Challenging the Status Quo: Digital Transformation with Virtual Reality

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ABSTRACT

Nightingale College's continuous focus on innovative, evidence-based design keeps the organization on the forefront of challenging the status quo and pioneering new higher education approaches. The College is currently facilitating a multiphase virtual reality (VR) pilot program to deliver a hands-on, simulated nurse training environment. Learners use VR headsets to apply their skills and knowledge in the safety of a virtual environment that mimics real-life nursing situations. They are immersed in typical nursing scenarios, including diagnosing patients, instigating treatments, and interacting with the interdisciplinary team. They may repeat experiences as often as they like, with the system offering multiple adapted outcomes based on their responses to fully interactive, simulated patients and their family members. They also receive personalized feedback, performance metrics, and a guided self-reflective debrief. Although the Nightingale College pilot program is still in its infancy, initial results are demonstrating excellent student feedback improved outcomes in critical thinking and clinical reasoning. Surveys indicate that learners enjoy using scenarios developed by Oxford Medical Simulation (OMS), which partnered with Nightingale. Future plans include expanding use of the OMS scenarios to include more learners and other courses. The College, unrestricted by traditional methods of instruction, continually searches for new ways to innovate in nursing education through its full-distance education model to improve outcomes and solve issues across the nursing profession, including the nursing shortage. This allows for effective execution of the institutional mission and contributes to the realization of health equity.

Within this paper, the authors will discuss the differences between VR simulations versus on-ground simulation experiences, review development of the pilot program plan and describe the multiphase approach toward implementation. Additionally, the authors present a review of initial outcomes and testimonies of learner experience throughout the pilot program and examine the learners' improvement in clinical reasoning skills with VR simulations.

ABOUT THE AUTHORS

Dr. Jeffrey Olsen currently serves as the Vice President, Learner Experience and Provost for Nightingale College. He holds a Doctor of Philosophy degree in Instructional Technology and Learning Sciences from Utah State University, a Master of Science degree in Instructional Design and Technology from Western Illinois University, and a Master of Arts degree in Secondary Social Studies Education with teacher certification from Pacific Lutheran University. His undergraduate education was completed at Brigham Young University. He has 15 years of experience in educational settings including public schools, Research 1 universities, regional health care system education, non-profit universities, and for-profit university environments.

Dr. Juliet Kolde is visionary nursing education leader dedicated to increase knowledge and practice of nursing within the clinical and educational realms. She is skilled in driving innovative curriculum changes to narrow the gaps in practice-theory and diversity, equity, and inclusion within nursing education. Dr. Kolde currently serves in the role of Director, Learning Resources for Nightingale College. Her 25+ years of nursing experience include critical care, pediatrics, school nursing, community health, informatics, nursing education and leadership and nursing curriculum development. She maintains professional memberships in National League for Nursing (NLN) and Sigma Theta Tau. Dr. Kolde currently lives in Cincinnati, Ohio.

Dr. Jack Pottle is Founder and Chief Medical Officer of Oxford Medical Simulation - an award-winning virtual reality healthcare simulation company. Having worked in hospital medicine for seven years, Dr. Pottle saw first-hand the gap between training and practice. He founded Oxford Medical Simulation (OMS) to bridge this gap with virtual

reality (VR). The OMS VR platform is now used worldwide to deliver simulation in a quality, scalable and cost-efficient manner. Prior to OMS, Dr. Pottle led a non-profit online medical education company, worked in healthcare on four continents, and completed a global health fellowship designing nurse-led clinics in South Africa. He is an NHS Innovation Fellow and has degrees in psychology and medicine from Oxford University.

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BACKGROUND

Working in distance education in a program that extends across the United States provides the potential to grant opportunities and access to high quality nursing education for learners anywhere in the country. However, the need to ensure that the education provides equal levels of quality and consistency in every location can produce various challenges for clinical placement and validating skills with both a distributed workforce and unique rotation sites in experiential learning. Despite a large partnerships network spanning the country, Nightingale College itself does not own or operate any client-facing facilities and therefore relies on strong established relationships to provide direct client-focused care experiences for our learners. Focused in nursing education, Nightingale College provides pre- and post-licensure training in a distance education model across the United States.

At the outbreak of COVID-19 in 2020, the College had begun preliminary plans to develop and integrate virtual reality into the experiential learning portion of the course to help expand and ensure the replicability and consistency of learning outcomes for our distributed learner body. As the lockdowns and isolation procedures came into effect, further complications to the traditional model of providing experiential direct focused patient care emerged. Procedures across the country varied by locality for how and when they would permit learners into the facilities, or if they would at all. The need to reevaluate how to create consistent, replicable, and validated within the curricular outcomes became acute. With facilities now restricting access to traditional in person the need to accelerate the timeline for virtual experiences in high quality virtual simulation spaces became essential to ensure learners were able to continue to progress in their educational journey with meaningful client interactions.

To validate the educational model while innovating the curriculum, the College began a multiphase approach to integrate the 2D computer-based simulation clients into the curriculum to scaffold support and ensure the maintenance and possible enhancement of learning during the transition. After an initial pilot, the College expanded the scope and integration to the use of the 3D environment to ensure the appropriate distribution, technical support, and scaffolded faculty engagement to maintain and further those academic success measures. And finally, a wider release of the virtual reality simulations is planned to full population sets in identified courses prior to more generalized release throughout the curriculum.

Utilizing a distance education model for all didactic instruction, experiential learning is broken into three parts: Intervention Skills-Based (ISB) instruction, Virtual Case-Based Client Care (VCBC) practice, and Direct-Focused Client Care (DFC) experiences. The interplay of how these elements interact will be discussed in the overview of curriculum to follow; however, the focus of this paper will narrow in on the work performed over the last two years in developing the virtual reality experiences for DFC, and more specifically the learning and academic outcomes for our learners in utilizing these interventions.

Overview of Curriculum

Nightingale College's Nursing Program uses a concept-based curriculum. Conceptual learning is an educational method that centers on big-picture ideas and learning how to organize and categorize information. Unlike more traditional learning models which concentrate on the ability to recall specific facts, conceptual learning focuses on understanding broader principles or ideas (concepts) that can later be applied to a variety of specific examples. The concept-based structure of the curricula facilitates the learner's journey through increasingly complex concepts, behaviors, and skills providing opportunities for the learner to progress along the novice-to-expert continuum. Based

on the principles of situated learning and cognition, all courses integrate concepts and information from all major areas of nursing practice within a contextual format of immediate and continuous application of prior knowledge and experiences.

Within each concept-based curriculum plan, there is a defined list of concepts that are emphasized throughout the corresponding academic program. The key concepts are consistently used for the selection of exemplars and the sequencing of didactic instruction and experiential learning activities, to support an integrated curriculum. The curricula are structured to ensure fundamental knowledge acquisition and strong medical-surgical foundation occurs early in the pre-licensure programs. Specialty concepts are concentrated in the higher-level and master's level degree courses and threaded throughout the programs. The curriculum was sparked by the call for radical transformation in nursing education presented in Educating Nurses (Benner, Sutphen, Leonard, & Day, 2010), a Carnegie Foundation for the Advancement of Teaching study on preparation for the nursing profession, and other literature including the Institute of Medicine and Robert Wood Johnson Foundation report on The Future of Nursing. The curricula are grounded in current evidence and professional standards and reflect the programmatic philosophy, key concepts, and current nursing practices.

In alignment with this mission and the goal of increasing geographic, demographic, and socioeconomic access to prelicensure nursing education, Nightingale College developed and implemented a learning delivery model accessible to learners in any setting. The implementation provided for the eventual substitution of high-fidelity virtual simulation for up to 50% of the direct focused client care (clinical) experiential learning, as consistent with program approval. In response to the coronavirus (COVID-19) pandemic, the College prepared and executed a response plan to avoid disruptions to the academic progress of its learners, ensure continued institutional effectiveness, and protect the well-being of learners, collaborators, patients, health care partners, and the communities it serves, which included implementation of virtual simulations earlier than anticipated. The vendor-created virtual activities are vetted nationally and integrated into other nursing programs across the nation. Integration of this new modality was designed consistent with nationally researched norms and practices proven effective in nursing programs nationally (Aebersold, 2018).

Simulation-Based Learning: No Longer a Novelty in Undergraduate Education

The College's prelicensure nursing programs' full-distance curriculum provides for a lock-step mechanism of didactic learning and initial skills acquisition with virtual simulation learning activities and supervised on-ground field experiences. Online instruction occurs asynchronously via the College's learning management system, supported remotely by faculty through video conferencing technologies, virtual simulation software, VR headsets, and faculty-led webinars.

Traditionally, on-ground nursing programs skills acquisition occurs in a one-to-many setting, which encourages passive observation with limited hands-on engagement. Necessary materials for ample practice leading to process improvement and intuitive skill recall are limited in availability during lab time. While this type of model may fulfill clock-hour requirements for a course, the approach provides minimal opportunity for individual practice and demonstration of critical thinking and clinical reasoning within the scheduled timeframe. The College's remote Virtual Case-Based Client Care (VCBC) experiential learning model eliminates these limitations of traditional large group simulation lab settings by providing numerous opportunities for faculty-supported repetitive practice. The initial VCBC is conducted synchronously with faculty oversight and debriefing via teleconference software, while allowing the learners the repetitive practice asynchronously needed to continue the development of clinical reasoning skills. For this reason, the College chose a product that did not require faculty to lead the simulation and would allow for these repeated learning opportunities.

Contextualizing Design Decisions

Simulation is an educational method that allows students to practice in a controlled, safe environment. It provides an opportunity to improve patient safety, work effectively as an interprofessional team, develop communication skills, and think critically (Pal, 2022; Shin, 2015). Simulation can be delivered in various formats including mannequin based, simulated patients and virtual simulation. Virtual simulation comprises Virtual Screen-based (VS) simulation- delivered via a computer screen; Virtual Reality (VR) simulation - delivered using a virtual reality headset; and Mixed Reality (MR) and Augmented Reality (AR) simulation - delivered using AR/MR headsets.

While AR and MR technology have lagged in terms of practical utility (Roundtable Learning, 2021), VS and VR have been broadly adopted and studied in nursing education (Shorey, 2021) with various benefits for learners and faculty.

Learner Benefits

Learner experience in virtual simulation is consistently positive, with virtual learning "affording a memorable, inclusive, and engaging means of learning" (Saab, Hegarty, Murphy, & Landers 2021, p.1). It provides opportunities for learners to problem-solve and apply knowledge effectively in a safe space for trial and error (Pal, 2022; Zackoff, 2020). In studies with nursing students, this learner experience appears to be similar to that in traditional simulation (Brown, 2021).

Virtual simulation is repeatable and flexible. Repeatability has been noted as one of the central features to successful simulation, but one that cannot be accomplished with the space, time, and faculty requirements of many simulation centers (Barry Issenberg, 2005; Butt, 2018). With virtual systems that require no faculty intervention, learners also can engage in simulation whenever they like for broader, flexible access (Pottle, 2019), and learners appreciate the increased access and flexibility by virtual platforms (Mendez, 2020).

Most importantly, systematic reviews in nursing education show that virtual simulation can effectively deliver a range of learning outcomes. It allows acquisition of knowledge and skills, increases in self-confidence, self-efficacy and satisfaction levels, and decreases in anxiety levels (Jallad, 2021; Foronda, 2020). Furthermore, this delivery of learning outcomes with virtual simulation has been demonstrated as equivalent or superior to that of traditional learning and physical simulation (Brown et al.,2021; Haerling, 2018; Padilah et al., 2019).

Institutional Benefits

From an institutional standpoint, virtual simulation can be rapidly delivered, to large numbers of learners, remotely, at significantly reduced cost compared to physical simulation (McIntosh, 2006; Zendejas, 2013; Pottle, 2019; Freeman, 2021). These benefits of scale, combined with virtual simulation requiring little or no permanent space, was a key driver behind the wide adoption of virtual simulation during the COVID-19 pandemic (Pal, 2022).

Virtual simulation frequently requires no faculty input to be able to function, freeing up faculty time. Note that many VR setups advocate a hybrid virtual simulation with educator-led setup and debriefing as this can significantly improves the learning experience (Mendez, 2020; Brown, 2021) but their lack of requirement for the simulations themselves allow more effective working.

Where virtual platforms do require educator input, scenarios are also objective and standardized. This ensures consistent quality and removes bias from the learning or assessment process. These systems also can generate large amounts of performance data - valuable for ensuring utilization, encouraging learner engagement, and for identifying struggling students who may benefit from further training (Kim, 2021).

VS and VR

While VS is therefore beneficial and becoming widely used (Shorey, 2021) the literature contrasting VS and VR has been difficult to disentangle, not least because of terminology confusion between the two (Foronda, 2020).

However, there is increasingly an understanding that the value of VR comes from immersion and the sense of presence – the feeling of "being there" – that it generates (Makowski, 2017). This allows learning from experience in a way that mirrors real life (Bailenson, 2018).

This improvement in learning between VR vs VS is borne out in the healthcare literature, with multiple studies demonstrating improved learning, cognitive, and psychomotor performance in immersive environments over non-immersive (Choi et al., 2021; Guitierrez et al., 2007; Kyaw et al., 2019). What remains to be seen is how the degree of this benefit is balanced against the additional hardware needed for VR over VS in individual institutions.

Design Through Virtual Reality

As mentioned previously, the coronavirus pandemic accelerated Nightingale College's timeline to implement virtual simulation and the use of Virtual Reality (VR) headsets as a learning modality. In the spring of 2020, the College's Curriculum Function converted all on-ground based activities (simulations and clinicals) to virtual delivery to allow for learners to continue to progress in their program despite the lack of available on-ground clinical opportunities. At the height of the COVID-19 surge, the College curriculum utilized three different virtual simulation vendors to ensure combined large library of available scenarios. This allowed curriculum virtual simulations gaps to be minimized. One vendor, Oxford Medical Simulation (OMS), afforded the opportunity to pilot the use of simulation with VR headsets. The initial pilot has proven enhancements to the curriculum, and OMS is the preferred vendor because of the versatility with both 3D and 2D (for those learners who cannot tolerate VR) options of the same scenarios.

Intervention Results

The initial results of the intervention began with the normative baseline results in Spring of 2020 where learners were performing all on-ground simulations on site with faculty, without any virtual computer-based simulations in the curriculum. As COVID-19 began to shut down clinical experiences and on-ground face-to-face instructional environments, the College's Experiential Learning Supervised On-Ground Field Experience (EL-SOFE), pivoted to providing fully online simulated experiences utilizing OMS 2D Computer-based simulations augmented by Shadow Health and Swift River simulation products. OMS simulation scenarios carried 10 of the 14 total simulations, with Shadow Health supplementing with three, and Swift River supporting the remaining one simulation within the curriculum. These simulations were used to replace the on-ground simulation environment of experiential learning during the pandemic emergency. Within that first semester of transition to computer-based virtual simulation in Summer 2020, total mean results on HESI outcome scores increased by 74 points as shown on Figure 1. Gains based on computer simulation continued to increase with no physical on-ground clinical experiences through the remainder of 2020.

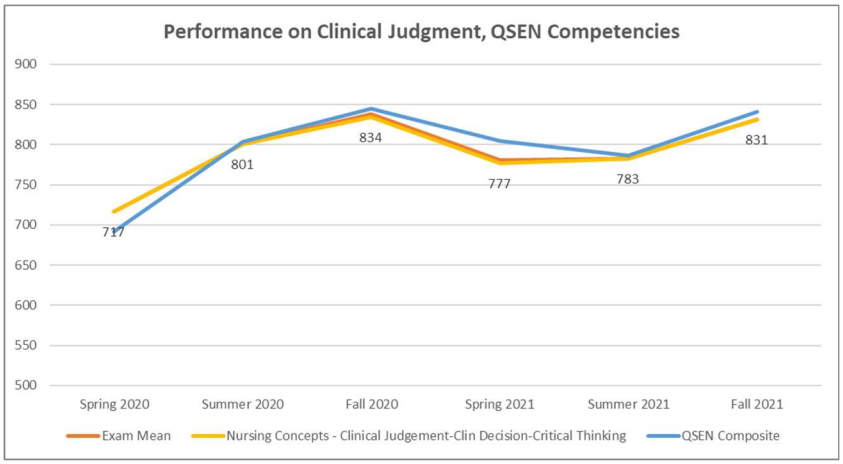

Figure 1. Performance on Clinical Judgement, QSEN Competencies

In the Spring of 2021, restrictions and lockdowns for on-ground experiential learning began to ease and open up opportunities for on-ground field experiences. Learners had been unable during COVID-19 to apply previously acquired knowledge and skills in the clinical setting during their educational experience because of the emergency environment. Clinical hours for this course consist of a maximum of six clinical experience, or EL-SOFE, days of ten-hour shifts, for a total potential of 60 hours of on-ground clinical experience. As physical clinical facility space became available, learners were scheduled up to the maximum within their geographic areas. The number of days available to learners varied with the average for the group being three days engaged by all in the Spring 2021 semester, and full hours to the maximum available during the Summer 2021 semester.

When learners began to return to physical on-ground clinical environments, our results showed learners were struggling to make the transference of previously only virtual simulations into the clinical setting to this point in their degree program. The drop in scores is reflective of that transference gap. While results showed a 50-point drop from previously only virtual simulation experiences, the drop still reflects a 60-point increase from the previous mean prior to any virtual computer simulation experiences in the curriculum at the start of 2020. Finding a balance between the

virtual simulation clinical environment, and the physical clinical space to aid that transference of knowledge, continued into the Summer of 2021 with moderate increases. Summer interventions did not change the number of virtual computer-based simulations integrated into the curriculum, but only increased the number of physical on-ground clinical experiences, or EL-SOFE activities, learners were able to engage in as pandemic restrictions continued to rise with partner clinical facilities.

In the Fall of 2021, the College expanded the virtual simulation environment with the introduction of VR goggles for the OMS simulations. VR goggles were introduced with an opt-in model, as described above, that allowed for comparison of those using the goggles, and those continuing in only the 2D simulation environment. Swift River and Shadow Health simulations continued in 2D computer interface settings with both interventions. With the introduction of the VR headsets to the curriculum with no other changes either to the mix of virtual simulation to physical clinical experiences, or EL-SOFE activities, a 48-point gain was achieved during the semester as a mean result on the HESI exams overall. Breakdowns between the two groups are outlined in Figure 2.

BSN 266

Section	VR/Screen	Avg Course Grade	HESI
1	VR	92.94	76.5
2	Screen	87.25	80
3	Screen	87.54	67.9
4	Screen	87.54	67.9
5	Screen	91.08	74.9
6	Screen	92.43	79.5
7	VR	94.64	84.4
8	VR	95.01	91.9
9	Screen	85.41	62.2

Figure 2. VR Goggles Compared with 2D Computer Simulation Learner Groupings in Fall of 2021.

Taking a more nuanced view of the comparison data is seeing performance of the group in VR simulation compared to the group in the 2D virtual space, indicated on the Figure 2 as Screen, three sections (one, seven, and eight) showed the highest levels of achievement in average course grade, and some of the highest performing scores in the Health Education Systems Incorporated (HESI) exam scores as well, and all were in the VR simulation group. While other sections of the course in the 2D environment were able to perform higher than one of the VR sections on the HESI exam specifically, overall course scores and performance engagement scores were highest in the VR intervention group. Further nuance into engagement is highlighted below in the qualitative data analysis.

Full breakdowns of the performance data on HESI exams taken over the course of the intervention, broken down by category, are detailed in Figure 3. The exam mean constitutes the trends lines from Figure 1, with the next two x axis categories focused on the NLN nursing judgement, and clinical reasoning constructs respectively. The remaining categories are identified by the QSEN Competencies for nursing education. While variances exist in all the category types broken out as to the percentage of gain or loss experienced by each semester grouping, the trend lines for all category classes followed essentially the same trajectory.

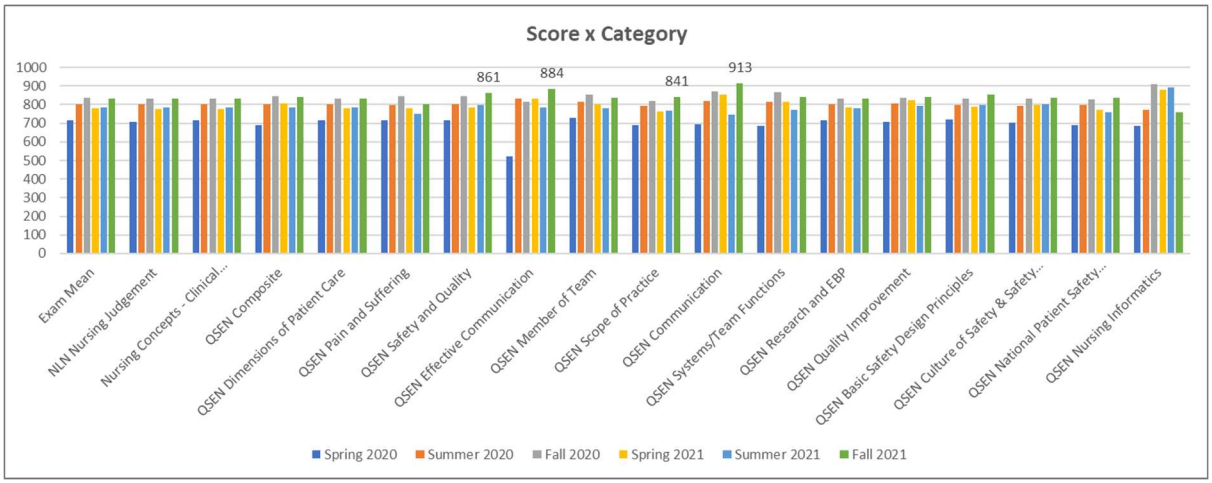

Figure 3. Performance Score by Category on HESI Exams from Spring 2020 to Fall 2021

Significant in these data sets is the need to balance the virtual simulation environment with physical on-ground clinical experiences to add transference of knowledge to skills. In 2020, we were able to demonstrate significant increases in standard testing results on the HESI exams during the strictly virtual simulation semesters. 2021. We then showed the transference of didactic and simulated experiences to on-ground clinical practice requires more scaffolding to maintain equal to greater gains than either the strictly computer simulation environment, or strictly on-ground clinical experiences alone. Further, the introduction of VR headsets to support the computer-based simulation environment where on-ground clinical experiences are present has demonstrated near equivalent high levels of achievement in bridging the transference gap from strictly online simulated environments and clinical practice.

Learner Qualitative Responses

An important aspect of ensuring successful adoption and integration of computer-based simulation environments and VR is an understanding of the learner experience while engaging in the resources. Surveys were the predominant method of collecting feedback from both a specialized survey on the OMS integration, and the traditional end of course survey and learner satisfaction index surveys conducted regularly at the end of the semester, and further qualitative feedback came from comments made to faculty and staff, as well as on the College's private social media pages. Composite scores from the OMS course survey on a seven-point scale are listed on Figure 4 after the survey questions. While those utilizing the headsets indicated some challenges in the initial setup and some motion sickness, of the group utilizing the headsets, only four elected to opt out to the computer-based 2D version in lieu of the goggles.

BSN 266 Early Course OMS Survey	Mean	Mode	Median			
Onboarding	5.11	6	5	Section Total		
The instructions I was given for using the headset and software were clear and easy to follow	4.64	6	5			
I was able to set up my account without any trouble	4.66	6	5			
I made use of the available resources for onboarding to the OMS system ("Getting Started" pages, videos, live support, et	6.02	7	7			
					Scale	
Set Up	4.49	4	4	Section Total	1	Not true at all
I had an easy time setting up the Oculus VR Headset	3.74	4.00	4		2	Somewhat untrue
The set up process was lengthy and time consuming	5.35	7.00	6.00		3	A little untrue
The headset was comfortable to use	4.39	4	4		4	Neutral
					5	A little true
Initial Thoughts	5.16	7	5	Section Total	6	Somewhat true
I'm excited to use VR throughout this course	5.06	7	5		7	Very true
I would find it easy to use this system frequently in the future	4.90	4.00	5			
This system will take me some time to get used to	5.52	7	6			
Experience	4.76	7	6	Section Total		
I experienced motion sickness while using the headset	3.88	4	4			
I am enjoyinging using the OMS scenarios	5.21	7	6			
I feel present (like I'm actually there) in the scenarios	5.18	7	6			
			*n=115			

Figure 4. Qualitative Survey Data Utilizing 7-point Likert Scale Breakdowns; all Groups, all Sections.

During the open-ended question on the end of course survey asking learners to please identify what they would consider to be the strength of the course, 69% of responses across all sections indicated OMS as a primary strength. Breaking that down between positive and negative comments between the two groupings, the results indicate those utilizing the VR goggles for the OMS simulations had a much more strongly positive experience than those utilizing it in strictly the 2D computer interface format, as outlined in Figure 5.

Sentiment x Medium			
	Positive	Negative	% Positive
Screen	13	10	56.52%
VR	11	4	73.33%

Figure 5: Summary of End of Course Comments Sentiments, all Course, all Sections Broken by Intervention Group.

A sample of direct qualitative feedback from the 2D computer interface intervention, also listed as Screen in Figure 5, and for those utilizing the VR goggles to complete the OMS simulations for both positive and negative comments are highlighted in Figure 6. Positive comments between the two groups focused on engagement and safe practice environments prior to entering in person clinical environments, while negative comments primarily highlighted limitations of the technology, orientation to the tool, or perceptions of the application itself within the wider curriculum design.

Intervention Type	Positive Comments	Negative Comments
Screen (2D)	"I believe the OMS simulations were very good and got you involved." "I think the OMS really helped bring our critical thinking to life without us making a mistake on a real person." "The strengths of this course are the OMS simulations and the EAQ's"	"I do not like the OMS" "I didn't find OMS helpful at all in assisting with clinical experience." "More training on new programs like OMS, the students to be oriented on the activities that are expected in it, and where items are located."
VR Goggles	"The addition of the OMS platform provided a really incredible learning tool. The ability to interact with the patient and carry out necessary clinical tasks really increased my critical thinking skills." "Applying learned material to real life situations, OMS was the best part of this course." "I enjoyed the interactive learning of this course with the newer technology. Since I worked with the VR version of OMS, it made the learning fun…"	"It was a rough transition getting acclimated to VR OMS. Consequently, I had a late start getting acclimated to the program." "The course could be improved with some of the OMS technology where the tasks that a nurse might perform while talking would be allowed. There were some lags in technology that required some work around to complete tasks that are designed to simulate real life situations." "The simulation are confusing with little to no explanation on how to approach the simulation assignment, which was very frustrating and I lost several points"

Figure 6. Open Ended Qualitative Feedback Samples by Intervention Type.

While qualitative data suggests the overall learner experience of using the technology was generally positive, areas of improvement are noted around further connecting the simulation performance to clinical practice, acclimation to the tool itself, and overcoming some technological barriers that may lead to lag or less than optimal performance.

Challenges

Several challenges were faced during the initial pilot, including: the need to accommodate for Americans with Disabilities (ADA), learners who experience severe motion sickness during VR headset use, and the various technical glitches related to the integration of the OMS VR software with the Learning Management System (LMS) used by the

College. The College's Academic Technology Services (ATS) function has worked with the vendor on temporary solutions and continues to collaborate on long term resolution.

While the data helps to understand the didactic and transference into the clinical experience allowing for greater contextual understanding in the metric performance, further research into transference to demonstrate the increase in EL-SOFE settings comparable to the didactic learning environments remains to be validated. The rationale behind satisfaction or comment disparity between the 2D screen environment versus the 3D VR space requires further investigation. Further, a deeper disaggregation of the classroom populations would allow for further distinction of where additional interventions and supports may be placed to ensure all learners succeed. Current data aggregates all learners into a single pool without distinction to potential historical disadvantages, prior performance, and situational barriers that may impact performance beyond design and integration models. Clarity into those demographic and situational factors also may help mitigate performance gaps within groups as well as between. Additionally, more guided support earlier in the program to acclimate to the simulation tools would permit for accelerated adoption, more seamless integrations, and more opportunity to link the simulations to their EL-SOFE activities. Factors that continue to create barriers for technological adoption of the tool remain to be overcome in both the support and design spaces.

Next Steps

The initial pilot program ran two semesters (Fall 2021 and Spring 2022). Ten VR Scenarios were used in the BSN 266: Concepts of Nursing II course. Plans for Summer 2022 include adding VR scenarios to BSN 346: Concepts of Nursing III course, with full curriculum-wide rollout to occur in Fall 2022. The use of VR headsets is the preferred manner for engagement within the VR simulations, but the learners are provided a mechanism to opt out if VR cannot be tolerated. The College's continuous focus on innovative, evidence-based design keeps the organization at the forefront of challenging the status quo and pioneering new higher education approaches. This allows for effective execution of the institutional mission and contributes to the realization of health equity.

Conclusion

Even as COVID-19 created significant barriers to the EL-SOFE activities, the pandemic also afforded opportunities to explore alternate ways of preparing learners for clinical practice. While the simulation environment showed substantial enhancements in the didactic and clinical reasoning skills assessed in their course and HESI exams, transference of those skills into the on-ground clinical space became strained without additional supports. Optimal transference of skills and knowledge enhanced to equivalent levels in an environment with blended 3D VR and EL-SOFE experiences over strictly 3D VR, which carried a diminished clinical transference, or strictly on-ground traditional simulation environment, which has restraints to safe, replicable, and repeatable time on task. Additional research into the demographic breakdowns would permit greater in-group intervention support and clarity into unintentional design or delivery bias.

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