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Three technological enhancements in nursing education: Informatics instruction, personal response systems, and human patient simulation

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Summary With the healthcare system in a state of flux, nursing education faces many challenges. Nursing faculty must design a dynamic curriculum that deals with the explosion of information, the complexity of the healthcare system, and optimal patient outcomes while addressing the diverse expectations of learners. Inclusion of information management and interactive technology facilitates learner engagement promoting critical thinking and improving clinical judgment. This paper details the faculty's vision for an ubiquitous information technology curricula, highlighting an undergraduate informatics course, use of a personal response system, and integration of human patient simulations.

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Some of the challenges of nursing education include the complexity of the healthcare systems, availability of exponential amounts of healthcare information, and enrollment of multi-generational learners. Curricular design must address these challenges. Dependent on the pedagogical approach inclusion of information management and interactive technology can increase dialog between the teacher and the learners, enriching the class-

room environment, enhancing metacognition, and promoting critical thinking. Fundamental to inclusion of technology in nursing education is information literacy and informatics. To prepare nurses for the challenge of the complex, dynamic healthcare environment, the faculty envisioned curricula infused with technological innovations. Multiple interactive technologies such as personal response systems (PRS), human patient simulation (HPS), personal digital assistants, web conferencing, pod-casting, and course management systems were integrated within the curriculum. This paper reflects the integration of information management and interactive technology into the undergraduate curriculum, highlighting the integration of nursing

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informatics, PRS, and HPS in an undergraduate curriculum.

Undergraduate nursing informatics

In Graves and Corcoran's widely accepted definition of nursing informatics, the three science entities of nursing, computer, and information were applied to the management of data, information, and knowledge in the practice of nursing (Graves and Corcoran, 1989). The most recent definition reflected the integration of nursing science, computer science, and information science "to manage and communicate data, information, knowledge and wisdom in nursing practice" (American Nurses Association [ANA], 2008, p. 2).

Nursing informatics is not word processing, electronic medical records, clinical documentation systems, online courses, or virtual simulation environments. In a survey of 540 nursing deans/directors and 1557 faculty, online course offerings and information literacy skills were erroneously equated to informatics (National League for Nursing [NLN], 2008, <http://www.nln.org/aboutnln/PositionStatements/index.htm>). These are tools of informatics which facilitate how data is collected and analyzed, as well as support decision-making in the discipline of nursing.

Integration of required nursing informatics courses into the undergraduate curriculum is almost non-existent (NLN, 2008, <http://www.nln.org/aboutnln/PositionStatements/index.htm>). While the healthcare profession in general has been slow to respond to the rapidly changing technology and the demands of restructuring healthcare, nursing education lags even further behind. The complex and dynamic state of healthcare requires that every nurse have a fundamental knowledge of nursing informatics.

A foundational nursing informatics course should provide students with the skills to become a knowledge-worker versus a task performer. It is a necessity that students be computer literate, which includes an understanding of the computer, software, and hardware, to effectively use these tools to collect and organize data. With organization and structure previously undefined data becomes meaningful as information. Information is processed to knowledge by interpreting, integrating, and applying nursing science to the information. The created knowledge is not stagnating, but fosters the collection of new data that perpetuates the cycle resulting in the complex process of decision-making. Wisdom is the outcome of interpret-

ing extracted data into information and applying actions or decisions. These complex activities are interdependent and perpetuate the continued process.

Information technology is pervasive and ubiquitous in our everyday lives. The present college-age population is the first generation to have always had the Internet, cell phones, and tech-influenced media. They not only expect, but also demand, technology applications in the educational process. The three informatics competencies, computer literacy, information literacy, and professional development/leadership, defined by the American Nurses Association, are underpinnings for pervasive and ubiquitous informatics in nursing curricula (ANA, 2008).

From the first to the last nursing course, students must see technology as fostering patient-centered care. Computer literacy, the ability to effectively use computers and other pieces of technology, is the first of the three informatics competencies (Barton, 2005). Second, information literacy is the ability to recognize the need for information, identify and retrieve information, evaluate information, and organize and utilize information in nursing practice (Association of College and Research Libraries, 2008, <http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.cfm>). Essential elements of evidence-based practice in nursing. The third nursing informatics competency, professional development/leadership, embodies "the ethical, procedural, safety, and management issues for information solutions in nursing practice, education, research, and administration" (ANA, 2008, p. 36).

Student assignments addressing ethical concerns should parallel the discussion of information management systems. Student nurses need to understand the role of ergonomics and the use of technology in healthcare. Nurses are the major users of technology in healthcare. Standardized language is an essential component necessary to define the phenomenon that is nursing, not only skills and tasks, but also nursing knowledge. While many nurse educators are not familiar and thus, not comfortable with standardized language, students must be introduced to the topic.

An assignment such as the creation of a health related educational Web page specifically designed for a diverse population requires that students demonstrate the application of computer literacy, information literacy, and professional development/leadership competencies. Knowledge of computer and software programs is necessary to create a Web page that provides accurate and current health information. Literacy skills of

identification, retrieval, and evaluation of information from journal literature, statistical sources, the Internet, and other sources are used to evaluate and integrate the information. Professional development/leadership is demonstrated as students create a health related educational Web page from a culturally based scenario within the context of a group experience. Application of leadership concepts is apparent as students are challenged to arrange face-to-face or virtual meeting times with the restraints of busy schedules. Additionally, as in the real work environment, there is the challenge of each group member meeting obligations in a timely manner.

The profession of nursing, as all of healthcare, is in a time of change. Recent significant publications have declared that the nurse must be prepared to function effectively in the technology-rich healthcare environment by understanding nursing informatics. "Information technology is healthcare's brave new word, and informatics is the language of that land. For nurses to achieve full citizenship, informatics must become our native tongue" (Simpson, 2007, p.17). As nursing students become more familiar with informatics and begin critical appraisal of nursing practice, instructive educational technologies are begin used to facilitate development of critical thinking and clinical decision-making skills.

Personal response systems

Educational trends such as discovery learning, cooperative learning, drill and practice, and project-based instruction are philosophies and techniques that were touted as new and improved instructional methods. Yet, teachers continue to use the traditional lecture format; a format that learners find boring and does not facilitate faculty-student dialog (Cuban, 1993). Personal response systems (PRS) provide interactive technology that engages learners, moving them from passive to active participants. Dependent on the pedagogical approach, PRS can increase dialog between the teacher and the learners, enrich the classroom environment, enhance metacognition, and promote critical thinking.

PRS consist of a response pad with alpha-numeric keys and a receiver connected to the computer's universal serial bus (USB) port. PRS were first introduced by the military in the 1950's (Judson and Sawada, 2002). As early as the 1960's, science faculty in higher education used PRS for stimulus response techniques in the classroom (Judson and

Sawada, 2002). However, there was minimal acceptance in the educational arena due to the cost and complexity of the technology. Recent advancements in PRS technology have resulted in easier integration and reduced costs, increasing faculty acceptance from diverse disciplines.

There are three basic ways to integrate the questions in PRS software: (1) as a screen in a PowerPoint Presentation; (2) as a screen within the PRS; and (3) questions developed on the fly, as verbal questions. All options allow faculty to include images, streaming video and active URLs in the questions.

Using PowerPoint, a question is presented on a slide with the distracters and answer. If desired, animation techniques, with a click of the mouse, can highlight the correct answer. Faculty who do not care to use presentation software can use the capabilities of PRS software to create questions prior to class, store the questions in the database, and during class, select the desired question. The verbal questioning option provides faculty an opportunity to ask the class a question and the students can respond using the keypad. Verbal questioning supports faculty who embrace spontaneity while promoting student examination of the implications and outcomes. This provides additional opportunities for the students to test their clinical judgment. Combining the techniques of using prepared questions and spontaneous questions can further enrich classroom discussion.

Beatty (2004) suggested that only 2–4 questions are optimal during a 50-min class. The questions should generate sufficient discussions and summarize key points or arguments put forth by the students. Supporting student-focused learning, faculty needs to resist the temptation to read the questions out loud. Class discussion can bring clarity to students regarding the content represented in the questions. Displaying the histogram generated by the students' responses supports class discussion of rationales, decision-making, and clinical judgments. Because of the anonymity of the responses, students become more engaged and willing to risk selecting an incorrect answer. The students also see the range of answers selected by their peers and feel more comfortable discussing their reasoning for selecting the distracters. Data from the students' responses can be saved as Excel[®] files and aggregated for further analysis.

Instructors using PRS have the potential to change the passive, traditional classroom to an active setting. Questions written at the application or higher cognitive levels provide students with the opportunity to draw parallels and identify

differences. Therefore, valuable class time can focus on probing understanding and helping the students construct their knowledge. In addition to PRS, human patient simulators can be used to help nursing students develop essential critical thinking and clinical decision-making skills.

Human patient simulation

Health care providers work in an environment in which unpredictable patient care situations occur. Appropriate responses to patient crises demand health care providers who are able to critically think through the situation, take immediate action, and perform tasks skillfully to provide safe patient care (Hovancsek, 2007). Human patient simulation (HPS) safely facilitates development of psychomotor and clinical decision-making skills to produce competent patient care providers without causing any patient harm (Rauen, 2001). Rather than passively receiving lecture, nursing students are actively involved in caring for a patient in crises bringing the textbook information to life. HPS is associated with educational outcomes of knowledge of pathophysiology and nursing interventions, skill performance, and critical thinking, as well as learner self-confidence and satisfaction (Jeffries, 2005).

In a simulated patient care environment the student uses nascent critical thinking skills to work through a patient care scenario in which they would be relegated to an observer role in actual patient care. The student acts on clinical decisions, and the simulator responds physiologically as a patient would react (Bradley, 2006). The student tries various approaches to handling the situation. The simulator is stopped mid scenario and restarted at an earlier point to more easily direct the student who is having difficulties (Rauen, 2001). HPS is a positive experience for students and an opportunity to use critical thinking skills. Student performance on objective structured clinical examinations improved significantly when HPS was used instead of or in addition to traditional nursing clinical curricula (Alinier et al., 2004, 2006). Debriefing helps students put the simulation into perspective (Rhodes and Curran, 2005) and explore the emotional, affective components of patient situations in a safe environment (Kneebone, 2005). Instructors supply feedback during the simulation that would not be possible in actual patient care environments (Hammond, 2004). Teams of healthcare students, such as respiratory therapy students, graduate and undergraduate nursing students, and medical students, are involved in the

same scenario, more closely simulating the hospital environment (Rauen, 2001).

Simulation is not without its difficulties. HPS is very costly and requires dedicated space and technical support. Faculty must become familiar with the simulator and integrate it into their pedagogy. Simulation scenarios require careful, detailed development (Rauen, 2001). Students may find simulations are disorganized or chaotic. They may have a dislike for role play and difficulty suspending disbelief of the less real aspects of the simulation. Too many students in the scenarios and ending scenarios too quickly interfere with student satisfaction (Rhodes and Curran, 2005). Learning and the development of critical thinking can be inhibited if nursing students experience anxiety related to their performance in a novel role or if they experience sensory overload in the dynamic, simulated environment (Rauen, 2001). Despite these limitations, the human patient simulator is a unique adjunct to clinical practice in the development of critical thinking and clinical judgment (Lasater, 2005). Careful management of the simulation experience is a skill nurse educators must develop just as educators in the clinical environment direct and support skill acquisition for their students.

Conclusion

In this era of electronic learning nurse educators have an obligation to evaluate emerging technologies in pedagogical methods to guide the learners in acquiring adequate knowledge. Nursing informatics represents the culmination of multiple technologies supporting evidence-based practice. Nurse educators should value, and model the use of technology as an adjunct to the delivery of safe patient care rather than a hindrance to the process. Faculty must embrace the use of technologies and invest the time and energy necessary to create an active learning environment. PRS and HPS are two examples of technology that promote critical thinking skills and clinical decision-making in non-threatening environments. Additional technologies which may be explored include pod-casting, personal digital assistants, and web conferencing. Course management systems support the use of such emerging technologies.

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