Abstract

The exponential proliferation of e-learning programs has considerably changed the landscape of contemporary nursing education. Nursing programs are delivered through classroom, blended, fully computerized or distributive models. The aim of this paper is to provide a critical theoretical analysis of potential pitfalls of the utilization of remote robots in nursing education. Against the backdrop of the nature of nursing knowledge, the usefulness of robots in nursing education is appraised. Robots enable students living in remote geographical areas to learn in their communities. The lack of evidence to support the efficiency of remote presence robots in nursing education, in general, and in clinical nursing education, in particular, raises some questions. Robots may run the risk of dehumanizing nursing education and impoverishing the acquisition of critical thinking skills. A critical examination of the advantages and disadvantages of remote robots should inform nurse administrators and educators before making decisions to rely on this cyber-based technology to support the delivery of nursing programs in remote areas.

Key Words distance education, mobile learning, nursing education, nursing knowledge, remote robots, technology

A Critical Analysis of the Use of Remote Presence Robots in Nursing Education

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Introduction

The past five years have seen an exponential proliferation of e-learning programs offered through blended, fully computerized or distributive approaches to teaching and learning in nursing.[1,2] E-learning encompasses any web-based learning approaches using technology to deliver nursing or allied health education.[3] Globalization, decreased public funding of universities, and fiery competition to attract international students explain the plethora of academic programs delivered through cyber-based or technology-based models.[4] Students benefit from greater access to higher education without leaving their homes while universities generate more revenues from increased tuitions.[5-6] Cyber-based delivery focuses on the learners' needs, enhances collaborative and experiential learning. It provides simulated clinical experiences to respond to the dwindling number of clinical placements.[7-11] Technology-mediated programs are used in medicine[6,12,13], dentistry[8] but to a much lesser extent than in nursing education.[10,14,15]

A variety of approaches is used to deliver technology-mediated nursing education. Distributive learning allows teachers and students to connect in the cyberspace from non-centralized areas regardless of time.[16] Mobile technology includes handheld devices like PDAs (personal digital assistants) or devices incorporating communication and wireless capabilities like smartphones and tablets.[11] Many scholars turn to social media to facilitate learning, disseminate research findings, or showcase conference presentations.[17-20] Defined as a "form of electronic communication through which users create online communities to share information, ideas, messages and

other content like pictures," social media facilitates the rapid dissemination of information to a global audience."[21 p10] In a qualitative study of physicians, pharmacists, and nurses in Catalonia, Lupianez-Villanueva et al.[20] report that social media are used for information consumption rather than for knowledge production. Distributive learning and blended models are the most frequently used approaches to delivering nursing education.[11] A sophisticated technology called remote robot represents the newest medium introduced in the field of distance education in nursing.[22]

The purpose of this article is to provide a critical theoretical examination of the potential pitfalls of the utilization of remote robot technology in nursing education. Against the backdrop of the nature of nursing knowledge, I explore the usefulness of remote robots to facilitate the teaching and learning of fundamental nursing knowledge and skills. First, I provide an overview of the advantages and disadvantages of mobile technology in nursing education. Remote robots can be included in mobile technology even if less mobile than palm-held devices. Second, I revisit the focus of the discipline of nursing and explore the nature of nursing knowledge as a means to examine the usefulness of remote robots. Third, I discuss the potential influences of remote robots on nursing education through an examination of the interrelations between knowledge, humans, robots, and technology. Fourth, I examine the pitfalls of a cyborg nursing culture. To conclude, I provide a few recommendations to align remote robots with nursing's ontological and epistemological foundations.

Locating Robots in the Nursing Literature

A scoping review of the literature performed in Medline® and the Cumulative Index of Nursing and Allied Health Literature (CINAHL®) databases was conducted to locate empirical studies on the use of remote robotics in nursing education. Fawcett and DeSanto-Mayeda suggest doing a scoping review "when the goal is to identify literature on a broad topic and determine gaps in that literature".[23 p285]) Criteria included: 1) full text, 2) peer-reviewed, 3) research-based, 4) published from January 2008 to March 2015, 5) English language and 6) indexed in Medline and CINAHL. A first search using remote presence as a keyword gathered a total of 20 references, 7 of them published between January 2008 and April 2015. Articles are from medicine. E-learning, nursing education, and remote presence were used as keywords to run the second search. The second search produced no results. A third search using e-learning and remote presence as keywords was performed and four

references were located. Three out of 4 articles on remote presence originate from the industry that manufactures the robots named InTouch Health®[24] or from technology users and early adopters of robots.[13,25] A fourth search using remote presence and clinical skills produced no results as well as a fifth run using remote presence and nursing education. A final search performed using telementoring and nursing education as keywords ended up with no results. The scoping review reveals a lack of empirical studies to support the effectiveness of remote robots in clinical nursing education. There is no evidence that compares the efficiency of remote robots over other technology-mediated models and traditional models (classroom lectures). No theoretical papers addressing the influences of remote presence robots on learning outcomes and the uptake of clinical skills in nursing or medicine was located. This dearth of evidence illustrates the novelty of robots in nursing education. This gap in knowledge indicates a priority for nurse researchers and educators to start examining how robots influence the delivery of nursing education. Conversely, the review shows that evidence on the use of mobile technology in nursing education exists. These studies mostly describe the advantages and disadvantages of blended, distributed, and fully asynchronous delivery models.[26-29] The scoping review illustrates a growing interest towards mobile and robot technology in nursing education. Based on the typology of mobile technology, robots can be classified into the category of mobile learning tools as robots represent objects or machines that faciliate the delivery of nursing programs.

Advantages of Mobile and Robot Technology

Traxler[30] argues that the major advantage of mobile tools reside in their portability and accessibility. Peters underlines these devices are readily available to provide personalized information "just in time, just enough, and just for me".[31 p10] Handheld devices can be very useful in clinical settings because students can consult an array of health applications without the need to leave the patient room to get his information. In a review of the literature on mobile technology, O'Connor and Andrews underline that "drug references guide was the most used software program".[11 p139] Medical dictionaries, drug dose calculators, and laboratory diagnostic manuals are among the other popular applications among nursing students.[11] O'Connor and Andrews report that mobile technology supports clinical learning and enhances knowledge retention. These authors assert "overall mobile technology enhances knowledge and skills, improves decision-making capacity, and increases productivity and confidence".[11 p139] Similarly, Simpson believes nurses

"gain a more complete understanding of the nuances and complexities associated with each clinical decision".[32 p86] Some authors report that theoretically-oriented nursing courses do not cause problems for distributed and online delivery, but providing clinical content is arduous to deliver using mobile technologies.[22] Other authors contend[22] that remote robots (RP-7i) represent the ideal means to offer clinical content to nursing students living in remote areas.

Inspired by principles of telemetry, remote presence robots are used to assist medical consultation and facilitate the provision of health care to underserved remote communities. Remote presence robots serve to perform medical and surgical procedures in emergency departments, critical care units, and operating rooms.[13] Approved by the U.S. Federal Drug Agency (FDA), remote presence RP-7ª robots are deemed efficient to ensure patients' monitoring and provide medical treatments.[13] Technology increases access to nursing education, most notably among students and practitioners in remote areas but delivering clinical content remains a challenge.[33,34] As such, remote presence robots may represent a better way than other technologies to deliver clinical courses to students living in remote areas.[22]

Empirical studies show that synchronous and asynchronous technology-mediated models of delivery provide students with interactive methods of learning useful for distance learners.[35,36] Remote robots appear to increase accessibility to medical education[13,24], yet these authors did not provide any evidence of the efficiency of robots over other more traditional modes of delivery. Empirical data describing the effects of robots on learning outcomes is missing.[13,24] Similarly, remote robots augment access to nursing education for northern and Indigenous students but the overall rate of success remains to be assessed and documented. Exner-Pirot and Butler[22] suggest that remote robots may increase the number of Indigenous nurses practicing in their communities. Also, they contend that remote robots may impact positively on the retention of nurses in northern areas where an acute shortage of nurses exists.[22] These assumptions appear optimist but a review of the disadvantages of mobile and remote robot technology may elicit a more balanced perspective.

Disadvantages of Mobile and Remote Robot Technology

In an analysis of technology learning tools in healthcare education, Petty[1] contends technology-mediated programs increase learners' satisfaction. However, she cautions that asynchronous delivery may not suit all learners due to

some limitations related to social interactions necessary for knowledge transfer and skills acquisition to occur. Petty[1] discusses the characteristics of the learners (post-licensure vs. pre-licensure) and the course content (theoretical vs. clinical courses). The high costs related to the purchase of technology and incidental expenses necessary to maintain the equipment should be considered.[1] Internet connection issues like "freezing out, crashing, and slow transmission" are among the most frequent problems occurring with the use of technology.[11 p140] Mendez and Van den Hof[13] emphasize the need to secure a reliable source of power supply to use robots. Technical issues must be addressed to avoid negative users' perceptions. Also, O'Connor and Andrews[11] mention that lack of technical support, insufficient computer literacy, and negative attitudes of nursing students and staff towards mobile devices hinder the use this technology. "Some nursing students were reluctant to use their mobile handset, as they believed it was rude, unprofessional, or made them look incompetent if they used it in front of patients".[11 p141] Patients' characteristics need to be accounted for when using mobile technology. For instance, the use of palm hand devices may create discomfort among psychiatric patients. The presence of robots on psychiatric units may prove problematic, especially if robots are taken into hospitals and community centres to support students in their clinical placements. For other scholars, mobile technology's immediateness may translate into a weakness. Computer literacy skills require nursing students to be able to not only access and retrieve information but also critique the quality of the information.[35] Finally, the lack of evidence to support the efficiency of mobile and remote robot technology is one of the major impediments to its implementation. O'Connor and Andrews underline "the lack of any clear definition of what mobile technology is and where its boundaries lie in clinical nursing education is a flaw in the current body of evidence".[11 p141]

Despite nursing's strong attraction to cyber-based and technology-mediated delivery models, very few nursing schools rely on robots to deliver long distance undergraduate or graduate education. Remote robots may be the way of the future, but the primary concern resides in the lack of evidence and pedagogical principles associated with the use of robots in nursing education. In the absence of empirical studies, how do nurses assess the impact of remote robots in nursing education? I suggest revisiting the focus of the discipline of nursing and examining the nature of nursing knowledge. The ontology and epistemology of the discipline may provide us with some insights as nursing education enters

the unchartered territory of cyber-based robot technology. The nature of nursing knowledge is examined through the perspectives of practical and speculative knowledge, ways of being and knowing in nursing, and knowledge as a social phenomenon.

The Nature of Nursing Knowledge

The nature of knowledge in nursing relates to the focus of the discipline, also described as its ontological foundation. The focus of the discipline of nursing represents this ontological foundation. The composition of the metaparadigm of nursing remains a debated topic in nursing philosophy, yet it is safe to contend that the metaparadigm encompasses four major concepts: Human beings, the environment, health, and nursing. A majority of the members of the discipline agree on the inclusion of these four concepts. Although a majority view may entertain the status quo on the development of knowledge, Thorne et al.[37] believe that the metaparadigm clarifies the phenomena of interests to nurses. Similarly, Fawcett and Desanto-Madeya[23] argue that the metaparadigm differentiates nursing from other health disciplines. The nursing's metaparadigm represents the focus or the essence of the discipline. For instance, Newman believes the focus of nursing is "caring in the human health experience".[38 p5] The major concepts of Newman's Theory of Health and Expanding Consciousness are consciousness, wholeness, transformation, and notions of space, time, and movement. Newman emphasizes that nurse-patient relationship is a foundational element in the discipline of nursing. "The nature of the nurse-patient relationship is fundamental to the ontology and epistemology of nursing".[39 p362] In other words, nurses' presence matter as a caring and authentic presence can be seen as a neutral and unifying view of nursing. In applying Newman's theory to nursing education, the quality of the educator-learner relationship in terms of presence becomes the hallmark of the teaching-learning process. Presence, role modeling, reciprocity, and engagement of educators and learners represent the core of the learning process. Wholeness is another interesting concept of Newman's theory that applies to nursing education. The concept of wholeness stipulates that an individual forms a unitary whole (being) greater than the sum of its parts. Illness and health experiences involve the wholeness of bodily, psychological, cultural, social, and spiritual dimensions. Newman [38] defines wholeness as the patterns of the whole and refers to the indivisibility of these dimensions. Because of the many dimensions of illness experiences nursing students and nurses draw on basic, applied, theoretical and practice knowledge to inform

practice.

Speculative and Practical Knowledge

Drawing on Johnson and Ratner,[40] I argue that the nature of the knowledge used in nursing be both speculative and practical. Speculative knowledge is theoretically-driven and relates to what has to be known whereas practical knowledge underpins nursing actions. Practical knowledge relates to what has to be done and refers to nurses' actions. Johnson and Ratner underline that "speculative knowledge is directed toward knowing for the sake of knowing, whereas practical knowledge is directed toward knowing for the sake of doing and making".[40 p12] Speculative and practical knowledge are not in opposition; they are located on a continuum of abstraction that spans abstract and concrete knowledge. Jacques Maritain (as cited in Johnson & Ratner) contends that "as one's proximity to action increases, the nature of the knowledge [speculative vs. practical] one requires to act changes".[40 p13]. Therefore, the closer to practice, the more concrete knowledge becomes.

Fundamental Ways of Knowing and Being

Carper[41] qualifies knowledge as ways of knowing. Ways or patterns of knowing are fundamental because these patterns represent the "kinds of knowledge that are held to be of most value in the discipline of nursing".[41 p200] Fundamental patterns or ways of knowing are used interchangeably in the nursing literature. Carper identifies four fundamental patterns of knowing: Aesthetic, empirics, personal, and ethical knowledge. Aesthetic knowledge, clinical skills and judgment represent practical knowledge whereas empirical and ethical knowledge constitute speculative knowledge. Therefore, practical and speculative knowledge guide nursing practice. Sociopolitical and emancipatory knowledge are additional ways of knowing used to guide nursing science and practice. Political knowledge enhances the acquisition of critical thinking skills necessary to understand health disparities arising from social injustice.[42] Postcolonial knowledge helps understanding how colonialism shapes racialized individuals and groups' health.[43] Specifically, postcolonialism explores how health, race, class, ethnicity, and gender intersect to create health and social inequities.[44] For instance, neocolonial health policies and practices correlate negatively to influence Indigenous' clinical and health outcomes.[45] Eurocentrist views of illness, rejection of Indigenous traditions, and racial inequity create the conditions of social, cultural, and economic marginalization affecting Indigenous populations in Canada and New

Zealand.[46,47] A social justice lens represents another fundamental knowledge in nursing. Social justice knowledge develops nursing students' social consciousness as future nurses and citizens.[48] Social consciousness is necessary to acquire emancipatory knowledge for understanding how power relations operate in the health care system.[49] Emancipatory knowledge helps to comprehend how social issues such as poverty, violence, gender inequity, and racism affect vulnerable peoples' health. Issues of inequities often translate into social marginalization within society and the health care system. If nurses are to take action on inequities, the acquisition of social and emancipatory knowledge facilitates the comprehension of the effects of injustice on individual or population health.

Conversely, Silva, Sorrell and Sorrell[50] believe that Carper failed to describe how nurses acquire the four ways of knowing. Because of this, Silva et al. add ways of "being" as a means for nurses to further develop and apply ways of knowing in practice. Ways of being arise from the ontology of nursing. The in-between (the how of nursing) are "aspects of reality, meaning, and being that persons only come to know with difficulty or that they cannot articulate or ever know".[50 p261] For Silva et al.[50] the acquisition of nursing knowledge cannot be linear and mechanistic. Rather, they propose a view of nursing integrating expertise, experience, reflexivity, and ethics. Ways of knowing cannot stand alone; ways of being are necessary to support the interrelation of being (ontology) and knowing (epistemology) in nursing. One has to know what nursing is before generating knowledge to inform practice.

Case, Patient, Person, and Social Knowledge

In another perspective of knowledge, Liaschenko and Fisher[51] propose that nurses possess what they refer to as case, patient, person, and social knowledge as the knowledge(s) to support practice. Case knowledge applies to science, biomedicine, and other disciplines.[51] The case refers to the disease per se. Patient knowledge is the knowledge that accounts for the context in which nursing care is provided. The acquisition of patient knowledge occurs within nurses-patients professional encounters. Person knowledge relates to the patient's individuality and personal biography. Person knowledge is about knowing the patient's individual experiences of health and illness.[51] Through person knowledge, nurses relate to patients' everyday lives experiences of illness. Social knowledge links patient and person knowledge as nurses seek to understand the social and cultural context in which experiences of illness unfold.

Liaschenko and Fisher's perspective on nursing knowledge aligns with Johnson and Ratner's views on knowledge. Case and patient knowledge represent speculative (general) knowledge whereas person knowledge (practical) becomes individualized, reflecting the patient's subjective experiences of illness. Person knowledge corresponds to practical knowledge and respects the uniqueness of the individual. Similarly Christensen[52] defines nursing knowledge as the knowledge, skills, and understanding of the environment and the complexities of care. Christensen sees knowledge production and its acquisition as "an integral process of ongoing experience, learning, and education. Learning involves cognitive, emotional, and social processes embedded in the scientific, experiential, and personal domains".[52 p875]

In summary, Johnson and Ratner[40] affirm that speculative and practical knowledge are essential to guide nursing practice. Speculative and practical knowledge must be taught in the nursing curriculum, regardless of the models of delivery. Speculative and practical knowledge emerge from scholarship that brings depth and breadth to a particular phenomenon of interest to nursing. Conveying information alone does not support in-depth analysis and acquisition of critical thinking skills necessary to examine nursing's phenomena of interest. For instance, remote presence technology may fail to support the uptake of knowledge and expertise about ways of ways of being and knowing. Similarly, if remote robots only provide information on how to provide "hands on" techniques, and even fall short of delivering them properly, the use of this technology undermines the quality of nursing education. I now turn to discuss the potential influences of remote robots in nursing education and expand on the culture of cyborg nursing.

Potential Influences of Remote Robots in Nursing Education

Remote presence robots may affect nursing education at two distinct levels. First, there is a risk of dehumanization of nursing education associated to the decontextualization of knowledge and skill acquisition and the technologization of learning.[53] Decontextualization of knowledge means a practice that is isolated from the human, cultural, social, and political contexts of nursing. On the other hand, technologization reifies the machine over the human experiences of learning. Singh, Kenway, and Apple point out that globalized neoliberal agenda and the corporatization of higher education are no strangers to dehumanization and technologization in academia.[53] As in nursing, the use of remote robots runs the risk of isolating the learners

from the reality of nursing practice, and this may contribute to the dehumanization of nursing education. The second level relates to the impoverishment of critical thinking skills. The dominance of technological way knowing or technologization of knowledge may lessen students' motivation to acquire aesthetic, ethical, sociopolitical, and emancipatory knowledge.

Dehumanization of Nursing Education

In their article, Lapum et al.[54] contend that an overreliance on technology risks uprooting nursing practice from the context of patients' experiences. Lapum and colleagues argue that if the technology becomes the prevailing way of knowing of the discipline, nursing risks becoming a dehumanized practice. Dehumanization occurs when "humanness is pushed into the background and ways of being become merely technologized and automatic".[54 p283] The pervasive presence of technology in our everyday lives makes it difficult to appreciate our dependence on technology. Lapum and colleagues even suggest "nurses and other healthcare professionals may not even recognize the ways that practices are technologically shaped and focused".[54 p285] This issue of false consciousness should be a concern for nurse educators. For instance, remote-presence may provide students with a form of standardized practical knowledge stripped of the ways of knowing and being in nursing. In describing the ontological tensions between the world of technology and nursing, Silva et al.[50 p269] mention:

> Virtual worlds and environments raise profound ontological questions about what is reality, what is meaning, and what is being. In preparation for the future, both nurses and nursing students must understand how to learn rather than how to hoard knowledge, how to critique rather than how to accept, how to expand rather than how to contract.

In her reflections on virtual nursing, Sandelowski[55] discusses the advantages and disadvantages of nursing in the post-human or virtual condition. For Sandelowski, the post-human condition implies a distance between the patient and the nurse and a greater invisibility of the patient body. Cyberspace entails new views of space and body, thus replacing the traditional view of the nurse-patient relation marked by the proximity of the physical body.[55] Pine describes how virtual encounters may ultimately influence nursing practice.[56] She says: "As nurses become more mechanized and alienated from their work, their human product is transformed into a commodity fetish".[56 p271]

Thorne reminds nurses that "the experiential domain of health and illness, [is] arguably the most complex and messy phenomena of the human universe".[57 p1] The complexity of nursing requires harmonization between ways of knowing and being. Robot-mediated nursing care runs the risk of dehumanizing nursing by dissociating the wholeness of mind, spirit, and body. Robotization may obfuscate the complexities of care. Kikuchi [58] points to nursing questions that science cannot answer. Similarly, one can say that there may be ways of knowing (e.g., aesthetic, sociopolitical and emancipatory) that remote robots cannot deliver in nursing education. The risk is that remote robots isolate clinical knowledge and skills from the ontology of nursing articulated around the metaconcepts of health, human beings, the environment, and the delivery of nursing care. Nursing techniques (hands-on care) are dissociated from speculative knowledge. Care (as cited in Exner-Pirot & Butler) reports that distance learners suffered from a "lack of personal contact with other students and instructors".[22 p17] Using remote robots can be seen as a linear way of teaching, neither better nor worse than the delivery of a one-sided classroom lecture. Engagement of students may be arduous despite the efforts of the most gifted nurse educators due to the limitations of the technology itself. Newman[38] reminds nurses that presence and wholeness are important to enact in nursing practice. In other words, the teaching and learning of relational practice may be more difficult if students are isolated from their instructors and their classmates.

Exner-Pirot and Butler[22] claim that the delivery of clinical content is problematic in distance education programs. They underline a cohort's success on Objective Structured Clinical Examination (OSCE) exams in a Canadian university, yet they did not report the limitations of OSCEs in measuring clinical competency.[22] Nurse researchers report a wide variation in pass rates between assessors due to subjective biases.[59] East et al. explain that subjective biases relate to instructors' perceptions of clinical competency.[59] Previous studies performed in the UK and Australia report OSCE's lacks consistency and reliability.[59,60] This lack of uniformity translates into a significant variation of the scores among assessors.[60] The paucity of Canadian nursing education research on the validity and reliability of Objective Structured Clinical Examination adds to the current void of evidence on the impact of remote robots on teaching clinical skills. This lack of scientific facts is not without raising some concerns, especially in the domain of critical skills necessary for practice.

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Impoverishment of Critical Skills

Furedi (as cited in Thompson and Watson) warns the nursing professoriate that "knowledge is increasingly seen as the product of a technical process rather than of intellectual work".[61 p123] Thompson and Watson move a step further in saying: "The current climate of anti-intellectualism and prevailing mood of philistinism denies the existence of variety or excellence".[61 p123] Thompson and Watson recommend engaging in activities that serve to "open the minds, arousing curiosity, and stimulating debate"[61 p123] for nursing to survive as an academic discipline. For these authors, intellectual activities constitute fundamental endeavours to develop knowledge in nursing.[61] Does linear content delivery either through classroom lectures or remote robots enable nurse educators to create a thirst for knowledge? If not, there is a risk that nursing students will no longer be educated but only trained to perform tasks. Students may lack exposure to speculative (theoretical), social, and emancipatory knowledge to inform practice. The upshot is the impoverishment of critical thinking skills.

In an era where some nurse scholars suggest "thinking is seen as a subversive activity",[62 p28] another concern as to whether remote robotics supports the development of critical thinkers, or the training of docile nurses arise. Docile nurses toil to maintain what Rudge refers to as the "well run system".[63 p167] Although the view of nurses as an oppressed group may appear debatable, other scholars argue that nurses may contribute to their disempowering practice and working conditions.[64-66] the use of cyber-based technology like the RP-7 robot in nursing education may be antithetical to the development of critical thinking skills by uprooting practice from its context of delivery. Does the learning environment provided by remote robots prepare students to develop the competencies to provide safe quality care and adapt to nursing workplaces?

Nursing students may not be equipped to address or negotiate the power relations affecting their future workplace and working environment. In a recent study, Udod[67] underlines that power relations embedded in institutional policies and management practices influence nurses' work. Consequently, a lack of exposure to sociopolitical and emancipatory ways of knowing associated with robot delivery may lead to impoverished critical thinking skills. Decreased critical thinking skills may hinder the understanding of the complex health issues arising from social inequities. Therefore, the use of remote robots may impinge on the development of social consciousness useful to apply sociopolitical and emancipatory knowledge. A deficiency of critical skills coupled with a lack of mastery of ways of knowing and being may create a cyborg nursing culture. At the extreme of the continuum, the birth of a cyborg nursing culture results from the dehumanization of practice and the uncritical technologization of nursing education. These two factors contribute to the isolation of nursing education from the focus of the discipline.

Towards a Cyborg Culture in Nursing Education?

Lapum et al.[54] emphasize the close relationship between humans and technology when they refer to nurses and health professionals (and each human being) as "cyborgs". For Haraway, a cyborg represents "a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction".[68 p149] Technology has changed the context of nursing education in general and clinical education in particular.[11] For instance, Lapum et al. report: "If nurses do not examine [their] cyborg ontology; [they] may be at risk of being solely governed by or struggling with technology".[54 p277] Beyond these binary struggles, remote robot delivery risks marginalizing the acquisition of knowledge and skills needed for providing competent and compassionate care. What if students focus on the robot instead of the patient? What if the robot becomes the focus of nursing care? The writings of Myrick[69] may help to answer this question.

Myrick suggests that "the original purpose of a university education was designed to foster a desire for right conduct and good things that ultimately cannot be neatly packaged and delivered".[69 p23] A return to Cardinal John Henry Newman's nostalgic view of the aims of a liberal higher education[62] is neither realistic nor desirable. However, the practice of nursing requires students to become knowledgeable and skillful practitioners. As such, being informed is not enough. Complex interactions between individuals, populations, and the environment occur and shape contemporary health issues. Nursing in the 21st century needs both speculative and practical knowledge. Nurses not only provide medication but also they need to know how to approach suicidal individuals, homeless youth, street workers or refugee men and women living in difficult socio-economic conditions. One needs critical thinking skills to address these contexts and how they shape nursing care. Myrick[69] suggests the knowledge to address complex and abstract concepts cannot be standardized into routines or neatly packed into bundles to be delivered through technology-mediated robots. Pine further explains:

The ritualized best practice of saying the same, noncore-related things to every patient/consumer obscures differences of class, culture, and gender embodied as subjectivity and inseparable phenomenologically from the healing process Scripting, which robotizices nurses, is used more effectively from a management perspective when controlled directly through computers.[56 p271]

Pine supports the need to teach critical thinking skills to understand the gendered, social, cultural, and existential contexts surrounding bodily and emotional experiences of illness.[56] An uncritical reliance on robotics may come at the price of relegating teaching and learning activities associated with aesthetic knowledge and ways of being in nursing. Caring and authentic presence still represent fundamental concepts of contemporary nursing practice.[70] These concepts may be absent in the culture of mechanical and computer engineering.[71] Metzler and Barnes[71] explicitly address the notions of consciousness and personhood by pointing to the complexity of human-robot interactions. The complexity of human-robot interactions lies in "psychological, philosophical, and even spiritual issues bearing significant implications for traditional nursing values".[71 p4]

In her *Cyborg Manifesto*, Haraway [68] reflects the risk of embracing an extreme human-computer identity or cyborg identity in nursing. She underlines:

The late twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and the body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we are frighteningly inert.[68 p153]

From a profession based on presence, caring, wholeness, a cyborg nursing culture would thwart or plainly oppose the ontology of nursing. As early as 1998, Nelson started interrogating the influence of technology on nursing education.[72] She asks: "In millenarian fashion, will the nurse involved in direct patient care cease to exist as a new age of remote sensors, care attendants, and nurses extenders dawns?".[72 p69] In short, robots may mediate an environment where human relations, communication, presence, social consciousness, and engagement become less visible. So how to use remote presence robots in nursing education while minimizing the dehumanization of the process of teaching and learning? I now turn to provide a few recommendations to reconcile remote robots, nursing ontological and epistemological underpinnings, and education.

Recommendations

Scholars argue that remote presence robot technology and nursing ontology and epistemology may be placed in opposition.[54] For others, robot technology, may be at odds with the embodiment of illness and suffering.[1,55,72] Nursing and health-related disciplines focus on the acquisition of technical skills because of the applied component of these professions.[8] Robots may emphasize the mastery of techniques in clinical courses at the expense of critical and emotional skill.[70] Remote robots may represent a linear approach to content delivery and may impinge on pedagogical activities like problem-based learning, reflexive exercises, or teamwork useful for the development of critical skills.[61,73] Ultimately, robots may give precedence to a cyborg culture undermining the quality of nursing education. The choice of remote robot technology over other models of delivery has to be lucidly assessed due to the current lack of substantial evidence on its effectiveness in nursing educational contexts. Thompson warns the discipline of nursing is "susceptible to fashion" as she cites some practices introduced in nursing "with little consideration given to planning, implementation, or evaluation".[74 p 695]

Solutions do not reside in rejecting sophisticated technologies to enhance the delivery of nursing education. Remote robots may represent an innovative model to deliver nursing programs to students living in remote northern locations. Rather, solutions reside in determining when and how to deliver nursing programs through robots. The utilization of robots must not become an end in itself. Nor shall it be implemented under the pressure of external forces (e.g. neoliberal policies and corporatization of universities) that can be deleterious to the discipline. Pressure can come from many different stakeholders, but the interests of the discipline must be explained to stakeholders who may not understand what nursing is. Thompson indicates that nursing compared to other disciplines is fragile to external threats: "In nursing [staff and students] typically implode, fragment, and bicker".[74 p695] Also, decisions to use remote robots should be made with consideration of the students' needs, their characteristics, and the content (theoretical vs. clinical) to teach.

Educational models of delivery must rely on sound pedagogic principles and operate with some evidence of their efficiency. Delivery models should be examined as to whether the best interests of the learners and the discipline of nursing are promoted. Nursing students need to become critical thinkers to navigate the churning water of the health system. The

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complexities of care require students to become socially conscious and culturally competent. An appraisal of the advantages and the disadvantages of remote robots should guide decision-making processes as to select this technology for distance education. Also, O'Connor and Andrews[11] recommend using a nursing theory to facilitate quality improvement and provide a framework for analysis. I suggest that Newman's theory may be useful to guide and anchor remote robots in the reality of nursing practice. The context of learning, the communities in which the students live, the academic, social, and internet technologies supports they may receive from their immediate and larger environment deserve considerations. The quality of clinical placements available in remote areas needs to be considered in the decision-making process. As Thompson points out, "nursing needs to aim high, and miss occasionally, rather than aim low and hit often".[74 p697] Finally, the development of the evidence related to remote robotics in nursing education is a pressing need to address. Future studies need to explore the efficiency of robot mediated technology on learning outcomes and acquisition of clinical skills compared to blended and traditional models of delivery. Future research may contextualize the Objective Structured Clinical Examination (OSCE) within the context of a greater use of remote robots to teach clinical skills.

Conclusion

In this paper, I argue that remote robots represent an innovative technological means to deliver nursing education. Robots increase the accessibility to nursing programs for students living in remote geographic areas. Like any innovation, the implementation of remote presence robots in nursing education must be carefully appraised because of the current lack of evidence. The dearth of empirical studies reflects the novelty of using remote robots in nursing education. Robots may reinforce the belief that the acquisition of speculative or theoretical knowledge is less desirable than the acquisition of practical knowledge. Also, remote presence robots may obfuscate ways of knowing and being in nursing. The upshot would be to dehumanize practice and robotize clinical education and create a cyborg culture. Finally, linearity and isolation may preclude students from acquiring the social and emancipatory knowledge to critically appraise complex health problems and understand the politics of health care and nursing workplaces.

Footnote

a. "The head of the robot is a flat screen monitor that displays

the image of the remote operator (instructor) and a window that provide the image of the student standing in front of the robot."[13 p2] The robot RP-7 is fully equipped with diagnostic devices, a laptop, 2 screens and 2 cameras. The instructor sits in a "control station and uses a joystick to maneuver the robot which can travel at a speed of 3km/h with a rechargeable battery." [13 p2] For a complete visual and technical description of the RP-7 remote-presence robot, please refer to the following website: http://www.intouchhealth.com/products-and-services/products/rp-7i-robot/ I do not promote the sales of robots manufactured by this company or by any other corporations. The goal is to direct readers to the website to get a visual of the technology.

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