see a problem (P 1387)
21IF	there is substantial evidence for how to perform debriefing successfully from other industries like aviation. However in medical matters there can be a reluctance to adopt successful practice from elsewhere. (P 1387)
23 TF	politically challenging, feasibleIF stakeholders value creation of consistent benchmarks (P 1471)
	I think this is a challenge and I will look forward to seeing what this would look like (P. 1373)
	Actually thought this might be easier than it probably would be. (P 1388)
24TF & IF	Relevancy? (P 1419)
25TF	Not convinced that commercial concerns are the best drivers (P. 1373)
33TF	If less expensive, more versatile technology was developed, implementation would be easier. (P 1428)
33TF & IF	Relevancy? (P 1419)
34TF & IF	Our faculty has a multitude of Allied health professions so I see this as really useful (P 1419)
35TF	There is no lack of technology that is preventing this from being completed. (P 1428)
36TF	Question deals with establishing a matrix for current technology, not a matrix for potential new developments. (P 1428)
37IF	Agree with Round 2 Comment “More research and development needed. Some political obstacles.” (P 1419)
37TF & IF	political barriers - sharing resources is threatening to many faculty (P 1471)
	Agree with Round 2 Comment “feel this is too big and could be to the detriment discreet disciplines.” (P 1419)
38TF	Watching current technology in action does not require the development of new technology. (P 1428)
39TF	This is a political question, not a technological one. (P 1428)
39TF &IF	political obstacles (P 1471)
40IF	Politics will be big. (P 1388)
41IF	Lack of political consensus will influence choices. (P 1388)
43TF &IF	Agree with Round 2 Comment “IP education is the way of the future so simulation fits nicely.” (P 1419)
44IF	individuals at the same institution are not always willing to share making institution sharing difficult (P 1471)
	agree with both comments below (P 1373) [Previous Comments: This can be a big task. I am more enthusiastic about portable models of good practice, rather than portable examples; Politics - many institutions would not be as open to sharing as others]
45TF	cost is the challenge for many rural schools (P 1471)
	Costs will influence balance. (P 1388)
46TF	There could be political issues with a collaboration between users and

Table I-1 Continued

Item	Comments
	developers. (P 1428)
50TF	not sure which technologies are being referred to here. Technological savvy seems not to be a problem for many students (P 1373)
51TF	sim leaders are often technology leaders also (P 1373)
	not sure how this would be assessed (P 1419)
52TF &IF	Agree with Round 1 Comment “likely not needed or unnecessary, or the question is based on a false perception of need, e.g. simulations specifically for allied health.” (P 1419)
55TF &IF	Unnecessary.” (P 1419)
56TF	An issue that needs to be openly addressed. (P 1373)
56TF &IF	Political and other hurdles. (P 1428)
59TF	complexity of technology requires time to understand (P 1471)
59IF	time is a barrier (P 1471)
	Lack of staffing ($) has a big impact. (P 1388)
63IF	Possible (P 1388)
64IF	Efforts need to be made to ensure administrators understand the complexities of curriculum design and evaluation (P 1373)
64TF & IF	This is based on our experience [Score 5] (P 1419)
	Efforts need to be made to ensure administrators understand the complexities of curriculum design and evaluation (P 1373)
68TF &IF	Overkill (P 1419)
69TF &IF	Disagree that this is a fact (P 1419)
70IF	Age is not the barrier, budget is limiting full time employment options (P 1471)
70TF &IF	Not a priority (P 1419)
71IF	lack of benefits (especially healthcare) is the most common reason for attrition at my institution (P 1471)
75TF	chicken and egg situation that needs organisational good will to address. (P 1373)
78IF	Big budget issues. (P 1388)
79TF	limited resources can be a challenge. (P 1373)
80IF	need versus want within a limited budget is a challenge (P 1471)
84TF &IF	based on our experience this would be helpful (P 1419)

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BIOGRAPHICAL SKETCH

Johanna Kenney received her Doctor of Education in curriculum and instruction from the University of Florida in the spring of 2014. She received her BA in political science and women's and gender studies from Eckerd College and her MA in social sciences from the University of Colorado at Denver. Johanna's research interests include modeling and simulations in healthcare education, social media and Web 2.0, online communities of practice (CoPs), and serious games for education. She currently works as a Learning Systems Developer for the United States Air Force. Johanna uses instructional design methods along with adult learning theories and validated research to find innovative approaches to integrate technology into military medical education and training.