Simulation in Saudi Arabian nursing education: Implications for student learning and patient safety

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ABSTRACT

This study seeks to determine the significance of simulation for the learning competencies of student nurses at the University of Hail. It examines student profiles, primarily reflected by academic indicators, alongside student responses to a questionnaire about the elements of simulation and the importance of academic indicators to each element. The target outcomes of simulation include but are not limited to the satisfaction of learning needs and competencies by the simulation activities and a degree of mastery in the students. The study utilized a non-experimental, descriptive design and employed the student version of the simulation design scale as its instrument. It consisted of 20 items and indicators that were further divided into four sections; each section asked different questions about the simulation's objectives and information; the support offered; the potential for problem solving and feedback/guided reflection; and its fidelity or realism. The findings revealed no significant correlation between the 202 student-nurse participants' profiles and their responses to the questionnaire on the elements of simulation. This study illustrates two important aspects of nursing education in Saudi Arabia that are also pertinent to the practice of nursing education around the world. Simulation is a learning technique that allows for the maximization of instruction to nursing students by allowing them to commit errors, learn from them and avoid committing them in clinical settings with real patients. Simulation allows errors to be committed during the learning process using dummies and under the expert guidance of instructors; it, therefore, promotes a safe clinical environment for patients and a safe working environment for students.

1. Introduction

The history of simulation can be traced back to the advent of modern time, when it was utilized by the military, nuclear power and aviation industries. In the field of aviation, flight simulators are used for pilot training to provide real-life scenarios (McLean et al., 2016), while in medical practice, simulation is considered a cornerstone for students to enhance their skills in clinical areas (Petrosoniak et al., 2017). Simulation forms an integral component of education for future healthcare providers in terms of both medicine and nursing. In the US, from 2005 to 2007, the Robert Wood Johnson Foundation in conjunction with the Joint Commission on Accreditation of Healthcare Organizations created a simulation training course to allow auditors to identify any system vulnerabilities that could imperil patient safety and the quality of care. The simulation was created utilizing existing systems for accrediting and certifying hospitals and other healthcare organisations. However, the Carnegie Foundation has also highlighted simulation as an effective strategy for the education of nursing students.

The challenge of advancing the practice of nursing lies in the preparation of student nurses. Their education is the most vital tool they bring to the clinical arena during their career as nurses. To this end, their preparation in the academe reflects the kind of nurses they might become. To provide effective care, nurses must not only be competent enough to render care, but must also be accountable for its outcomes. Nursing education is geared towards integrating theoretical knowledge from multiple sources, whether in print or other media, into usable and applicable forms. To realize this, issues on patient safety, ethical concerns and even

legal perils influencing the practice of nursing students must be addressed (Adams, 2014). Simulation-based clinical education is a means to address these concerns utilizing various pedagogical approaches in learning by simulation, nursing students are given opportunities to render nursing care to patients while being allowed a margin of error (Tremel, 2012).

Depending on the needs of the students and the nursing procedure to be performed, simulation can range from low fidelity to high fidelity; it may be engineered to adapt to the learning needs of the students as well as the kind of procedures to be performed (Kardong-Edgren, 2016). High-fidelity simulation (HFS) allows the students to have a realistic experience of the entire procedure. Medley and Horne (2005) asserted that HFS replicates actual clinical situations almost exactly. During the simulated procedure, students are allowed to commit mistakes without harming the patient and can learn from their errors. This is made possible through feedback mechanisms that are either provided by the simulator or through the intervention of the nursing instructor (Bussard, 2015).

2. Simulation in Middle Eastern nursing education

Fayed et al. (2016) acknowledged the fact that there is an imbalance between the number of educators and the number of students at Gulf Cooperation Council (GCC) universities. Therefore, there are a limited number of educators who can provide personal and hands-on training to students; hence the need for simulation-based training (SBT). The study further emphasized that simulation increases the learning capacities of the students while enhancing their competence.

The Saudi Commission for Health Specialties in the Kingdom of Saudi Arabia (KSA) reported that simulation allows for the optimization of patient care and increases its standard. However, based on a survey, the practice of simulation in KSA varies from region to region (Ware and Lababidi, 2015). The central and western regions of KSA had greater levels of SBT delivery than all other areas of the kingdom and even than the entire GCC. This disparity is attributable to the lack of mobile training facilities in certain regions and parts of the GCC and the inability to provide equal coverage to all universities in KSA as well as other parts of the GCC (Ware and Lababidi, 2015).

Davies and Alinier (2011) discussed the emergence of simulation-based education and training in the Middle East. Davies and Alinier (2011) categorically stated that the Middle East is experiencing huge growth in SBT with well-funded projects. She added that many of the large-scale simulation centers being opened are in the planning or building phase in Oman, Saudi Arabia, the United Arab Emirates and Qatar. She claimed that each of these institutions will adopt simulation modalities attached to other modern types of media and facilitates to better enhance delivery.

The impetus for this progress is the desire to expand and develop healthcare institutions and the healthcare workforce in the region. Added to this need is the requirement for qualified staff to manage these facilities by recruiting specialists and professionals from around the world. Simulation is a mode of teaching and learning that is globally recognized and utilized and may be implemented to objectively validate the competence of the healthcare workforce.

Potentially, simulation can improve patient safety protocols, foster modifications and assist in staff development, as well as help with recruiting staff.

3. Method

This quantitative correlational study among nursing students at the University of Hail, KSA, commenced in January 2017 and continued until mid-August 2017. Two hundred and two nursing students took part in the study—both male and female. The study was devised to target students ranging from first-year to internship level. However, no students from either first-year or internship level actually participated in the study; therefore, the polarities of this range were excluded. A questionnaire was used as the primary instrument of the study and was distributed together with an informed consent form prior to the actual data collection.

The main survey questionnaire was labelled Simulation Design Scale (Student Version) and was available for download from the website of the National League of Nurses (NLN). Prior to its use, an email granting permission for the utilization of the questionnaire was procured from the NLN, together with some instructions in the use of the survey tool and a study describing the validity of the instrument. Primarily, the instrument is intended to be used to assess students' perceptions of the significance of the elements of the simulation by which they are being taught. The rating scale was in Likert form, ranging from 1 to not applicable (NA). Here, 1 = 'strongly disagree with the statement'; 2 = 'disagree with the statement'; 3='undecided—neither agree nor disagree with the statement'; 4= 'agree with the statement'; 5= 'strongly agree with the statement'; and NA= 'not applicable—the statement does not pertain to the simulation'. There were two sub-sections of the questionnaire, divided into two columns. The first column offered an assessment of the simulation design elements, while the other column showed a rating scale on the perceived importance of each item to the student. There was another rating scale for this, which ranged from one to five, where 1= 'unimportant'; 2= 'somewhat important'; 3= 'neutral'; 4= 'important'; and 5= 'very important'. The first column assessing the elements of the simulated procedure was further divided into five categories; in each category there were four or five items; however, one category had only two items

under it. The categories were 'objectives and information', 'support', 'problem solving', 'feedback/guided reflection' and 'fidelity (realism)'.

KSA practices a co-educational, or 'co-ed', style of learning from primary school through to higher education. Under the Ministry of Education, the College of Nursing at the University of Hail is managed in the same way as other government funded universities in Saudi Arabia. Male and female students are physically located in separate campuses some kilometers apart. Female nursing students are taught only by female nursing instructors in terms of both theoretical, classroom-based learning and practical, hospital-based training; the same applies for the male students, who are taught solely by men. The male and female campuses each have simulation laboratories; the required simulation equipment, including machines and dummies; and rooms—one for each of college.

Since its establishment in 2005, the University of Hail has offered courses in the sciences and in computer science. The Bachelor of Science in Nursing (BSN) was first offered at the university in 2009, in response to Royal Decree 135, which requires all nurses to have a bachelor degree, rather than a diploma in nursing. All hospital-employed nurses with diplomas were obligated to return to university to finish two more years of study and a further one-year internship to make them eligible for the licensure exam in nursing under the authority of the Saudi Commission for Health Specialties. Aside from the creation of a College of Nursing, through which to offer the BSN, another development in universities to enhance nursing education was the construction of simulated laboratories. These laboratories were initially planned for the application of learned nursing procedures as well as to complement the learning needs of the student. The use of these laboratories enables students to become familiar with the different nursing procedures commonly performed in real, clinical settings with real patients. This allows students to improve their practice by providing an avenue whereby their skills can be mastered while allowing for errors to be committed. Such errors reveal the specific needs for improvement in each student, facilitating individual learning competencies in different nursing procedures.

After the procurement of an ethics approval from the university ethics committee, the questionnaire was reproduced for the calculated number of participants: a total of 250. When all permissions had been obtained and informed consent had been sought from the participants, 250 questionnaires were distributed to the entire student populace of the College of Nursing, male and female campuses. After the instrument had been distributed and the students had been provided with enough time to answer it, a total of 202 questionnaires were successfully collected and checked for accuracy by making sure all items had been answered. Thus a total of 202 questionnaires were returned and processed in statistical analysis.

Along with the section on informed consent and the questionnaire provided by the NLN, another part of the instrument asked for the demographic profiles of participants, such as gender, year (from first-year to internship level or fifth year) and fluency in English (rated high, moderate, minimal or none). To ascertain academic status, the questionnaire asked whether participants were regular or bridging students. The term 'bridging student' refers to diploma graduates of nursing that had been working as nurses before the implementation of the law requiring them to finish two more years to attain a BSN degree.

All students who completed the questionnaire became participants in the study. A total enumeration sampling technique was made available for all participants during the scheduled data collection periods. When all data had been collected, tabulated and readied for the statistical computation by Spearman's rank correlation to determine the correlation of the profiles of the participants to the design elements of the study, the statistical computation ensued. Using the Statistical Package for Social Sciences (SPSS) Number 16, results were derived with accuracy. Prior to computation by SPSS, the data were inspected for accuracy, cohesion and completeness.

4. Results

There were a total of 202 participants involved in this study and all were nursing students enrolled during the second semester of the 2016 to 2017 academic year. In terms of gender, out of the 202 students, 106 were female and 95 were male, comprising 53% and 47% of the total participants respectively. In regard to year level, there were no first-year students or internship-level participants; however, 21 second-year students participated, along with 151 third years and 29 fourth years, forming 10%, 75% and 14% of the total respondents respectively. As for fluency in the English language, 21 or 10% of students were highly fluent, 80 or 40% were moderately fluent and 100 or 50% were minimally fluent, but none of the participants lacked English altogether. In terms of academic status, of the 202 participants, 169 or 84% were regular students while 32 or 16% were classified as bridging students (Table 1).

5. Discussion

Saudi Arabia shares the issue of patient safety with the rest of the world. Professional competency is always of concern, reflecting the need to enhance the knowledge and skills of nurses and other allied health professionals. The public expects, if not demands, that medical professionals, including nurses, providing care to the public should be competent enough to meet their responsibilities to patients under any circumstances. Nursing education plays a crucial role in realizing this goal. Nursing programs offered by universities and colleges, such

as those in Saudi Arabia, should enhance their curricula, ensuring that simulation is included as one of the main tools for teaching nursing concepts. Qualified professors, clinical instructors and even administrators should complement this approach, united in the aim of developing and creating students who are competent in the field.

Table 1. Demographic profile of the participants

Profile		Frequency Distribution	Percentage Distribution (%)
Gender	Female	106	53
	Male	95	47
Year level	1st	0	0
	2nd	21	10
	3rd	151	75
	4th	29	14
	Internship	0	0
Fluency in English	High fluency	21	10
	Moderate fluency	80	40
	Minimal fluency	100	50
	No knowledge	0	0
Academic Status	Regular	169	84
	Bridging	32	16
Total		202	100

At the University of Hail, the English language is the primary medium of instruction, delivered by a diverse group of instructors and professors who are fluent in English. English is not only utilized as the means of instruction, but also for other resources including books, teaching slides, portfolios, additional learning tools and simulation instructions. None of the participants in this study were without knowledge of the English language because to be accepted into the college and to be enrolled in the BSN degree, students must first have undertaken and passed preparatory subjects, one of which is English. Another exam on English proficiency must be taken and passed by all students before being accepted into the course. Although the majority of participants, at 50%, had minimal knowledge of English, this knowledge was sufficient for the course, especially for understanding the concepts and applications requisite to the various nursing subjects, including instruction by simulation.

One of the critical roles of nurses in the clinical area is the administration of medication. Karthikeyan and Lalitha (2016) reported that in Saudi Arabia, 47.3% of medication errors occur through over-dosage or errors in dosage. It was further noted in the same study that errors in IV fluid administration are common throughout the world. Agrawal et al. (2008) claimed that the reasons for inaccurate dose administration encompass various factors, including miscommunication, errors in landing and lack of knowledge about the use of equipment. Such errors may be avoided in future if the practice of drug administration can be learned and mastered through simulation.

A different study by Daupin et al. (2016) utilized a realistic simulation of systemic medication-use errors in a mother–child hospital setting. The study found that certain steps in the process may be improved to identify errors in medication administration. They concluded that simulation alone is an effective and efficient method of enhancing the learned procedures of nursing students.

Simulation is a tool of instruction that can be adapted by schools of nursing regardless of curriculum or means of instruction. However, the need for investment in this project cannot be underestimated; nonetheless, studies show that students who experienced simulation during their learning years had an edge when faced with real clinical scenarios (Stroup, 2014).

6. Conclusion

Based on the statistical analysis of the participants' responses and their demographic profiles, student gender was significant to the objectives of and the information provided by the simulation at 0%; year level was significant to the support given during the simulation process at 4% and to the feedback offered (realism) at 2%. Fluency in English was significant in terms of the objectives of and the information provided by the simulation at 5% and in terms of feedback offered (realism) at 1%. Finally, student status was significant in regard to problem solving at 5%. The results were based on a 5% level of significance (Table 2). The statistical operation utilized for the derivation of results was the Spearman's rank correlation.

To understand the preceding discussion, it must be recalled that the questionnaire contained 20 items, each of which sought to reflect the perceived significance of the simulated nursing procedure from each student's personal point of view. In basic terms, the study provides a rating scale to ascertain how each student perceives the activity in question using multiple choice ratings from 1 to 5 or NA. The 20 items are classified into five categories: objectives and information (items 1–5), support (items 6–9), problem solving (items 10–14), feedback or guided reflection (items 15–18) and fidelity or realism (items 19–20).

Table 2: Spearman's rank correlation

		Gender	Year Level	Fluency	Status	Education	SDE-Objective info.	SDE-Support	SDE-Prob. Solving	SDE-Feedback	SDE-Realism
Gender	Correlation coefficient	1.000	.506**	.845**	.460**	-	-.231**	-.020	.079	-.053	-.127
	Sig. (2 tailed)	-	.000	.000	.000	-	.001	.774	.263	.454	.073
	N	201	201	201	201	201	201	201	201	201	201
Year Level	Correlation coefficient	.506**	1.000	.440**	-.040	-	-.108	-.144*	.084	.095	-.162*
	Sig. (2 tailed)	.000	-	.000	.576	-	.128	.040	.237	.181	.022
	N	201	201	201	201	201	201	201	201	201	201
Fluency	Correlation coefficient	.845**	.440**	1.000	.420**	-	-.136	-.097	.079	-.048	-.171*
	Sig. (2 tailed)	.000	.000	-	.000	-	.055	.172	.263	.503	.015
	N	201	201	201	201	201	201	201	201	201	201
Status	Correlation coefficient	.460**	-.040	.420**	1.000	-	-.005	.080	.140*	-.082	.089
	Sig. (2 tailed)	.000	.576	.000	-	-	.947	.257	.048	.249	.208
	N	201	201	201	201	201	201	201	201	201	201
Education	Correlation coefficient	-	-	-	-	-	-	-	-	-	-
	Sig. (2 tailed)	-	-	-	-	-	-	-	-	-	-
	N	201	201	201	201	201	201	201	201	201	201
SDE-Objective info.	Correlation coefficient	-.231**	-.108	-.136	-.005	-	1.000	-.036	-.060	-.013	.065
	Sig. (2 tailed)	.001	.128	.055	.947	-	-	.608	.396	.859	.361
	N	201	201	201	201	201	201	201	201	201	201
SDE-Support	Correlation coefficient	-.020	-.144*	-.097	.080	-	-.036	1.000	.151*	-.256**	.023
	Sig. (2 tailed)	.774	.041	.172	.257	-	.608	-	.033	.000	.742
	N	201	201	201	201	201	201	201	201	201	201
SDE-Prob. Solving	Correlation coefficient	.079	.084	.079	.140*	-	-.060	.151*	1.000	-.256**	.029
	Sig. (2 tailed)	.263	.237	263	.048	-	.396	.033	-	.000	.688
	N	201	201	201	201	201	201	201	201	201	201
SDE-Feedback	Correlation coefficient	-.053	.095	-.048	-.082	-	-.013	-.256**	-.265*	1.000	-.159*
	Sig. (2 tailed)	.454	.181	.503	.249	-	.859	.000	.000	-	.024
	N	201	201	201	201	201	201	201	201	201	201
SDE-Realism	Correlation coefficient	-.127	-.162*	-.171*	.089	-	.065	.023	.029	-.159*	1.000
	Sig. (2 tailed)	.073	.022	.015	.208	-	.361	.742	.688	.024	-
	N	201	201	201	201	201	201	201	201	201	201

** correlation is significant at 0.01 level (2 tailed); * correlation is significant at 0.05 level (2 tailed)

Returning to the results of the study, the demographic profile that bears the most significant relationship to one of the five categories of the questionnaire is objectives and information, which relates to the profile of gender. One reason for this may be that simulation encompasses any form of learning that requires skills and the application of psychomotor abilities in their most general sense. Regardless of gender, in the nursing profession, simulation is viewed as a replication of real-world, clinical scenarios, allowing trainees to perform skills and learn actively. One common way of discussing simulation relates to fidelity, or how closely a simulation experience reflects or mimics reality at a given time. There are diverse options available for simulation equipment, including low-fidelity or high-fidelity manikins capable of manifesting human physiologic indicators.

In terms of the significant relationship of year level to the support and feedback offered during simulation, one possible reason for this is that students learn by incremental progress—as their year level proceeds, their learning progresses and becomes more specialized. Through simulation, students practice providing care and performing nursing procedures prior to an actual patient encounter. This method provides them with thorough feedback on their performance and allows them to master the skills before dealing with real patients. One further advantage of simulation is that it allows students to cut their teeth without hospital distractions, such as family interventions, demanding hospital routines and pressure from other medical and nursing staff.

Fluency in the English language was significant to the category of objectives and information as well as to that of feedback. It is an imperative component of learning that students have a good command of the English language. It is a requirement of higher education in Saudi Arabia that students pass an English language exam before admission. To promote an efficient understanding of the concepts in nursing, students are obligated to learn, to study and to practice the language by various means.

Yang (2005) introduced English for Nursing Purposes, an intensive training program aimed at providing student nurses with the competence to understand, speak and write at the level of English necessary for their BNS courses.

Student status also bore a significant relationship to the category of problem solving. Kim and Park (2001) defined academic self-efficacy as the learner's ability to organize and implement activities necessary for performing an academic task related to the learning situation. According to this definition, students tend to learn problem solving skills, providing solutions in an ongoing process of learning, such as during simulation. Whereas regular

students are saturated by academic requirements and demands without being affected by external factors, bridging students have other responsibilities beyond school.

This study reveals the need to adopt a scientific-based approach to learning and teaching, which is offered by simulation. Previous studies have shown that novice nurses are less focused, have limited integration of necessary skills and knowledge and can be neglectful of important cues. These observations are general and do not reflect the abilities of all student nurses. Nonetheless, developing skills and allowing for the mastery of nursing procedures prior to the commencement of actual nursing care protects not only the nurse, but also and most importantly the patient.

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

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