European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 03, 2022

A virtual reality simulation-based nursing education through epistemological network model

[1]**S. Sujitha**,
Associate Professor Department of Child Health Nursing, Sri Venkateswara College of Nursing, Chittoor – 517127, AP
[2]**Prof. Edna Sweenie J**,
Deputy Director & Professor, Department of Child Health Nursing, Sri Venkateswara College of Nursing, Chittoor – 517127, AP
[3]**Dr.S. Maha Lakshmi**,
Professor Department of Community Health Nursing, Sri Venkateswara College of Nursing, Chittoor – 517127, AP
[4]**Prof. C. Rathiga**,
Department of Community Health Nursing, Sri Venkateswara College of Nursing, Chittoor – 517127, AP
[5]**G. Sujana**,
Associate Professor Department of Community Health Nursing, Sri Venkateswara College of Nursing, Chittoor – 517127, AP

Abstract - Because they provide low-risk, immersive approaches to introduce pre-licensure students to clinical contexts while also situating the development of necessary information and skills for patient care, simulations are commonly used in undergraduate nursing education. In the field of clinical education, virtual reality (VR) simulations provide fresh options. Research in this field is exploding, with topics ranging from perceptions of virtual reality as a medium to adoption of the technology to educational outcomes that virtual reality simulations may assist achieve. In this paper, we demonstrate the application of epistemic network analysis (ENA), a quantitative ethnography (QE) technique, to model how one nursing educator facilitated clinical judgement, nurtured quality and safety education for nurses' competencies, and nurtured quality and safety education for nurses' competencies through the use of the Simulation Learning System with Virtual Reality (SLS VR) (SLS with VR). Three simulation sessions in October and November 2020, all containing a basics scenario requiring second-year nursing students to exercise basic assessment and care management, were used to create a model of the discourse. Using immersive learning environments and learning analytic tools, we want to make significant advances in research in healthcare education, especially nursing education, in order to benefit patients and the public.

Index terms— nursing education, virtual reality simulations, epistemic network analysis, quantitative ethnography, CJMM, QSEN.

I. Introduction

The nursing profession is complicated and constantly changing. New nurses are expected to be proficient in a variety of overlapping behaviours (e.g., communication, awareness of one's own feelings, conflict resolution, change management, and leadership), according to nursing leaders in hospitals [1. Furthermore, cognitive functions such as clinical judgement have been shown to be directly related to almost half of the activities done by entry-level nurses, followed by problem-

solving and critical thinking [2]. Nursing educators are naturally driven to include realistic, effective, and relevant pedagogical techniques into their nursing courses in order to improve nursing education. This need is made even more pressing in light of the difficulties associated with providing students with high-quality clinical experiences.

Hayden and colleagues [3] came to the conclusion that high-quality simulation experiences may replace up to 50% of clinical hours in typical pre-licensure nursing programmes, according to a landmark research spearheaded by the National Council of State Boards of Nursing (NCSBN). To this end, researchers have conducted studies to evaluate whether or not simulations with varied degrees of accuracy have an influence on intended learning outcomes [4]. The need for more investigation into how we may grasp and exploit the value simulations bring in developing clinical nursing education [5],[6] cannot be overstated.

Here, we investigate whether virtual reality (VR) simulations may improve the facilitation of clinical judgement (as described by the Clinical Judgment Measurement Model, CJMM) [7] and quality and safety education for nurses (QSEN) competences [8] among nursing educators. Initial research into virtual reality simulations in nursing education is discussed. In the next section, we present Quantitative Ethnography (QE) [9] and discuss research on Epistemic Network Analysis (ENA), which has been conducted mostly in the context of healthcare education. We next illustrate the usage of ENA to mimic Tanya (pseudonym), a nursing faculty member's use of the Simulation Learning System with Virtual Reality (SLS with VR) in the context of a nursing fundamentals scenario in the context of a nursing fundamentals scenario. At the end of the paper, we suggest areas for further study.

A *Virtual reality*

It is predicted that virtual reality (VR) would have a significant influence on teaching and learning methods in higher education in the 2020 Horizon Report by EDUCAUSE [10], an annual book that covers present instructional technology as well as anticipates their implementation. This prediction is consistent with the fact that virtual reality applications are becoming more popular in a variety of industries, including the military, healthcare, retail, automotive, tourism, architecture, art and design, recruiting, and sports [11]. Virtual reality simulations are not a new concept in nursing education [12]. The advent of current technical breakthroughs, on the other hand, has made it feasible for virtual reality settings to provide disciplinary experiences and interprofessional skill learning with unprecedented immersion and interaction. These advantages have prompted new questions and techniques to better understand faculty preparedness and student perspectives, adoption processes and hurdles, and results that are important when contemplating the use of virtual reality simulations in nursing education, among other things (e.g. [13], [14]).

B *Virtual reality simulations in nursing education*

There are a variety of reasons why faculty and students are favourable about virtual reality simulations. Using a virtual reality simulation of an IV 171 catheter insertion process, Jenson and Forsyth [15] assessed faculty preparedness for virtual reality simulations after eight nurse educators trained a VR module on the operation. All of the professors who took part in the study agreed that virtual reality simulations, which include features such as haptic feedback, might improve students' understanding and confidence in the method. It would be especially beneficial for students to have hands-on experience with such treatments before they enter a clinical environment. Patients' acuity,

a high student to teacher ratio, patient safety, and students' desire for immediate feedback were all cited as reasons why faculty thought virtual reality simulations may assist them solve typical challenges in clinical teaching. After doing their research, Jenson and Forsyth [15] came to the conclusion that virtual reality simulations may give teachers with the freedom to monitor student progress remotely, change settings, and provide tailored feedback. Students will also benefit from the expanded chances to put their theoretical knowledge into practise, to practise nursing skills, and to prepare for clinical experiences.

Further research has recently been published by Chang and Lai [16], who examined the perspectives of 60 students enrolled in an adult nursing and practise course about: (a) practising skills in virtual reality vs conventional techniques; and (b) how VR helps and impedes skill acquisition. In this study, students' perceptions and experiences with virtual reality simulations for skill learning processes were classified into five themes: convenient to practise but requires adaptation, fast skill learning process, stress-free learning environment, environmentally friendly, and lacking a sense of reality. The authors came to the conclusion that virtual reality simulations may be used as a complement to conventional skill training methodologies, enabling students to utilise VR simulations to practise care-giving skills [16] while also learning. In their respective studies, both sets of researchers urged for empirical investigations that revealed teaching techniques and student results using VR simulations [15], [16].

According to the growing body of research in this field, virtual reality simulations may assist students in mastering certain skills and applying important information in order to be better prepared for patient care. For example, Ramakrishnan and colleagues [17] showed the deployment of three virtual reality simulations aimed to improve students' situational awareness, clinical judgement, clinical decision making, and comprehension of patients' viewpoints during their clinical rotations. On the other hand, Bayram and Caliskan [18] analysed the evidence about the usefulness of virtual reality (VR) simulations for teaching students to participate in safe practises while delivering excellent treatment to patients. General positive support has been found for virtual reality simulations and their effect on helping students correctly identify patients, improving effective communication, increasing the safety of high-alert medication, ensuring correct-site, correct-procedure, and correct-patient surgery, decreasing the risk of healthcare-associated infections, and reducing the risk of patient harm caused by falls [18]. Additional study is required to establish the usefulness of virtual reality simulations, despite the positive first findings [19].

c *Quantitative Ethnography*

Using a Quantitative Ethnographic (QE) methodology, we think that we may progress both research and practise regarding virtual reality simulations in nursing education. It is a research methodology that combines qualitative and quantitative approaches. It is frequently used to examine large amounts of data (e.g., conversations, transcripts, videos) from digital environments (e.g., simulations, intelligent tutoring systems, social media platforms) in order to uncover meaningful patterns in human behaviour and interaction [9, 10]. Qualitative inquiry techniques can be used to gain insights into what learners are doing and how they are thinking as they immerse themselves in a culture (e.g., nursing students completing CJMM tasks in a simulated paediatric scenario), how groups of learners differ (e.g., first-year versus second-year students), why and when (e.g., pre-briefing, simulation, and debriefing) in that environment (e.g., pre-briefing, simulation, and de One

of the most important contributions of qualitative research is the ability to provide statistical support for qualitative assertions or tales.

ENA [9] is a qualitative discourse analysis approach that has been used to quantify and display data produced from qualitative discourses in order to detect, model, and assess the co-occurrence of codes within a domain.

Recently, a high-performing primary care team [20] used ENA to examine communication patterns and workgroup dynamics in order to improve patient care and outcomes. Nurse simulations have also been the subject of multimodal data analysis by researchers to visualise team mobility. [21]. [22] In the Immersive Learning Research Network (iLRN), ENA has been utilised to represent learning as identity exploration in virtual learning settings, which has been shown to be effective. Specifically, in this research, we utilise ENA to simulate how nursing faculty use VR simulations, and as a result, how they improve their capacity to enable desired abilities in nursing education; particularly, clinical judgement, quality and safety instruction for nurses, and so on (see Table I and Table II).

We were able to identify differences in nursing faculty instruction based on the instructor roles outside (as oneself) and within (through manipulation of virtual characters in a VR simulation) a VR simulation system by employing this unified methods approach, and then test whether this interpretation applied to the data in general. As a result, we conducted a grounded analysis of the data [23] in which we read and reread the conversation in order to uncover patterns and themes, and then coded these topics in the data. In order to quantify and display the distinct patterns for a nurse educator while participating in the activity, we employed epistemic network analysis to quantify and illustrate the links between discourse parts. Pre-nursing students received a variety of types of education, which vary based on how she utilised the virtual reality simulation system, as shown by the findings of this study. We thus address the topic "How can a nurse educator employ a virtual reality simulation system to assist clinical judgement and quality and safety education?" in this research.

II. Methods

A *Context*

This examination is part of a larger pilot study being conducted by Elsevier, a worldwide health and analytics organisation, in the fall of 2020 (October-November 2020). In order to prepare for the introduction of the Simulation Learning System with Virtual Reality (SLS with VR) in early 2021, it was necessary to conduct a pilot to gather meaningful insights and comments on the effectiveness, usability, and viability of the system.

SLS with VR is a lab-based simulation system for undergraduate nursing education that includes a virtual reality component. Faculty (10+) and students (150+) from six nursing universities throughout the United States agreed to take part in the study because they were interested in enhancing clinical experiences via the use of virtual reality simulations, which were provided by SLS with VR. As a result of the COVID-19 pandemic, the pilot project was built to be flexible, so that researchers could assist participants and gather data both synchronously and asynchronously in an online-only, hybrid, or in-person format, depending on the circumstances. In part, this was made

feasible by the architecture of SLS with VR, which allows instructors and students to communicate in a virtual world while being physically present in their respective places.

B *SLS with VR*

SLS with VR was developed with the purpose of allowing faculty to enable immersive clinical experiences in nursing simulation laboratories in conjunction with existing practises. (e.g., hands-on simulations). The technology was created in such a way that just one moderator (or facilitator) would be necessary to conduct virtual reality simulations. There are 100 situations to choose from in nursing that cover a variety of topics (for example, basics, medical-surgical nursing, paediatric nursing). Only 44 scenarios were provided at the time of the study's inception. When it comes to faculty, SLS with VR situations are chosen, watched, and moderated using an interactive computer-based interface. During this time, students use Oculus Quest headset equipment and hand controllers to engage in the virtual reality experiences. Faculty who are moderating pupils have a complete perspective of what they are seeing in the VR environment. They also have access to commands and activities that assist them in facilitating a scenario, such as the ability to add several virtual characters (e.g., patient, nurse, doctor, dietician, employer), as well as distractions (e.g., phone calls) that students must deal with [see Fig. 1].

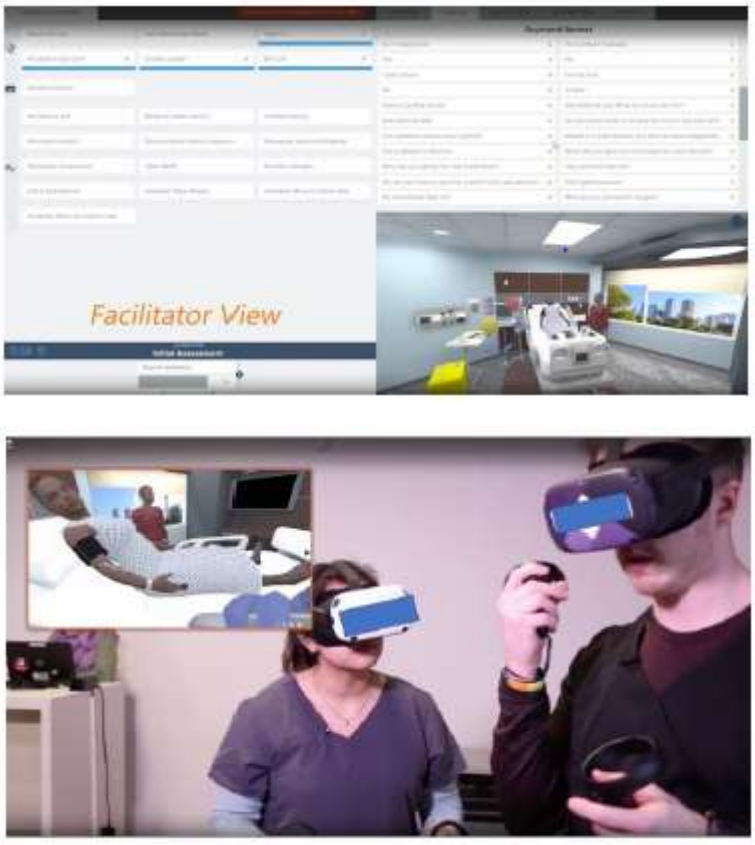

Figure. 1. SLS with VR moderator and student view

C *Participant*

She is a nursing professor at a public institution in the northeastern part of the United States who teaches in a standard nursing programme (Bachelor of Science in Nursing, BSN) and is going by the name Tanya.

She has 6-10 years of experience guiding or helping with simulations, with the majority of her work involving BSN students in their first semester of their second year of study. Simulators in a variety of formats (hands-on or lab-based simulations employing low and high-fidelity manikins, screen-based simulations, augmented reality simulations) are used in her research. Tania conducts simulated events on an almost weekly basis; nevertheless, she facilitates four or more simulations throughout each event session. Tanya's institution often conducts simulations with a group of four or more professors. In addition to role-playing as a patient and other roles (doctor, secretary, family, etc.) as appropriate, faculty members participate in pre-briefing and debriefing sessions, facilitate simulations, and provide feedback to students and fellow faculty. When asked about her primary goals for providing simulated clinical experiences, Tanya stated that she was concerned with the development of skills such as communication and professionalism, the development of clinical judgement skills, and the provision of exposure to a variety of patients and situations.

Tanya was serving as the primary teacher for the Fundamentals of Nursing programme at the time of the investigation. She was in charge of the pre-briefing, the facilitation of simulations, and the debriefing thereafter. Additional roles included acting as patients in role-playing scenarios and assigning clinical simulation preparatory assignments to participants. Tanya's cohort did not have access to a clinical site at the time of the research, which took place during the Fall 2020 semester. Instead, simulations were employed on a weekly basis.

Tanya highlighted her appreciation for the opportunity for students to connect theory and practise when asked what she loved the most about guiding simulations the most when asked. "I appreciate it the most when students are able to clearly connect multiple things they have studied in class because they are in a setting that forces them to think at an application-level," says Tanya. " During pre-briefing, during the simulation, or during the debriefing, this might occur." Tanya also stressed the importance of savouring the "ah-ha" learning moments that simulations provide; that is, the times when students realise they have applied what they have learned in class to a real-life patient. Some of the difficulties encountered in designing simulations were the time and effort required to coordinate setup of the simulations with the lab, assigning prep-work to students, keeping extra faculty informed, and arranging rotation schedules. Tanya remarked that it was difficult to perform simulations and provide comments during the seminars she attended.

Tanya's desire for "active learning strategies that promote the connection of didactic principles to clinical competencies" motivated her to participate in the pilot study. "Active learning strategies that promote the connection of didactic principles to clinical competencies" are what she was looking for. Her aim for SLS with VR was to determine whether virtual reality simulations are a suitable match for supporting course and clinical goals by giving a chance for students to engage with a patient in a nonthreatening setting, which she accomplished. In addition, other researchers have reported on the use of online and digital tools in fundamentals of nursing courses during the COVID-19 pandemic to assist students in (a) thinking like a nurse, (b) engaging in deliberate practise of professional communication, and (c) practising technology enhanced patient assessment and care [24].

D *Procedure*

Taney participated in the pilot for seven weeks (from October to November 2020), and she was one of 29 students who were in their second year of the BSN programme at the time of their participation. Throughout the trial, researchers provided her with asynchronous assistance by sending her onboarding materials, VR student and teacher manuals and safety advice, as well as directions on how to set up the play environment for the students. Aside from that, she had access to activities for her pupils that were targeted to the situations being presented inside SLS with VR, such as reading assignments for pre/post-simulation quizzes and pre/post-exercises, as well as pre/post-simulation exercises. Additional resources for each scenario, including as case narratives, pre-briefing and debriefing guidelines, in-depth scenario information and charts, were made available to Tanya via the SLS with VR ecosystem. Finally, a sandbox scenario was made accessible to all participants, and Tanya was invited to introduce her pupils to the virtual reality environment and controls before they engaged in situations either directly or as observers in the scenarios. Moreover, researchers assisted Tanya synchronously while remotely watching her as she conducted planned sessions including SLS with VR, beginning with pre-briefing, continuing through conducting the simulation, and concluding with a debriefing session with her students.

Our research team selected to analyse Tanya's simulation activities using SLS and VR over the course of two weeks (once in October and again in November 2020 on the same day), in order to complete this work. Each session followed a similar format (pre-briefing, executing a scenario utilising SLS with VR, and debriefing) and was conducted in the same manner. Students who role-played as nurses in the virtual reality scenario were frequently present in each session, as were students who watched. For the three sessions, audio and video data were captured using the Zoom software. Tanya picked a foundational scenario from the SLS with VR collection to use for each of these training sessions. A fundamental scenario such as this one was designed to provide students the chance to undertake a basic nursing evaluation while dealing with and prioritising many distractions. The following was a high-level summary of the scenario:

Table I. Definitions Of Clinical Judgment Measurement Model (Cjmm)

Code Name	Definition
Recognizing Cues (RecCues)	Filtering information from different sources
Analyzing Cues (AnaCues)	Organizing and linking the recognized cues from the previous step to the client's clinical presentation. Candidates should establish probable client needs, concerns, or problems
Prioritizing Hypothesis (PriHyp)	Evaluating and ranking hypotheses according to priority (urgency, likelihood, risk, difficulty, time, etc)
Generating Solutions (GenSol)	Identifying expected outcomes and using hypotheses to define a set of interventions for the expected outcome
Taking Actions (TakAct)	Implementing the solution(s) that addresses the highest priorities. Important to recognize that sometimes no action is an action itself
Evaluating Outcomes (EvalOut)	Comparing observed outcomes against expected outcomes

Kyle Miller, a 41-year-old Caucasian male, was admitted to the hospital on Monday morning with a low-grade fever and cellulitis of the forearm as a result of a puncture wound that had occurred

recently. Antibiotics were supplied intravenously, and the damaged region was cleansed and wrapped with dry gauze to prevent infection. Kyle's fever has now returned to normal, and he is expected to be discharged from the hospital on Tuesday morning, according to the hospital. The scenario will take place on Tuesday at 0800, at which point a preliminary assessment must be completed. The provider has requested an SBAR update in order to assist in planning for Kyle's release, but the hospital unit is cluttered with distractions, and Kyle's visitor has a lot of questions for him.

This scenario will provide students with the chance to undertake a basic nursing evaluation while dealing with and prioritising a variety of distractions.

E *Data Coding and Analysis*

As soon as the data was obtained, two raters coded the audio conversation data inductively and deductively for each speech included in the data [25]. The reliability and validity of qualitative coding were investigated using social moderation, in which two raters (a nursing educator and a learning scientist) rated all 770 lines of data and then reached agreement on each code [26]. It was decided whether or not each statement had one of the abilities that are fundamental to clinical judgement (CJMM, see Table I) or to quality and safety education for nurses (QSEN, see Table II), allowing for the quantification of qualitative data.

Table II. Definitions Of Quality And Safety Education For Nurses (Qsen)

Code Name	Definition
Patient Centered Care (PCC)	Recognizing the patient or designee as the source of control and full partner in providing compassionate and coordinated care based on respect for patient's preferences, values, and needs
Safety	Minimizing risk of harm to patients and providers through both system effectiveness and individual performance
Teamwork and Collaboration (TCC)	Functioning effectively within nursing and inter-professional teams, fostering open communication, mutual respect, and shared decision-making to achieve quality patient care
Evidence-Based Practices (EBP)	Integrating best current evidence with clinical expertise and patient/family preferences and values for delivery of optimal health care

We also came up a well-established code of rights for patients that states that "important patient health information must be protected from disclosure without the patient's agreement or awareness."

We utilised epistemic network analysis (ENA; explained in detail elsewhere [27]) to model the structure of links between CJMM and QSEN within a given dialogue to investigate how Tanya established connections between participating as herself and using SLS with VR. In this context, a conversation was a collection of lines of data that were presumed to be semantically linked. CJMM and QSEN codes were connected by a four-utterance moving window [28] for this investigation, which moves across the data and measures the linkages between the two. There was no connection between codes that happened outside of this timeframe. For each utterance, ENA used the moving window approach to display how each code was related to other code within their recent temporal

context, defined as a predetermined number of lines prior to the present utterance. Singular value decomposition was used to lower the data dimensionality of ENA's network models for all utterances for each unit. We used an ENA algorithm called a means rotation [29] that combined a (1) hyperplane projection of the high-dimensional points to a line that maximised the difference between the means of two units—in this case, the instructor as self and the instructor using SLS with VR—and (2) a singular value decomposition to analyse the data. Because of this, the resultant high-dimensional space was able to show any discrepancies between the units by placing their means as near as possible to the space's xaxis. This algorithm created a model to compare Tanya's SLS with VR system speech to Tanya's SLS as herself.

The weighted network graph, which depicted these connections as networks where the nodes corresponded to the codes and the lines reflect the relative frequency of the connection between two codes, and a plotted point, which represented the network as a value as coordinates in the high-dimensional space, were used for each unit. Tanya's CJMM and QSEN codes were evaluated in this research, and we looked at how these codes varied when the teacher talked as herself vs when she used SLS with VR to handle virtual characters.

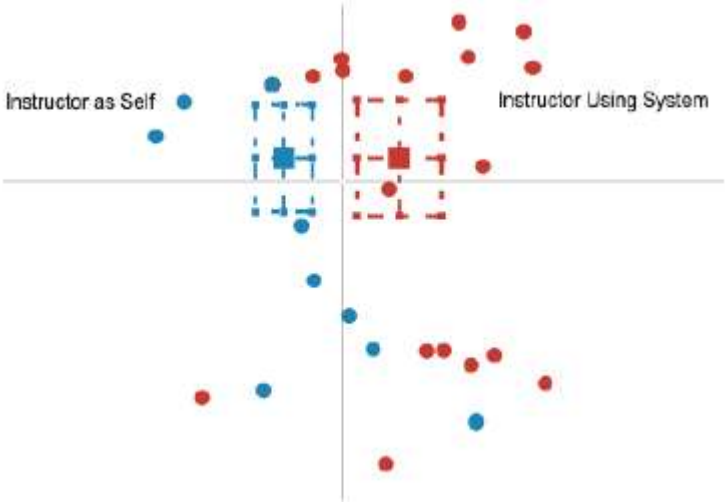

Figure. 2. Means (squares) and plotted points (circles) for Tanya facilitating student discussions during prebriefing-simulation-debriefing phases (blue) and her facilitation using SLS with VR (red) across three sessions

Mann-Whitney U tests were used to see whether the two trajectories differed significantly over the course of three sessions. The researchers looked back to the interactions and activities captured in the data to complete the interpretative loop and therefore fully grasp the phenomena replicated in the model for Tanya and her usage of SLS with VR. The researchers were able to focus on the most important topic in this work, which is the utilisation of VR simulations by teachers and students alike, by taking this last step. By averaging connection strengths across all moving windows, the mean networks for each role (i.e., teacher as herself and instructor usage of numerous virtual characters inside the SLS with VR scenario) were created. Each role's average ENA score was calculated by averaging the ENA ratings on each dimension. After subtracting the strength of the mean networks for each group, we created a difference network to compare roles graphically, and then plotted differences in weights. Using the Mann-Whitney U tests, we compared the mean ENA scores across groups to see whether there were any significant differences.

III. Results

What Tanya taught her students and conveyed was varied depending on how she positioned herself in relation to her students throughout the pre-briefing, simulation, and debriefing stages of combining SLS with virtual reality (VR).

A *Quantitative Analysis*

There were significant differences in ENA space between instructors who used SLS with VR (the system) as themselves and instructors who used SLS with VR (the system) as themselves (see Fig. 2).

According to the mean placements and confidence intervals, Tanya's instruction differed on the x-axis, but not on the y-axis (y-axis).

ENA scores were compared across jobs to see whether there were any statistically significant differences in ENA values. As you can see on the x-axis, the Mann-Whitney U test revealed that Tanya's patterns of connections were statistically substantially different from those she created when using SLS with VR (Mdn = 0.64, N = 18; U = 66.50, p 0.01, and r = 0.75), when measured at the alpha=0.05 level. We generated mean networks for each position in order to investigate these discrepancies (see Figs. 3 and 4).

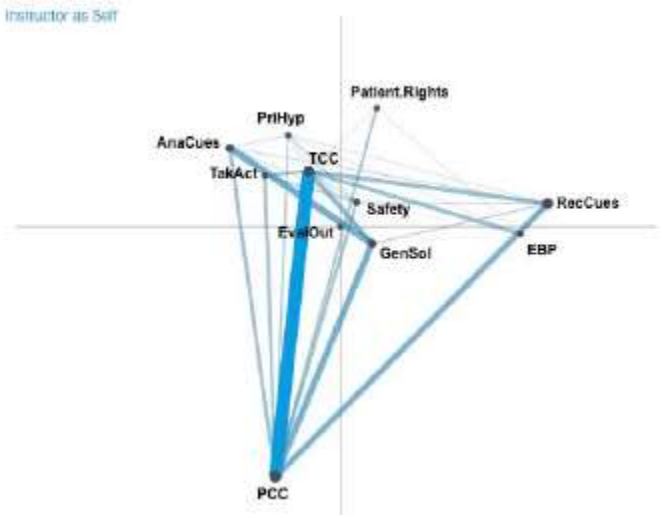

Figure. 3. Mean network representation for Tanya as herself during prebriefingsimulation-debriefing phases (blue). Thicker lines represent more frequent connections.

There were discrepancies in the instructor's connections to these notions, notably inside and between these two sets of codes, despite Tanya's use of QSEN and CJMM codes in both roles (herself and controlling characters in the SLS with VR scenario). Tanya's role as a facilitator was to draw the dots between Patient-Centered Care (PCC), Teamwork & Collaboration (TCC), and Analyzing Cues (AnaCues) and Generating Solutions (GENSOL). Tanya used SLS with VR to make links between RecCues (RecCues) and TCC and PCC when she guided. More connections were made between TCC and PCC, RECOGNIZING CUES and GENERATING SOLUTIONS when utilising SLS with VR.

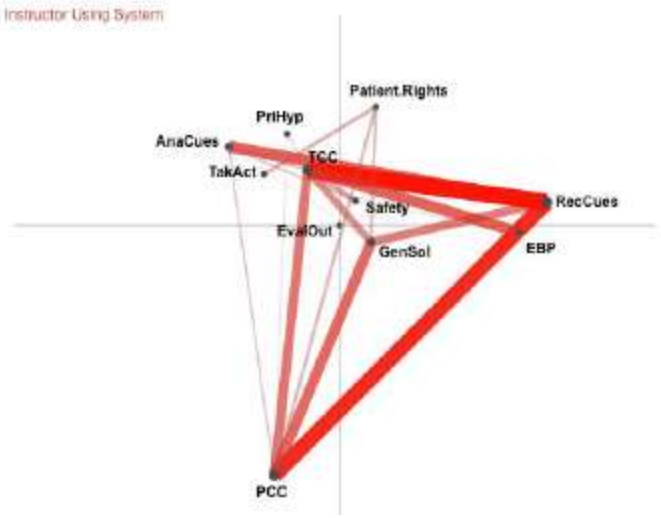

Figure. 4. Mean network representation for while facilitating the scenario using SLS with VR during the simulation phase (red). Thicker lines represent more frequent connections.

We developed a difference network (see Fig. 4) to analyse the similarities and differences between the two jobs. Virtual character linkages were stronger, but teacher-to-instructor links (blue lines) were more common when the instructor was speaking in her own voice. Stronger connections are shown by thicker lines, whereas weaker connections are indicated by thinner lines.

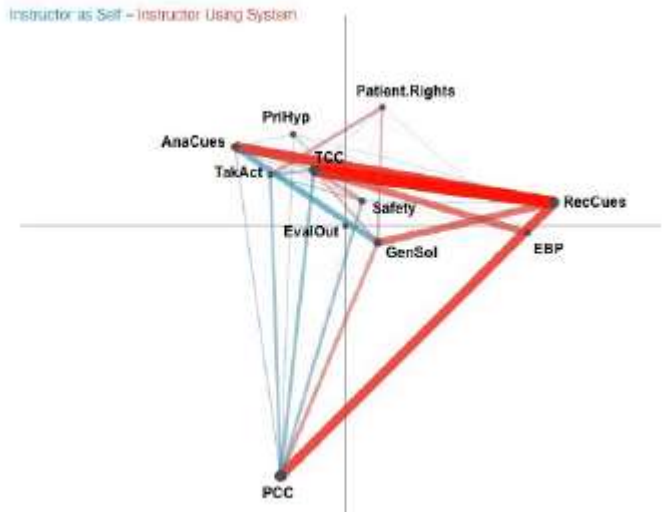

Figure. 5. Difference Network Instructor in Traditional Role (blue) Instructor using Simulation (red).

The statistically significant difference between the mean of the plotted points for the teacher performing a conventional role and the mean of the plotted points for the instructor employing SLS with VR is due to changes in the patterns of connections (see Fig. 1 and 4).

B *Qualitative Interpretations*

On the basis of an epistemic network and a grounded analysis of data, we found that a major difference between how the teacher led dialogues as herself and via the management of virtual characters in SLS with VR was the way she taught students about PCC.

C *Instructor as herself*

Tania emphasised PCC and cues that needed appropriate communication with the patient, the family member, and the care team throughout the many activities she participated in, such as RECOGNIZING CUES and ANALYZING CUES (her own) (PCC and TCC). It was after one debriefing that teacher discussed how patient and family (PCC) contacts proceeded throughout the scenario, for example "Okay, so how did you respond the wife?" she inquired. It's up to the observers to tell me how well they performed. Wife: How did they respond to your question? Tanya was particularly interested in how participants interacted with the patient's wife and how they responded to her queries. "I think Laura's (pseudonym) remark was suitable," the teacher said before anybody could respond. Instead of stating, "Oh, the doctor will be around," or anything along those lines. So "let us complete our exam and then I'll get back to you" was her response. The participant in this case was able to balance inquiries and patient care while still finishing the examination of the patient, as Tanya shown in the example above. While discussing PCC in subsequent sessions, the teacher focused on the need of prioritising particular stages in order to analyse cues and address patient concerns about results (Generating Solutions) (TAKING ACTIONS).

As a result, PCC was taught through including students in discussions on how signals were linked to outcomes and how a nurse must be sensitive to the requirements of the patient. For pupils to be better able to produce answers, take actions, and assess results, the teacher trained them to examine clues while she was herself. According to the quantitative data mentioned above, this qualitative observation is in line with this.

Meaning that her pupils learned how to use cue analysis in clinical judgements to provide patient-centered care (PCC).

D *Instructor using SLS with VR*

While using the SLS with VR, the teacher was able to teach students how to create more direct links between the RECOGNIZING AND ANALYZING CUES and the PCC. RECOGNIZING CUES was a central theme in each of these linkages. SLS with VR was utilised to teach students what information was crucial to concentrate on while the instructor talked via the manipulation of virtual characters inside the situation. A simulation, for example, allows the facilitator to provide information in a variety of ways, such as by presenting the symptoms and involve patients in their treatment. The virtual nurse reported symptoms (e.g., a construction site puncture wound) as "wound healed on its own and it's healing nicely, the surrounding skin is pink and undamaged," whereas the virtual family member supplied symptom descriptions (e.g. There is less redness on his arm now than there was yesterday." It seems to be improving, and I'd want to hear from you about what you're experiencing." Still a touch sore, but considerably better than it was yesterday, "said the narrator. The SLS with VR moderator tool, actions, conversations, and virtual character manipulation were just some of the ways Tanya utilised SLS with VR to present information from a variety of viewpoints. As a result, Tanya chose to employ non-player characters such as a virtual patient and a virtual family member to convey information rather than debate or evaluate it.

It was amazing to learn that the lecturer identified a new technique to use SLS with virtual reality (VR). The teacher acted as a virtual employer in the scenario to show how PCC might cause problems and cause diversions. "He phoned in sick today and I heard he was in the hospital," the virtual employer inquired. What may be wrong with him?" Despite the virtual employer's concern in the patient's well-being, revealing this information is both insulting and against hospital policy. By having the virtual boss remark, "Oh, come on," Tanya attempted to entice the participants to provide more information. "Kyle's hospitalisation isn't exactly a huge secret."

After a few tries in this way, the participant eventually said, "Per the hospital regulations, I am not permitted to divulge any information." Tanya fleshed out concepts concerning PATIENT'S RIGHTS in this extract, which emphasised essential intricacies of PCC. Students were able to learn how to identify chances for PCC by using Tanya's usage of SLS and virtual reality to highlight frequent dangers to PCC.

IV. Discussion

This research demonstrated Tanya's use of SLS and VR to integrate CJMM and QSEN skills in a variety of ways for and with her students.

By modelling and visualising Tanya's discourse with her pupils at various stages of training (pre-briefing, simulation, debriefing), we discovered statistically significant patterns that indicate underlying qualitative narrative gathered over the course of three sessions (October- November, 2020). It seems from these findings that ENA may be a useful tool for assessing the many phenomena that arise in nursing education. As a result of this research, a QE strategy to integrating qualitative and quantitative methodologies is now a viable option for simulating clinical judgement and essential nursing competences like QSEN.

We propose that QE provides insights into what instructors are doing, how they are thinking, and ultimately, how VR simulations like SLS with VR might facilitate learning in nursing education.. A strong grasp on complicated and transitory phenomena may be gained via the use of statistics, which can be used to support statements regarding teaching and learning. Using VR simulations as high-quality clinical education experiences is advancing our capacity to ask and evaluate questions regarding their usability, effectiveness and viability. With SLS and VR, Tanya was able to involve students in clinical judgement and quality and safety procedures in patient care by assuming numerous personas, conversations, and actions. What instructors would expect to see in a basics of nursing simulation (e.g., patient-centered care, teamwork, and cooperation) and beyond is consistent with the dominating codes in the data.

The findings of this research, although novel and methodologically advanced, are not without their flaws. The number of sessions with the same and other teachers is quite modest, and future research will benefit from examining a larger sample size.

In addition, we gather data on the spoken exchanges that take place throughout the VR simulation. Actions captured in video data were not the focus of this research, but they may be in future studies. It is important to know how students interact with the simulation and what they take away from it [30]. For future research, additional elements of SLS with VR, including as variations in pre- and post-briefings between courses and topic categories (e.g., Medical Surgical), should be examined.

Tanya's use of SLS with VR and her reflections on the experience revealed how she connected with students in a variety of ways, despite the study's constraints. It's also important to note that the flexibility of nursing education VR simulations is essential, allowing educators to address difficulties and misunderstandings like PCC's nuanced patient rights in the larger context. The adaptability of SLS with VR was proved. There must be a systemic and meaningful model of how instructors and learners utilise these systems to evaluate learning in these systems, and these techniques must be capable of this. ENA has shown that this is possible.

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