Disrupting the Status Quo: Nursing Curriculum Transformation with Virtual Reality

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ABSTRACT

Nightingale College's continuous focus on innovative, evidence-based design keeps the organization disrupting the curricular status quo with new higher education approaches and curriculum resources. In one initiative, the College partnered with Oxford Medical Simulation (OMS) to implement a multi-phase rollout of the use of virtual reality (VR) 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 of virtual avatars. 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 synchronous faculty facilitated debrief. Initial pilot data indicated excellent student feedback and improved outcomes in critical thinking and clinical reasoning, and data from the full program rollout of this resource continues to trend upward. The College 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 share the multiphase approach toward implementation of the use of VR in nursing curriculum and discuss the challenges and interventions implemented between the initial pilot, previously presented, and full program rollout. The presenters will share updated data around learners' improvement in clinical reasoning skills using VR and testimonies of learner experience throughout the program. Additionally, the authors plan to discuss future augmentation of this initiative, including partnering in the creation of customized VR solutions based on identified curriculum gaps.

ABOUT THE AUTHORS

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 Vice President, Nightingale Innovations for Nightingale Education Group. 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. Jeffrey Olsen currently serves as the President, 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 20 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. 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.

Casey Brown currently serves as the Manager, Analytics for Nightingale Education Group, LLC. He holds a Master of Information Science with an emphasis in data analytics, data science, and business intelligence and a Bachelor of Psychology from the University of Utah. He has 9+ years combined experience in healthcare and higher education and is skilled in various programming languages including SQL, R, Python, and Java. Casey currently lives in Ogden, Utah with his wife and children.

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BACKGROUND

Participating in a nationwide distance education program enables individuals throughout the United States to access high-quality nursing education. However, ensuring consistent quality and equal educational standards across all locations presents challenges, particularly when it comes to clinical placement and skills validation. Nightingale College, despite having an extensive network of partnerships across the country, does not own or manage any client-facing facilities. Consequently, the College relies on well-established partnerships to provide learners with tailored hands-on care experiences.

As lockdowns and isolation measures were implemented during the COVID-19 pandemic in 2020, it became evident that the traditional approach to providing direct patient care experiences faced additional challenges. There was a pressing need to reassess how to develop curriculum experiences that were consistent, replicable, and aligned with the desired educational outcomes. Given the restricted access to traditional in-person facilities, it became crucial to fast-track the implementation of high-quality virtual simulation spaces to ensure that learners could continue their educational journey and engage in meaningful interactions with clients.

A multiphase approach was initiated in innovating the curriculum to include Virtual Reality (VR) and actively validating the impact on learner outcomes. The first phase involved integrating 2D computer-based simulation clients into a single curriculum course to provide support and maintain or enhance learning during the transition. Following an initial pilot, the curriculum expanded the integration to include the use of the 3D environment. This expansion ensured that the distribution, technical support, and faculty engagement were properly scaffolded to continue promoting academic success. The curriculum initiated the most recent phase over the past year and integrated virtual reality simulations into all clinical courses across the undergraduate nursing curriculum. Plans for the final phase of VR implementation include integration into non-clinical courses and soft skills training.

The curricululm utilizes a distance education model for all didactic instruction, breaking experiential learning into three parts: Intervention Skills-Based (ISB) instruction, Virtual Case-Based Client Care (VCBC) practice, and Direct-Focused Client Care (DFC) experiences. While the overview of the curriculum will discuss how these elements interact, this paper will focus on the work conducted over the last three years in developing virtual reality experiences for DFC. Specifically, it will examine the learning and academic outcomes achieved by our learners through the utilization of these interventions.

Overview of Curriculum

The 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 emphasized throughout the corresponding academic program. Developers consistently refer to key concepts to select exemplars and sequencing of didactic instruction and experiential learning activities, to support an integrated curriculum. The curricula are structured to ensure fundamental knowledge acquisition with strong medical-surgical foundation occurring 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, the 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 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 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, a product was selected that did not require faculty to lead the simulation and would allow for these repeated learning opportunities.

VRS Use in Nursing Higher Education

Virtual reality simulation (VRS) has become a recognized pedagogy in nursing education, equipping learners to navigate the challenges associated with transitioning to professional practice. Amid increased competition for clinical placements in nursing schools and heightened public demand for patient safety, there is a growing necessity for alternative pathways that enable students to hone their essential clinical judgment skills. Coinciding with this need, the National Council Licensure Examination (NCLEX-RN) introduced the NextGen (NGN) version of their exam in April 2023 (Dickison, 2019). This latest iteration emphasizes clinical judgment in its question items, creating a perfect opportunity for VRS to be a vital component in exam preparation. As reported by the National League for Nursing (NLN), there's an increase in interest regarding the incorporation of VRS in nursing education programs, a trend that is expected to continue (NLN, 2021). The surge in available nursing-centric virtual reality cases and the increasing familiarity of educators with this teaching technique reflects its growing acceptance. VRS technology enables

instructors to manipulate the patient scenarios that students encounter, ensuring repeated exposure to critical skills practice. Within the virtual domain, students can gather data, make informed decisions, and evaluate care outcomes. Evidence from multiple studies shows that consistent exposure to these safe, controlled virtual settings can alleviate anxiety among nursing students while boosting their confidence and self-efficacy, and knowledge (Jallad, 2022, Pardue, 2022, Mabry, 2020). Additional support comes from a recent systematic review that explored the application of immersive technologies, including VRS. The study highlighted advancements in cognitive learning and the development of psychomotor abilities. (Choi, 2022).

VRS vs Traditional Education and Physical Simulation

VRS and traditional simulation offer different but overlapping sets of benefits. Whereas physical task trainers or mannikins may be most appropriate for procedures such as IV insertion or in-situ training, VR will be the best solution for allowing scenarios to happen flexibly, repeatedly and in a standardized manner. These differences aside, there are many situations where learning objectives can be approached with either methodology, allowing VRS and physical simulation to be effectively utilized interchangeably. Brown (2021) compared the use of VRS to traditional simulation in nursing emergency scenarios. VRS was rated as "good to excellent" in terms of usability and the learning experience using VRS was similar to face-to-face simulation. Furthermore, nurse practitioner students consistently had superior experiences with VRS compared to in-person and face-to-face training. Haerling (2018) also found that VRS with nursing students delivered the same learning and performance outcomes as physical simulation, whilst being significantly less expensive. A meta-analysis conducted by Kyaw (2019) found that VR significantly improved healthcare knowledge and skills more than in-person education or e-learning. A study by PwC in 2020 reinforced these findings by indicating that VR learners were four times more focused than e-learners, learned four times faster than traditional learners, and were almost four times more emotionally connected than classroom learners. A randomized control trial (RCT) conducted by Padilha (2019) showed that VR significantly improved nurses' knowledge over case-based learning and led to higher levels of learning satisfaction.

VRS vs Screen Based Learning

The current research supporting the use of VRS in the field of healthcare education is largely positive regarding its effectiveness compared to traditional screen-based learning. VRS is favored for its immersive qualities that enrich learning experiences and its demonstrable capacity to facilitate better transfer of knowledge and skills to real-world patient care. In healthcare education, research conducted by Gutierrez (2007) showed that VRS significantly outperforms screen-based learning in terms of enhancing learning outcomes. Likewise, a study by Bowman (2009) reported that VRS significantly boosts memory performance and improves the transferability of knowledge to real-world situations, compared to screen-based learning. Additionally, Makowski (2017) further highlighted that the sense of presence offered by VRS significantly enhances memorization compared to screen-based learning. Not all studies align with these findings. Azher (2023) found that VRS using a headset offered a comparable experience to screen-based simulation when measuring performance scores, usability, cognitive resources, and emotional experiences. Further research and exploration are necessary to fully understand the potential benefits and limitations of VRS in comparison to screen-based learning methods.

Efficacy of VRS

A number of studies reveal the impact and efficacy of VRS in enhancing the learning experience. Brown (2022) highlighted Oxford Medical Simulation (OMS)'s platform for its effectiveness and usability with two-thirds of all learners studied giving the highest rating of usability as measured with the System Usability Scale (SUS). In the same paper, the Simulation Effectiveness Tool-Modified (SET-M) was used to assess effectiveness with 100% of learners rating the learning experience highly, selecting either "strongly agree" or "somewhat agree" to all components of the SET-M. The authors of the study concluded that integrating OMS throughout the curriculum and implementing facilitated debriefing has potential to improve patient care. Mallick (2021) found that learners using OMS demonstrated significant increases in clinical confidence and performance improvement to Kirkpatrick level 3. Additionally, 96% of learners noted that VR scenarios were better for knowledge retention than standard eLearning modules. In another study by Seager (2020), learners using OMS exhibited increases in their clinical confidence and showed improvement in their performance as a result of the VRS training they received. Particular changes noted were improvements in time management, prioritization, delegation, recognition of changes in patient condition, teamwork, and patient assessment skills. Studies have confirmed these findings in areas such as trauma decision-making

(Harrington, 2017), resuscitation training (Creutzfeldt, 2016), and even for physician training in removing cardiac leads (Maytin, 2015). Thus, the collective evidence points to VRS as a powerful tool in healthcare education, with OMS acting as a prime example of this technology.

VRS Cost Effectiveness

VRS continues to establish itself as a cost-effective solution across a broad array of applications, yielding a significant return on investment (ROI) both in monetary terms and time efficiency. The costs of physical simulation-based training can be challenging to assess but include costs (equipment, consumables, repair, buildings, personnel), time, and space (square feet) required to deliver a high-quality learning experience (Hippe, 2020). In a 2022 Economic Impact Study that examined OMS VRS specifically, the costs associated with operating VRS solutions like OMS range between $2.22 and $14.38 per use, compared to physical simulation costs which ranged from $28.38 to $394.95 per use. By taking a conservative average of costs at $12.10 per use, the ROI of OMS therefore ranges from 120% to 3,000%. Several studies corroborate this cost-effectiveness of VRS, such as Haerling (2018), which concluded that VRS is significantly less expensive than physical simulation while delivering the same learning and performance outcomes. Bumback (2022) found that VRS education requires 22% less time than traditional physical simulation, making it 40% less expensive. Taken together, these findings further illustrate the substantial cost-effectiveness and ROI of VRS.

INTERVENTION RESULTS

As previously published (Olsen, Kolde, Pottle, & Schleicher, 2022), the initial intervention began 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. As noted on Figure 1, the score range on Health Education Systems Incorporated (HESI) exams is between 0-1500, with 850-900 being the recommended performance success range. 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 in the BSN 266 course on the MedSurg HESI exam, to within 19 points of recommended performance range. The next semester and subsequent semester average scores have remained at or above the target performance metric range gaining a total average of 202 points from the beginning of the tracking period through Spring 2023. Gains based on computer simulation continued to increase with no physical on-ground clinical experiences through the remainder of 2020. In Fall of 2021, the currciulum expanded the simulation environment with the introduction of VR headsets using the same VR simulations already integrated in the 2D screen mediated space with an accompanying 48 point mean gain on HESI exams within the target range.

In Fall of 2022, aligned with the Phase II results, performance outcome increases were extended further with the transition of sections of BSN 266 that were in the 2D environment, in favor with strictly 3D VR headset environments, barring learners with ADA accommodations or health concerns. Performance outcome mean data from the pilot extending through the Phase II results are displayed in Figure 1. While learners have been demonstrating a positive trend in performance outcome on HESI exams over the last two years of presented data, with the introduction of strictly VR simulations in Fall of 2022, increases have continued to see steady incremental trend gains totaling 26 points above previous highest trend point in Summer 2022, by Spring of 2023.
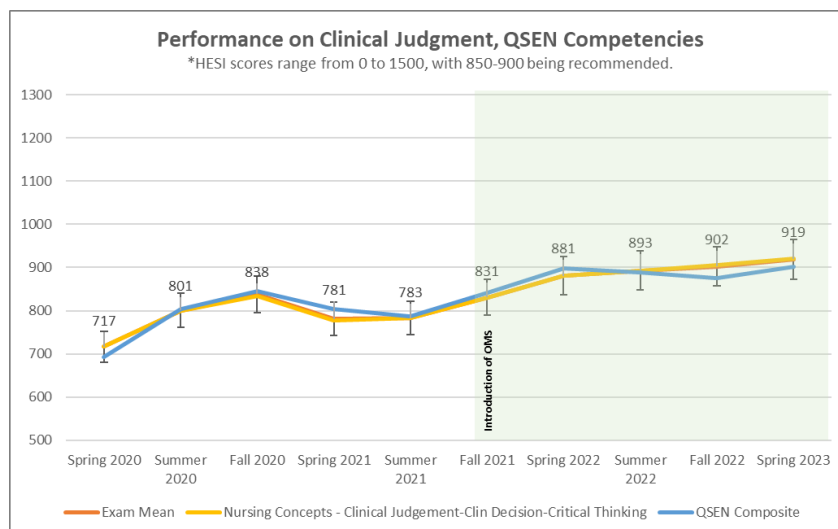
Figure 1: Performance on Clinical Judgement, QSEN Competencies, on MedSurg HESI exam.

Breaking those performance metrics and trend lines further, as explained with figure 2, trendlines for all competencies have continued to see increases, except Informatics. Variance range bars have been included on the mean score for semester performance averages in each QSEN competency category broken down by semesters before the pilot and after the pilot through the Spring semester of 2023.
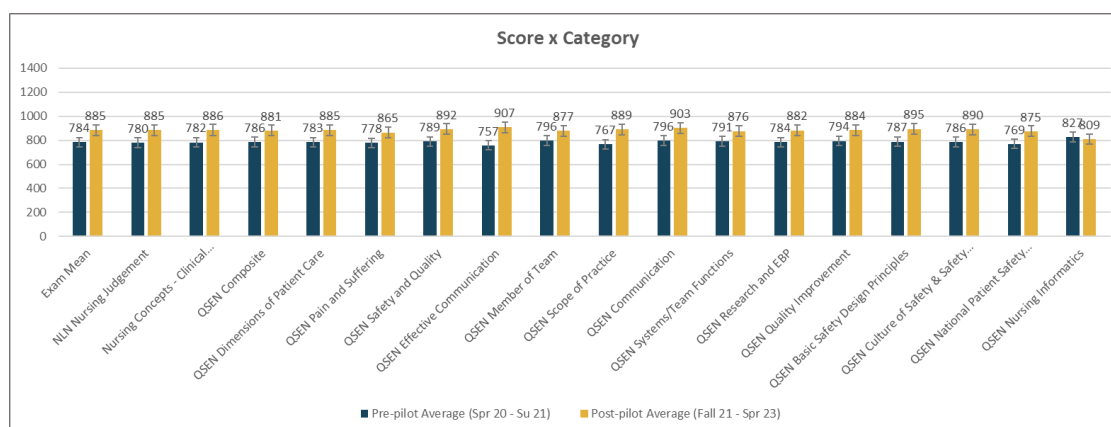

Figure 2: Performance Score by category on MedSurg HESI Exams from Spring 2020 to Spring 2023

These early pilot gains were steadily rolled out to BSN 346: Concepts of Nursing III, permitting learners who previously had exposure to the simulations technology to engage again at a higher level without needing to overcome the hurdle of learning the technology along with the content.

Phase II Rollout

Building on the earlier success of the pilot in BSN 266, in the Fall semester of 2022 the VR simulations in BSN 266 were transitioned to all VR headset sections, rather than the pilot which utilized sections on the 2D screen against other section utilizing the 3D VR headsets (refer to figures 1 and 2 for more details), and 3D VR headset simulations were rolled into the curriculum in BSN 346 (Obstetrics HESI), and BSN 366 (EXIT HESI). Unlike previous iterations, this population had already had exposure to the 2D and 3D simulation environments during their BSN 266 course. Therefore, the simulations were able to be integrated without the typical learning curve of learning the tool along with the content that existed within their previous BSN 266 course. The BSN 346 course utilized 2D computer-based simulations, also performable in a 3D VR headset space, augmented by simulations by Shadow Health, and Swift River, as previously introduced in the pilot. While these simulations did not replace all On-ground Direct Focused Care (DFC) in the clinical space, the simulations did form a crucial part of those experiential learning activities.

Results for performance data are presented through the HESI data in the four integrated nationally normed HESI exams in the curriculum, noting that the curriculum also uses two custom exams not presented here as they are not normed assessments nationally.

Obstetrics HESI Benchmark OB Fall

Similar to what was discussed and viewed in the Fundamentals HESI data in Figure 1, Figure 3 below demonstrates a similar pattern of early introduction of VR simulation decline in performance scores, followed by a sharp increase in outcomes the following semester well above the historic high. In this case, outcomes in Spring 2023 performed 138 points higher than the previous highest performance mean outcome in Spring 2022. Statistical variance in scores are included to support range understanding as well.
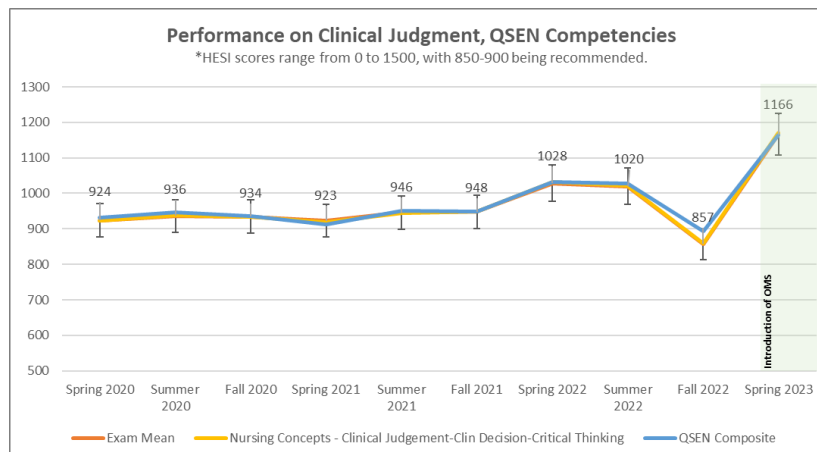

Figure 3 Performance on Clinical Judgement, QSEN Competencies, on Obstetrics HESI exam.

Figure 3 scores broken down by category below on Figure 4 show that after the implementation on VR in this course in Spring 2023 learners demonstrated a substantive increase over historic norms and trendlines in all areas. It is noted that this population also benefitted from the familiarity with the tool from prior course implementation, and have continued their increased gains in subsequent courses where it has been implemented.
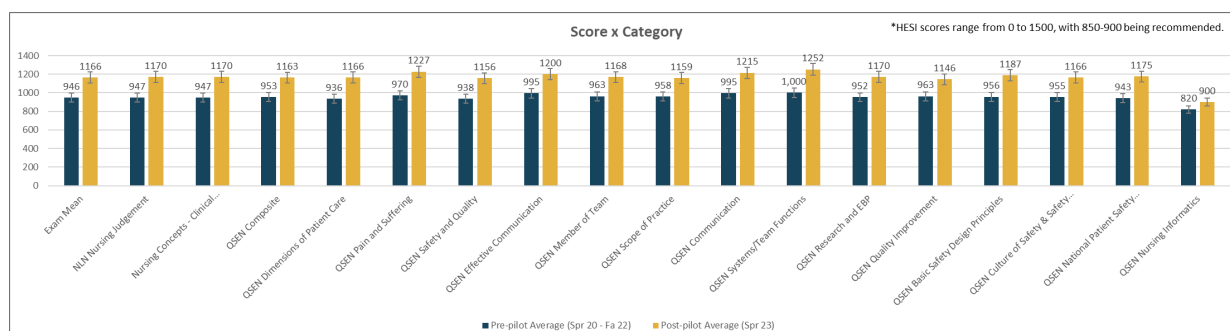

Figure 4: Performance Score by category on Obstetrics HESI Exams from Spring 2020 to Spring 2023

Exit HESI Benchmarks

Observing the trends from the previous three HESI results, Table 5 below shows that on the Exit HESI showed a more volatile result, declining 13 points from the previous all-time high outcome mean of 943 in the Summer of 2022 just prior to the full rollout, and aligned with outcome means from the previous high in Spring of 2021. These numbers appear to have stabilized in the low-mid 900s, above the nationally normed average predictor scores for NCLEX first time pass rate at 900 for a high probability score of passing on a first attempt.
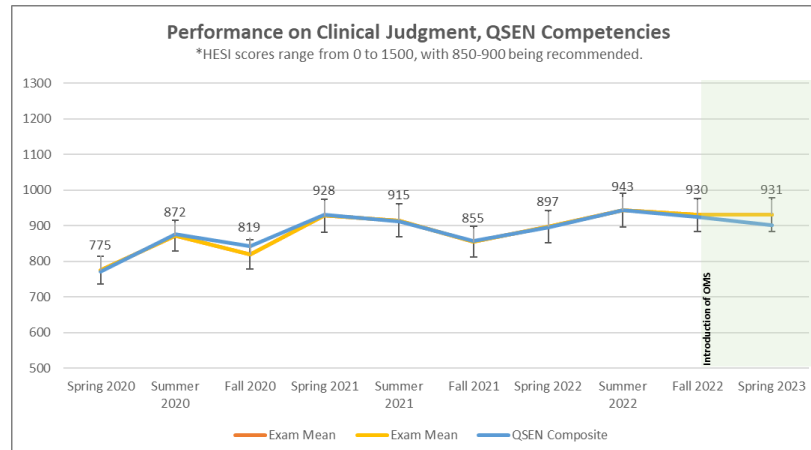
Figure 5: Performance on Clinical Judgement, QSEN Competencies, on Exit HESI exam.

Breaking down the Figure 5 scores into categories in Figure 6, shows no significant areas of volatility, although there is a dramatic drop in Informatics. All other areas exhibited statistical mean improvement pre to post pilot. Aligned with other noted results on other HESI exams, Informatics persists as a notable area of needed focus within the curriculum. There is also a notable jump in communications in Summer of 2022 on the raw data set, one semester after the notable increase in Spring 2022 on the MedSurg exam. These results appear more normative on Figure 6 based on average score norming for the semesters under review. However, this result helps to show how a notable result in one cohort may show similar aberrant results in the same section, semester over semester, on different exams and needs to be looked at as a single cohort result, not a wider organizational trend, as evident in Figure 6.
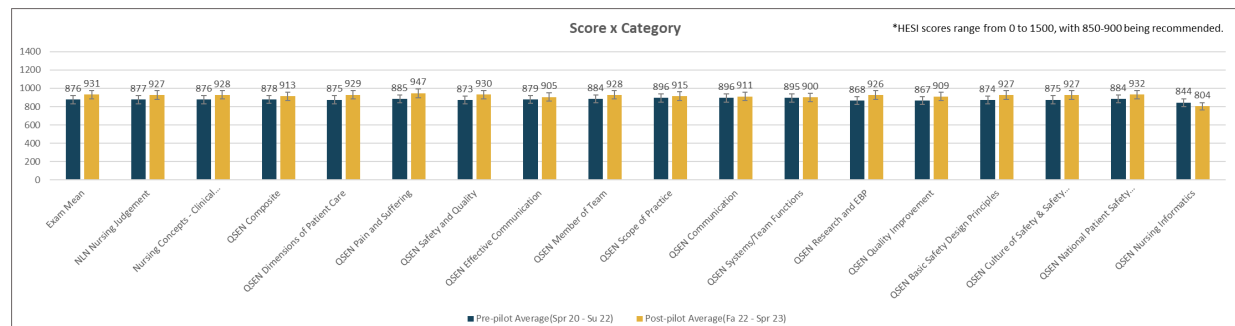

Figure 6: Performance Score by category on Exit HESI Exams from Spring 2020 to Spring 2023

Significant in these data sets is the trend of potential declines in performance from early adoption and the need to ensure substantive faculty support and training to maintain effective positive gains from the introduction of a new technology or tool in the classroom. While the Obstetrics HESI exam shows a dramatic drop in performance outcomes in the semester of VR introduction, the MedSurg course did not show declines. This is explainable in that the faculty supporting the MedSurg course had been part of the initial pilot and were both familiar with and adept to the needs of the technology and how to support learners in the experience while the faculty in other courses were being introduced to supporting learners in the new technology for the first time. This learning curve of supporting and engaging the technology in the most effective way possible demonstrated an early dip in learner outcomes that was quickly ameliorated in the subsequent semester when faculty had both the tools and effective experience and training to fully support learners.

Learner Qualitative Responses

While learner qualitative responses ranged in tone from the aggressive to benign, the majority of the comments were neutral to positive across the learner population. However, much can be gleaned from the extremes in the commentary. For that reason, selected comments in the extreme of positive and negative qualitative feedback are included in Figure 7 below. Themes include the time element viewed as a positive and negative, positive sentiment around critical

thinking and reasoning skills required as well as the replicability of practice, and negatively around grading, and motion sickness. Individual learner feedback is denoted as a separate bullet in the table, with each bullet inclusive of the full comment. Note that no editing has been performed on the feedback from learners, so all punctuation, spelling, and grammatical errors are original.

Positive Responses	Negative Responses
• The OMS assignments had a better ability to invoke a feel of urgency than Simchart or Shadow Health has done Being in a virtual room with the subject in front of you talking moving and reacting was more immersive than the other simulation types I have done in the past Really strong addition to the learning simulators being used here • I really enjoyed the OMS assignments They really make you use critical thinking and it is realistic It is nice that we don't have to score at least 80 and we can repeat the scenario as much as we would like • With new equipment like the oculus OMS, at the start it can be intimidating how to use it. But in reality, it is a good safe clinical practice. I had probably tried it 19 times to improve my score. Any new introduction of tools like SIMCHART, shadow health they are really good hands-on practice. It is a good model and very good for skill enhancement. Like what the saying goes, practice makes it perfect! We are always given 2 chances to improve our score and a good reinforcement for learning! • The VCBC provided group discussions about each concept and the OMS assignments helped me manage care in order and practice my critical thinking skills.	• less assignments due all at once and allowing for time to focus and redo those assignments we need to focus on The OSM are helpful just hard to navigate and time consuming to continuously redo them for the correct way to complete them • OMS It was awful Would repeat multiple times differently and not be scored appropriately or be told doing something wrong and right • OMS stimulation please remove it It makes people so sick Every time I was done with one of them my head just wanted to explode • The OMS Sim was not very helpful It was al about completing it on time instead of actually thinking and assessing properly • Things that need to be improved include the OMS. It's hard to take notes with the headset on, I recommend having students do the OMS with the headset on 2-3x then allow students to use the on-screen tether.

Figure 7: Qualitative feedback from learners from Phase II VR Goggle Rollout Fall 2022

Phase III Rollout

In Fall of 2022 the previously intended full curriculum rollout was postponed due to support concerns with vendors and the need to have the simulation tools available in the app store of the VR headsets, so plans were modified to move BSN 205 early Skills Assessments into the VR space. The BSN 205 course is the first required course in the nursing curriculum and includes summative assessment of basic nursing skills. Figure 8 presents final score means on the skills assessment from spring 2020 through Spring 2023 when the VR was introduced into the course. While there were high performance benchmarks in 2020, it should be noted that the rubric for evaluation at that time needed recalibration for rigor and relevancy of requirements. Once that work was undertaken, scores began to linger semester over semester in the upper 60s as a mean rate. While the rubrics remained consistent, the introduction of the VR headsets in Spring of 2023 saw a jump of nearly ten points over the previous semester with learners expressing a higher feeling of preparation and practice going into their skills assessment.
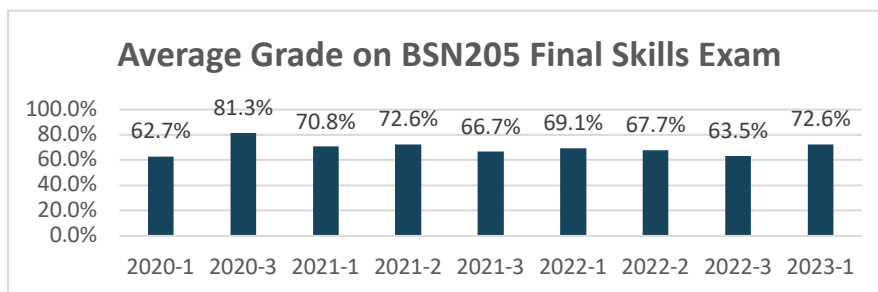
Average Grade on BSN205 Final Skills Exam

62.7%	81.3%	70.8%	72.6%	66.7%	69.1%	67.7%	63.5%	72.6%
2020-1	2020-3	2021-1	2021-2	2021-3	2022-1	2022-2	2022-3	2023-1

Figure 8: Average Grade on BSN205 Final skills Exam

Challenges

Previous challenges identified from the pilot program included the need to provide accommodations for those with accommodation requirements for physical disabilities or who suffer severe motion sickness during use of the VR headset, clarity around transference for experiences performed in traditional didactic settings versus virtual reality, and the disaggregation of earlier pilot data to determine if there were any potential disparate performance gaps between special groupings of learners that might indicate the need for adjustments to ensure design equity.

Within the full rollout, questions related to providing adequate and appropriate accommodations was resolved in implementation of support and alternative options, such as completion in the 2D space. With the further opening up of clinical Direct Focused Client Care (DFC) experiential learning sites, the metacognitive transference of knowledge and skills between spaces is also ameliorating as faculty are able to better see and speak to the ways the simulated spaces prepare learners for clinical practice, and early demographic breakdowns have not yielded significant results to indicate that any special grouping or subgrouping of learners is any more hindered or helped by the tools than any other. Significant in this data set is the way and through which means we can support faculty in making the transition to new tools more readily and effectively to support learners without the barriers of learning the tools while also trying to learn the content.

Next Steps

The initial pilot program ran two semesters (Fall 2021 and Fall 2022), with a phase two rollout in Summer of 2022, and skills assessment rollout for BSN 205 in Fall 2022. Further Phase IV rollout will continue in the Summer of 2023, with VR simulations rolling into the BSN 225 and BSN 246 courses; assessed with the HESI Fundamentals exams respectively. Given the results through these consecutive phases of VR simulation engagement, further refinement in support of transference, specifically the concept of readiness to practice, are planned to support learner connection from simulated reality to physical practice in a clinical space. While testing and performance results have demonstrated effective gains, the perceptive connection between the two spaces with learners remains an area for continued focus for curricular refinement beginning in Fall 2023. With continued expansion of learners in more distant and rural locations around the country, supporting learners through technological means to be able to perform their required education remains a crucial institutional objective in the execution of the institutional mission and supports the realization of health equity.

CONCLUSION

The team has successfully integrated virtual reality (VR) simulations into its nursing curriculum, overcoming the challenges posed by the COVID-19 pandemic. By adopting a distance education model and leveraging partnerships, the college has provided learners throughout the United States with access to high-quality nursing education. The implementation of VR simulations has allowed for consistent and replicable experiential learning, addressing the limitations of traditional large group simulation labs. Learners have benefited from the immersive and flexible nature of virtual simulations, which have been shown to enhance learning outcomes, increase self-confidence, and reduce anxiety levels. From an institutional perspective, virtual simulations offer scalability, cost-effectiveness, and standardized assessment processes. The use of VR headsets has further enhanced the curriculum, with positive outcomes observed in HESI exam scores and competency development. This innovative approach to nursing education

through VR simulations demonstrates its commitment to preparing future nurses and meeting the evolving demands of the healthcare industry.

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