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Virtual Simulations: Cultivating Self-Efficacy among Undergraduate Students to Manage Obstetric Emergencies in Nursing

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Abstract

Quality clinical education is a core requirement in the nursing curriculum. Pre-licensure nursing students rarely have opportunities to manage obstetric emergencies in nursing even though lack of this exposure to situations may lead to poor patient outcomes. This paper explores integrating virtual simulation into an existing curriculum to manage obstetric emergencies in nursing and offer ways to develop and enhance current teaching strategies. The study also reported the preference and perceived learning outcomes of undergraduate students who engaged in a virtual simulation experience. Results from the survey and student evaluation indicated that students had an overall positive experience. The virtual simulation sessions provided a flexible, engaging experience to develop critical thinking skills and were evaluated as highly satisfactory and easy to navigate. A more massive, multisite repetition of the study would be helpful. Surveying various programs, including graduate studies and RN to BSN programs, might yield different results.

Keywords: Virtual Simulation, Obstetric Nursing, Clinical Education, High Fidelity Simulation, Student Engagement, Technology

1. Introduction

Facilitating quality clinical experiences for students is a significant challenge in nursing education. Employers of new graduates expect them to be equipped with clinical skills that will enhance bedside practice and improve the care delivered to patients. Nurses' lack of clinical preparedness resulting from traditional pedagogies, coupled with limited clinical placement opportunities, has called for a renovation in nursing education (Benner et al., 2009).The assimilation of virtual reality platforms into nursing curricula has assisted in this educational transformation (Schaffer et al., 2016) and has been associated with improvements in student learning outcomes (Foronda et al., 2017). Traditionally, clinical competencies and skills for nursing students are molded through a combination of laboratory practice sessions and also through direct observation of nurses in the practice settings. In addition to the traditional model, high fidelity simulation provides more experiential and application-based learning opportunities (Foronda et al., 2017).

1.1 Virtual Simulation in Nursing Education

Implementing virtual simulations (VS) into the curriculum provides students with theoretical knowledge into a simulated clinical situation, prompting them to make decisions in a safe environment (DeGagne et al., 2013; Ulrich et al., 2014). The use of VS enhances the adoption of knowledge and clinical skills and further improves the quality and safety of clinical practice. Technology-based learning methods like Virtual Patients (VPs) may foster independent knowledge acquisition, communication skills, critical thinking, reflection, and problem-solving skills (Cummings & Connelly 2016). Typically, clinical training is an integral part of all nursing programs. Training with virtual patients, together with clinical practice, elevates the quality of clinical education.

Virtual reality simulation (VRS) is an interactive technology-based experiential clinical environment in which students are required to make decisions to take care of the virtual patients (Verkuylet al., 2017). Students access virtual patients through a web-based platform and get exposed to a wide variety of dynamic patient scenarios. In this way, the students get an opportunity to be involved with experiential learning that is possibly not available in the "real world" clinical setting. In these settings, students are unafraid of making mistakes and gain confidence knowing that they could repeat and redo the cases.

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Another advantage of VRS is its safe environment to practice critical skills without the risk of patient harm (Kolb et al., 2014). In the study by Verkuyl et al. (2017), the nursing students thought the virtual patients were suitable for practicing the clinical skills and reflecting on their clinical reasoning process. These characteristics make it increasingly desirable in nursing curriculum.

Although VS does not occur in an actual clinical site, it provides a richer understanding of complex cases that encourages critical thinking. Training is very crucial for students, as they may face the enormous demands of caring for challenging patients. For example, a nurse should be able to manage many challenging situations, including patients who are angry, non-English speaking, culturally diverse, and/or mentally impaired. Today, nurses are also confronted with patient relatives who can be upset, worried, or disturbed in other ways. Therefore, nurse education should include preparedness for handling adverse family situations. Virtual reality can provide challenging scenarios between students and patients in realistic settings, thus promoting development skills and experiential knowledge (Curran, 2014). Virtual simulations can offer realistic and engaging simulations of any clinical condition, including cases that seldom appear in the clinical site. In this way, VRSs can offer practice for lifelong learning and be a successful educational model for nursing students.

Innovation in simulation technologies has made available high-fidelity simulators that have supported the change in the health education paradigm. However, we have been facing challenges with the increasing cost of simulators, the difficulties of space management, and the low number of clinical scenarios. Compared to the mannequin-based simulation, VS holds several advantages. First, single-user VS systems apply to large cohorts of students. Further, the faculty workload of facilitating the simulations is significantly reduced. Third, there is a cost-savings when comparing the expenses of purchasing sophisticated mannequins, maintenance, and supporting the human resources of simulation facilitators. Additionally, VS requires minimal physical space and is efficient. Virtual simulation offers advantages of convenience and self-remediation not previously available for students.

Recent literature supports VS as an effective learning strategy. Virtual simulation can trigger affective domain and develop emotional connections between the learner and the virtual patient (Johnsen et al., 2016; Verkuyl et al., 2017) and can promote student engagement (Duff et al., 2016; Irwin and Coutts, 2015). The interactive and experiential nature of VS has the potential to develop the skills required for clinical practice (Johnsen et al., 2016). In an integrative review by Duff et al. (2016), VS was found to match and, in some cases, exceed outcomes when compared to live simulation. Verkuyl and Mastrilli's (2017) review found a large number of studies reporting greater satisfaction and self-efficacy with VS by nursing students.

1.2 Clinical Nursing Education in Obstetric Settings

A significant problem in clinical nursing education is the lack of clinical experiences available to students to apply the knowledge gained in theory class. Opportunities to train for some clinical situations are severely limited. For students in obstetric rotation, traditional hospital-based instruction does not always provide the same types of patients discussed in the classroom. Besides, a high-risk obstetric unit may have a low census, leaving some students without a patient and no opportunity to practice essential skills and competencies. In some situations, the unit may be too busy to help students understand the crucial concepts behind patient care. Because of these circumstances, students may lack the hands-on experience with real patients to become competent, thorough, and clinically successful nurses (Aurilio & O'Dell, 2010; Wagner et al., 2009). This is a significant issue in maternity units, where inadequate experience impacts student confidence in caring for mom and fetus (Pearson, 2011).

Nursing education in the contemporary world requires a thorough examination of how educators implement the clinical curriculum and what strategies will best train future nurses (Benner et al., 2009). Research findings in the field of education must be transformed into evidence-based approaches to vitalize nursing education. There is a greater need for nursing education strategies that engage students and promote clinical reasoning skills, while allowing them to practice safely. For example, sentinel events infrequently occur in any given clinical site. Still, the exposure to that situation is needed to prepare a well-trained healthcare team. Educational innovations, like VRS, play a significant role in training future workforces.

As this new pedagogy is expanding, information must be gathered about VS. This study explored students' perceptions of a VRS designed to facilitate the early identification and management of obstetric emergencies. Simulation of obstetric emergencies can be especially useful since their unpredictability can make them impossible to experience in a real clinical setting. The student's role will likely be limited to observation if an emergency does occur at a clinical site. A crisis is often a high- stress situation, where a novice student cannot usually adequately perform the vitally needed rapid and correct action.

In contrast, if a simulation is scheduled, the student can sufficiently prepare for it. The simulation is highly realistic and provides the needed stressful situation for teaching effective practice under pressure. Students who received training through these simulated experiences should enter the clinical area better prepared to provide safe patient care (Issenberg et al., 2005). Student proficiency with important core maternity concepts may need to be fostered earlier to allow for advancement to increasingly complex content areas. Supplementing coursework with VS targeted at those gaps can facilitate learning and improve confidence and competence in patient-centered care (Farra et al., 2013).

1.3 Clinical Education during the COVID-19 Pandemic

The COVID-19 pandemic opened the doors to explore non-traditional methods of teaching within a very short span of time. With a swift move to online education, challenges arose in teaching in the virtual setting; however, advances in technologies created various exciting options for educators and students. As most of the clinical sites were not available for student education, VRS replace the traditional learning experiences for students. But little evidence has emerged regarding its effectiveness for fostering clinical reasoning skills (Costello et al., 2014; Tichon, 2012).

Traditional classroom pedagogies cannot fully replace the clinical experience for students. Crucial clinical skills cannot arise from lectures and discussions alone. So, VRS experiences focus on developing skills in a less stressful, safe environment without clinical time limitations. It provides more reflection of the clinical scenarios, thus giving additional learning opportunities in a self-directed manner.

1.4 Purpose

The purpose of this paper was to describe the integration of VS into an existing curriculum to manage obstetric emergencies in nursing, and also offer ways to develop and enhance existing teaching strategies. Furthermore, the study explored the preference and perceived learning outcomes of undergraduate students who engaged in a VS experience.

1.5 Ethics

The study was approved by the institutional review board at the institution. Participants provided informed consent before participation

2. Methods

2.1 Setting and Sample

The study employed a mixed-methods design using a descriptive, quantitative, and descriptive-qualitative approach. A VS module was offered into an existing curriculum to manage obstetric emergencies in nursing. The sample was obtained from a cohort of 60 generic undergraduate bachelors of science in nursing (BSN) students at a public university in California. The sample size was adequate to test and refine this strategy before expanding it into more extensive undergraduate specialty courses. Data were collected using online surveys completed after the VS that were conducted in Spring 2020. Participants were recruited by word of mouth and class announcements. No extra credit or incentives were provided for study participation.

2.2 Instruments

System Usability Survey (SUS, 2018), a User Reaction Survey (URS), and a Virtual Simulation Assessment Survey, were used to collect the surveys. The SUS (a = .92) is a valid instrument that has been used in numerous studies and publicly available for use (Bangor et al., 2009). SUS comprises a 10-item scale with questions about effectiveness, efficiency, and satisfaction with a system such as software, hardware, and applications. A URS designed by Butt et al. (2018) was used to measure assessment of the VS. In the URS, participants were asked to consider their experiences with VS and respond to the questions using a 5-point scale anchored by Strongly agree and Strongly disagree. These items will address issues regarding the system's use and design, engagement with the system, and self-ratings of how many participants would use or learn from and practice in the system. The virtual Simulation Assessment Survey consisted of 11 questions about confidence and engagement with the simulation. These three instruments were combined into one continuous electronic survey. Open-ended questions included "List two or three key points that you learned through the VS. What was your main takeaway from this experience? Did you find it effective to repeat the simulation, and did you find the VS realistic/effective in enhancing your learning? Why or why not?"

2.3 Procedures

Students were informed about the study and were invited to participate in a VS at the end of the semester. An alternative assignment was offered for the same number of points for those who did not want to participate. No student chose the alternate assignment. Accessing and completing the surveys implied consent. VRS was offered through the learning platform.

The Assessment Technology Institute (ATI) Real-Life Clinical Reasoning Scenarios 3.0 was used to provide VS. Students interacted with the virtual patient through dialogues, monitoring the physiological parameters, observation, physical examination, and the intervention's implementation. The responses to and the development of the clinical case were dynamic and conditional on the decisions taken. Students could use various options to respond to the situation, such as traditional four-option items or alternate format items, such as a multiple-choice with graphic, image, or video options, and a response item, or an essay. An Individual Report was automatically generated when students completed the scenario. The report provided an overall reasoning score, performance related to outcomes, and feedback on questions answered.

Participants could play the VS as many times as they wanted to improve the score. The instructions included a pre-brief that contained information on the options in the VS, the learning objectives, and how the scenario would progress. Throughout the VS, feedback was provided related to "incorrect" or "not the best" responses. Upon completion of the VS, they completed the usability and experience in the electronic survey. The total practice time and participant scores were recorded within the simulation score.

3. Results

Thirty-eight participants completed the study. Demographic data were represented by 38% Hispanic/Latino, 41% white, and 4% black, with others fewer than 9%. Seventy-five percent were female.

Table 1 Item-wise Analysis of System Usability Scale

System Usability Scale	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Weighted mean
I think I would like to use this website frequently.	1 (3%)	1 (3%)	4 (11%)	9 (24%)	23 (61%)	4.368
I found this website unnecessarily complex.	16 (42%)	12 (32%)	4 (11%)	4 (11%)	2 (5%)	2.053
I thought this website was easy to use.	0 (0%)	1 (3%)	3 (8%)	9 (24%)	25 (66%)	4.526
I think that I would need assistance to be able to use this website.	30 (79%)	7 (18%)	0 (0%)	1 (3%)	0 (0%)	1.263
I found the various functions in this website were well-integrated.	0 (0%)	3 (8%)	3 (8%)	10 (26%)	22 (58%)	4.342
I thought there was too much inconsistency in this website.	23 (61%)	9 (24%)	6 (16%)	0 (0%)	0 (0%)	1.553
I would imagine that most people would learn to use this website very quickly.	0 (0%)	1 (3%)	5 (13%)	6 (16%)	26 (68%)	4.500
I found this website very cumbersome/ awkward to use.	27 (71%)	6 (16%)	4 (11%)	0 (0%)	1 (3%)	1.474
I felt very confident using this website.	0 (0%)	2 (5%)	4 (11%)	11 (29%)	21 (55%)	4.342
I needed to learn a lot of things before I could get going with this website.	24 (63%)	5 (13%)	7 (18%)	1 (3%)	1 (3%)	1.684

In this study, around 73.7% of the cases had a low system usability scale, and 26.3% of the cases had an average system usability scale. No cases with a high system usability scale were noted. The mean system usability scale was 30.11 (60.2%), with a standard deviation of 2.357. The minimum and maximum system usability scale was 26 and 36, respectively.

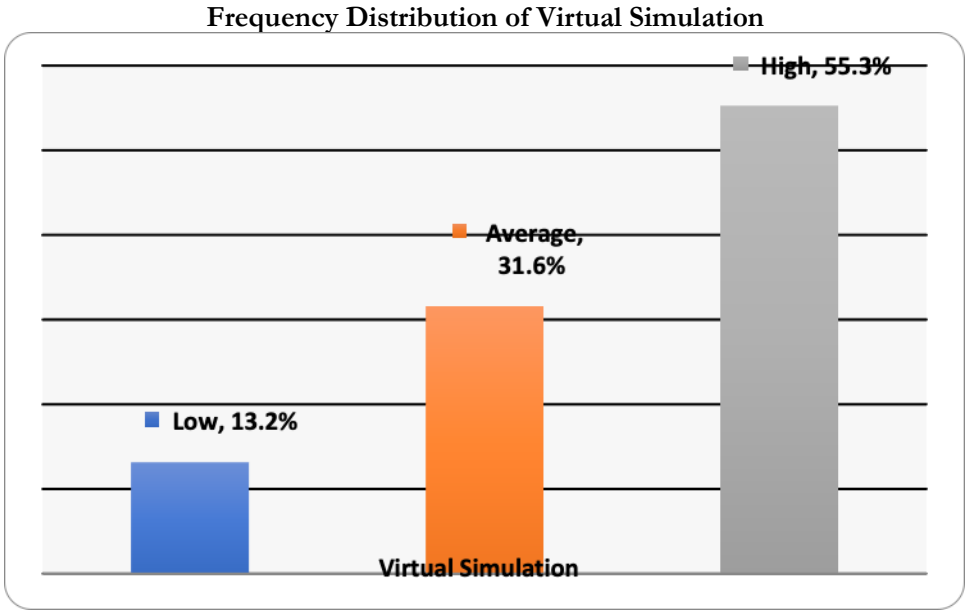
Table 2 **Item-wise Analysis of User Reaction Survey**

User Reaction Survey	Highly disagree	Disagree	Neutral	Agree	Highly agree	Weighted mean
At times during the hour, I felt totally absorbed in practicing.	0 (0%)	1 (3%)	10 (26%)	13 (34%)	14 (37%)	4.053
I did not find any challenge within this game.	2 (5%)	22 (58%)	8 (21%)	2 (5%)	4 (11%)	2.579
Practicing this way was fun.	0 (0%)	1 (3%)	8 (21%)	8 (21%)	21 (55%)	4.289
I felt engaged in my own learning while practicing.	0 (0%)	0 (0%)	6 (16%)	11 (29%)	21 (55%)	4.395
There were elements of challenge within the game.	1 (3%)	2 (5%)	7 (18%)	12 (32%)	16 (42%)	4.053
I found learning this way frustrating.	15 (39%)	13 (34%)	8 (21%)	2 (5%)	0 (0%)	1.921
I found my way around the game easily.	1 (3%)	0 (0%)	5 (13%)	15 (39%)	17 (45%)	4.237
I would rather practice in SIM Lab with faculty providing feedback.	1 (3%)	2 (5%)	12 (32%)	7 (18%)	16 (42%)	3.921
I got the feedback I needed when I needed it.	0 (0%)	5 (13%)	14 (37%)	6 (16%)	13 (34%)	3.711

In this study, around 2.6% of the cases had a low user reaction score, and 81.6% of the cases had an average user reaction score. Almost 15.8% of cases with high user reaction scores were also noted. The mean user reaction score was 33.16 (73.7%), with a standard deviation of 3.071. The minimum and maximum user reaction scores were 27 and 38, respectively.

Table 3 Item-wise Analysis of Virtual Simulation

Virtual Simulation	Do not agree	Agree	Strongly agree	Weighted mean
I am better prepared to respond to changes in my patient's condition.	0 (0%)	13 (34%)	25 (66%)	2.658
I developed a better understanding of the pathophysiology.	4 (11%)	17 (45%)	17 (45%)	2.342
I am more confident of my nursing assessment skills.	4 (11%)	15 (39%)	19 (50%)	2.395
I felt empowered to make clinical decisions.	1 (3%)	12 (32%)	25 (66%)	2.632
I developed a better understanding of medications. (Leave blank if no medications in scenario)	1 (3%)	9 (24%)	28 (74%)	2.711
I had the opportunity to practice my clinical decision-making skills.	0 (0%)	6 (16%)	32 (84%)	2.842
I am more confident in my ability to prioritize care and interventions	0 (0%)	12 (32%)	26 (68%)	2.684
I am more confident in communicating with my patient.	6 (16%)	12 (32%)	20 (53%)	2.368
I am more confident in my ability to teach patients about their illness and interventions.	4 (11%)	14 (37%)	20 (53%)	2.421
I am more confident in my ability to report information to health care team.	2 (5%)	17 (45%)	19 (50%)	2.447
I am more confident in providing interventions that foster patient safety.	2 (5%)	13 (34%)	23 (61%)	2.553



In this study, around 13.2% of the cases had low VS, and 31.6% of the cases had average VS. Almost 55.3% of cases with high VS were also noted. The mean VS was 28.05 (85.0%), with a standard deviation of 4.854. The minimum and maximum VS were 17 and 33, respectively.

4. Discussion

Adoption of VS was "just-in-time" for COVID-19 transition from in-site clinical instruction to a virtual platform. In this study, 75% of positive questions on general usage were answered using Agree or Strongly agree. Students did not report difficulty in using the simulation. The high satisfaction, self-confidence, and usefulness in the survey scores were supported by the qualitative questions, which helped the team interpret the quantitative data related to those outcomes.

4.1Student Satisfaction and Engagement

Students reported feeling more engaged with the VRS. They appreciated having a safe, friendly environment to practice critical thinking skills similar to providing patient care in a clinical setting (De Gagne et al., 2013; Farra et al., 2013; Muckler, 2017). Curiosity, connectivity, and social interactions are characteristics that suggest engagement (Bouvier et al., 2014). Students demonstrated involvement by their active responses to the scenario, connection to the virtual reality actors, and their interest in the client's outcome, resulting in high levels of satisfaction with the simulation experience. Finally, the convenience of access from the home to practice the VS and the relative decrease in barriers related to time and location was identified as a positive finding. Furthermore, students receiving immediate and timely feedback regarding their responses improved the score when repeating the simulation (Farra et al., 2013).

4.2 Virtual Simulation Utilization

The use of VRSs reduced education barriers by allowing students to access course materials from home or other convenient locations, which further enhanced utilization and active engagement. The ability to complete their assignments where they lived and worked can support successful retention and completion of the course in a timely fashion. This, in turn, can increase the supply of available healthcare providers and increase quality patient care. The adoption of VS helps students who wish to pursue advanced health care education, as it is more adaptive to family and/or employment obligations and the school. The qualitative analysis of the written student comments provided greater insight into perceptions. The participants confirmed that utilitarian factors related to ease of use and aspects of the usefulness of simulation were essential factors. Participants reported feeling safe to make mistakes. These design elements contributed to enhanced user immersion, engagement, and deepening of knowledge.

4.3 Technology

Online virtual reality sessions can offer a time-efficient and cost-effective approach to teaching crucial, often high-stakes, communication skills in a safe environment. Student feedback indicated that this VRS experience was highly valuable. Although the online approach was convenient and highly satisfactory, it was

challenging for students with WIFI bandwidth issues. Nevertheless, virtual simulation sessions can potentially fill a gap in critical skills development in the current nursing curriculum.

4.4 Limitations

The research was conducted at one baccalaureate RN program from one institution, which reduced the generalizability of the results. A larger, multisite repetition of the study would be helpful. Conducting the survey in various programs, including graduate studies and RN to BSN programs, might yield different results. Student learning styles, study patterns, and how students achieve proficiency in the simulation could not be controlled and could have influenced the students' final grades.

5. Conclusion

This study incorporated VS as a pedagogical strategy for learning that contributed to the improvement of knowledge retention using the realm of information technology. As hypothesized, student satisfaction was a significant factor in using VS for nursing education. The results showed the potential of clinical VS to support the development of clinical competencies in future nurses, thus improving the safety and quality of patient care. The technical, evaluation, and assessment challenges can be addressed through careful planning and implementation. Additional research studies are needed to facilitate the development of nursing competencies through VS that improves patient outcomes.

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