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Correlates of Student Performance during Low Stakes Simulation

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ABSTRACT

Background: Simulation plays a vital role in nursing education, however, modifiable factors influencing students' simulation performance have not been sufficiently examined. The purpose of this study was examine relationships among anxiety, self-efficacy, nursing knowledge, and performance during simulation.
Methods: The study used a mixed-methods design. Anxiety, self-efficacy, academic achievement, and performance during simulation were measured quantitatively; correlations between key variables were calculated. Qualitative data were collected during post-simulation debriefing and triangulated to inform quantitative findings.
Results: Significant relationships were identified between knowledge of nursing care and simulation performance. Student qualitative reports of heightened anxiety and lack of confidence and uncertainty contrasted from quantitative measures. Potential reasons for this finding were explored.
Conclusions: The relationship between knowledge of nursing care and simulation performance supports the effectiveness of simulation as a means to evaluate the application of knowledge in a clinical laboratory setting. Further research is needed to explain the complex relationships between anxiety, self-efficacy, and performance during simulation.

Nurse Educators use patient simulation as both an instructional and evaluative tool in student education programs (Cant & Cooper, 2010; Reiley, Lin, Yuh, & Hager, 2011). Low stakes simulation has been reported to effectively facilitate learning in an environment free from harm to live patients (Kolozsvari, Feldman, Vassiliou, Demyttenaere, & Hoover, 2011), and improve quality of learning, leading to safe and effective patient care (Alexander et al., 2015; Jeffries, 2012). Low stakes simulation has a focus on mastery of learning, rather than grading of performance (Rutherford-Hemming, Kardong-Edgren, Gore, Ravert, & Rizzolo, 2014). For simulation to be a valid and reliable evaluation tool, simulation performance needs to be correlated with what the student knows (Hauber, Cormier, & Whyte, 2010). Application of nursing knowledge is critical for successful nursing practice (Benner, Sutphen, Leonard, & Day, 2009). However, anecdotal experience has demonstrated that students who excel academically may struggle in simulation. Students often report stress and anxiety during simulation as negatively affecting their performance (Burbach et al., 2016; Foronda, Liu, & Bauman, 2013) but empirical measures of this relationship are needed. Literature to date primarily focuses on the impact of simulation *upon* improving nursing knowledge and self-efficacy, and decreasing anxiety, rather than examining the relationships among these factors and actual simulation performance.

Anxiety, Self-Efficacy, Nursing Knowledge and Simulation Performance

Little research has examined the relationship between anxiety and simulation performance. Integrative review reports of simulation based learning describe a decrease in student anxiety following simulation (Cantrell, Meyer, & Mosack, 2017; Foronda, Liu, & Bauman, 2013), but little is known regarding the relationships between pre-simulation anxiety and student performance during simulation itself. Increasing levels of pre-simulation anxiety have been correlated with both decreased (Cheung & Au, 2011) and improved simulation performance (Colbert-Getz, Fleishman, Jung, & Shilkofski, 2013). McKay, Buen, Bohan, and Maye (2010) reported elevated anxiety levels were associated with both low and high simulation performance. More research is needed to examine and clarify these relationships.

Self-efficacy describes an individuals' level of confidence related to mastering a given task (Bandura, 1986). Confident individuals are more

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likely to be successful with given challenges. While previous research has examined the impact of simulated-practice on self-efficacy of nursing students, few published studies have examined the relationship between pre-simulation self-efficacy and health care student performance during simulation. Mavis (2001) found students with high self-efficacy scores performed better on high stakes simulation testing. Alternatively, Shinnick, Woo, and Evangelista (2012) found self-efficacy was not a predictor of knowledge of heart failure during simulation.

Several studies have explored the impact of simulation on student learning (Foronda, Liu, & Bauman, 2013; Gates, Parr, & Hughen, 2012); however, no studies were located that examined relationships between nursing knowledge and student grades in nursing courses and simulation performance.

Simulation plays a vital role in addressing challenges in nursing education, improving student clinical skills, and improving critical decision-making capacity in order to improve patient outcomes. Strategies and approaches to improve students' simulation performance are crucially needed. Learning what modifiable factors influence simulation performance will make it possible to identify interventions to improve outcomes. Furthermore, without controlling factors that influence simulation performance, the use of simulation as a valid and reliable measure of learning is difficult to establish. Consequently, the discrepancy in the performance between nursing knowledge- and simulation-based testing makes assessing students' true competency in patient care challenging. To fill this gap in knowledge, the purpose of this study is to examine the relationship among anxiety, self-efficacy, and nursing knowledge and students' performance during low stakes simulation.

Conceptual Framework

A theory-based conceptual framework was developed using constructs from Bandura's social cognitive theory (Bandura, 1986) and the National League for Nursing (NLN)/Jeffries Simulation Theory (Durham, Cato, & Lasater, 2014; Jeffries, 2012). Jeffries Simulation Theory proposes that students perform differently during simulation, including the knowledge and past achievements the student brings to the simulation. Bandura's social cognitive theory suggests that self-efficacy has a crucial role in motivating individuals to achieve high performance in an assigned task. Simulation research has reported a significant relationship between anxiety and simulation performance as previously described. Based on existing theory, the framework, and literature, the proposed conceptual framework hypothesized that students' simulation performance is related to anxiety, self-efficacy, and nursing knowledge.

Purpose

The purpose of this study was to examine the relationships among anxiety, self-efficacy, and nursing knowledge and students' simulation performance during low stakes, high fidelity patient simulation (HFPS).

To investigate the topic, we posed the following four research questions:

1. What is the relationship between pre-simulation state and trait Anxiety and performance during low-stakes simulation?

2. What is the relationship between pre-simulation self-efficacy and performance during low-stakes simulation?

3. What is the relationship between nursing knowledge (operationalized as grade point average [GPA] in related nursing courses) and performance during low-stakes simulation?

4. How do students describe anxiety and self-efficacy in relationship to low-stakes simulation?

Methods

Study Design

A mixed methods design was used for this pilot study. Quantitative measures examined the relationships among anxiety, self-efficacy, and nursing knowledge and students' simulation performance during low stakes, HFPS. The qualitative component further explicated quantitative findings.

Sample and Setting

Study participants were recruited from two campus locations of a large Midwestern university-based college of nursing. Students on each campus shared the same nursing curriculum. Inclusion criteria were enrollment in second semester nursing courses on one of the identified campuses, and being a minimum of 19 years of age. All 120 students enrolled in second semester nursing courses completed the simulation as a component of their clinical requirements. The low-stakes simulation scenario took place in the dedicated simulation suite on each of the two campus locations. Study participation was not mandatory. All students provided informed consent in keeping with Institutional Review Board Policy. In general, a sample size of about 128 is needed for an independent *t*-test and pilot samples as low as 10% of that number are seen as sufficient (Hertzog, 2008), therefore an a priori power analysis was not conducted. While underpowered for statistical hypothesis testing, this study is adequately powered for a pilot study (Hertzog, 2008). Analyses will focus on descriptive statistics, estimation of effects and hypothesis generation. Each statistical test will be conducted at $p = .05$ level.

Study Measures

Spielberger State-Trait Anxiety Inventory (STAI)

The STAI has 20 items for assessing trait anxiety and 20 for state anxiety. All items are rated on a 4-point Likert scale. Higher scores indicate greater anxiety. Internal consistency coefficients for the scale have ranged from 0.86 to 0.95 with 0.95 found in this study. Test-retest reliability coefficients have ranged from 0.65 to 0.75 over a 2-month interval (Spielberger, 1983). Test-retest coefficients for this measure in the present study ranged from 0.69 to 0.89. Considerable evidence exists to support the validity of the scale (Spielberger, 1983).

General Self-Efficacy Scale for Pre-Simulation (GSESPS) (Dykes, 2011)

The GSESPS was adapted from Schwarzer and Fuchs (1996) General Self-efficacy scale by Dykes to evaluate self-efficacy for simulation performance by pre-licensure nursing students. The GSESPS is an 18 item self-report measure, 4 point Likert scale (not at all true = 1, exactly true = 4) with internal consistency (coefficient alpha) ranging from 0.77 to 0.91, with the majority in the high 80s. The scale is unidimensional. Criterion-related positive validity was found with favorable emotions, dispositional optimism, and work satisfaction. Negative validity was found with depression, anxiety, stress, burnout, and health complaints. In the current study, the reliability was 0.86.

Self-Efficacy for Care of the Simulated Patient with Diabetes (SEPD)

A simulation specific self-efficacy scale was developed because Bandura (1982, 1986) noted that academic domain-specific assessments of self-efficacy are needed to provide a reasonably precise judgement of capacity matched to a specific outcome. This measure of self-efficacy mirrored the content the students would encounter in the simulation, and tightly fits the definition of self-efficacy of “beliefs in one's capability to organize and execute the courses of action required to manage prospective situations” (Bandura, 1997, p. 2). The instrument was developed through an iterative process of item writing, testing, and refinement within the nursing student population. Items were written and refined by content experts, based on the content contained in the selected NLN Nursing Simulation Scenario (NLN, 2007). The items were field tested in prior classes of the same level nursing students, $n = 219$, across four college campuses. Items were identified for removal or refinement based on the homogeneity of the scale, which was assessed through the item-total correlations. Additionally, it was believed that the instrument would be unidimensional and further refinement was made through factor analysis using a combination of eigenvalue > 1, scree plot, and parallel analysis techniques. The initial field test of the instrument contained 50 items and the final instrument contains 17 items on a 1–8 Likert scale. The Cronbach's Alpha of the instrument in the research study was 0.96. Content validity was established through consultation with two experts in diabetes management, scale structure was established in consultation with an expert in scale development (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013).

Creighton Competency Evaluation Instrument (C-CEI)

The C-CEI was used to quantify simulation performance. The C-CEI is a 23-item scale with 4 subscales, students are rated as "Demonstrates competency" or "Does not demonstrate competency" on each item (Todd, Hawkins, Hercinger, Manz, & Tracy, 2015). The C-CEI has a Cronbach's alpha of 0.974 to 0.979; inter-rater reliability 79.4%. When individual items were examined, 20 of 23 items had > 73% agreement. BSN agreement 83%; ADN Agreement 74%. Validity: Content validity – 35 nursing faculty rated on 1–4 Likert scale, on content: M = 3.89, SD = 0.19; Reflective of appropriate category M = 3.86 SD = 0.22; Behaviors easy to understand: M = 3.78, SD = 0.27 (Hayden, Keegan, Kardong-Edgren, & Smiley, 2014). This instrument was developed to be flexible for use with multiple simulations. The instrument developers recommend researchers review each item prior to data collection, and determine whether or not each item applies to the simulation scenario in the study, and what behaviors constitute "Demonstrates competency" (Todd, Hawkins, Hercinger, Manz, & Tracy, 2015). For this study, 6/23 items were determined not to be applicable to the scenario, and were recorded as such prior to data collection. One example of an excluded item is "Documents clearly, concisely, and accurately", which was excluded because documentation was not part of the simulation scenario. This resulted in a measure with 17 items and 4 subscales.

Grade Point Average (GPA)

Nursing knowledge was operationalized as the average of grades in the following nursing courses: first semester nursing theory course, Pathophysiology I and II, and Pharmacology. Each of these courses are taught by nursing faculty and considered nursing courses in our curriculum. Student GPA data was collected from course instructors.

Qualitative Debriefing Interview

Qualitative data were collected during debriefing, which immediately followed completion of the scenario. Debriefing was conducted using a modified Plus-Delta Model as described by Gardner (2013). Students were asked to reflect on their simulation performance, focusing on what went well, and what they wish they had done differently. Duration of debriefing varied student by student, and ranged from 14 to 30 min. Debriefing discussions were conducted by the PI; audio recorded, de-identified and transcribed verbatim for analysis.

Procedures

Institutional review board approval was obtained from the University of Nebraska Medical Center prior to contacting students for potential study participation. Following this approval, a member of the research team went to both campuses, described the study, provided copies of the informed consent documents, and advised students that participation in the study was voluntary. Students were instructed to place the consent form, signed or unsigned, into a sealed box in the back of the room after the research team member left the room. Those signing the consent form would have their data retained; students who chose not to participate in the study would experience the same simulation and complete the same study instruments if they chose to do so, but their data would be destroyed. Students also consented to give the researcher access to grades. The primary investigator and simulation facilitator were not involved with instruction or grading of students at the time of data collection. Simulation performance had no impact on students' grade.

Students were given preparatory assignments two to four weeks prior to beginning the simulation. Preparatory assignments included assigned readings from the course textbook, and patient education guides for patients newly diagnosed with insulin-dependent diabetes mellitus (American Association of Diabetes Educators (AADE), 2015a, 2015b, 2016). Students were instructed to complete the reading prior to coming to the scheduled simulation. Prebriefing for the simulation was conducted individually, immediately prior to the simulation. Students were asked to keep their performance during the simulation confidential, and advised that details of their own performance would be used for research analysis only if consent had been provided earlier. Prebriefing included a discussion of role expectations, how to reach out for assistance during the simulation, and orientation to room and equipment. Student questions were answered in full prior to the simulation beginning.

The simulation scenario concerned the care of an adolescent patient newly diagnosed with diabetes. This was a core case, designed for beginning students (NLN, 2007). An electronic high-fidelity manikin (SimMan, Laerdal) was used as the patient, and the simulation facilitator was stationed behind a one-way mirror in an adjacent room. The facilitator responded as the patient using audio technology integrated into the simulation suite throughout the scenario. The same facilitator guided the simulations on both campuses. In order to accommodate the number of students, simulations were scheduled over a 6-week period on each campus location. Students were instructed not to share details of the simulation with peers until the end of the data collection period.

During the scenario, students were expected to safely administer scheduled insulin and reinforce prior teaching related to diet and insulin administration. Patient vocal prompts, embedded in the simulation, included requesting breakfast prior to insulin administration, and asking how soon the insulin would take effect. The simulation ended when insulin administration and patient teaching were completed; or when the student exited the patient's room indicating care was complete.

Data Collection

Data collected at the time of enrollment included: demographic characteristics (age, gender, marital status, number of dependents, type and amount of employment); students also completed the trait inventory of the STAI, and the GSESPS. The STAI, state version, and the SEPD were collected immediately prior to beginning the simulation.

During the simulation, the PI (BB) scored simulation performance using the C-CEI. After the simulation, student reflections related to simulation performance were collected in a debriefing interview. Grades from the first nursing course, pharmacology, and pathophysiology were obtained after all students had completed the scheduled simulation activity.

Data Management and Analysis

Data were entered into Excel, checked by a separate data entry method, and then converted to SPSS 22.0. Data were cleaned and the assumption of a normal distribution and homoscedasticity were verified. All summary scales fell within the range of ± 1 for skewness and kurtosis. An a priori alpha level of 0.05 was selected for all inferential testing. Variables were summarized using descriptive statistics. Student

Table 1
Demographic and baseline characteristics of sample.

Variable	n	Mean	S.D.
Age	104	23.06	4.40
Hours worked per week for those employed	95	9.68	8.76
Years worked in healthcare	103	2.18	2.78
General self-efficacy	104	54.63	6.79
Self-efficacy for care of patient with diabetes	104	93.13	16.81
Trait anxiety	103	37.21	8.85
State anxiety	102	38.85	9.09
C-CEI	104	12.11	2.09
Grade in first patient care course	103	3.65	0.31
Grade in pharmacology	102	3.20	0.63
Grade in pathophysiology	101	3.49	0.51

Variable		n (%)
Location	Site 1	46 (44)
	Site 2	58 (56)
Gender	Female	98 (94)
	Male	6 (6)
Marital status	Single	84 (81)
	Married	16 (15)
	Divorced	2 (2)
	Other	1 (1)
	Missing	1 (1)
Number of dependents	0	92 (88)
	1	2 (2)
	2	6 (6)
	3	1 (1)
	4	1 (1)
	Missing	2 (2)
Healthcare experience	Yes	69(66)
	No	35 (34)
Current employment	Full time	2 (2)
	Part time	70 (67)
	Not employed	32 (31)

Note. C-CEI = Creighton Competency Evaluation Instrument (Todd, Hawkins, Hercinger, Manz, & Tracy, 2015)

grades were summated for two semesters of Pathophysiology into one average GPA for that course. The two college of nursing campuses were compared regarding baseline and intervention variables using Chi-square tests for categorical variables and independent *t*-tests for continuous variables. A Pearson product-moment correlation coefficient was computed to assess the relationships between anxiety, self-efficacy, performance, and nursing knowledge. The same rater scored all simulations; post-simulation inter-rater and intra-rater reliability (with a nursing simulation expert outside of the study) was conducted on a random 20% of the simulation recordings. Qualitative data were analyzed using thematic analysis methods (Braun & Clarke, 2006).

Results

Table 1 displays the demographic, baseline, and grade data for the 104 participants, with 6 males and 98 females with an average age of 23 ± 4.4 years. The majority of participants were single, had an average of 2.18 ± 2.78 years of healthcare experience, and worked part-time at 10 h per week and had zero dependents (88%); 104/120 (87%) eligible students consented to participate in the study. Students on both campus locations had participated in previous simulation-based learning experiences. No significant differences ($p > .05$) were found between baseline data, performance during the simulation, and campus location; therefore, data in each group are pooled and presented together. Post-simulation C-CEI scoring reliability was 100% for intra-rater reliability, and 92% for inter-rater reliability.

Due to small cell numbers in gender, marital status, dependents and current employment, inferential statistics were not used to explore the potential relationships between these demographic variables and the outcome variables. Pearson correlations were used to examine the relationship between age, hours worked in healthcare, years worked in healthcare and the outcome variables of general self-efficacy, self-efficacy for care of patient with diabetes, trait anxiety, state anxiety, and the C-CEI. The only significant correlation between demographic and outcome variables were with age and general self-efficacy $r(104) = -0.20$, $p = .04$ and age and state anxiety $r(102) = 0.23$, $p = .02$.

Mean STAI State (38.85 ± 9.1) and Trait (37.21 ± 8.8) anxiety levels were reported. Students scored slightly higher than published standards for normal levels of anxiety, but below levels associated with exam conditions (Spielberger, 1983), indicating students were not very anxious coming into the simulation (state anxiety). Timing of scheduled simulation was examined as a possible influence on anxiety level. Students had higher STAI scores if scheduled for simulation early in the data collection period ($p < .05$). Students rated themselves as moderately self-efficacious on both the GSESPS ($M = 54.63 \pm 6.83$) and SEPD ($M = 93.13 \pm 16.81$). The GSESPS and SEPD were significantly correlated with each other ($r = 0.40$, $p < .001$). No significant differences in SEPD scores were identified based on timing of scheduled simulation.

Students earned an average score of 12.11 ± 2.09 (out of a possible 17) on the C-CEI; 83% of students made one or more errors (range: 0–4, $M = 1.33 \pm 0.88$) in care during the simulation. The most frequent error was failure to roll the vial of mixed insulin prior to drawing up the dose in the syringe (65%). In addition, 38% of students did not provide evidence-based rationale during patient education. This was exemplified when the patient asked the programmed cue, "Why can't I eat before getting my insulin?" Students who responded with information about the actions or onset of insulin received credit for this item; students who responded with, "Because that is how it is ordered" (or similar) were scored as not demonstrating competency for this item. No significant differences in C-CEI scores were identified based upon timing of simulation participation.

Relationship Between Anxiety and Student Performance

For research question 1, the relationships between nursing student state/trait anxiety and student performance during low-stakes, high fidelity patient simulation (HFPS) were not significant, with a correlation of State Anxiety and C-CEI, $r = 0.164$ and Trait Anxiety and C-CEI, $r = -0.015$ (See Table 2).

Relationships Between Self-Efficacy and Simulation Performance

For research question 2, the relationship between nursing student self-efficacy and student performance during low-stakes, HFPS was not significant, with a correlation of GSESPS and C-CEI, $r = 0.137$ and SEPD and C-CEI, $r = 0.059$.

Relationship Between Nursing Knowledge and Simulation Performance

For research question 3, relationships between nursing student nursing knowledge and student performance during low-stakes, HFPS; no significant relationship was identified between overall GPA in nursing courses and simulation performance. GPA was then separated into its three components, performance in first patient care nursing course, pathophysiology, and pharmacology courses. Significant relationships were identified between performance on the C-CEI and the grade in first patient care nursing course ($r = 0.226$, $p = .02$) and with pathophysiology grades ($r = 0.205$, $p = .04$). No significant relationship was found between simulation performance and grades in pharmacology.

Table 2
Relationships among key variables.

	C-CEI	STAI-S	STAI-T	GSESPS	SEPD	Pharmacology	Pathophysiology
C-CEI							
STAI-S	0.164						
STAI-T	−0.015	0.416**					
GSESPS	0.137	−0.154	−0.106				
SEPD	0.059	−0.139	−0.104	0.400**			
Pharmacology	0.184	−0.291**	−0.187	−0.040	0.094		
Pathophysiology	0.205*	−0.277**	−0.176	−0.077	0.042	0.847**	
Patient Care	0.226*	−0.129	−0.024	−0.077	0.075	0.756**	0.602**

Note. C-CEI = Creighton Competency Evaluation Instrument (Todd, Hawkins, Hercinger, Manz, & Tracy, 2015); STAI-S = State Anxiety Inventory (Spielberger, 1983); STAI-T = Trait Anxiety Inventory (Spielberger, 1983); GSESPS = General Self-Efficacy Scale for Pre-Simulation (Dykes, 2011); SEPD = Self-Efficacy for Care of the Patient with Diabetes. Pearson Product Correlations *$p < .05$ (2-tailed). **$p < .01$ (2 tailed).

Students' Experiences of Anxiety and Self-Efficacy in Simulation Performance

For research question 4, "How do students describe anxiety and self-efficacy in relationship to performance during low-stakes simulation?" the following three qualitative themes were identified: *Intertwining of Anxiety and Self-Efficacy, an Uncertain Journey to Achievement – Using a Road Map,* and *An Uncertain Journey to Achievement – Needing a Navigator.*

Intertwining of Anxiety and Self-Efficacy

Nearly all students expressed anxiety in some form either upon entry to the simulation suite, or during the debriefing interview. The following student expressed the experiences shared by many, that a sense of mastery was experienced, despite the initial anxiety coming into the simulation:

[*I am*] *kind of nervous going into simulation…I kind of psych myself out…I am not.*

prepared, I don't know things, but then when I actually succeed and I do well it is like 'oh my gosh! I am learning and I do know these skills and I do know what to do' and you

know, or if not, I know where to look to figure it out.

One student eloquently described her experiences with anxiety and performance in nursing school.

I have figured out that there is a correlation between the times that I am really nervous, it.

is really important; I almost always come out of it fine. It is just it is like my way of.

pumping myself up; I get in there and I do fine…I am sure it will go away with.

experience but when I am like that I know it is important.

Some students reported feeling less anxious in the debriefing interview, as they had heard from peers about the simulation experience prior to their scheduled participation. "*I had heard from people in the class that it was like you know not intimidating and like pretty easy to do and pretty relaxed so yeah it was pretty much what I expected it to be.*"

Uncertain Journey to Achievement – Developing a Plan

Students discussed uncertainty as a part of anxiety; several students shared that they had developed a plan to manage this prior to coming to simulation.

Whenever I do simulations I always like I know what I need to do before I start…it makes me less anxious….say it is about working smart and like you have certain tasks that you need to have done and you need to put them in order of what needs to be done ahead of time.

Other students looked to the patient for performance cues.

It is just so different, like you don't really know what to expect when you have a new patient, but sometimes they help you out and tell you where they expect their shots or what the previous nurse did and kind of guides you.

An Uncertain Journey to Achievement – Needing a Navigator

Unlike the students who had a plan coming into the simulation, other students clearly expressed a sense of incompetence with provision of care to the simulated patient.

Honestly I came in, saw the sim guy, and I was like, well it is going to have to do with insulin but I really had no idea what it was actually going what I was going to encounter.

If I was told and [*it was*] *outlined what I should say and do I would probably make correct responses* [*to the patient*].

Discussion

Our findings suggest that quantitative measures of pre-simulation anxiety and self-efficacy have no significant correlation with performance during low stakes simulation, and confirm a significant relationship between nursing knowledge and simulation performance as measured by the C-CEI. The presence of a significant relationship between knowledge of nursing care and simulation performance supports the effectiveness of simulation as a means to evaluate the application of knowledge of patient care in a lab setting. Unlike findings from previous research, we did not detect the significant relationships between anxiety, self-efficacy and simulation performance (Burbach et al., 2016; Cantrell, Meyer, & Mosack, 2017; Cheung & Au, 2011; Colbert-Getz, Fleishman, Jung, & Shilkofski, 2013; Foronda, Liu, & Bauman, 2013; McKay, Buen, Bohan, & Maye, 2010). In addition, students in this study had lower than anticipated levels of anxiety on the STAI, which was inconsistent with the anxiety levels reported in the qualitative findings. One possible explanation for these findings may be related to the instrument used to measure anxiety.

The intent of the STAI was designed to characterize a longstanding trait of anxiety and depression among individuals coping with chronic conditions, which is not sensitive to change of anxiety level induced by performance testing over a relatively short period of time. (Bados, Gómez-Benito, & Balaguer, 2010); however a more sensitive, detailed instrument specific to measure simulation-related anxiety may be needed. Alternatively, nursing students may simply be "used to" a higher level of anxiety than the general population. Nursing students frequently experience anxiety in nursing school related to frequent testing and assessment (Shapiro, 2014); the low-stakes nature of this simulation may have failed to provoke greater anxiety than other graded clinical activities. Students may have been more anxious had simulation performance affected their academic standing. Students grow in confidence with clinical experience (Quail, Brundage, Spitalnick, Allen, & Beilby, 2016); students later in the data collection period had completed more in-patient clinical care than those doing the simulation early in the term. Peer-to-peer sharing also may have affected student anxiety levels as was reflected in the qualitative data.

Students in this sample reported being moderately self-efficacious for simulation. Similar to other studies examining student self-efficacy related to simulation performance (Shinnick et al., 2012), students in this study tended to be confident in their ability to provide care and teaching for the newly diagnosed patient with diabetes. Increased self-efficacy did not translate into improved performance, which is also congruent with findings from previous research (Merriman, Stayt, & Ricketts, 2014; Shinnick et al., 2012; Stayt, Merriman, Ricketts, Morton, & Simpson, 2015). More multi-site, rigorously designed research is needed to further inform what, if any, role self-efficacy has on simulation performance.

It is unknown to what degree peer-to-peer sharing influenced study outcomes. Students had been instructed not to share information about the simulation with their peers, however qualitative data indicates some sharing did occur. Implementation of a signed confidentiality agreement prior to data collection may have prevented information seepage between students. Additionally, shortening of the data collection period may have also prevented this sharing. Unfortunately, this was not possible due to the need to accommodate clinical schedules on the two sites.

Implications for Nursing Education

As educators, we need to consider that although students may express anxiety coming into a low-stakes simulation experience; this may not affect how well the student performs in the simulation. Simulation in this study was intended as low-stakes; our findings may have been much different had simulation performance influenced student standing in a course or program. Faculty must be aware that students may overestimate their capabilities and readiness for simulation; addition of objective pre-simulation assessments would better quantify readiness for the learning experience than use of measures of self-efficacy alone.

It was reassuring to find that students who do well in didactic coursework performed better in simulation than students who struggle in nursing coursework. Simulation is routinely used as a vehicle to promote learning by allowing students to learn by trial and error. Future studies examining objective learning outcomes following simulation-based learning experiences are needed to inform the effectiveness of simulation with academically challenged students.

Limitations

This pilot study used a homogenous, convenience sample of students from a single university. Although the students were from two separate campus divisions, they shared the same curriculum. Increasing diversity of the sample, to include students from other colleges or universities, would lessen the risk of bias and improve generalizability of the findings. Our findings are limited to student performance during the second semester of nursing school and limited to students in this stage of their development as a nurse. The findings should only be considered for simulation experiences that are low-stakes in nature; the results cannot be generalized to simulations that affect student standing in their program of study.

Conclusion

This study proposed that anxiety and self-efficacy, as well as nursing knowledge, influence simulation performance. Nursing knowledge, not anxiety nor self-efficacy, was related to quality of simulation performance. Low levels of student anxiety found in this study may be addressed through use of a higher stakes, graded simulation, or use of an instrument more sensitive to simulation-related anxiety. The presence of a significant relationship between knowledge of nursing care and simulation performance supports the effectiveness of simulation as a means to evaluate the application of knowledge of patient care in a lab setting. The ultimate goal of nursing education is for improved patient outcomes (Benner, Sutphen, Leonard, & Day, 2009). The findings from this study provide additional evidence to support the role of simulation in nursing education and, ultimately, in improved patient care.

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References

AADE (2015a). Learning how to inject insulin. Retrieved from https://www.diabeteseducator.org/docs/default-source/legacy-docs/_resources/pdf/general/Insulin_Injection_How_To_AADE.pdf.
AADE (2015b). Understanding insulin. (2015). Retrieved from https://www.diabeteseducator.org/docs/default-source/legacy-docs/_resources/pdf/general/Insulin_Injection_Understanding_Insulin_AADE.pdf.
AADE (2016). Pro tips for insulin injections. (2016). Retrieved from https://www.diabeteseducator.org/docs/default-source/legacy-docs/_resources/pdf/general/Insulin_Injection_Pro_Tips_AADE.pdf.
Alexander, M., Durham, C. F., Hooper, J. I., Jeffries, P. R., Goldman, N., Kardong-Edgren, S., ... Radtke, B. (2015). NCSBN simulation guidelines for prelicensure nursing programs. *Journal of Nursing Regulation, 6*(3), 39–42.
Bados, A., Gómez-Benito, J., & Balaguer, G. (2010). The state-trait anxiety inventory, trait version: Does it really measure anxiety? *Journal of Personality Assessment, 92*(6), 560–567.
Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122–147.
Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Engelwood Cliffs, NJ: Prentice-Hall, Inc.
Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.
Benner, P., Sutphen, M., Leonard, V., & Day, L. (2009). *Educating nurses: A call for radical transformation.* San Francisco: Jossey-Bass.
Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101.
Bruning, R., Dempsey, M., Kauffman, D. F., McKim, C., & Zumbrunn, S. (2013). Examining dimensions of self-efficacy for writing. *Journal of Educational Psychology, 105*(1), 25.
Burbach, B. E., Thompson, S. A., Barnason, S., Wilhelm, S., Kotcherlakota, S., Miller, C. L., & Paulman, P. M. (2016). Lived experiences during simulation: Student-perceived influences on performance. *Journal of Nursing Education, 55*(7), 396–398.
Cant, R. P., & Cooper, S. J. (2010). Simulation-based learning in nurse education: Systematic review. *Journal of Advanced Nursing, 66*(1), 3–15.
Cantrell, M. L., Meyer, S. L., & Mosack, V. (2017). Effects of simulation on nursing student stress: An integrative review. *Journal of Nursing Education, 56*(3), 139–144.
Cheung, R. Y., & Au, T. K. (2011). Nursing students' anxiety and clinical performance. *Journal of Nursing Education, 50*, 286–289.
Colbert-Getz, J. M., Fleishman, C., Jung, J., & Shilkofski, N. (2013). How do gender and anxiety affect students' self-assessment and actual performance on a high-stakes clinical skills examination? *Academic Medicine: Journal of the Association of American Medical Colleges, 88*(1), 44–48. http://dx.doi.org/10.1097/ACM.0b013e318276bcc4.
Durham, C. F., Cato, M. L., & Lasater, K. (2014). NLN/Jeffries simulation framework state of the science project: Participant construct. *Clinical Simulation in Nursing, 10*(7), 363–372.
Dykes, M. E. (2011). The effects of simulation on junior level baccalaureate nursing students' self-efficacy and intrinsic motivation (doctoral dissertation). Retrieved from *Electronic theses & dissertations (Paper 561)*.
Foronda, C., Liu, S., & Bauman, E. B. (2013). Evaluation of simulation in undergraduate nurse education: An integrative review. *Clinical Simulation in Nursing, 9*(10), e409-e416.
Gardner, R. (June, 2013). Introduction to debriefing. *Seminars in perinatology. Vol. 37. Seminars in perinatology* (pp. 166–174). WB Saunders No. 3.
Gates, M. G., Parr, M. B., & Hughen, J. E. (2012). Enhancing nursing knowledge using high-fidelity simulation. *Journal of Nursing Education, 51*(1), 9–15.
Hauber, R. P., Cormier, E., & Whyte, J. (2010). An exploration of the relationship between knowledge and performance-related variables in high-fidelity simulation: Designing instruction that promotes expertise in practice. *Nursing Education Perspectives, 31*(4), 242–246.
Hayden, J., Keegan, M., Kardong-Edgren, S., & Smiley, R. A. (2014). Reliability and validity testing of the Creighton competency evaluation instrument for use in the NCSBN national simulation study. *Nursing Education Perspectives, 35*(4), 244–252.
Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health, 31*(2), 180–191.
Jeffries, P. R. (2012). In P. R. Jeffries (Ed.). *Simulation in nursing education: From conceptualization to evaluation.* NY: National League for Nursing.
Kolozsvari, N. O., Feldman, L. S., Vassiliou, M. C., Demyttenaere, S., & Hoover, M. L. (2011). Sim one, do one, teach one: Considerations in designing training curricula for surgical simulation. *Journal of Surgical Education, 68*(5), 421–427.
Mavis, B. (2001). Self-efficacy and OSCE performance among second year medical students. *Advances in Health Sciences Education, 6*(2), 93–102.
McKay, K. A., Buen, J. E., Bohan, K. J., & Maye, J. P. (2010). Determining the relationship of acute stress, anxiety, and salivary alpha-amylase level with performance of student nurse anesthetists during human-based anesthesia simulator training. *AANA Journal, 78*(4), 301–309.
Merriman, C. D., Stayt, L. C., & Ricketts, B. (2014). Comparing the effectiveness of clinical simulation versus didactic methods to teach undergraduate adult nursing students to recognize and assess the deteriorating patient. *Clinical Simulation in Nursing, 10*(3), e119-e127.

National League for Nursing (2007). Diabetic insulin administration, core case. *National league for nursing simulation in nursing education* (pp. SP6234). NLN/Laerdal rev A.
Quail, M., Brundage, S. B., Spitalnick, J., Allen, P. J., & Beilby, J. (2016). Student self-reported communication skills, knowledge and confidence across standardised patient, virtual and traditional clinical learning environments. *BMC Medical Education, 16*(1), 73.
Reiley, C. E., Lin, H. C., Yuh, D. D., & Hager, G. D. (2011). Review of methods for objective surgical skill evaluation. *Surgical Endoscopy, 25*(2), 356–366.
Rutherford-Hemming, T., Kardong-Edgren, S., Gore, T., Ravert, P., & Rizzolo, M. A. (2014). High-stakes evaluation: Five years later. *Clinical Simulation in Nursing, 10*(12), 605–610.
Schwarzer, R., & Fuchs, R. (1996). Self-efficacy and health behaviours. *Predicting health behaviour: Research and practice with social cognition models* (pp. 163–196). . Retrieved from http://userpage.fu-berlin.de/~gesund/publicat/conner9.htm.
Shapiro, A. L. (2014). Test anxiety among nursing students: A systematic review. *Teaching and Learning in Nursing, 9*(4), 193–202.
Shinnick, M. A., Woo, M., & Evangelista, L. S. (2012). Predictors of knowledge gains using simulation in the education of prelicensure nursing students. *Journal of Professional Nursing, 28*(1), 41–47.
Spielberger, C. D. (1983). *Manual for the state-trait anxiety inventory STAI (form Y)(" self-evaluation questionnaire").* Menlo Park, CA: Mind Garden, Inc.
Stayt, L. C., Merriman, C., Ricketts, B., Morton, S., & Simpson, T. (2015). Recognizing and managing a deteriorating patient: A randomized controlled trial investigating the effectiveness of clinical simulation in improving clinical performance in undergraduate nursing students. *Journal of Advanced Nursing, 71*(11), 2563–2574.
Todd, M., Hawkins, K., Hercinger, M., Manz, J., & Tracy, M. (2015). Competency evaluation instrument. Retrieved from http://nursing.creighton.edu/academics/competency-evaluation-instrument.