Students' Learning in Theory-Based Simulation: A Socio-material Study

Abstract

Objectives: Simulation-based education (SBE) is crucial to prepare nursing students prior to their clinical learning experience. Theory-based simulation learning is increasingly important for analyzing how students learn. This study describes and analyzes how nursing students learn through simulation in the context of palliative care communication under a socio-material approach and explores the transfer of their knowledge and skills from simulation to clinical practice.

Methods: Twenty-seven final-year nursing students in six groups participated in two simulated scenarios, followed by a debriefing and post-clinical focus groups to capture their reflections and learning. Fourteen of them joined the post-clinical focus groups after completing their clinical placements. Video recordings of the simulation, debriefing, and post-clinical focus groups were transcribed and coded based on the human and non-human elements that were observed. These were triangulated with data collected through team participant observations, an analysis of the existing syllabi and curriculum, and a participant mapping exercise after the simulation. These various data sources illustrate how student learning and reflections took place.

Results: The three themes of student learning derived from the results and analysis were: 1) students' expanded learning of healthcare communication through a socio-material approach in the context of palliative care; 2) students' discovery of the diverse and complex relations and interactions between humans and materials and 3) students' new perspectives on healthcare communication and the transfer of knowledge and skills through a socio-material approach in clinical practice.

Conclusions: This study highlights how SBE can be further expanded using a socio-material approach to prepare students to learn beyond standardized and cognitively-driven approaches and procedures. Student learning demonstrates that SBE may develop beyond high fidelity and standardization to leave room for emergent learning and increased awareness in learning for students and teachers to optimize learning outcomes and competence.

1. Introduction

Healthcare graduates are required not only to be knowledgeable and skillful, but also adaptive to changing work demands. The increasing use of simulation-based education (SBE) in healthcare education is to prepare future healthcare professionals for their practice. Current practices in simulation-based education (SBE), however, often focus on the rehearsal of planned, standardized, and pre-designed approaches based on assessments and evaluations of skills and knowledge. They specify the conditions under which students can master clinical knowledge and procedural skills in their future practice, rather than endeavor to raise awareness of the nuances and uncertainties that invariably emerge in real-world healthcare settings.[1] This points to the importance of possible emergent learning, as students need to learn to become attuned to environmental factors and complex and dynamic ward situations.

Moreover, education for healthcare professionals still focuses predominately on the individual and on cognition.[2] Recently, there has been a movement in healthcare education to promote the idea that no phenomenon relating to humans can exist independently of the influence of the non-human aspects in a given environment.[3] Theory-based simulation learning is increasingly important for analyzing how students learn.

The socio-material approach provides a theoretical perspective on expanding and deepening student learning in simulation-based medical education.[4] The socio-material approach draws on various approaches from different theories, including the Actor-Network Theory, Complexity Theory, and Practice Theory, to name a few.[5] Specifically, the Actor-Network Theory[6] is about seeking to understand how humans and non-humans jointly produce effects through looking into

practices, processes, and perceptions of the way things happen. Similarly, in Complexity Theory[4] these interactions are viewed as a system in which human and non-human elements interact and also self-organize and allow for emergence.[5]

In a study on theorized simulation for higher education, Dahgren et al. showed that socio-material perspectives take learning beyond cognitive considerations to address the dynamics of material, situational, representational, and relational difficulties in experiential learning.[7] Similarly, Green and Hopwood proposed the idea that learning and knowing in practice is embodied and relational, interwoven with historical, social, and material aspects.[8] The roles of body posture, distance, touch, non-verbal communication, protocol use, checklists, rules, technologies, and settings are crucial in identifying how these tools and spaces are made intelligible in a simulation-based setting.[9]

The socio-material approach makes the relationship between different practices and settings intelligible by making visible[10] the meaning of non-human aspects that are intimately tied to performance, which underpins the notion of emergence. Some objects may prefigure certain actions through shared understandings, intentions, rules, social norms, and other elements, but do not determine them.[11] It is important to note that highlighting the active roles played by these non-human aspects does not preclude paying attention to humans. Rather it reorients our inquiry into taking into account the multiple ways in which human and non-human elements relate to each other when put together.[12] Using this approach, SBE highlights the emergence of various factors in the environment and the emergent learning of students; that is, the continuously unfolding predictable and unpredictable learning that occurs through the emergence in the

system of various factors, events, and actors—the aspect of not knowing what will happen in advance so that students can learn about how they act and what may have influenced their thoughts in the moment of changing conditions or work problems.[8]

In healthcare education settings, the socio-material approach enables us to understand healthcare conditions by highlighting interactions between human and non-human factors in a complex clinical environment , which involves changing events and different stakeholders including patients, families, and an interdisciplinary team.[13] Through this approach, SBE allows room for interactions with non-human elements in an ambiguous dynamic interplay of people, things, and events in a manner that is non-linear,[16] unpredictable, and emergent.[14] Instead of aiming for high fidelity and adherence to standardized SBE, emergence involves the unfolding of the co-existence of stability and change, thereby displaying the complex and unpredictable conditions that students can learn in the moment.[15]

In exploring an innovative and theoretical approach to simulation-based learning for students, based on the socio-material perspective, this study is situated within the context of palliative care communication among final-year nursing students. Palliative care is found in a highly complex and stressful medical environment, and palliative care communication and interactions encompass the dynamics of human intentions, meanings, purposes, desires, and thinking, which play important roles in developing care practices.[16] In particular, we examine socio-material relations and interactions as entanglements and configurations of human elements (that is, healthcare professionals), and non-human elements.The non-human aspects that could be identified in the palliative care setting of this study refer to the set-up and the physical layout,

taking into account all material items, such as chairs, tables, hospital beds, curtains, medical equipment, and the high-fidelity simMan; and to relational components such as empathy, connecting, and feeling as discussed in communication protocols and guidelines. They also refer to distance, space, gestures, and body position, including whether or not to sit next to the patient, to display closeness during communication.

The introduction of a socio-material approach in this study is not only part of our design for SBE to facilitate student learning, but is also intended to help future healthcare professionals reflect on and learn about the relationship between their actions and decisions involving non-human elements. This study aims to describe and analyze how nursing students learn in simulations in the context of palliative care communication through a socio-material approach and to explore their perceptions of the transference of knowledge and skills from the SBE into other ward settings.

2. Methods

2.1 Methodological Approach

Spradley's ethnographic method was adopted in this study.[17] It is suitable for a project with a socio-material emphasis, given its focus on material culture.[11] Its notable feature is the injunction to allow observations to be made on what is happening and "what people do and say in particular [SBE] contexts."[18] It will reveal what the student participants are learning with regard to communication in a palliative care situation through bringing their interactions with the human and non-human aspects to the fore in the settings. Such data are often analyzed using ethnographic methods to make visible from a socio-material perspective the dynamics and

interactions that are involved.[13] The ethnographic approach informed by the Actor-network Theory highlights the emergence of human and non-human elements and the interactions between them, using such methods as participant observations, interviews, and documentation.[13] Researchers are required to be attuned to everyday objects and mundane practices that might otherwise be overlooked. [10]

2.2 Participants and recruitment

Participant recruitment was carried out through purposive sampling [19]of final-year undergraduate nursing students. These students had previous experience with clinical placements. They had also undergone structured case-based SBE but had not previously taken any courses on palliative care in the curriculum. Student participation in this simulation study is not part of the curriculum and their participation was voluntary, as the research associate emphasized that participation was completely independent from the academic program.

The research associate for the study, who was not a staff member of the academic program, invited final-year nursing students from a university in Hong Kong to take part in this study after information was provided to them by two members of the research team, who are members of the academic staff of the university's School of Nursing. The research team consisted of three subject lecturers, one clinical staff, and an overseas nursing colleague with a background in philosophy and history. None of the members would be in any position to evaluate the student participants within their program, hence the participants were not likely to be affected. The students signed informed consent forms and were told that they could withdraw from the study at any time.

A total of 27 final-year nursing students were recruited. Six simulation groups were formed and students were scheduled according to their availability. These participated students also consented to the possible post-clinical follow-up after their clinical placement, of which 14 of them joined five post-clinical focus groups.

2.3 Design of the study

The SBE in this study was comprised of pre-simulation, simulation observations, a post-simulation debriefing focus group, and a post-clinical practice focus group. One week before each simulation, the research team sent students an online pre-simulation survey link to solicit their experiences, reflections, and views on palliative care and its communication. This information served to provide a baseline understanding of their experiences in palliative care and communication. It was found that the participants had no experience with palliative care and communication. Their self-reported experiences aligned with the findings of the document review, conducted by two members of the research team who reviewed the syllabi of the various subjects within the nursing curriculum. They found little reference to palliative care and its communication.

The simulation group sessions and debriefing focus groups were held on the university campus between February 2021 and August 2021. The research team gave a pre-simulation briefing to the participants to further prepare them to understand the purpose and topic of the study, along with a brief chat about their reflections on the topic and about what they had read in the articles from the link that had been sent to them one week before the session. There were no expected

scripts for the students to follow. The pre-simulation briefing also included a PowerPoint introduction to the meaning of palliative care, current practices, palliative care communication, a complexity-based pedagogical design, and socio-material approaches.

In each simulation group, the student participants drew lots to be assigned to the role of either observer or performer in the two simulation scenarios. The two scenarios consisted, first, of a patient (hi-fidelity simulators with a voice, which was that of a laboratory staff member) with a chronic respiratory problem who had experienced an unexpected deterioration in his condition. His wife (a human actor), who was very anxious and worried, was present. The other scenario involved a female patient (a human actor), who had been admitted with severe bone pain, which hindered her mobility and which turned out to be recurrent breast cancer that had metastasized to her bones. She had just received the bad news from her doctor. The research team also observed the student performers' interactions with the patients and the family member. The student performers were briefed about the two patients, and the student observers were provided with an observation sheet to guide their observations. The student performers, observers, and research team engaged in debriefing focus group sessions immediately after the simulation to explore with students their learning and experiences.

With regard to the post-clinical experience, focus groups were held within two to three months after the students' SBE, and the research team conducted the focus groups via Zoom due to pandemic restrictions. Semi-structured interview questions were used to guide the students' discussions on what they had learned from the SBE and to measure their transfer of knowledge,

including their awareness of the interactions and relationships between the human and non-human aspects of their clinical experience.

2.4 Data Collection

The data were collected and triangulated through 1. Team participant observations; 2. Video-recordings of nurse-patient communication in simulation; 3. Post-simulation debriefing focus group interviews; and 4. A document analysis of the existing syllabi and curriculum. The researchers engaged in observations, watching the human and non-human aspects in action through the field and video footage to determine which particular element—human or non-human—revealed an important feature that could be considered to be shaped by and that itself shaped the students' actions of care. Documenting the productive role of materials in the field helped us to move beyond the assumption that palliative care communication and healthcare education are uniquely human concerns.

Then, during the debriefing, the nursing students were asked questions to clarify what they were doing with the non-human aspect, the actions that they took, and the reasons why the certain ways in which they had acted and interacted with the objects were related to their presence in the environment. The observers also started talking about their observations, and about what they had unexpectedly learned from the performers. They shared their experiences, followed in some instances by feedback from the performers. Other performers began with their own comments about what they thought was a challenge, as part of emerging learning, but came up with a better way to deal with the situation during the discussions. As they reflected on their performance during the discussion, as part of the socio-material approach, a mapping exercise[5] was also held

where students were invited to draw a map of their preferred setting of the simulated ward to illustrate the interactions and relationships between the human and non-human elements involved in palliative care and communication.

Since conventional interview skills typically pay little or no attention to non-human elements, in socio-material approaches and methodologies interviewees are invited to draw a map/picture related to their practice of palliative care and communication for a simulation. This map could illustrate relationships between students and technologies, specific scenarios, objects, patients, and the family member involved in the simulation. Interviewing to the double is a strategy that involves asking the students to describe their activity in the simulation as though they were giving instructions to someone who is going to replace them for a day as a double.[5] Questions for debriefing focus groups and post clinical focus groups are reported in Appendix D.

2.5 Data Analysis

Data analysis includes analyzing multiple data points—including observations and interviews—as they become relevant or important. The researchers worked through multiple data sources to describe, analyze, and interpret the collected data. The audio recordings from the debriefing and post-clinical focus groups and the video recordings from the simulation came to a total of 1,200 minutes of recordings and were transcribed verbatim with content analysis.[20] Coding frameworks were made through a description of the data. Interpretation involved both foregrounding the elements of the environment, and determining how these non-human aspects come together with the students, the patients, and the family through networks of relations in producing the students'

learning about palliative care and communication through simulation. Constant comparison also enables the identification of codes and themes that stand out across the focus groups and data.

With regard to the video-recorded data, two researchers reviewed the videos separately and observed what the student performers said and did, and their body positions in relation to the patients and the family member, with the physical arrangements and the protocol in use. They identified moments that were pedagogically interesting. They also shared their codes on what they had observed of the relationship between the set-up of the simulation and the scenarios, equipment, and use of theoretical knowledge such as the palliative communication guide.

They also discussed the students' communication and caring approaches in shaping relations between people, and between people and the materials in the environment. Their analyses were compared and presented at the research team meetings for more discussions and to reach a consensus. The findings from the video-recordings were triangulated with those from the observations made during the simulation and from the debriefing.

The research team used NVivo Qualitative Software V12 for Windows (QSR International) to analyze the data. The socio-material approach provided the theoretical framework to interpret the results deductively. The unit of analysis in the observations of the video recordings was the actions and relationships between the students, the patient, and family actors; and between people and the material environment. Meanwhile, the results from the post-simulation debriefing focus groups, through the students' own narratives, formed the inductive findings and analysis, as the coding and themes illustrated the emergent learning, moments of observation, and changes in the students'

decisions and actions. Coding was conducted based on the human and non-human elements that were observed. The codes were discussed and drawn out according to the range of the data that were collected, from which sub-themes and themes were identified.

The research team observed data saturation in the focus groups. Most of the themes were formed by the third group. For the fifth and last simulation groups, the data collection process reached code saturation and meaning saturation respectively, as no new codes were developed and no new information came from saturation of meaning, indicating that no extra focus groups were needed.[19] The process yielded a mix of concrete and abstract codes. As for the post-clinical focus groups, data saturation reached code and meaning saturation by the third group and the themes and examples substantially illustrate students' transfer of knowledge and skills into clinical setting, without new codes and further examples.

The analysis was guided through a set of questions, including: What are the human and non-human interactions in the simulation scenarios? How does palliative care play out within the socio-material perspective? Table 1 and Fig. 1 in the Appendix shows examples of coding and how sub-themes were identified and themes were developed in the context of the students' learning about palliative care communication under a socio-material approach. These coding examples show that codes were made based on the various data sources, and coded under categories that included the use of various non-human objects and human and non-human interactions. These codes were gathered, compared, and contrasted to map overall student learning across all simulation groups. Sub-themes were identified as patterns of code were identified, and themes

were developed to illustrate the students' learning about palliative care communication in simulation under a socio-material approach.

Researcher reflexivity was ensured through multiple layers of reflection to connect the insights gained throughout the process.[21] Under the ethnographic approach, researchers are part of the phenomenon of intermingling. Therefore, having the researchers position themselves within the phenomenon led to a reconfiguring of the situation under study because the researchers were both insiders and outsiders, participants and observers, which required awareness of independence and the presence of the influence.[13] The researchers' reflexivity enabled the phenomenon to be understood, and the gaps in understanding to be filled in during and after the research process, especially through participation in debriefing sessions, which enabled the researchers to understand the students' learning process and points of reflection.

While we applied socio-material entanglement empirically, we ran into an initial issue of thinking dualistically about the social and material.[22] We then tried to illustrate our findings without succumbing to the inclination of focusing more on the social than on the material. In our analysis, we were able to balance an emphasis on the social with that on the material and continuous looked for their relations and interactions.

This study was approved by the Hong Kong Polytechnic University. Ethics ID: HSEARS20200117001.

3. Results

The three themes that came from the results and analysis were: 1) students' expanded learning of healthcare communication through a socio-material approach in the context of palliative care; 2) students' discovery of the diverse and complex relations and interactions between humans and materials; and 3) students' new perspectives on healthcare communication and the transfer of knowledge and skills through a socio-material approach in clinical practice.

3.1 Expanded Learning of Healthcare Communication through a Socio-material Approach in the Context of Palliative Care

The nursing students in this study said that their concept of communication skills was mostly basic bedside communication with patients and family members. In the debriefing focus groups, they reflected they could not simply rely on standardized clinical procedures or follow any scripts on communication skills when talking with patients and family members about a complex healthcare situation and about death and dying. Participants illustrated that they learned about the need to communicate with patients and involve family members in the medical care process amidst the emotional turmoil of the situation. Guiding questions for the debriefing also helped the participants identify the interaction between human and non-human factors in the healthcare context. These included bodily responses as non-human cognitive aspects in the building of trust; giving the patient time and space; and the use of distance, silence, and spatial positions such as standing up or sitting down.

> I realize that non-verbal elements are even more important than verbal communication. That includes the look in your eyes, your gestures, your tone, silence, pauses, and your pace of speaking. (Post Simulation Debriefing Group 1)

> I know how to handle cases that require practical medical procedures, but for Scenario 2, the patient was just informed about the bad news and I did not know how to respond, but I learned that a tap on the shoulder and silently standing next to her can offer her the understanding and emotional support she needs. (Post Simulation Debriefing Group 3)

> I have learned that it will be helpful to involve family members in the care procedures, for example to teach the wife to do mouth care for the patient. (Post Simulation Debriefing Group 5)

3.2 Students' Discovery of the Diverse and Complex Relations and Interactions between Humans and Materials

Nursing student participants described their learning in the simulation as that of becoming attuned to the complex dynamics in palliative care, beyond those of ordinary procedures and practices. Instead of following protocols and steps of care, researchers observed that students have become attuned to the situation through taking the time to look around and interact with the non-human and human materials in the environment, including the equipment, vital signs, a chart board, the setting, and the reactions and interactions of patients and family members. Table 2 in

the Appendix gives examples of the dynamics, complexity, and interaction of factors and materials according to the two simulation scenarios in this study. These examples display how students learned about the complexity of material and environmental interactions and flow in palliative care with emergent circumstances, including the complaints and discomfort of the patient or the worries and concerns of family members about the immediate point of care or about carrying out the doctor's routine orders.[17] Students learned about diversity, creativity, and complexity by dynamically interacting with non-human objects in the scenario, as the objects offered different meanings and functions[27] to enable medical care and communication. An example in scenario 2 illustrates the power of interacting with a non-human object—a chart—which could offer information about the patient while also providing a buffer for a student to buy the time to think of what to say to ease the anxiety and tension in the highly tense and stressful environment of palliative care.

In scenario 1, a few participants chose to follow the doctor's order first, which may reflect the hierarchical structure that they observed in the clinical settings. They also delayed in responding to a patient's complaint of anxiety despite the fact that an oxygen mask had been put on the patient for shortness of breath and family member was enquiring about the patient's status. Through what they said and did, the students lived their future professional selves in simulation, with variations in their responses and a sense of attunement to the situation. Some students were attuned to certain materials and to the changing meanings and performativity of these materials in the environment. For example, the students interacted with the electronic bed or the oxygen equipment to relieve the patient's shortness of breath and anxieties. Based on their previous knowledge about managing shortness of breath, they expanded the patient's chest by adjusting

the electronic bed to elevate the patient's head to allow the patient to breathe better. Other nursing students assessed the patient's oxygen level with an oximeter. This guided their subsequent actions in reassuring the patient of his condition using both verbal and non-verbal forms of communication, such as tapping on his blanket. In addition, the need to attend to the concern and feeling of helplessness of the patient's wife showed the complexity of the situation. This was where attunement brought out a different kind of learning in the moment in response to the dynamics of the situation and the need to attend to the doctors' orders. At the same time, they learned about the influence of non-human objects, such as the use of a chart and distance as buffers to allow them to compose themselves, in promoting palliative care communication with emotionally distressed patients.

In scenario 2, when nurse participants had to communicate with a patient who had just received bad news, some students would hold a chart and stand at a distance from the patient; others would approach the patient, narrowing the distance between them, or lower their body to sit in a chair beside the patient. In the debriefing, the chair was seen as a site for sitting mostly for the patient or their family, but participants became attuned to a change of meaning because the chair allowed the students to sit down to draw closer to the patient for the purpose of palliative care communication. Nursing students initially experienced stress and uneasiness and felt the need to respond and react to the patient and the patient's family in ways beyond the routine steps of care and doctors' orders.

As they felt discomfort, they were being pushed to rethink the options and alternatives for performing care in relation to the non-human aspects.

> I really hope to find out what I have to do next to fulfill the task, but I realize I have to be flexible and open to the environment at the moment, for example to observe, communicate, and provide answers to the patient and their family members to address their anxiety and concerns, first through the help of measurements on machines or by stepping closer to the patient or the patient's family.
> (Post Simulation Debriefing Group 2)

Through the simulation and debriefing, which were based on a socio-material approach, students were observant and aware of non-verbal palliative care communication as part and parcel of their interactions with non-human objects and resources. They learned that non-verbal communication can play a large part in conveying care, for example, by encouraging the patients to use a call bell to seek help from the nurse, and understanding how to draw information from the chart and how to use it as a buffer to buy time to respond when they felt stressed and did not know what to say.

> "I told the patient that even when I am not around, he can look for me any time through the call bell. We can make use of this object to let them know that they are welcome to ask us for help." (Post Simulation Debriefing Group 6)

> "I truly believe that when there are lots of things to handle at one time … I can easily overlook something…. I didn't want that, I was so anxious and I kept touching the

patient's chart and flipped through the chart to give myself time to think or to see if there was anything that I had missed."(Post Simulation Debriefing Group 2)

Both the students who observed and those who acted in the scenario emphasized that they were learning through observations of how groupmates reacted to the dynamics between human and non-human elements of the situation, the debriefing discussions and interactions with their simulation groupmates, and the comments and questions of the teacher facilitators.[23]

My aha moment was when Classmate A invited the family member in the first scenario to step out of the cubicle so that she could be more focused in caring for the patient without other distractions. Also, other classmates and a facilitator had suggested this because some procedures might be too shocking for the family members to watch. I never thought of that option and was just panicking in front of the family. I will try that possibility next time. (Post Simulation Debriefing Group 2)

I really admire Classmate B for encouraging the patient in scenario 2, telling her that she is strong and asking if the chemotherapy was really uncomfortable for her, while I mostly just stayed quiet and listened. It would have been really good if I had also encouraged the patient and asked her some questions. (Post Simulation Debriefing Group 3)

Nonetheless, many were able to attune their learning in the moment through unscripted SBE, which enabled them to learn to use space, distance, and questions, especially open-ended

questions, to facilitate communication, build trust, offer comfort, and explore the strengths and resources of the patients.

> (When a patient's wife was concerned) Do you have anything you want to ask? (Pause.) Is there anything that you are worried or concerned about? (The patient said that he felt better.) For now the oxygen will improve your breathing. We will book you for a blood test later. Is there anything else you want to ask? (Video Recording Simulation Group 4)

3.3 Developing New Perspectives on Health Care Communication and the Transfer of Knowledge and Skills through a Socio-material Approach in Clinical Practice

As the students experienced the dynamics, interactions, and complexity of materials in a simulation situation and reflected on them throughout the process and during the debriefing sessions, they developed new perspectives and an increased an awareness of and confidence in healthcare communication that goes beyond verbal communication. Not only did the students learn the importance of different materials in the clinical settings, they also translated the knowledge into clinical practice and became more aware of the interplay between material and environmental matters in conveying care, hope, and comfort. Students said that after the simulation learning experience, they became more aware of the importance of using curtains to provide privacy for patients with emotional needs. They observed that in clinical settings some nurses might not have the habit of closing curtains and would change the patients' clothes in front of their family members. The awareness and availability of these materials and equipment shaped and were shaped by the participants' understanding and planning in the delivery of care.

The student's learning did not stop with the SBE experience, as they brought their continuous learning into the taken-for-granted aspects of clinical settings and became more aware of the needs of patients and of the non-human aspect in relations and interactions.

> In the rehabilitative ward, I realized that the overhead table is a significant piece of furniture that gives patients a sense of security. We always tend to push it away to perform procedures, but do not push it back for the patients. I am now more aware that we should push it back in place for the patients. (Post Clinical Focus Group 4)

> For bedbound patients, it is important to not only give them warm water but to push the table close to them as many of them have been hospitalized for a long time and have their own water kettle on the table beside their bed. It becomes a way for them to exert some control in caring for themselves, as they can drink water by themselves without extra help from nurses. (Post Clinical Focus Group 2)

4. Discussion

This study demonstrates the use of an ethnographical method and the socio-material theoretical perspective to study human and non-human relations and their interplay within the context of palliative care nursing education. The theory-based SBE through socio-material approach used in this study may reveal the importance of objects that are often taken for granted. Overlooking such objects has led to false assumptions regarding the human or social in relation to the

material, and may have limited our understanding of what and why certain events occur in student learning in healthcare simulations.[24]

4.1 Implications of Student Learning in Theory-Based SBE in Healthcare Education

As was pointed out in previous studies[11] the socio-material approach serves as a theoretical framework that allows non-linear and continuously evolving dynamics[13] and interactions to emerge, making it possible for students to learn with diversity and creativity when offering care and support to patients and their families.[4] Unlike existing developments in SBE, which focus on standardized skills, patient encounters, and symptom management[25,26] the students in this study managed to experience, observe, and reflect on the complexity of the setting and communication in palliative care, and to react to the dynamics and interactions of different material and environmental factors in the simulation environment. The socio-material approach provides the crucial backdrop to prompt students to identify and even analyze their learning and reflections. The actor-network theory, one of the socio-material approaches that we adopted in this study, provides healthcare educators with a lens through which to better capture the realities of a practice that is diverse, non-linear, complex, and filled with uncertainties.[27] The results of this study demonstrate that through reacting to the dynamics in a simulated environment, students are able to learn beyond a planned simulation scenario, with better attunement to their environment and a better understanding of why they acted in the moment. The results help educators to trace the diversity and complexity of student learning, by shedding light on how human and non-human aspects relate to each other.

Since one key element in student learning in SBE is the debriefing, through a sociomaterial perspective, this was conducted as an open inquiry approach allowing reflections and turn-taking, with some guided questions based on the topic of interest. Students identified issues that were important to them, and constructed their own narratives from their simulations [28] and from observations for reflection in the debriefings on the interactions between human and non-human elements in the simulated ward environment. Other pattern of SBE debriefing could however focus more on a set of normative and descriptive rules. This may constrain what issues will be discussed with the learners.[28]

In SBE in undergraduate healthcare programs, students are supposed to learn professional knowledge and skills that that they have not yet acquired. Hence, it is important to focus on the students' perceptions of learning to uncover the reasoning processes behind their actions, rather than simply applying traditional protocols of assessment.[29] In the simulation, students experienced unfamiliarity because they were "acting" as independent registered nurses: performing tasks while unsupervised, taking on new care responsibilities, and not working in a group as students do in their clinical learning. From the unplanned and relatively unstructured approach of the simulation experience, the students were seen to go beyond textbook knowledge when things came alive to them. From being patient-centered they became aware of other human and non-human factors, especially when most became sensitive to interacting with family members in the hope of facilitating the nursing care. The students demonstrated the ability to react creatively. For example, some invited family member to step out of the patient's cubicle, creating a spaceof comfort to lessen anxiety not only for the family member but also for some

students' sense of control of the situation. This in turn has however allowed the students to follow-up with the family and to achieve a more holistic approach that would benefit the patient.

A part of the students' learning process, the students' observations of their peers' performances also provided them with opportunities to reflect on how they or their peers delivered healthcare and communication in the palliative care simulation scenarios. Previous literature also indicated that the role of observers in simulation helps to optimize learning, as the participants examine matters clearly from a distance and give meaningful feedback as active participants rather than passive observers.[30] In the debriefing focus groups, it was revealed that their feelings of anxiety and discomfort in facing the simulation scenarios pushed them to reflect on better ways of doing things, on precisely what could be improved, and on what environmental human and non-human factors can help to achieve such improvements in care and communication. There was also the pedagogical potential in the students' observations of the simulations. They were able to notice and learn from various aspects of their peers' actions and unease, and to potentially become attuned to various practices. This might not have been possible if they had been fully engaged in the action. Such experiential experiences may also allow the participants to embody their future professional selves as observers at work.[29]

In addressing the use of palliative care and communication as the context to illustrate the possible socio-material perspective in students' learning in SBE, the research team is mindful about possible cultural influences in the scenario that was used. However, we were also cognizant of recent debates about cross-cultural competence and about the importance of giving our students the expertise and tools that they need (which reflect traditional mainstream views),

versus the more current central focus on developing cultural sensitivity and humility in the students.[31] Adopting the latter view, we introduced the fundamental aspects of cultural and linguistic diversity in palliative care and communication, in an attempt to focus on a multifaceted and flexible definition of culture. To avoid stereotyping in cross-cultural and palliative care and communication, Semlali et al. suggested the importance of regarding person/patient centered care as culturally sensitive care and stressed that healthcare providers need to reflect on and be aware of their attitudes in palliative care and communication.[31] We have attempted to give the students the basic knowledge for them to reflect on their own attitudes and reflective learning over cultural diversity, without prioritizing one culture over another, from the SBE as a starting point. These are topics that can be further considered in future studies.

As far as we are aware, this is the first study on palliative care communication using a theory-based socio-material approach to SBE. It highlights how SBE can be further expanded using this approach to prepare students to learn beyond standardized and planned approaches and procedures. What is demanded of our future graduates is that they not only be able to perform specific tasks and apply codified knowledge appropriately with standardized competence assessments, but also have the potential to navigate through unexpected and unfamiliar territory.[32]

4.2 Implications of Transfer of Knowledge and Skills from Socio-material Approach SBE into other Ward Settings

The students' transfer of knowledge and skills into their clinical placement after the SBE in this study are important indicators that theory-based simulation education can effectively prepare healthcare professions to adapt to work demands and attune themselves to environmental factors. Past studies had had shown that simulation-based training helps surgeons to transfer their surgical skills to the operating theatre, when compared to a conventionally trained control group.[33,34] However, Finan et al. found that simulation training brought improvements immediately post intervention but did not translate to a clinical environment.[35] Similarly, Norman et al. illustrated the minimal relationship between the level of simulation fidelity and the transfer of learning, while pointing out that an understanding of context and effect in psychology in relation to how to manage a complex clinical environment are crucial steps that can affect the students' learning.[36]

This brings us to reflect on the cognitive focus of SBE, where the emphasis is mostly on the rehearsal of skills and the planned response; while the focus in theory-based SBE is to enhance the students' learning so that they can transfer their skills to clinical practice—something that is becoming ever more important in a fast-changing healthcare environment. Conventional SBE can help healthcare professionals to familiarize themselves with replicable and planned steps and protocols; while increasingly transparent healthcare practices and complex and dynamic clinical environments are pushing us to prepare for unpredictable situations and unplanned attunement through embodied knowledge and skills.

Through the participants' self-reported reflections on their learning in the clinical placement post-SBE in this study, it was evident that they had acquired the skill to see the potential of non-

human objects in enhancing healthcare, including the use of an overhead table and the desirability of preparing warm water. Drawing reference to the student learning process from the above section, students went through the process of making sense of their actions and of the human and non-human factors in the environment, and also reflected on possible improvements in future practices. The emergence of multiple actions based on the same scenario, but to which different students attributed different meanings and were attuned to different degrees, reflects the uncertainty and diversity described by Practice Theory.

Hopwood et al. illustrated the importance of this sense-making process and of the sense of acknowledging observations, which will become crucial to embodying their experiential learning, knowledge, and skills in the SBE.[9] The transferability of skills and knowledge to a clinical placement after SBE also indicates the continuous learning that takes place, which gives students the perspective to learn beyond taken-for-granted aspects in clinical settings. SBE may develop beyond high fidelity and standardization to leave room for emergent learning in the moment and increase awareness in learning for students and teachers, allowing them to optimize their learning outcomes and competence.[37] Specifically, in the future, developments in SBE can involve looking into theories and approaches that can help students to embody the simulated experiences, so as to maximize the transferability of the knowledge, skills, and perspectives that they had learned, to allow them to deal with the predictable and unpredictable factors that they will face in a clinical environment.

5. Limitations

The main limitation of this study is that the sample involved one particular institution and one particular area of nursing. However, our observations and learning may provide insights to healthcare educators and offer different possibilities based on a theoretical approach to SBE, specifically in palliative care communication, for further development. The use of focus groups has the potential to generate data based on a broad range of perspectives. The team might not have been able to capture the narrative depth of all issues. However, the team resorted to data triangulation in an attempt to develop a better understanding of the students' intentions and their interactions with the non-human aspects of the environment. In addition, there is considerable diversity among and within the socio-material approaches. Our adoption of the ethnographic approach with reference in particular to the actor-network theory was due to its emphasis on practice and exploration, as well as recognizing its many adaptations within a complex theoretical construction.

6. Conclusion

This study showed how nursing students learned about medical care and communication through SBE under a socio-material perspective, and indicated the importance of socio-material interactions and emergent learning in the complex and uncertain backdrop of palliative care communication. The approach enabled students to describe the connections between their prior learning, the moment of the simulation, and their future learning and performance in new ways. Theory-based SBE and an unplanned attunement in learning are crucial to equip health professionals and educators to address student practices in new ways that may enhance the care that they provide, and to transfer their knowledge and skills to the uncertainties and complexities of clinical practice.

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