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The Shifting Sands of Nursing Informatics Education: From Content to Connectivity

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Abstract. This chapter considers the development of nurse education over the past 50 years and ventures a view towards 2020. A link will be made to the introduction of informatics to nursing curricula. It is clear when looking over the recent history of nurse education that it has moved from a medical model and content driven apprentice mode to that of a reflective agile professional mode where autonomous practice allows for collaboration in care and connectivity between health professionals. Parallel to these pedagogical changes are the introduction of informatics across healthcare, starting with computer skills and moving through information management to decision support. The chapter will conclude with some thoughts around the next possible steps forward for nursing informatics education.

Keywords. Nursing education; Learning Theories; Connectivism

1. Introduction

Nursing education has changed over time, from an apprenticeship model approach, to one where nursing education is valued for creating critical thinking, problem solving autonomous practitioners [1]. Nursing competencies have been introduced into nursing education internationally in an attempt to produce nurses who can demonstrate performance against the expected role of a Registered Nurse (RN). Berwick [2] describes this saying “During professional preparation, nurses-in-training should experience, reflect upon, and develop the knowledge, skills, and attitudes that create competence in patient-centred care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics”.

This chapter considers the historical development of nursing education, then links the changes in nursing education to the development of nursing informatics education. Learning theories are described, following the evolving approach taken by nursing and nursing informatics education over time. This chapter concludes with identifying some of the challenges facing nursing informatics education towards 2020, and the question of whether post connectivism can support the development of the agile health practitioner needed in an ever-increasing digital world.

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2. Changes in the education of nurses

Early nursing education followed an apprenticeship model based in hospitals [1]. Senior nurses and doctors provided the training, along with on-the-job experience supervised by qualified and more senior student nurses. Servicing the needs of hospitals, not the educational needs of the students, was the emphasis in the apprenticeship model of nursing education.

From the early 1970s nursing education started to move to the education sector. The focus shifted to student learning and understanding of nursing. Education that supported the development of nurses' decision-making power was introduced, accompanying a change from task oriented practice, from 'doing' to 'knowing' [3]. The literature describes a paradigm shift that occurred in nursing education coined as a 'curriculum revolution' [4]. Key themes of the 'revolution' included social responsibility, the centrality of caring in nursing, an interpretive stance, reflection and critical thinking [4-6]. It is now well recognized that nursing education needs to provide for lifelong learning including critical thinking ability, communication skills, and information literacy [7-9]. Resulting in part from the information explosion and increased access to information through the Internet, there is less emphasis on what students need to learn as a finite body of knowledge and more on the process of learning [10].

The use of nursing competencies started to appear in literature in the 1970s, being touted as being a way to provide a standard approach to education [11, 12]. Rather than set a core curriculum the preference grew to describe competencies that nurses would develop, which was considered to provide education providers sufficient guidance and also the opportunity to be creative in how their curricula were designed [11]. The Quality and Safety Education for Nurses (QSEN) project [13] describes competencies as including knowledge, skills, and attitudes, highlighting achievement of competencies as indicators of nurses who can provide safe and effective care. The effectiveness of competencies in nursing education is proven, but also highlights the important role of nurse educators [14], which is addressed in section B chapter 1.

The challenge is in preparing nurses for the future, recognizing that most programmes of learning to become a nurse take at least three years, and therefore a forward-looking approach is always needed. It is well known that future nurses will be working in a healthcare environment that is increasingly complex, where change is constant, and with individuals who will be living longer, are more likely to have a long-term condition and multiple co-morbidities [15-17]. In conjunction with this is the view that health should be considered longitudinally, across the lifespan of the person, rather than as episodic, where healthcare intercedes only when the person is sick [18]. This means nurses need a stronger focus on health promotion and disease prevention, rather than a sickness focus and the knowledge, skills and tools to achieve this.

3. Learning theories

Nursing education has always been open to new models of learning and teaching, moving and drawing on behaviorism, cognitivism, constructionism and connectivism, but at each juncture there has been a focus on the teacher rather than always understanding the student needs first. This may reflect early healthcare where

historically a paternalistic approach to practice dominated, rather than negotiated care and working in partnership with patients and their families [1].

Behaviorism led into a world of classic conditioning or stimulus-response learning with the underlying concept that behavior was more influential to actions, including learning, than thinking or feeling [19]. Many will have learnt about Pavlov's dogs, where the dogs were conditioned to salivate upon hearing a bell even though there was no food presented, a classic conditioned response [20]. More recently Skinner [21] added further with his concept of operant conditioning where the mind of an individual plays a part in the way in which we do things, so the start of adding 'thinking' to the way in which we learn. Through development of Skinner's work emerged the theory of 'Law of Effect' where rewarded behavior tends to be repeated and behavior unrewarded tends to reduce or go away completely [22]. There remain elements of behaviorism in nurse education today where students follow regime processes such as the essentials of aseptic technique or the use of risk assessment tools whereby selection of responses result in a treatment protocol. However, in today's nursing education additional elements for student learning provide further enhancement which allows for an individualised approach.

The development of individualism allowing for greater conscious thinking came with cognitivism as a learning theory in the 1960s. The main concept behind cognitivism was that the process of learning was more important than the outward response to learning [23]. At the time of emergence of this theory there were significant developments in the uses of computers in different sectors of society which may have led to the theory often being described as concerned with the student as an information processor. Thinking, memory, problem-solving were at the heart of cognitivism where learning was considered as a thought change rather than just a response to stimuli [24]. In application to nurse education this theory heralded the start of the transition to individualised patient care through the understanding of processes with added variance due to individual patient need, which was shown in written nursing care plans.

In the 1980s a further expansion on individual learning was expounded through constructionism theory [25]. Bruner is one of the main theorists of constructionism and he suggests that learning is an active process, stimulated by curiosity [26]. Additionally, learning occurs when the information and experiences are meaningful and specific to the individual [27]. Students are seen as not just responding in a behaviorist way to stimuli, but seeking to understand and find meaning in the stimulation provided by the learning experience. This represents a significant shift away from 'teacher-led' education towards understanding and implementing 'student-led' learning where the activity of educational construction lay with the individual student constructing solutions guided or facilitated by a set of learning objectives which could be attained in more than one way, allowing for diversity of knowledge and thought by the student. Nursing education has drawn extensively from this theory of learning as it allows for individualised patient care whilst acknowledging that the process of learning is also individual and centred on the student, based on what the student needs to know related to gaps in their knowledge.

This brings us to the most recent theory espoused by Siemens called connectivism, which is considered a learning theory appropriate for the digital age [28]. The main thrust of this theory is that learning is moving from the 'know-how' or 'know-what' to the 'know-where', reflecting the need for information literacy skills around information accessing, filtering, and sequencing so the student knows when an appropriate resource has been located. Connectivism has been described as a dynamic state where

knowledge is created beyond the individual participants, and is constantly shifting and changing: Knowledge is a shifting phenomenon as information flows across networks that themselves are inter-connected [29]. An obvious example of this is Wikipedia, where information is fluid and evolving. Wikipedia also indicates the need for students to be able to filter, and the need for information literacy to discern the credibility and usefulness of information accessed. Applied to nursing education, learning starts with the individual student who forms networks to aid their learning and extend their personal communities; hence their learning also draws on the experiences and learning of others. The use of social media among today's nursing students emphasizes the place of connectivism.

4. Nursing informatics education

The use of information and communications technology (ICT) in the delivery of healthcare is now usual practice in many countries. However, this occurred because of instrumental nursing informatics pioneers [30]. Now, more than ever, the increased use of ICT is being driven by patients and population demand, with countries looking for ways to improve efficiency with most nations struggling with inadequate resources. In many countries consumers can access and control their care records and participate in their health care. Nursing education prepares students for beginning practice as a RN, and this now includes being ready to act as information management advocates for patients and their families, to help them navigate the masses of accessible information. Moreover, nurses also need to be prepared to act as custodians of health information within a governance framework.

In the early 1960s the World Health Organization arranged international seminars on automatic data processing in health care but nurses were not invited until 1971 [31]. Then in 1982, the first world congress for nursing and ICT was held in London and attracted delegates from all over the world. It was this conference that resulted in the International Medical Informatics Association (IMIA) establishing a Working Group specifically for nursing; this working group continues to be at the forefront of nursing informatics today [30]. At this first nursing informatics conference in 1982, Constance Berg [32] presented a paper entitled 'The importance of nurses' input for the selection of computerized systems' and gave a profound warning:

"The choice is there and the time to make the choice is now. The decision must be whether to act traditionally and have change thrust upon the profession [nursing] from the outside or to anticipate this revolution in nursing practice, familiarize nurses with it, and prepare them to take an active part in the introduction of computers into the nursing community".

Nursing informatics education builds on essential concepts within nursing education, such as communication skills, teamwork, the importance of nursing documentation, and working within legal and ethical boundaries. Early nursing informatics education followed the broad steps seen in nursing education. Initially the focus was on 'doing' tasks, such as how to use a computer with the aim of nurses developing basic computer skills. Then the emphasis moved to 'knowing' about information management and issues associated with using ICT. Nursing informatics is often presented drawing on the data-information-knowledge-wisdom framework [33, 34]. Over time the importance of nurses understanding how ICT can be used wherever

nursing occurs, including patients using ICT, and both nurses and patients developing information literacy skills, has come to the foreground in our increasingly connected world. Nursing informatics frameworks and competencies are seen as one way to encapsulate the knowledge, skills and attitude nurses need.

5. Nursing informatics frameworks

In order to determine the most appropriate nursing informatics competencies it is helpful to understand the focus of various frameworks from different countries, organisations or individuals. An example from each is briefly offered here.

An European Union (EU) and United States (US) collaboration created HITComp - the Health IT competencies [35]. These EU/US health IT competencies were developed as a collaboration under the auspices of the Standards and Interoperability Framework of the US Office of the National Coordinator of Health Information Technology and the EU through the European Commission's Directorate General for Communication. A workgroup of public and private sector industry, ICT and e-health professionals, together with educators and clinicians, created a database. The outcome of this collaboration was published online in May 2015 and is a searchable database of skills and competencies needed across a variety of healthcare roles, including nursing [35].

An organisational example is the Quality and Safety Education for Nurses (QSEN) project which developed knowledge, skills and attitude competencies aimed to prepare nurses to continuously improve the quality and safety of the healthcare systems where they work [13]. QSEN acknowledges nursing informatics and developments such as electronic health records (EHR), social media, the increased role of consumers and their use of technology, mobile-health, smart phones, and health related applications. Additionally, QSEN suggests that ICT "is an enabling tool that links data, information, knowledge, and wisdom and facilitates problem solving and decision making". A further organizational example of nursing informatics frameworks is provided by the Technology Informatics Guiding Educational Reform (TIGER) Initiative [36] and this is described fully in section B chapter 3.

Bond and Procter [37] are individual nurse academics based in the United Kingdom. They proposed a framework to enable all RNs to have an essential understanding of informatics to work effectively in the healthcare information intensive environment. Figure 1 is taken from their work and as an overall view would appear to support many of the leading nursing informatics competency frameworks including, TIGER [38] and the HITComp [35]. The model (Figure 1) attempted to identify various informatics elements considered important for inclusion in a course preparing nurses for registration. The relationship between new knowledge (informatics) and advancing conventional healthcare knowledge was considered crucial in giving contextual meaning to the inclusion of informatics for the students. The original paper contains the 'key' to the various elements, but even looking at a meta level it is the movement in the learning that the student can undertake from bottom left to top right which binds such learning in a larger curriculum [37].

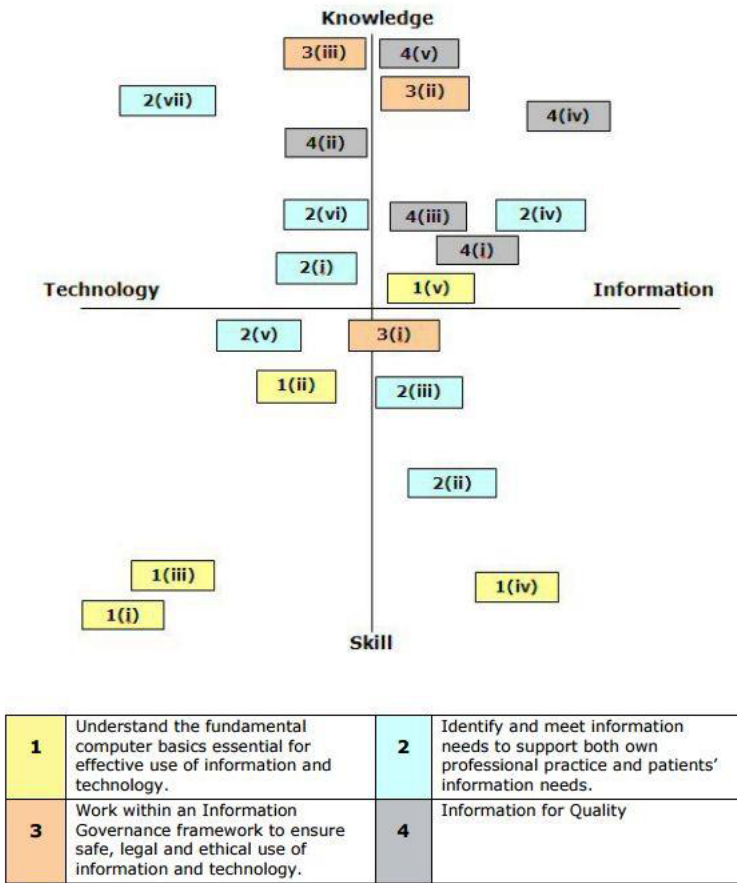


Figure 1: High level scatter chart of nursing informatics competencies across two continuums (Bond and Procter 2009) [37].

6. Challenges facing nursing education

With the changes to the models of nursing education, nursing informatics education has also changed. The changes in nursing education have been driven by societal and professional expectations of high quality nursing. In addition, new nursing roles have emerged, with RNs working at levels of advanced practice, yet all nurses are required to work with technology in their day to day work. While there have been significant changes and improvements in nursing education over the last century, there have also been challenges, which today include the blurring of health professional roles where professional boundaries overlap and sometimes cause increased workload due to duplication whilst the emerging roles find their place [39]. The growing division between service delivery and RN preparation causes a delay between curriculum designs meeting the needs of service improvement. This response delay increases the

necessity to construct the education of nurses in a more generalist manner which has a flow on effect regarding a lack of professional identity which has the potential of returning nurse education to the early years where the curriculum design was developed to meet service need [40].

The Horizon Report suggests a number of developments in technology that will impact higher education in the next five years, with two key long-term influencing trends being advancing cultures of innovation and changes in how education providers (universities, colleges) work [41]. These changes and trends equally impact nursing education. For example, this report suggests technological developments as including students bringing their own devices, adaptive learning, augmented and virtual reality, affective computing, and robotics, which are already emerging or present in nursing education [42, 43].

The following competencies were identified as being important; and these are listed with examples for entry-level nurses, those studying to become a RN, and for the nurse educators involved in their education.

- Respect the individual's preference in their use(s) of digital health applications.
- Support individuals and family/carers through available information sources.
- Describe and work within the legal and ethical rules/ regulations associated with managing and sharing patient information.
- Identify, improve, encourage and use new technologies, including remote care from a clinical and community perspective of connected care.
- Find the most reliable sources of information to support evidence based practice.
- Incorporate information and communications technology into consultations.
- Manage the nurse-patient relationship when the nurse is not physically in the same place and/or time as the patient.
- Perform accurate and timely data entry at the point of care which is clinically meaningful.
- Explain the role of technology in the delivery and organization of care.
- Extract data to support decisions, monitor the outcomes of practice and generate knowledge.
- Support other users to identify and use relevant information and communications technologies for connected care.

7. Post connectivism

Earlier nursing informatics education mirrored nursing education, with a focus on tasks associated with using a computer [44-47]. In her chapter on the history of nursing and the computer, Saba in 2001 described 'computer' as an all-encompassing term including the internet [48]. With the increasingly widespread availability and connectivity to the Internet, web-based learning options came to the fore, so that by the late 1990s the focus was more on improving access to learning opportunities and using the technology to enhance learning [8, 49-51]. This change indicated a more cognitive approach to nursing informatics education [52]. More recently the focus has been on using ICT to collaborate, recognizing the power of the internet, electronic communications and social media, heralding a change of focus to connecting and networking amongst nurses.

In 1999 McGuiness and Hardy distinguished between personal, professional and educational technology for health professionals [53]. This synergy between the use of technology by nurses in their personal and professional lives, and for their ongoing education, indicates a blurring of the boundaries between each aspect, and with the ability to connect to other people, resources and ideas we are truly living in what Skiba termed 'The Connected Age' [43]. The Educause Center for Education and Research (ECAR) report of a study involving over 112,000 students from 250 higher education institutions across 13 countries suggests students are connected, with students reporting that technology makes them feel more connected to their school (64%); their teachers (60%), and to each other (53%) [54]. But this report also cautions that although students may be ready to use their mobile devices more in relation to their learning, their education providers need to provide a need to do so; also, that students are rightly concerned about their privacy. This highlights the challenge for educators to keep abreast of recent advancements and to also be cognizant of future developments so that their teaching strategies are suitable to prepare students for the future, rather than just the status-quo.

Is there an argument for considering nursing informatics as a seamless attribute to the nursing role rather than something extra-ordinary? Procter and Woodburn [55] suggest that nurses and the profession have a choice to engage with and lead the development of these technologies to ensure that they can continue providing patients with high quality and safe care, or not. In reality though, nurses must get involved in building their knowledge base and working towards adding information management wisdom to the professional knowledge.

8. Conclusion

The profession of nursing, and therefore the education of nurses, has seen significant changes over time to a place where nursing is now a respected profession. Changes in nursing education have been driven by a greater need for efficiency and safety, and as a response to public expectations. These changes also impact on nursing informatics education, and nursing informatics is now recognized as appropriate for a profession with its own body of knowledge and the ability to regulate itself. One of the changes in nursing, and therefore nursing informatics education is the introduction of competency based education, where knowledge, skills and attitudes are considered important to guide developing RNs. Having internationally agreed, clearly articulated nursing informatics competencies, may address a lack of nursing informatics awareness and skills in the nursing workforce, and the need for continued nursing informatics leadership within the profession.

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